Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

Physiological and Biochemical Study of Renal Failure Patient In Salah al-Din

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Received: 00/00/0000
Accepted: 00/00/0000
Online: 00/00/0000

ABSTRACT

One condition brought on by renal malfunction is kidney failure· A robust, natural kidney serves as the body's primary filter, balancing bodily fluids, chemicals, and blood acidity· It also generates hormones that regulate the synthesis of red blood cells and the development of new bone· Kidney failure affects people of all ages, but it is more common in the elderly· It causes waste products to accumulate in different bodily parts **,** A higher heart rate was associated with a lower estimated glomerular filtration rate (GFR) and an increased likelihood of proteinuria 10 to 13% of the world's population is affected by chronic kidney disease, and millions die each year due to the lack of inexpensive treatment choices, The incidence increases dramatically with age,CKD is associated with several undesirable outcomes, including an increased risk of cardiovascular events, acute kidney injury (AKI), and progression to end-stage kidney disease (ESKD), making its diagnosis essential the initial and continuing risk factors for chronic kidney disease include genetic, ethnic, socioeconomic, and age variables .

Background: The study was conducted on patients with renal failure in Salah AL-Dean province, specifically in Ballad General Hospital and Tikrit Teaching Hospital· The collection of samples took place from November 1, 2023, to December 1, 2023· It involved collecting blood samples from Each patient in the studied groups, The groups were divided into two categories within a specified age range of 20 to 65 years, as follows: Control group (30 individuals): They were healthy and free from any chronic diseases, confirmed through comparison with the patient group, patient group (60 individuals): They were diagnosed with the disease based on the conducted criteria.

Methods: he variables studied were; B Urea, S Creitinine, S Uric acid, S Sodium, S Calisum and anti-oxidant Super oxideDismutases (SOD), Malondialdehyde (MDA), The results showed an increase in the rate of urea, creatinine and uric acid , and there were significant differences at level P< 0·05· and there were significant differences in the concentration of MDA

Results: The results showed an increase in the rate of urea, creatinine and uric acid , and there were significant differences at level P< 0·05· and there were significant differences in the concentration of MDA, and there were significant differences in the concentration of SOD among the study groups compared to the control at a significant level of P< 0·05, and shows that serum calcium levels in patients were significantly lower than in healthy controls at level (P≤ 0·05*), but there is no significant change in the sodium level in patients with kidney failure

Conclusion: The results of this study showed that patients with renal failure had a significant increase in the concentration of urea, creatinine, uric acid, and antioxidants, as well as a decrease in the percentage of calcium and blood in patients compared to the control group

Keywords: : renal failure, B·Urea, S·Creitinine ,S·Uric acid, S·Sodiuom, S·Calisum and anti-oxidant Super oxideDismutases (SOD), Malondialdehyde

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 11, 2024

(MDA)https://doi.org/10.24126/jobrc.20xx.xx.x.xxx

1-INTRODUCTION

One condition brought on by renal malfunction is kidney failure· A robust, natural kidney serves as the body's primary filter, balancing bodily fluids, chemicals, and blood acidity· It also generates hormones that regulate the synthesis of red blood cells and the development of new bone· Kidney failure affects people of all ages, but it is more common in the elderly· It causes waste products to accumulate in different bodily parts ·

There are two primary types of kidney failure: acute renal failure and chronic kidney failure· Acute kidney failure is defined as an abrupt and nearly total loss of kidney function, as well as high blood levels of urea, creatinine, and nitrogen as well as the kidneys' incapacity to control water and balance·, acids, and chemicals such as sodium and potassium· This sudden failure occurs within hours or days and is different from chronic failure in that it is Chronic failure can be treated if diagnosed and the causes are known, or it can lead to death if left untreated (Irazabal, M· V·, & Torres, V· E2020).

