

Evaluation of Physiological and Biochemical Parameters in Chronic Kidney Disease Patients at AL Assabah Dialysis Center in Libya

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تقييم المعايير الفسيولوجية والكيميائية الحيوية لدى مرضى القصور الكلوي المزمن في مركز غسيل الكلى بالأصابعة في ليبيا

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Abstract:

Kidney failure is a health problem affecting people worldwide. Hematological problems in dialysis patients are associated with altered physiological and biochemical parameters in patients with renal failure. This study aimed to measure changes in physiological and biochemical parameters in patients undergoing dialysis. The study was conducted from July 2024 to August 2024 at the Al-Assabah Dialysis Center. It included 37 patients with kidney failure and 20 healthy individuals. Biochemical and hematological parameters, including blood sugar, cholesterol, triglycerides, urea, creatinine, uric acid, phosphorus, hemoglobin, platelets, red blood cells, and white blood cells, were examined and compared with those in healthy individuals. The study revealed that 73% of patients were men, with the majority falling within the 30- to 40-year-old age range. The study revealed statistical significance between the two groups in hemoglobin levels ($P = 0.002$) and red blood cell count ($P < 0.000$). The study also showed differences between the two groups in urea and creatinine levels. The study found that blood sugar levels were normal, and there was no significant difference between the sexes or the two groups, although men represent the majority of infected cases in the study population. The study concluded that there is a significant difference in the levels of biochemical parameters, hemoglobin, and red blood cell count in kidney failure patients compared to the healthy group, and that males are more susceptible to kidney failure.

Keywords: Chronic kidney failure, Physiological parameter, Creatinine, Glucose, Phosphorus.

المخلص

الفشل الكلوي مشكلة صحية تؤثر على الناس في جميع أنحاء العالم. ترتبط المشاكل الدموية لدى مرضى غسيل الكلى بتغير المعايير الفسيولوجية والكيميائية الحيوية لدى مرضى الفشل الكلوي. هدفت هذه الدراسة إلى قياس التغيرات في المعايير الفسيولوجية والكيميائية الحيوية لدى المرضى الذين يخضعون لغسيل الكلى. أجريت الدراسة من يوليو 2024 إلى أغسطس 2024 في مركز غسيل الكلى بالأصابعة. وشملت 37 مريضاً مصاباً بالفشل الكلوي و20 فرداً سليماً. تم فحص المعايير الكيميائية الحيوية والدموية، بما في ذلك سكر الدم والكوليسترول والدهون الثلاثية واليوريا والكرياتينين وحمض اليوريك والفوسفور والهيموغلوبين والصفائح الدموية وخلايا الدم الحمراء وخلايا الدم البيضاء، ومقارنتها بتلك الموجودة لدى الأفراد الأصحاء. أظهرت الدراسة أن 73٪ من المرضى كانوا من الرجال، وكان معظمهم تتراوح أعمارهم بين 30 و40 عامًا. كشفت الدراسة عن دلالة إحصائية بين المجموعتين في مستويات الهيموغلوبين ($p=0.002$) وعدد خلايا الدم

الحمراء ($p=0.000$). أظهرت الدراسة أيضًا اختلافات بين المجموعتين في مستويات اليوريا والكرياتينين. وأوضحت الدراسة أن مستويات سكر الدم كانت طبيعية، ولم تكن هناك علاقة بين الجنسين والمجموعتين، بالرغم من أن الرجال يمثلون غالبية الحالات المصابة في مجتمع الدراسة. وخلصت الدراسة إلى وجود فرق كبير في مستويات المعايير الكيميائية الحيوية والهيموغلوبين وعدد خلايا الدم الحمراء لدى مرضى الفشل الكلوي مقارنة بالمجموعة السليمة، وأن الذكور أكثر عرضة للإصابة بالفشل الكلوي.

الكلمات المفتاحية: الفشل الكلوي المزمن، المعايير الفسيولوجية، الكرياتينين، الجلوكوز، الفوسفور.

