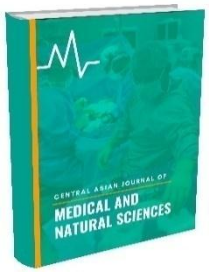
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 04 Issue: 04 | Jul- Aug 2023 ISSN: 2660-4159

http://cajmns.centralasianstudies.org

The Percentage of Anemia in Chronic Kidney Disease Patients: A Single Center Study

Alaa H. Abed (PhD)[1], Mohammed Ail Naeem (BSc)[2], Raffah Jassim Ali (BSc)[2], Fatima Hussein Nayyef (BSc)[2], Hader Mohammed Nazar (BSc)[2]

Received 22nd May 2023,
Accepted 23rd June 2023,
Online 29th July 2023

[1] *Assistant professor in Community Medicine, Basra University College of Science and Technology, Basra, Iraq*

[2] *Bachelor senior student, Basra University College of Science and Technology, Basra, Iraq*

Abstract: This study focuses on reviewing the existence, probable risk factors, and consequences of anemia in patients with chronic kidney disease (CKD). Anemia in CKD is mainly caused by decreased production of erythropoietin (EPO) due to renal failure and/or altered iron balance. Treatment with EPO or iron supplements may be necessary, but the potential benefits and risks of these therapies must be carefully considered. **Aim:** The aim of conducting this research was to determine the existence of anemia in chronic kidney disease patients who are admitted to the Center for Kidney Diseases and Transplantation in Basra. **Patients and method:** This cross-sectional study was conducted from December 2022 to January 2023, at Al-Sadr Teaching Hospital in Basra City. The study population included all patients with renal failure of both sexes and of all ages. Data was collected through a structured questionnaire, patient interviews, and review of medical records. The sample size was determined to be 62 patients, to whom the procedure of measuring CBC and RFT. The study received official endorsement from the Basra Directorate of Health, the Hospital Administration, and the Director of Central Laboratories. **Results:** In this study, the average age of the study population was 50.5 years and about 53.3% were females. The median hemoglobin level of the study population was found 8.8gm/dL. Hypertension was found to be associated with 95% of the sample. It is also clear that about 96.7% of

the patients were taking medications. **Conclusion:** There were similarities between Iraqi CKD patients and international patients with respect to the most common reasons for consultation when CKD was detected, the most common chronic diseases associated with CKD, associations of abnormal urine color, and hemoglobin level, RBC, WBC, PLT, MCH, and MCHC in CKD. There was some variation in the levels of blood urea and serum creatinine in CKD. Anemia appears to be associated with CKD. Chronic kidney disease has nothing to do with level of education and profession.

Key Wards: chronic kidney disease, anemia, hemoglobin, erythropoietin.

Introduction

Iraq's health problems related to chronic kidney disease (CKD) are projected to worsen and continue to be a major national health concern [1]. A number of faults ensue from the kidneys' loss of function in End Stage Renal Disease(ESRD), which causes unfavorable health issues and results [2]. When ESRD is identified, the patients will either have a kidney transplant or have to go through dialysis for the remainder of their lives [3].

The major responsibilities of the kidneys are to sustain and maintain fluid, electrolyte, and metabolic acid-base balance. This is done by regulating solute and fluid levels, preserving nutrients, and excreting metabolic wastes [4]. Endocrine and exocrine activities of the kidneys include the regulation and upkeep of vital biological processes in the body. Acid-base control, excretion of bodily waste, fluid and electrolyte balance, and other exocrine activities are also included [5]. Endocrine processes include hormone production for blood pressure control and red blood cell synthesis [6], as well as the activation of vitamin D for the incorporation of calcium into bones [7].

The occurrence of renal impairment lasting at least three months is considered chronic renal disease, as is a decrease in the glomerular filtration rate (GFR) below 15 mL/min/1.73m2 [8]. Diabetes, high blood pressure, and anemia are becoming more common, and chronic kidney disease is also expected to become common. Acute kidney injury (AKI) and type 2 diabetes mellitus (T2DM) are among the most common diseases in people with CKD [9].

