

# Evaluation of Some Blood Constituents of Patients with Chronic Renal Failure in Baquba City, Diyala Province, Iraq

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## Abstract

The study carried out in hemodialysis center, Educational General Baquba Hospital, Diyala, 2021. A total 108 patients 57 (52.8%) males and 51 (47.2%) females of 30-77 years old, suffering from chronic renal insufficiency, presented for hemodialysis center were depended in the study. The range of their age represent four age groups. Group (I) include 19 individuals of 30-39 years old; (II) 25 of 40-49 years; (III) 28 of 50-59 years; and (IV) 36 of 60-77 years. In male age ranged between 32-77 years, with mid age 53 year, while in females 30-73 with mid age 51 years.

The study revealed, that at the level of age groups, mean values of blood urea, blood creatinine, blood glucose and phosphorus, were higher than reference values. While mean values of albumin, sodium, and potassium were within normal range, meanwhile mean value of protein was lower than normal. At individual levels, blood urea, creatinine, and phosphorus, levels were higher than reference values in all patients (100%). While blood sugar was higher in only 67 (62.04%); (male 38 (66.67%); female 29 (56.86%); albumin at 34 (31.48%); (male 16 (28.07%), female 18 (35.29%); meanwhile protein level showed 1 (0.93%) more than reference value (male 1 (1.75%); female 0%) and 60 (55.56%) less (male 32 (56.14%), female 28 (54.90%); Sodium 16 (14.81%) more; (male 15 (26.32%, female 1 (1.96%); and 11(10.19%) less (male 0%, female 11 (21.57%). and potassium levels were 40 (37.04%) more (male 25 (43.86%), female 15 (29.41%); and 3 (2.78%) less (male 1 (1.75%), female 2 (3.92%).

**Keywords:** Blood Constituents, Chronic Renal Failure, Diyala province.

## 1. Introduction

Diseases of the urinary system are amongst the most important causes of death in many countries throughout the world [1, 2].

Renal failure refers to many kidney and urinary tract diseases, leading to a gradual and progressive reduce of kidney function. Chronic Kidney Disease (CKD) is enhanced by different factors, including infections, immune diseases, diabetes, hypertension, endocrine disorders, cancer, and toxic chemicals. Associated with unhealthy lifestyle in the growing elderly population in industrialized and in some developing countries. It is the ninth leading cause of death in many industrialized nation throughout the world [1-6].

Chronic renal failure occurs over a period of weeks, months, or years – as the kidneys slowly stop working [7]. Nagata et al. [8] referred that the prevalence of chronic kidney disease would increase over time as a result of hypertension, glucose intolerance, obesity and hypercholesterolaemia.

Hemodialysis is one of the renal therapy [9]. Plays a vital role in the process of removal of waste products such as creatinine, urea and free water from the blood. Hemodialysis is usually performed for two or three times a week, the required times for dialysis vary from two or four hours [10], depending on different factors, as kidney function, amount of waste in body, level of salts and body weight [11].

Progression of kidney damage is marked by rise of two substances, blood creatinine and blood urea. Which used to evaluate kidney function [12].

Creatinine is produced from muscles and is excreted through the kidneys along with other waste products [13]. Males have higher serum creatinine levels than females because males have greater muscle mass.

Calculation based on serum creatinine and the age groups of the patient are used to estimate more precisely the degree of kidney function [14-16].

Urea an organic compound, is a waste product from dietary protein, filtered into urine by the kidneys [17, 18]. The level of urea in blood rises with kidney failure.

Therefore, we decided to evaluate the state of certain mineral, constituents in blood of patients submitted to hemodialysis. In addition to monitor blood urea and creatinine states pre and post hemodialysis.

## 2. Materials and Methods

### Patients and samples collection

Blood samples were collected from patients with renal failure presented to Educational General Baquba Hospital, center for hemodialysis, 2021. Study enrolled 108 patients with signs and symptoms of renal failure as identified by nephrologists. Among them, males were 57 (52.8%), and female 51 (47.2%), their age ranging between 30 – 77 years. The blood samples (10 ml) were collected before and after hemodialysis, centrifuged individually at 3000 rpm for 10 minutes to separate serum and stored at -20°C for biochemical evaluation.