Introduction

Chronic kidney failure is a major health problem worldwide. Moreover, it represents a significant burden on healthcare, in terms of the large expenditures allocated to it, especially for developing countries (Muhammad et al.,2020). Chronic kidney disease (CKD) is a condition in which the kidneys fail to function properly (Asif et al., 2024). Chronic renal failure is the destruction of the kidney glomeruli or the occurrence of deformities or defects that lead to a decrease in the efficiency of kidney filtration (Rajauria et al.,2020). Globally, the incidence of kidney failure is on the rise. A study indicates that the global prevalence of kidney failure in 2024 was 9.1% of the world's population suffering from kidney failure. Many regions face an increased risk of kidney failure, including Southeast Asia, North Africa, Latin America, and Eastern and Central Europe, with differences in mortality rates between these regions (Arriola.Montenegro et al.,2025).

CKD affects 5-10% of the world's population, impacting health-related quality of life and imposing a significant economic burden (Humudat & AL-Naseri,2021). In addition, the rate of premature deaths resulting from chronic kidney failure is expected to increase by 2040, making kidney failure one of the fastest- growing causes of death among non-infectious diseases (Foreman et al.,2018). According to information provided by the Spanish Dialysis Registry, in 2016, an 8.2% mortality rate was recorded for that year (Arriba et al., 2021). Indicators show that the number of people suffering from kidney failure in Libya is estimated at 10-15%. In addition, these cases usually reach advanced complications that lead to a decline in kidney function and complete kidney failure, which requires dialysis or even a kidney transplant (Bansal et al., 2017).

As for end-stage renal failure, it is characterized by a gradual decline in kidney function and the body's inability to maintain fluid and electrolyte balance, which results in blood poisoning and a decrease in the glomerular filtration rate, which subsequently leads to many complications such as high blood pressure and an increased likelihood of developing cardiovascular diseases, bone diseases, and others (Habib et al .,2017;Abuagela and Essarbout,2025). This study aimed to assess the physiological and biochemical changes among dialysis patients and healthy individuals with renal failure. Due to the significant increase in the number of kidney failure patients in Libya and the lack of recent studies on this disease and its associated changes, this study was conducted at the Al Assabaa dialysis center in Libya.

Material and methods

This study was conducted on 37 hemodialysis patients at the Al-Assabah Dialysis Center and a group of 20 healthy volunteers. The patient group's age ranged from 30 to 80 years, with 27 males and 10 females. Blood samples were collected from the patient group before dialysis to evaluate the effect of this procedure on the patients' physiological variables. A questionnaire was prepared for all study participants to obtain information related to variables such as gender, age, hemoglobin level, red blood cell count, white blood cell count, platelet count, triglyceride levels, cholesterol, urea, creatinine, blood cells, glucose level, and phosphorus level, after obtaining the consent of the patient and volunteer. All these tests were performed in the center's laboratory according to the established protocol. Statistical analysis of the data was conducted using SPSS. We obtained approval to conduct this study from the Faculty of Medical Technology, University of Zintan, and verbal consent from all individuals participating in the study after interviewing them.

Results and discussion

Table 1 presents the distribution of the participants based on their age and gender in each group.

Table 1: Distribution of the participants based on their age and gender in each group.

Variable	Patients		Healthy group	
	N	%	N	%
Gender				
Male	27	73%	9	45%
Female	10	37%	11	55%
Total	37	100%	20	100%
Age				
30-40	14	37%	9	45%
41-50	4	10%	4	20%

51-60	6	16%	4	20%
61-70	9	24%	3	15%
71-80	4	10%	-	-
>80	-	-	-	-
Total	37	100%	20	100%

Table 1 shows that the majority of the participants (73%) in the patient group are males, while females are 37%. In the healthy group, more than half of the sample (55%) are females, and males constitute 45% of the total sample. Figure 1 presents the distribution of the sample based on their gender.