The most prevalent illness among CKD patients is anemia. When kidney function declines, the prevalence of anemia steadily rises [9]. Both CKD progression and patient survival have a substantial correlation with anemia. Moreover, anemia in CKD patients directly affects medical expenses and quality of life (QOL) during both the pre-dialysis and dialysis periods. With advancing age, anemia (with or without CKD) is substantially more common [10]. Erythropoietin (EPO) insufficiency,

reduced EPO responsiveness, limited red blood cell survival, iron deficiency, and chronic inflammation are the main causes of anemia in CKD patients [11]. Patients with chronic renal disease frequently get anemia as a consequence. Patient quality of life might be impacted if mistreated. Anemia in this patient population might have a variety of reasons. Patients may have iron shortage when their kidney function declines, which will reduce the amount of iron that gets to their bone marrow as a result of medicines and dietary limitations [12].

There are several complications that can arise from anemia in CKD patients, including a lack of (EPO), the toxic effects of uremia on marrow precursor cells, lower red cell survival, and increased blood loss because of capillary fragility and suboptimal platelet function. [13]. Also, it results in decreased dietary iron intake, absorption, and utilization. Moreover, according to some research, men get anemia related to CKD more commonly than women. Consequently, anemia in CKD worsens with other illnesses including diabetes, cardiovascular disease, and hypertension [14].
Anemia is a frequent side effect of chronic kidney disease (CKD), which places a heavy burden on individuals and the healthcare system. The clinical practice guidelines for Kidney Disease Improving Global Outcomes (KDIGO) define anemia of CKD as hemoglobin (Hb) 12.0 g/dl for non-pregnant women and 13.0 g/dl for men. This anemia is primarily brought on by a decline in erythropoietin (EPO) production by the failing kidney and/or altered iron homeostasis [15].
Those with CKD could not use their body's iron reserves as effectively. Because of this, a lot of individuals, especially those who get dialysis, would need to have greater renal function. Additionally, additional iron treatment may be necessary for those with chronic renal illness. The hormone erythropoietin stimulates bone marrow to make its own blood [16].

Each patient will eventually need to be treated with injections of erythropoietin or similar medications. Several iron and EPO products have gained approval in recent years to treat anemia in people with CKD. Also, many of papers have covered the benefits of each treatment as well as any potential risks related to long-term treatment [17].

The available recommendations provide guidance to healthcare practitioners on how to screen CKD patients for anemia and which patients should be evaluated for alternative causes of anemia [18].

The aim of conducting this research was to determine the existence of anemia in chronic kidney disease patients who are admitted to the Center for Kidney Diseases and Transplantation in Basra.

METHOD:
This cross sectional study was conducted from December, 8 2022 to January, 12 2023 and involved extracting data from the records of the Center for Kidney Diseases and Transplantation at Al-Sadr Teaching Hospital in the center of Basra City. In addition, interviews with the patients were carried out to complete data collection form. A research plan had been developed to conduct this research.

The study population
-inclusion criteria:

The study was conducted on chronic kidney disease patients undergoing hemodialysis including reviewing their case sheets. It involved all renal failure patients of both sexes and of all ages.
There were no exclusion criteria.

Sampling

The days of work were simple randomly selected to collect data from the patients. It was decided that 62 patients would be enough to conduct the study based on the result of the equation given below.

$$N= Z^2 p (1- p) / m^2[19]$$

Where :

Z:1.96 P: 0.6375 [20] M: 0.12

$$N= \frac{(1.96)^2\times0.6375\times0.3625}{0.12^2} = \frac{3.8416\times0.23109375}{0.0144} = \frac{0.88776975}{0.0144} = \mathbf{61.65067\simeq60\ patients.}$$

Study tool

A set of questions containing the required information about the patients was structured and evaluated by experts.