**Table -1- Age groups of patients depended in the study**

Age group	Male	Female	Total
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30-39 years	7 (36.8%)	12 (63.2%)	19 (17.6%)
40-49 years	13 (52%)	12 (48%)	25 (23.1%)
50-59 years	20 (71.4%)	8 (28.6%)	28 (25.9%)
60-77 years	17 (47.2%)	19 (52.8%)	36 (33.3%)
Age range	32-77	30-73	30-77
Totally	57 (52.8%)	51 (47.2%)	108 (100%)

The determination of blood elements depended in study were performed by approved methods. The chemicals and kits that were used in this study were of the highest purity.

Statistical analysis

All analyses were performed in SPSS statistics version 23. Continuous variables were reported as means (Mean  $\pm$  SE), whereas categorical variables were expressed as the number and the proportions. T-Test was done in analysis,  $P < 0.05$  was considered as significant.

### 3. Results

The results of study revealed, that at age group level, mean values of blood urea, blood creatinine, blood glucose and phosphorus, were higher than reference values. While mean values of blood albumin, sodium, and potassium were within normal range, meanwhile mean value of blood protein was lower than normal (Table -3 and 4).

The study revealed that, at individual levels, blood urea, blood creatinine, and phosphorus, levels were higher than reference values in all patients (100%). While blood sugar level was higher in only 67 (62.04%); male 38 (66.67%); female 29 (56.86%), and albumin in 34 (31.48%); male 16 (28.07%), female 18 (35.29%); meanwhile protein level showed 1 (0.93%) more than reference value in male only 1 (1.75%); and 60 (55.56%) less; male 32 (56.14%), female 28 (54.90%); Sodium 16 (14.81%) more; male 15 (26.32%), female 1 (1.96%); and 11 (10.19%) less only in female 11 (21.57%). and potassium levels were 40 (37.04%) more male 25 (43.86%), female 15 (29.41%); and 3 (2.78%) less (male 1 (1.75%), female 2 (3.92%)). (Table- 3 and 4- )

**Table-3- Range of values of depended parameters in study at level of male and females**

Parameter	Male				Female			
	From	To	More	less	From	To	More	Less
Urea	59	185	57 (100%)	0%	45	173	51 (100%)	0%
Creatinine	1.5	9.5	57 (100%)	0%	1.7	9.2	51 (100%)	0%
Glucose	74	228	38 (66.67%)	0%	70	324	29 (56.86%)	0%
Albumin	25	45	16 (28.08%)	0%	29	43	18 (35.29%)	0%
Protein	35	88	1 (1.75%)	32 (56.14%)	54	78	0%	28 (54.90%)
Sodium	120	155	15 (26.32%)	0%	126	159	1 (1.96%)	11 (21.57%)
Potassium	3.0	8.1	25 (43.86%)	1 (1.75%)	2.8	8.8	15 (29.41%)	2 (3.92)
Phosphorus	1.5	8.3	57 (100%)	0%	1.8	8.4	51 (100%)	0%

**Table-4- Range of values of depended parameters in study at total individuals (Males and females)**

Parameter	Male and female			
	From	To	More	Less
Urea	45	185	108(100%)	0%
Creatinine	1.5	9.5	108(100%)	0%
Glucose	70	324	67(62.04%)	0%
Albumin	25	45	34(31.48%)	0%
Protein	35	88	1(0.93%)	60(55.56%)
Sodium	120	159	1(0.93%)	26(24.07%)
Potassium	2.8	8.8	40(37.04%)	3(2.78%)
Phosphorus	1.5	8.4	108(100%)	0%

Levels of blood urea were the highest in age group (III) (128.3  $\pm$  5.0); then (II) (127.4  $\pm$  6.4); (IV) (123.54  $\pm$  5.11); (I) (122.7  $\pm$  6.1) respectively. Total mean (124.6  $\pm$  2.9), all means of groups and total mean were higher than reference values (7- 22.4 mg/ dl).

Blood creatinine levels were the highest in age group (III) (5.6  $\pm$  0.3); followed by (II) (5.5  $\pm$  0.3); then, (IV) (5.41  $\pm$  0.24), (I) (5.1  $\pm$  0.3). Total mean (5.4  $\pm$  0.1), all means of groups and total mean were higher than reference values,

(0.8 – 1.4 mg/dl) in males and (0.56 – 1.0 mg/dl) in females.