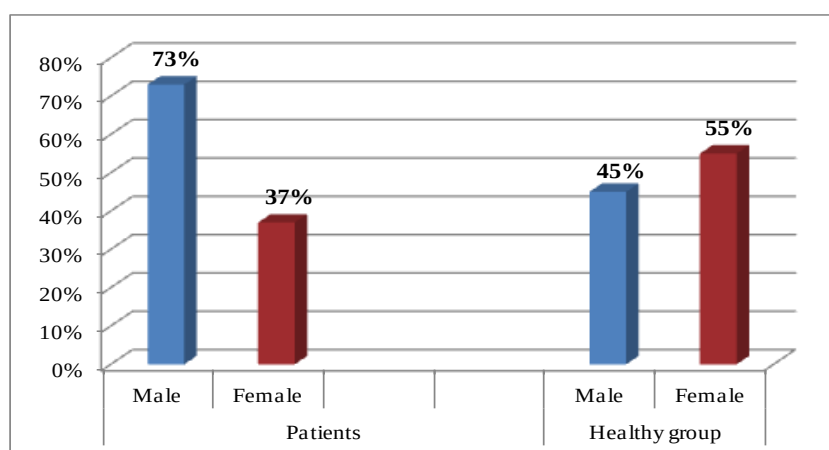


Figure 1: distribution of the sample depending on their gender

As for the age of the participants in the patient group, it is interesting to note that most of the participants (37%) are under 40 years old, followed by those aged between 60 and 70 years old (24%) and 51-and 60 years old (16%). The age groups 41and 50 years and 71-80 years constitute the smallest groups with only 10% of the total sample. On the other hand, the majority of the participants (45%) in the healthy group are between 30-40 years, while the least age group (15%) is between 61-79 years. The other groups, 41-50 and 51-60 years, constitute 20% of the overall sample. Figure 2 below displays the distribution of the participants according to age. Table 2 shows the differences between the two groups in terms of glucose, CHOL and TG.

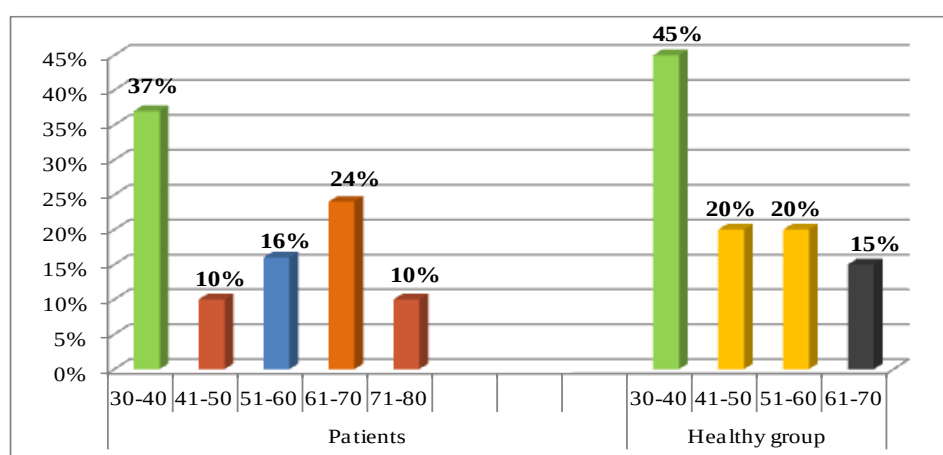


Figure 2: Sample distribution according to age.

Table 2: Biochemical variables.

Variable	Patients (N=37)		Control(N=20)		p-value
	M	SD	M	SD	
Glucose	113	61.19	109	35.23	.766
CHOL	120	31.75	133	33.58	.142
TG	109	32.49	100	35.96	.375

An independent sample t test was conducted to examine the differences in Glucose between the patient's group (M=113, SD= 61.19) and the healthy group (M= 109, SD= 35.23). The results revealed

that there is no significant difference in the level of glucose between the two groups, $t(55) = .299$, $p = .766$, 95% CI [-25.39, 34.3]. The results also reveal no significant difference in the CHOL level between the patient's group ($M = 120$, $SD = 31.75$) and the healthy group ($M = 133$, $SD = 33.58$); $t(55) = -1.491$, 95% CI [-31.43, 4.62]. As for TG, there was no significant difference between the patients group ($M = 109$, $SD = 32.49$) and the healthy group ($M = 100$, $SD = 35.96$); $t(55) = .894$, 95% CI [-10.39, 27.13]. Table 3 presents the changes in kidney function related to the patient group and the healthy group. An independent sample t test was performed to compare between the patient group ($n = 37$) and the healthy group ($n = 20$) regarding the levels of creatinine, uric acid, and phosphorus.