The procedure

It was done by going to the Al-Sadr Teaching Hospital and interviewing the patients in the Dialysis and Kidney Transplantation Department of the Center for Kidney Diseases and Transplantation. The data was collected by asking the patients, taking their history and collect their laboratory analysis results from hospital records.

Variables determination /definition

The data was taken through a set of questions, which included: The patient's age; sex; educational attainment, according to the number of years of schooling that included (illiterate, primary, secondary, tertiary education); the occupation, whether it was self-employed, retired or working for others; the percentage of hemoglobin measured in units (g / dl); PLT (10^3 / µL); RBC been taken (10^6 / µL); WBC (10^3 / µL) MCH (pg); MCHC (g / dl); blood urea measured in mg / dl; measured in mg / dl; the creatinine ratio is measured in mg / dl.

Official endorsement

The approval of Basra Directorate of Health, the hospitals management, and the director of the central laboratories in these hospitals, were obtained.

Training

Training on data collection process was conducted by members of the research team to ensure effectiveness and efficiency.

Pilot study

An experimental study was conducted on 10 patients with reviewing their case sheets to see if the research was feasible or not.

Checking the quality

Single checking: it was used to verify the data taken by the filling in after each patient to ensure the correctness and completeness of the information.

Double checking: The data forms were exchanged among the team members to verify if they were complete and correct. They were completed and/or corrected where needed, on the next day if any.
Triple checking: Then it was verified by the supervisor after feeding it into the software .

Statistical Analysis

For Statistical analyses we used the SPSS software (version 26, SPSS, Chicago, IL, USA). We expressed categorical variables as frequencies and percentages and quantitative variables as mean± standard deviation (SD) or median (minimum– maximum). We used Kolmogorov Smirnonv and Shapiro Wilk tests to evaluate whether the distribution of quantitative data was normal or not.

RESULTS:

Table (1) shows that the median age of the study population was 50.5 years with a minimum of 19 years and maximum of 80 years and a male: female ratio of 1.14:1. Most of them were primary school certificate holders (60%), followed by secondary school certificate holders (25%). From occupation point of view, housewives were the most frequent (41.7%) followed by self-employed (33.3%).

Table (1): Sociodemographic characteristics of the study patients

Variable	**Mean ±SD**	**Median (Min.-Max.)**
Age	48.88±16.35	50.5 (19-80)
	Frequency	**Percent**
Sex:		
Male	32	53.3
Female	28	46.7
Academic Achievement:		
Illiteracy	7	11.7
Primary School Certificate	36	60.0
Secondary School Certificate	15	25.0
Bachelor Degree	2	3.3
Occupation:		
Housewife	25	41.7
Self employed	20	33.3
Retired	11	18.3
Student	2	3.3
Governmental employed	1	1.7
Journalist	1	1.7
Total	60	100.0

The most frequent causes, of consultation when chronic kidney disease was discovered, were hypertension (28.3%) and leg swelling (23%).

Table (2): The cause of consultation when chronic kidney disease was discovered

Chief Complaint	Frequency	Percent
Hypertension	17	28.3
Leg swelling	14	23.3
Repeated vomiting	9	15.0
Back Pain	4	6.7
Kidney stones	4	6.7
Diarrhea	2	3.3
Dizziness	2	3.3
Hyperglycemia	2	3.3
Nausea	2	3.3
Urinary tract infection	1	1.7
Anemia	1	1.7
Atherosclerosis	1	1.7
Thalassemia	1	1.7
	Mean±SD	**Median (Min.-Max.)**
Duration between first admission and dialysis	1.75±1.8	1 (0-8)
Number of dialyses	2.28±1.04	3 (0-4)

About 95% of the patients had hypertension before developing chronic kidney disease and 28.3% of them had diabetes mellitus (Table 3).

Table (3): Presence of other chronic diseases

Disease	Frequency	Percent
Hypertension	57	95.0
Diabetes	17	28.3
Cardiomegaly	2	3.3
Thalassemia	1	1.7
Asthma	1	1.7
Total	**60**	**100.0**

It is clear from Table (4) that 61.7% of the study population had abnormal colored urine. Moreover, it shows that the median of urination times was 2, ranged from 0 to 6 times.