1-2 CHRONIC KIDNEY DISEASE

Chronic kidney disease (CKD) is a chronic, irreversible loss of renal function in which the body's ability to maintain metabolic, fluid and electrolyte balance fails, causing uremia or azotemia (Kefale, 2018)· Obesity, hypertension, and diabetes mellitus (DM) are just a few of the factors that can lead to kidney disease· Uncontrolled diabetes or hypertension can quickly progress to end-stage renal disease (Kazancioğlu, 2013)· Other causes of AKI include glomerulonephritis, genetic problems, medications, cardiovascular illness, multisystem diseases, urinary tract blockage, and infections (Noble & Taal, 2019)· The most important risk factor for the development and progression of CKD is high blood pressure· In order to avoid the progression of CKD, lowering blood pressure is an aim (Zhang *et al*·, 2019)·

Additionally, the heart rate has been associated with the development of CKD· A higher heart rate was associated with a lower estimated glomerular filtration rate (GFR) and an increased likelihood of proteinuria (Zhang *et al*·, 2019)·

10 to 13% of the world's population is affected by chronic kidney disease, and millions die each year due to the lack of inexpensive treatment choices (Crews *et al*·, 2019)·

The incidence increases dramatically with age· CKD is associated with several undesirable outcomes, including an increased risk of cardiovascular events, acute kidney injury (AKI), and progression to end-stage kidney disease (ESKD), making its diagnosis essential·

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The initial and continuing risk factors for chronic kidney disease include genetic, ethnic, socioeconomic, and age variables (Johansen *et al*·, 2021)·

2- MATERIAL AND METHODS

2·1 Study Design

The study was conducted on patients with renal failure in Salah AL-Dean province, specifically in Ballad General Hospital and Tikrit Teaching Hospital· The collection of samples took place from November 1, 2023, to Decamber 1, 2023 .

It involved collecting blood samples from each patient in the studied groups, The groups were divided into two categories within a specified age range of 20 to 65 years, as follows

Control group (30 individuals): They were healthy and free from any chronic diseases, confirmed through comparison with the patient group·

Patient group (60 individuals): They were diagnosed with the disease based on the conducted criteria·

2·2· Blood samples and physiological tests:

90 blood samples were collected from patients with renal failure A venous blood sample of 5 ml was drawn from each patient using medical syringes with a capacity of 5 ml·The blood collection process was performed under proper sterilization conditions· The samples were then placed in EDTA-free tubes and left at room temperature for 15 minutes to allow for blood separation using a Centrifuge device at a speed of 6000 rpm for 5 minutes· This process aimed to obtain serum, which was drawn using a micropipette and transferred into 2 ml Eppendorf tubes·,The tubes were labeled with the sample number, patient's name, and group number using adhesive tape, They were stored in refrigeration at a temperature of -20°C until further analysis· Another portion of the sample was isolated in a tube containing an anticoagulant substance (EDTA) for blood cell imaging,Two milliliters of the sample were placed in each tube and subjected to proper mixing using a shaker before conducting the required tests for this study·

2·3 Statistical analysis

Data were analyzed using the Minitab computer system version 17, with ANOVA and t-tests employed· The means compared using Duncan's multiple range test at a significance level of $P<0·05$

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3-RESULTS

Table 1 Renal function (urea,creatinin &Uric acid) in the patient and control group

The studied variables	Control mean±S·D n=30	Patent mean±S·D n=60
Urea mg/dl	·47±10·9 0	24·7* 1·127±
Creatinine mg/dl	42·0 92·1±	* 70·6±33·2
Uric acid mg/dl	·5±51·1 51	*1·41 15·6±

The findings of this investigation indicate elevated urea levels, attributed to renal failure resulting in impaired excretion· Urea is the fundamental nitrogenous compound produced from metabolic waste and subsequently eliminated· Urine is expelled externally due to a malfunction affecting the kidneys, resulting in its buildup inside the renal system· Consequently, blood levels will increase; any elevation in urea indicates a deficiency in the kidneys' filtration capacity (Vanholder et al·, 2018; Abdulwahed, et al.,2020)·

Increased concentrations of urea and creatinine in the bloodstream signify impaired renal function, since their presence denotes kidney failure· Serum creatinine is generally recognized as a primary measure for assessing renal function· The results of the present investigation align with the findings of Canovas et al·(2019) ·The findings presented in this study demonstrated a statistically significant rise in the concentrations of urea,

creatine, and uric acid in the study groups relative to the control group, with a significance level of $p<0·05$.