Blood glucose was the highest in age group (II) (128.2  $\pm$  9.0); followed by group (IV) (127.19  $\pm$  9.3); then (I) (120.8  $\pm$  8.4); (III) (113.8  $\pm$  5.3). Total mean (122.8  $\pm$  3.9) all means of groups and total mean were higher than reference values (59-105 mg/ dl).

Blood levels of albumin were higher in age group (II) (38.2  $\pm$  0.7), (I) (37.2  $\pm$  0.9), (III) (36.9  $\pm$  1.0), (IV) (36.29  $\pm$  0.72). Total mean (37.0  $\pm$  0.4) all were within reference levels (36-52 g/l).

Blood levels of protein were highest in age group (III) (67.5  $\pm$  1.1); then (IV) (66.24  $\pm$  1.23), (II) (65.6  $\pm$  1.9); (I) (64.7  $\pm$  1.2). Total mean (65.8  $\pm$  0.9) all were lower than normal level (68-86 g/ l).

Sodium levels were highest in age group (IV) (139.62  $\pm$  1.05); then (II) (139.4  $\pm$  1.4), (III) (138.8  $\pm$  1.1), (I) (138.6  $\pm$  1.3). Total mean (139.2  $\pm$  0.6) all were within normal range (136-155 mmol/l).

Potassium levels were highest in (IV) (5.37  $\pm$  0.26), (III) (5.2  $\pm$  0.2), (II) (4.9  $\pm$  0.2), (I) (4.6  $\pm$  0.2). Total mean (5.1  $\pm$  0.1), within normal range (3.5 – 5.3 mmol/ l) except in group

(IV).

Phosphorus levels were highest in age group (II) ( $5.1 \pm 0.3$ ); then, (III) ( $4.8 \pm 0.3$ ), (IV) ( $4.77 \pm 0.26$ ), (I) ( $4.3 \pm 0.3$ ). Total mean ( $4.8 \pm 0.1$ ) all means of groups and total mean were higher than reference values ( $0.8 - 1.4$  mmol/l)

parameter	Age groups					Reference
	I	II	III	IV	Totally	
Urea mg/dl	122.7 $\pm 6.1$	127.4 $\pm 6.4$	128.3 $\pm 5.0$	123.54 $\pm 5.11$	124.6 $\pm 2.9$	7-22.4
Creatinine mg/dl	5.1 $\pm 0.3$	5.5 $\pm 0.3$	5.6 $\pm 0.3$	5.41 $\pm 0.24$	5.4 $\pm 0.1$	0.8-1.4
Glucose mg/dl	120.8 $\pm 8.4$	128.2 $\pm 9.0$	113.8 $\pm 5.3$	127.19 $\pm 9.3$	122.8 $\pm 3.9$	59-105
Albumin g/l	37.2 $\pm 0.9$	38.2 $\pm 0.7$	36.9 $\pm 1.0$	36.29 $\pm 0.72$	37.0 $\pm 0.4$	36-52
Protein g/l	64.7 $\pm 1.2$	65.6 $\pm 1.9$	67.5 $\pm 1.1$	66.24 $\pm 1.23$	65.8 $\pm 0.9$	68-86
Sodium mmol/l	138.6 $\pm 1.3$	139.4 $\pm 1.4$	138.8 $\pm 1.1$	139.62 $\pm 1.05$	139.2 $\pm 0.6$	136-155
Potassium mmol/l	4.6 $\pm 0.2$	4.9 $\pm 0.2$	5.2 $\pm 0.2$	5.37 $\pm 0.26$	5.1 $\pm 0.1$	3.5-5.3
Phosphorus mmol/l	4.3 $\pm 0.3$	5.1 $\pm 0.3$	4.8 $\pm 0.3$	4.77 $\pm 0.265$	4.8 $\pm 0.1$	0.8-1.4

The results revealed that blood urea reduce from (a range of  $123, 5 \pm 5.1$  to  $128.3 \pm 5.0$ ) in patient's pre hemodialysis to (a range from  $30.2 \pm 5.1$  to  $36.2 \pm 4.8$ ). While Creatinine level reduced from (a range from  $5.1 \pm 0.3$  to  $5.6 \pm 0.3$ ) in pre hemodialysis to (a range from  $2.7 \pm 0.2$  to  $3.2 \pm 0.3$ ) in post hemodialysis. t –test exhibit a significant to the Mean  $\pm$  SE values of blood urea and serum creatinine in all 4 groups and  $p < 0.05$  (Table -5 -).