Table (4): Current urine characteristics

Variable	Frequency	Percent
Urine Color:		
No urine	7	11.7
Normal	16	26.7
Abnormal	37	61.7
	Mean±SD	**Median (Min.-Max.)**

Frequency of Urination/ day	3±1.51	2 (0-6)
Total	60	100.0

When blood was investigated, it was found that the median values of blood urea, blood creatinine, hemoglobin, red blood cells, white blood cells, platelets, mean corpuscular hemoglobin, and the mean corpuscular hemoglobin concentration were 129.38, 9.295, 8.8, 3.46, 6.225, 182.5, 26.05 and 30.7 respectively (Table 5).

Table (5): The results of investigation of the study population

	Blood Urea mg/dL	**Creatinine mg/dL**	**Hb g\dL**	**RBC 10^6 /µL**	**WBC 10^3 /µL**	**PTL 10^3 /µL**	**MCH pg**	**MCHC g/dL**
Mean	134.35	9.72	8.61	3.55	6.87	191.37	25.78	30.78
Median	129.38	9.295	8.8	3.46	6.22	182.5	26.05	30.7
SD	52.29	3.94	1.38	0.96	3.07	68.64	2.61	1.51
Minimum	23.54	2.34	4.7	2.22	3.17	91	18.4	27.8
Maximum	280	18	11.2	8.13	19.53	437	30.5	35.7

In Table (6), it is clear that about 96.7% of the patients were taking medications.

Table (6): Details of the medication currently used

Variable	**Frequency**	**Percent**
Current medication details:		
Take a medication	58	96.7
Does not take	2	3.3
Total	**60**	**100.0**

By testing the probability of correlations among quantitative variables, it was found that age was significantly inversely correlated to hemoglobin level with a correlation coefficient of 30% and to MCHC level with a correlation coefficient of 26.9%; hemoglobin was significantly directly proportional correlated to red blood cells count with a correlation coefficient 77.9%; blood urea level was directly proportionally correlated to blood creatinine level with a correlation coefficient of 53.5%; red blood cells count was significantly inversely correlated to 29.8%; white blood cells count was directly proportionally correlated to platelets count; and MCH was directly proportionally correlated to MCHC (Table 7).

Table (7): Spearman non-parametric correlations among age, hemoglobin, creatinine, and MCH

		Blood Urea mg/dL	**Creatinine mg/dL**	**Hb g\dL**	**RBC 10^6 /µL**	**WBC 10^3 /µL**	**PTL 10^3 /µL**	**MCH pg**	**MCHC g/dL**
Age(year)	R	0.089	-0.120-	-0.300-*	-0.022-	0.120	0.021	-0.082-	0.269*
	Sig.	0.499	0.361	0.020	0.868	0.360	0.874	0.531	0.038
Hb g/dL	R		0.001	0.211	0.779**	-0.155-	-0.079-	0.097	0.238
	Sig.		0.995	0.106	0.0001	0.239	0.546	0.462	0.067
Blood Urea	R			0.535**	-0.007-	0.243	0.143	-0.066-	0.080

mg/dL	Sig.			0.0001	0.956	0.062	0.277	0.614	0.546
Creatinine	R				0.136	0.140	-0.058-	0.028	-0.016-
mg/dL	Sig.				0.301	0.287	0.660	0.829	0.906
RBC	R					-0.088-	0.073	-0.298-*	0.106
10^6 /µL	Sig.					0.505	0.579	0.021	0.422
WBC	R						0.377**	-0.061-	0.211
10^3 /µL	Sig.						0.003	0.646	0.106
PTL	R							-0.194-	-0.070-
10^3 /µL	Sig.							0.138	0.594
MCH	R								0.287*
pg	Sig.								0.026

Hemoglobin levels were compared when categorized according to sex, education level, and occupation, no any significant statistical differences could be found (Table 8).