Study conducted by Nisha et al· (2017) found that the mean of urea level in patients with CRF undergoing dialysis was (134·33 mg/dl), also in the same study found that the mean of creatinine level in patients with CRF undergoing dialysis was (9·7 mg/dl).

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Study conducted by Mohammed R· Al-Shaheen et al·(2023) Results of this study demonstrated a high significant increase in S·uric acid for ESRD patients when compared with control group .

Table 2 Anti oxidant (SOD&MDA)

*= Significant P< 0·05

The results appeared in Table (4-2) and there were significant differences in the concentration of MDA, and there were significant differences in the concentration of SOD among the study groups compared to the control at a significant level of P<0·05·

The studied variables	Control mean±S·D n=30	Patent mean±SD n=60
SOD ng/ml	31·3±8·7	39·7±9·4*
MDA ng/ml	886±82·1	1079±83·4*

The results of this experiment are in line with (Al-Jabbirri& Tawfeeq· 2021) with regard to

MDA concentrations; while SOD concentrations are not, They showed that the study groups had decrease SOD concentrations and MDA increase concentrations among the study groups compared to the control at a significant level of P<0·05· .

In the case of renal failure, ROS will attack cell membranes, thus causes the change in the antioxidant enzymatic mechanism, and lipid peroxidation products such as MDA (Montazerifar *et al*·,2012)·

Reactive oxygen species (ROS) can damage cellular proteins, lipids, and DNA, ultimately leading to cellular dysfunction (Wang *et al*·, 2018)·

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TABLE 3 Electrolyte (Ca &Na)

The studied variables	Control mean±S·D n=30	Patent mean±S·D n=60
Calcium (Ca) **mg/dl**	8·997±0·390	8·390±0·368 *
Sodium (Na) **mEq/L**	140·67±2·06	139·89±2·56 ns

There are significant differences at a moral level p<0·05 Ca

no morale differences at moral leval p< 0·05 Na

Table 3 shows that serum calcium levels in ESRD patients were considerably lower than in healthy controls (P≤ 0·05*)· Probably as a result of the impairment of several homeostatic processes that control blood calcium metabolism caused by renal failure· Patients with chronic renal illness are affected significantly by both positive and negative calcium balances·

These results aligned with what Kathleen M· and colleagues (2017) reported· Hypocalcemia is common in advanced ESRD and ESRD, and bringing it back to normal levels is standard therapy, maybe to prevent hypocalcemia (Cozzolino et al·, 2004)·

One important element that is vital to many biological processes is calcium (Ca)· It is quite challenging to regulate the calcium balance in dialysis patients due to the loss of renal function· The results of this study are consistent with the findings published by Van der Sande F et al (2019)·

The management of calcium balance is quite complex because of renal failure, endocrine disorders, and the use of drugs such phosphate binders and vitamin D analogs (van der Sande et al·, 2019)·

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Table 4 Blood Parameters :-PCV & HB

The studied variables	Control mean±S·D n=30	Patent mean±S·D n=60
HCT %	39·64±7·66	29·99±4·41*
HB g/dl	12·95±2·88	9·80±1·45*

The study's findings indicated a substantial reduction ($p \leq 0 \cdot 05$) in hemoglobin and packed cell volume levels relative to the healthy group· In patients with chronic kidney disease (CKD), anemia is regarded as a prevalent consequence· Studies that corroborate our findings include those conducted by Astor, Patel, and Stevens (Astor B·, et al· 2002)·

Anemia in these individuals is also a consequence of iron deficiency· Iron is essential for hemoglobin synthesis; a deficit occurs due to a decrease in ferritin, a protein believed to store iron· Dietary limitations and decreased iron absorption may potentially be contributing factors; much research has been undertaken for this purpose· Fishbane, S· (2006)·

The primary reason for a decreased red blood cell count is a decrease in erythropoietin production by the kidneys, which leads to the inhibition of erythropoiesis· (Suresh M· et al·, 2012)