Table 3: Changes in kidney function associated with renal failure

Variable	Patients (n=37)		Control (n=20)		p-value
	M	SD	M	SD	
Urea	111.8	34.59	30.3	8.92	.000
Creatinine	5.92	1.99	.810	.158	.000
Uric acid	4.61	1.81	6.16	8.13	.269
phosphore	4.71	1.52	3.75	.803	.012

The levels of urea ($M = 111.8$, $SD = 34.59$), creatinine ($M = 5.92$, $SD = 1.99$), uric acid ($M = 4.61$, $SD = 1.81$), and phosphorus ($M = 4.71$, $SD = 1.52$) of the patient group were compared to the levels of urea ($M = 30.3$, $SD = 8.92$), creatinine ($M = .810$, $SD = .158$), uric acid ($M = 6.16$, $SD = 8.13$), and phosphorus ($M = 3.75$, $SD = .803$) of the healthy group. The results of t test showed that there are significant differences between the two groups in terms of the level of urea $t(55) = 10.315$, $p = .000$, 95% CI [4.21, 6.01], and the level of creatinine $t(55) = 11.42$, $p = .000$, 95% CI [65.67, 97.34]. However, there are no significant differences between the groups regarding the level of uric acid $t(55) = -1.11$, $p = .269$, 95% CI [-4.33, 1.23], and the level of phosphorus $t(55) = 2.61$, $p = .012$, 95% CI [.223, 1.69]. Table 4 displays the results of independent sample t test. The independent sample t test was conducted to determine the differences between the groups in regarding the levels of Hb, Platelets, RBCs, and WBCs.

Table 4: Haematological variables

Variable	Patients (n=37)		Control (n=20)		p-value
	M	SD	M	SD	
Hb	11.1	2.67	13.51	2.69	.002
Platelets	217.7	61.64	214.8	46.25	.858
RBCs	3.51	.928	4.41	.707	.000
WBCs	6.21	1.27	7.14	1.91	.031

The differences are examined in terms of the level of Hb ($M = 11.1$, $SD = 2.67$), Platelets ($M = 217.7$, $SD = 61.64$), RBCs ($M = 3.51$, $SD = .928$), and WBCs ($M = 6.21$, $SD = 1.27$) of the patient groups, and the level of Hb ($M = 13.51$, $SD = 2.69$), Platelets ($M = 214.8$, $SD = .46.25$), RBCs ($M = 4.41$, $SD = .707$), and WBCs ($M = 1.91$, $SD = .0317$) of the healthy group. The results of t -test demonstrated that there are significant differences between the two groups in terms of the level of Hb $t(55) = -3.23$, $p = .002$, 95% CI [-3.89, -.91] and the level of RBCs $t(55) = -3.75$, $p = .000$, 95% CI [-1.37, -.41]. On the other hand, no significant difference was observed between the groups in terms of the level of Platelets $t(55) = .179$, $p = .858$, 95% CI [-28.76, 34.42] and the level of WBCs $t(55) = .179$, $p = .858$, 95% CI [-1.78, -.090]. Table 5 below presents the results of Pearson correlation test. Pearson correlation test was carried out to investigate the relationship between the creatinine and the level of glucose among the patient group.

Table 5: The relationship between creatinine and diabetes for patients

Variable	Correlation	Creatinine
Glucose	Pearson correlation	-.087
	P-value	.519

As can be shown, the results revealed no significant relationship between the creatinine and the level of glucose $r(55) = -.087$, $p > .001$. To investigate the relationship between genders (men and women), a chi-square test was conducted to confirm this relationship.

Table 6: The association between Gender and groups

Gender	Patient		Healthy		Chi Square	P-value	Odds ratio
	N	%	N	%			
Male	27	73%	9	45%	4.36	.037	3.3
Female	10	27%	11	55%			

It can be seen that the males in the patient group are 27 (73%) and the females are 10 (27%), while the males in the healthy group are 9 (45%) and the females are 11 (55%). The results of chi-square show that there is no significant association between the genders and groups. The study showed that the percentage of infected males is 3.3 times that of females. It can be concluded that there is no significant difference between the genders and groups with males being more likely to be patients compared to females.