Table (8): Distribution of hemoglobin levels categorized according to sex, education level, and occupation

	Hb (g\dL)			Sig.
	N	Mean	SD	
Sex:				
Male	32	8.6906	1.64618	0.621*
Female	28	8.5118	1.02211	
Education level:				
Illiteracy	7	8.4571	1.47293	
Primary School	36	8.5119	1.35030	0.481**
Intermediate School Certificate	15	8.7133	1.47448	
Bachelor	2	10.0500	0.77782	
Occupation				
Housewife	25	8.5372	0.90867	
Self employed	20	8.5300	1.62484	
Retired	11	8.5909	1.89286	0.634**
Student	2	8.5500	0.35355	
Governmental employed	1	10.2000	----------	
Journalist	1	10.6000	----------	
Total	60	8.6072		

* t-Test

** OneWay ANOVA

Hemoglobin level was found to be significantly inversely correlated to the number frequency of urination/ day with correlation coefficient of 32% and the number of days were found to be directly proportionally correlated to the number of dialyses with a correlation coefficient of 37.9% (Table 9).

Table (9): Spearman nonparametric correlations

		Number of days	Number of dialyses	Frequency of urination/ day
Hb (g\dL)	R	-0.037	0.227	-0.320-*
	Sig.	0.776	0.081	0.013
Number of days from admission to conducting dialysis	R		0.379	
	Sig.		0.003	

Table (10) shows that there was no any significant difference in the levels of hemoglobin when categorized according to urine color.

Table (10): Differences of hemoglobin levels according to the urine color

Urine color	Hb (g\dL)			Sig.*
	N	Mean	SD	
Non	7	9.0286	0.60198	0.394
Normal	16	8.8625	1.26326	
Abnormal	37	8.4170	1.51800	
Total	60	8.6072	1.38204	

* Oneway ANOVA

DISCUSSION:

This study aimed to find out the percentage of anemia in patients with renal failure, who were admitted to the hospital for follow up or dialysis purposes. During this study, there were some issues that may have affected the research conclusions, including memory recalling of some of the medical history information of the patient. Also, there were some patients whose health conditions were not suitable for taking information from them.

As well as not knowing the type of treatment that is given to the patient in the case of ward by some doctors, because some doctors had not written in the case sheet, and also because the patient does not know the types of treatment.

Most of these points can be grouped under the non-completeness and non-accuracy of the medical records data.

In this research the median age of anemic CKD patients in this study was 50 years, which was consistent with Maskey M, *et al* [21]. However, it differs from Brenda David J. Cohen median age, which was 66 years [22]. The reasons for differences in age of anemic patients in CKD between countries can be complex and multifactorial, and may involve factors such as healthcare systems, demographics, lifestyle factors, genetics, and treatment practices [23].

Also, in this research, the average male: female ratio was 1.14:1, which was correspondent to Elizabeth A. Miller, *et al* [24].

In this research, it was found that the majority of the study sample were primary school certificate holders, followed by secondary school certificate holders, which was consistent with Keith C. *et al* [25].

Regarding occupation, the researchers could not find any figure in the international literature which considers this issue.

It was found that the most common reason for consultation, when CKD was discovered, were hypertension (28.3%) which corresponds with Josef Coresh [26]. However, it differs from Chunhua Liao, *et al* (12%) [27]. who stated that such a difference in the existence of hypertension among patients with anemia in chronic kidney disease between countries may be due to various factors such as differences in the patient population, genetic factors, environmental factors, and healthcare practices [28].

The other most common reason for consultation, when CKD was detected, was leg swelling (23%), which was consistent with D. Weisbord *et al* [29]. Although, it differs from Hsi-Hao Wang, et al (38%). There could be various reasons that could contribute to the difference in leg swelling among anemic patients with chronic kidney disease between countries; differences in patient demographics, comorbidities, and treatment practices. For example, if patients in a country have more severe chronic kidney disease or are more likely to take certain medications that affect fluid balance, this may contribute to a higher prevalence of leg swelling in anemic patients [30].