The reduced lifespan of red blood cells results in a diminished RBC count· This shortened lifespan may be attributed to uremia, which elevates the expression of phosphatidylserine on the external surface of RBCs· Consequently, this leads to increased macrophage-mediated damage to the RBCs, thereby decreasing cell viability· (Michael R· et al·, 2004)

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Table 5 Renal Function urea, creatinine and uric acid in the patient and control group according to Gender

The studied variables	**GENDER**	**control** *mean±S·D* n male=18 n female=12		**Patient** *mean±S·D* n/ male=31 n /female=29	
UREA Mg/dl	Male	33·118±6·920	b	136·312±13·10	a
	Female	29·067 ±5·970	b	123·321±14·35	a
CREATININE Mg/dl	Male	0·935±0·3280	b	7·415±2·3550	a
	Female	0·746±0·1382	b	6·321±2·2920	a
URIC ACID Mg/dl	Male	6·111±1·024	a	6·343±1·516	a
	Female	4·115±1·016	b	6·069±1·298	a

Table(5) shows that the urea rate in the male group was higher than the female group compared to the control group· It also shows that the creatinine and uric acid levels in the men were higher than the females Due to the nature of food and muscle mass as well females have less muscle mass as compared to males and the muscle mass is a major determinant of serum creatinine level·

The concentration of serum creatinine is mostly used to assess renal function; however, it may be influenced by factors such as age, gender, ethnicity, muscle mass, dietary habits, and the administration of certain drugs· Moreover, females had lower muscle mass than men, and muscle mass significantly influences blood creatinine levels· Furthermore, the disparities in glomerular morphology, glomerular hemodynamics, and hormonal metabolism between females and men may significantly impact the gender gap· (Q·-L· Zhang & Rothenbacher, 2008; Alkanaani,et al.,2020)·

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Stevens et al· (2007) and Wright et al· (2019) indicated that serum creatinine levels may fluctuate owing to extrarenal variables unrelated to kidney function, including age, gender, race, muscle mass, nutritional status, total parenteral feeding, and illness· Moreover, sustained vigorous activity may elevate blood creatinine levels owing to heightened muscle creatinine synthesis· The use of creatine supplements and cooked meat may elevate blood creatinine levels, since the cooking process converts creatinine in meat to creatinine, which is then absorbed by the gastrointestinal system· Conversely, restricting dietary protein may decrease blood creatinine levels·Moreover, serum creatinine levels may vary owing to renal factors unrelated to kidney function· For instance, various medications modify the tubular secretion of creatinine, resulting in alterations in serum creatinine that are independent of glomerular filtration rate (GFR)· Conversely, blood urea nitrogen (BUN) is influenced by non-renal factors unrelated to kidney function, such as protein intake, catabolic state, upper gastrointestinal bleeding, volume status, and high-dose steroid therapy·Consequently, variations in serum creatinine and BUN in end-stage renal disease are neither highly sensitive nor selective for minor fluctuations in glomerular filtration rate (van Veldhuisen et al·, 2016)· Healthy kidneys may excrete substantial quantities of urea· The production rate is enhanced by a high-protein diet, the assimilation of amino acids and peptides from digested blood following hemorrhage into the digestive cavity or soft tissue· The measurement established it as a prevalent test, noting its insensitivity, since over 50% of renal glomerular function must be compromised for blood urea levels to be influenced· The blood is influenced by dietary proteins and the extent of glomerular filtration· Elevated catabolism due to starvation, tissue damage, infection, or corticosteroid treatment In instances of catabolism, circulatory factors often hinder glomerular function, hence contributing more to elevated blood urea levels than to increased production (Crook, 2013; AL-Samarraie, et al.,2019)·

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Table 6 Anti oxidant (SOD&MDA) in the patient and control group according to Gender

The studied variables	Gender	Control mean±S·D n /male=18 n/female=12	Patient mean±S·D n /male=31 n/female=29
MDA	Male	564·4±52·9 d	1162·0±93·4 b
	Female	1367·0±95·0 a	991·0±71·9 c
SOD	Male	35·14±6·69 a	39·87±8·16 a
	Female	40·51±9·22 a	39·56±9·24 a