Discussion

Out of the total 37 patients, 73%(n=27) were male and 27%(n=10) were female while in the control group 55%(n=11) were female and 45%(n=9) were male participants. The ages of the patients suffering from kidney failure in the current study were between 30-80 years. The age groups of 41-50 and 71-80 years had a lower incidence of kidney failure, while patients aged between 30-40 had a higher frequency of kidney failure. Our findings disagree with those of other study (Saini et al., 2022).

Serum urea, creatinine, uric acid, and phosphorus are known to be used as diagnostic tests for prominent functions, and this study confirmed significant increases in both urea and creatinine, directly in serum uric acid, in chronic and common healthy subjects. This result is consistent with many previous studies (Manhas et al., 2022). The high concentration of urea and creatinine in the blood serum of patients with renal failure indicates that they are metabolic wastes that are naturally excreted through urine, the reason for the high concentration of uric acid in the blood serum of patients is due to the kidney's decreased excretion of uric acid as a result of the low rate of glomerular filtration, which causes uric acid to accumulate in blood (Zilva et al., 1989).

This study reveals that the values of phosphorus level were normal in renal failure and healthy group. Regarding glucose indicators our study demonstrates that most renal failure group had a normal glucose level the mean value of glucose count patients group (m =113, SD=61.16) and healthy group (m=109, SD=35.23) Although diabetes is one of most common causes of kidney failure according to the results of various study (Mansour et al., 2023). In our study we found TG and CHO level to be low in chronic kidney failure patients on hemodialysis and healthy group moreover our study demonstrate that there no significant differences in the CHO level between the patients group and the healthy group, on the other hand Triglyceride levels appear higher in patients compared the control group, and this consistent with the results indicating a significant increase in lipid levels among patients with chronic kidney failure. (Shukur & Hussein, 2025).

In our study demonstrate that there are significant differences in the Hb level between the patient group and the healthy group. this result agrees with many studies have indicate that anemia represents one of the most important problems associated with kidney failure (Tahir et al., 2025; Shastry and Belurkar, 2019). The results of this study were complications that accompany chronic kidney failure (Erslev & Besarab, 1997).

Regarding RBCs indicate our study demonstrates that there are significant differences between the patient group and the healthy group. This study agreed with what was mentioned (Kadhim et al., 2020). The present study showed no statistically significant differences in platelets. Conversely in previous studies that shown high levels of platelets in kidney dialysis patients (Shenkut et al., 2024). While there were no significant differences between the levels of white blood cells in the patient group and the control group, this differed from other studies that showed a decrease in white blood cell levels in cases of kidney dialysis (Rautela et al., 2024). There was no relationship between creatinine and diabetes in patients with kidney failure according to our observations, where the probability value ($p=0.519$) is greater than the significance level. The results of chi-square test show that there is no significant association between the genders and groups, and the odds ratio indicates that males are 3.3 times more likely to get kidney failure than females. The results in this study agreed with what was mentioned (Mukakarangwa et al., 2018).

Conclusion

The study evaluated the physiological and biochemical parameters (hemoglobin level, red blood cells, white blood cells, platelets, cholesterol level, triglycerides, uric acid, phosphorus, and blood glucose level) in patients with chronic renal failure at the Assabah Dialysis Center in Libya, by comparing them with a group of healthy people, in addition to focusing on relationship between gender, age and the prevalence of renal failure. The result of this study was that there were differences between the variables of hemoglobin, red blood cells, creatinine and urea between the patients and healthy group. The study also indicated that the majority of the study members were males, and that the age group 30-40 years was the most distributed among other age groups. Also, the appearance of a higher level of triglycerides in the patient group compared to the healthy group. Regarding of the variables (cholesterol level, uric acid, platelets, white blood cells, phosphorus, and glucose), and there are no differences between the two groups, and there is no a relationship between glucose and creatinine levels, the results of chi-square test show that there is no significant association between the

genders and groups, although males were the most common. Among the results of the study, we recommend that patients with kidney failure follow up and monitor the hemoglobin and red blood cell variables that are affected in patients with kidney failure. We also recommend conducting other studies in this context, with a larger sample size, on other blood variables

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