Age group	Blood urea		Blood Creatinine	
	Pre	post	Pre	post
I	122.7 $\pm 6.1$	30.2 $\pm 5.1$	5.1 $\pm 0.3$	2.7 $\pm 0.2$
II	127.4 $\pm 6.4$	31.2 $\pm 5.5$	5.5 $\pm 0.3$	3.0 $\pm 0.1$
III	128.3 $\pm 5.0$	35.2 $\pm$ 4.5	5.6 $\pm 0.3$	3.2 $\pm 0.3$
IV	123.5 $\pm 5.1$	36.2 $\pm 4.8$	5.4 $\pm 0.2$	3.1 $\pm 0.4$
Total	124.6 $\pm 2.9$	34.5 $\pm 3.5$	5.4 $\pm 0.1$	3.2 $\pm 0.3$

## 4. Discussion

The current study showed that blood creatinine level was significantly higher than normal range (up to 1.4 mg /dl) in renal failure patients undergoing dialysis. As the creatinine level ranged from ( $5.1 \pm 0.3$ ) in age group (I), 30-40 years, to ( $5.6 \pm 0.3$ ) in group (III), 51-60 years. These values were lower than what recorded by other authors, as recorded it at ( $7.95 \pm 2.44$ ) in patients group. While showed that serum creatinine level was highest in age group (I) 21-40 years old ( $10.48 \pm 3.06$ ) and lowest ( $8.27 \pm 2.60$ ) in group (III) 61-80 years. Creatinine is a resultant of muscle metabolism and its elevated level in blood indicates kidney disease. [7] Suggest that difference

factors like age, sex and physical status of person affect serum creatinine level. [19] Found nearly similar results. The difference between age groups of creatinine may be attributed to the fact that smaller body size has lower metabolic demands and shorter individuals require less renal function.

The result of our study showed that, blood urea level was significantly higher than normal range levels up to ( $22.4$  mg/ dl). As the levels ranged from lowest in group (I) ( $122.7 \pm 6.1$ ) to highest in group (III) ( $128.3 \pm 5.0$ ). These levels were lower than what recorded by others, as recorded it at level of ( $165.24 \pm 34.77$ ) in patient group and ( $32.16 \pm 5.74$ ) in control group. While showed that the levels was ( $130.58 \pm 23.11$ ) in group [7] age 61-80 years, ( $133.98 \pm 36.41$ ) in age group (2) 41-60 years, and ( $138.44 \pm 49.31$ ) in age group (1) 21-40 years. Found that significant increase in urea and creatinine concentration in chronic renal failure patients when compared with those of the control group. Urea, one of the by- products of protein metabolism, accumulates in the blood of patients with kidney failure and causes uremia [20].

In current study blood albumin levels were within normal range, as they ranged between the highest ( $38.2 \pm 0.7$  in group (II) and lowest ( $36.29 \pm 0.72$ ) in group (IV). along with other chronic interstitial diseases minimal normoalbuminemia has been defined as features of Chronic Kidney Disease of unknown etiology CKDu. [21] Showed essentially normal serum albumin. Hypoalbuminemia was common in CKD (78.4%), but unusual in CKDu.

In CKDu

In current study blood phosphorus levels were higher than normal range ( $0.8 - 1.4$  mmol/ l), as they ranged between the highest ( $5.1 \pm 0.3$  in group (III)) and lowest ( $4.3 \pm 0.3$ ) in group (I). The phosphate retention and hyperphosphatemia were extremely common in patients with End Stage Renal Diseases (ESRD) and CKD [22]. Fernando et al. [21] only minority of group had bone mineral abnormalities.