Malondieldehyde (MDA) : The analytical statistics in relation to MDA concentration in Table (1_6) showed was showed a significant ($p \leq 0{\cdot}05$) increase 1162·0±93·4 ng/ml in CKD male patints in compared with control male group 564·4±52·9 ng/ml·

The level of MDA was significant ($p \leq 0{\cdot}05$) decrease 991·0±71·9ng/ml in CKD female patients in compared with control female group 1367·0±95·0 ng/ml ·

The data showed a significant ($p \leq 0{\cdot}05$) increase in the level of MDA in the serum of CKD male patients in compared with CKD female patients the mean are 1162·0±93·4 ng/ml and 991·0±71·9 ng/ml respectively, while there was significant decrease in the level of MDA in the serum of control male and female group the mean are 564·4±52·9 ng/ml and 1367·0±95·0 ng/ml respectively·

Superoxide dismutase (SOD) : The analytical statistics of SOD levels in Table 6 Was showed significant level at ($p \leq 0{\cdot}05$) 39·87±8·16ng/ml in CKD male patients in compared with control male group 35·14±6·69 and was non-significant ($p \leq 0{\cdot}05$)

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39·56±9·24ng/ml in CKD female patients in compared with control female group 40·51±9·22ng/m

Table 1-7 Electrolyte (Ca &Na) in the patient and control group according to Gender

The studied variables	GENDER	Control mean±S·D n /male=18 n /female=12	Patient mean±S·D n /male=31 n /female=29
Ca Mg/dl	Male	9·046 ±0·4490 a	8·375 ±0·3439 b
	Female9	9·158 ±0·2937 a	8·392±0·3965 b
Na mEq/L	Male	141·294±1·855 a	139·839±2·806 a
	Female	139·864±2·314 a	140·379±2·274 a

Table 7 shows that in the percentage of calcium concentration, there are significant differences between the patient group and the control group, but there are no significant differences between males and females in the group of patients and healthy people as well·

As for the percentage of sodium concentration, there are no significant differences between the group of patients and healthy people because the patients are included in periodic dialysis, and also there are no significant differences between males Females in both healthy and sick groups

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Table8 Blood Parametar :-PCV &Hb in the patient and control group according to Gender

The studied variables	GENDER	Control mean±S·D n /female=12	n/male=18	Patient mean±S·D n /male=31 n /female=29	
PCV %	Male	44·752±8·530	a	29·293±4·164	c
	Female	36·367±4·610	b	30·467±4·716	c
HB g/dl	Male	13·639±3·274	a	9·790±1·415	c
	Female	11·925±1·844	b	9·817±1·517	c

The findings of Table 8 indicated a drop in PCV levels in male patients compared to the female group, while the Hb levels in male patients were also lower than those in the female group· The research findings indicated a substantial reduction ($p \leq 0 \cdot 05$) in Hb and PCV levels relative to the healthy group·In patients with chronic kidney disease (CKD), anemia is regarded as a prevalent consequence, as corroborated by research conducted by Astor, Patel, and Stevens (Astor B·, et al 2002; Al-Samarrai,et al.,2019)·

Iron deficiency is a contributing factor to anemia in these patients· Iron is a crucial element for hemoglobin synthesis, and its deficiency arises from a reduction in ferritin, which is a protein responsible for iron storage, as well as from decreased iron absorption and dietary restrictions· Numerous studies have indicated this cause (Fishbane S·, 2006)

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Table 9 Renal function (urea,creatinin &Uric acid) In the patient and control According To The Age

The studied variables	Age	Control mean±S·D	Patient mean±S·D
Urea mg/dl	G1= 20-35	n=20 31·37 ± 6·60 b	n=8 140·125±31·60 a
	G2= 36-50	n=6 34·83±7·99 b	n=18 129·474±21·30 a
	G3= 51- 65	n=4 37·75±8·91 b	n=34 122·727±34·18 a
Creatinine mg/dl	G1= 20-35	n=20 0·853±0·137 b	n=8 7·785±4·590 a
	G2= 36-50	n=6 0·917±0·216 b	n=18 6·789 ±1·826 a

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	G3= 51-65	n=4 0·975±0·200 b	n=34 6·433±1·364 a
Uric acid mg/dl	G1= 20-35	n=20 5·247±1·479 c	n=8 7·237±1·878 a
	G2= 36-50	n=6 5·733±1·360 bc	n=18 6·305±1·474 ab
	G3= 51-65	n=4 5·277±1·666 c	n=34 5·939±1·140 b

The first age group, which is between the ages of 20 and 35, has the greatest rate of urea in patients with kidney failure when compared to other age groups· Table (8) also shows the percentage of creatine and uric acid levels in these patients· The highest readings were found in the first group· in addition to the other age groups mentioned in the preceding table

TABLE 10 Anti-oxidants (SOD/MDA) in the patient and control group according to The Age

The studied variables	Age	Control mean±S·D	Patient Mean ±S·D
SOD Ng/dl	G1= 20-35	n=20 26·80±4·54 b	n=8 39·43±4·85 a
	G2= 36-50	n=6 20·96±3·51 b	n=18 40·80±7·01 a
	G3= 51-65	n=4 25·34±5·11 b	n=34 40·40±9·91 a
	G1= 20-35	n=20 593·9±57·31 d	n=8 782·0±80·00 c

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MDA Ng/dl	G2= 36-50	n=6 1287·0±98·73 a	n=18 1268·0±112·5 a
	G3= 51-65	n=4 447·6±81·10 d	n=34 1049·0±130·2 b

Table 10 shows that the highest value was recorded in the second age group in the group of patients whose ages ranged from 36 years to 50 years in measuring each of the antioxidants

The highest readings were also recorded in the second age group, SOD, as well as MDA

Table 11Electrolyte (Ca &Na) in the patient and control group according to Age

The studied variable	Age	Control Mean±S·D	Patient Mean ±S·D
Ca mg/dl	G1 20-35=	n=20 9·110±0·2687 a	n=8 8·275±0·459 b
	G2= 36-50	n=6 9·1667±0·1366 a	n=18 8·247±0·3634 b
	G3= 51-65	n=4 9·125±0·5250 a	n=34 8·4735±0·3351 b
	G1= 20-35	n=20 140·667±1·984 a	n=8 139·500±2·507 a

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Na mEq/L	G2= 36-50	n=6 140·167±2·137 a	n=18 139·425 ±2·744 a
	G3= 51-65	n=4 140·700±2·870 a	n=34 140·454±2·316 a

Table10 shows the percentage of calcium concentrations in the patient group compared to the healthy group that there are significant differences, and the second group, whose ages ranged from 36-50 years, was the category with the greatest decrease in calcium concentrations in the patient group compared to the healthy group , As for sodium concentrations, there are no significant differences between the group of patients and healthy people, but also the second category is the category in which sodium concentrations appeared to decrease in patients compared to the healthy group

Table 1-12 Blood parameters :-PCV &Hb in the patient and control group according to the Age

The studied variable	Age	Control Mean ±S·D	Patent Mean ±S·D
Hb g/dl	20-35	n=20 13·570 ±2·282 a	n=8 9·625±1·875 b
	36-50	n=6 14·250±2·173 a	n=18 9·768±1·021 b
	51-65	n=4 13·050±3·630 a	n=34 9·660±1·565 b
	20-35	n=20 41·12±6·300 a	n=8 30·36±5·360 b

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Pcv	%	36-50	n=6 42·87±6·170 a	n=18 29·93±3·264 b
		51-65	n=4 39·18±9·560 b	n=34 29·67±4·805 b

Table12 shows the percentage of hemoglbin concentrations in the patient group compared to the healthy group that there are significant differences, and the first group, whose ages ranged from 20-35 years, was the category with the greatest decrease in hemoglob concentrations in the patient group compared to the healthy group ,

As for pcv, there are significant differences between the group of patients and healthy people, but the third category appeared to decrease in percentage in patients compared to the healthy group

5-CONCLUSION

The results of this study showed that patients with renal failure had a significant increase in the concentration of urea, creatinine, uric acid, and antioxidants, as well as a decrease in the percentage of calcium and blood in patients compared to the control group

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