Current study blood potassium levels were within normal range ( $3.5-5.3$ ), as they ranged between the highest ( $5.37 \pm 0.26$  in group (IV) and lowest ( $4.6 \pm 0.2$ ) in group (I). Hypokalaemia has been described in

In comparison between the pre and post hemodialysis levels of blood urea, the present study recorded that the levels reduced from a range of ( $122.7 \pm 6.1$ ) to  $128.3 \pm 5.0$ ) pre hemodialysis to a range of ( $30.2 \pm 4.1$ ) to  $31.2 \pm 5.5$ ) post hemodialysis. This agree with who, showed that the level reduced from a range of ( $130.58 \pm 23.11$  to  $138.44 \pm 49.31$ ) to a range of ( $54.87 \pm 28.82$  to  $59.66 \pm 16.05$ ). There was significant difference in the levels of serum urea observed before and after hemodialysis with respect to different age groups: ( $138.44 \pm 49.31$ ) in 21-40 years, ( $133.98 \pm 36.41$ ) in 41-60 years, ( $130.58 \pm 23.11$ ) in 61-80 years before hemodialysis, reduced to ( $54.87 \pm 28.82$ ) in 21-40 years, ( $58.26 \pm 19.95$ ) in 41-60 years and ( $58.26 \pm 19.25$ ) in 61-80 years, after hemodialysis. Generally urea accumulation in blood serum of kidney failure patients arises from the degradation of food and tissues such as muscle. The high level of urea in blood leads the body very sick unless remove it from the blood

stream by kidney [23]. Mass differences [24]. During hemodialysis, excess urea from the patient's blood is slightly removed in order to prevent accumulation. The occurrence of balanced amount of consumed proteins is also an important step to avoid excessive production of urea [25].

According to Draczevski et al. [2] the assessed pre and post hemodialysis urea levels, obtained reflected a significant reduction in serum levels, indicating hemodialysis as an efficient technique. Removal of waste during dialysis also depends upon proper timings of dialysis, patient awareness, and appropriate dialyzer and dietary habits of patients.

The current study showed that creatinine levels reduced from a level ranged from (5.1 ±0.3 to 5.6 ±0.3) to a range of (2.70 ±0.2 to 3.2± 0.3). Hemodialysis induced an effective act on serum creatinine level which reduced to mean normal value. All hemodialyzed patients had serum creatinine below (5.03 ± 1.76) after dialysis (reduced from a range of (8.27 ±26.0 to 10.48 ±3.06) to a range of (4.36 2.54 to 5.03 ±1.76). The results of our study were near to the findings of [19] in renal failure patients undergoing hemodialysis which has positive effected on a significant fall in serum creatinine level. Creatinine clearance is the best method for the examination of kidney functioning. Reduction in the level of creatinine during hemodialysis is also used as a surrogate marker of the inadequacy of dialysis. It was also noted that people between the age group of 41 and 60 years were more prone to kidney failure which might be due to conditions like hypertension, diabetes or some other age related changes. Urea and creatinine levels are important biomarkers as they play a pivotal role in diagnosis and follow-up of kidney failure.

In current study, groups (II) 40-49 years and (III), 50-59 years, were mostly affected by CKD, while less group was (I), 30-39 years. The peak affected age of CKD correlated with life expectancy of the country. In Iraq with a life expectancy of 74.9 years [26], peak age of CKD was 60 years [27]. In western countries with a life expectancy more than 80 years [26], peak incidence is found at the age of 75 years [28]. The peak age group was 51 years which is unusual for a country with an average life expectancy of more than seventy years [21]. Alarming, more than 50% of cases had family history indicating the genetic tendency of CKDu [29, 30]. In comparison to other forms of CKD, there are several described characteristics features in CKDu. [29] Young or middle –aged male farmers were mostly affected by CKDu. It was noted that people between age group of 41 and 60 were more prone to kidney failure which might be due to conditions like hyper tension, diabetes or some other age related changes. The results indicated that different factors as age, sex and physical status of person affect serum creatinine levels [8].

## 5. Conclusions and Recommendations

Urea and creatinine levels are important blood constituents as they play an important role in diagnosis and follow-up of kidney failure.

The assessed pre and post hemodialysis urea levels, reflected a significant reduction in serum levels, indicating hemodialysis as an efficient technique. Removal of waste during dialysis depends upon proper timings of dialysis, patient awareness, and appropriate dialyzer and dietary habits of patients.

In current study, groups (II) 40-49 years and (III), 50-59 years, were mostly affected by CKD, while less group was (I), 30-39 years. The study revealed that all patients undergo dialysis have high blood urea, blood creatinine and phosphorus. But not all of them suffered from higher level of blood glucose and potassium. Meanwhile albumin, protein and sodium levels showed depress level in comparison with reference values.

A firm relationship was observed between serum creatinine and serum urea levels among renal failure patients among varied age groups. Both serum creatinine and serum urea are widely accepted biomarkers to assess the renal functions.

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