The researchers found that the most common prevalent chronic disease, when CKD was detected, was hypertension (95%). This study was in contrast to a study in Malaysia by Zhang L, et al (60.8%) [31]. There are some possible reasons for the differences in the prevalence of hypertension in chronic kidney disease between countries. Among these reasons are racial and genetic differences, as well as differences in environmental factors [32].

The other most common chronic disease, when CKD was discovered, was diabetes (28.3%). This study differs with Chen Y, *et al* (45.7%) [33]. The study also disagreed with Ranjit Mohan Anjana, *et al* (17.2%) [34]. Again, the possible reasons for the difference in prevalence of diabetes mellitus can be due to differences in genetic predisposition, lifestyle factors, environmental factors, healthcare systems and access to treatment. Additionally, differences in study methodology, sample size and patient population can also contribute to the variation in reported prevalence [35].

In this study, the researchers found that 61.7% of the study population had abnormally colored urine, and this study disagreed with Hamid Nasri, *et al* (31.5%) [36]. The study also disagreed with Mustafa Serkan Karakaş, *et al* (25,5%) [37]. International research found that the most common association of abnormal urine color was with hematuria, proteinuria, pyuria, dehydration, and certain medications/supplements can cause changes in urine color [38].

The researchers also found that the average frequency of urination was 2, which was consistent with Tae-Hee Kim, *et al* [39].

In this study, the researchers found that the median values for hemoglobin were relatively close to Kim JH, *et al* (9.9gm/dl) [40].

Also in this study, after examining the patients' blood, it was found that the median values of blood urea differed with the study of Santoro A, *et al* (82.4mg/dl) [41]. The median values for blood urea levels in anemic patients with CKD may vary due to several factors. CKD patients may have different stages of kidney disease and levels of kidney function, which can impact blood urea levels. Additionally, comorbidities and other factors such as age, sex, and race can also impact blood urea levels [42]. Treatment approaches and medications used to manage CKD and anemia can also influence blood urea levels [43]. It is important to consider each patient's individual medical history and characteristics when interpreting their blood urea levels [44]

It was found in this study that the median values of creatinine among chronic kidney disease patients differed with Park JI, *et al* (2.5mg/dl) [45]. The reason for the difference in mean values of creatinine among patients with chronic kidney disease can be attributed to variations in the severity of kidney damage and underlying health conditions, among other factors. As kidney function declines, creatinine levels tend to increase. However, the severity of CKD can vary among patients, leading to differences in mean creatinine values. Additionally, underlying health conditions that cause or contribute to CKD, such as diabetes and hypertension, can affect creatinine levels and thus impact the mean values [46].

It was also found in this the study that the median values red blood cells count was consistent with Santoro A, *et al* (3.9*106/µl) [47].

Moreover, as it was found in this study, the median value of white blood cells count was consistent with Ohkawa S, *et al* (6.2*103/ µl) [48] and close to Roshani A, *et al* (7.1*103/ µl) [49].

The researchers found in this the study that the median value of platelets was relatively consistent with Kim H, *et al* (209*103/ µl) [50]. The reason for the lower platelet count in CKD patients is likely multifactorial and may be related to reduced production of platelets due to decreased erythropoietin production, increased platelet destruction due to bleeding and clotting disorders, medications, comorbidities, and chronic inflammation associated with CKD. However, further research is needed to fully understand the relationship between CKD and platelet count [51].

This study indicates that the median values of MCH were consistent with Sasongko, *et al* (30.4pg) [52]. Moreover, it was found in this study that the median value mean corpuscular hemoglobin concentration was consistent with Aliberti GM, *et al* (33.6gm/dL) [53].

The researchers of this study found that about 96.7% of the patients were taking medication. This study disagrees with McDonald R, *et al*, who found only 80.3% were taking medication [54]. The reasons for differences in rates of medication use among patients with CKD include disease severity, comorbidities, access to healthcare, patient preferences, and health literacy. Disease severity can impact the choice of medications and dosages used to manage CKD, while comorbidities can influence the choice of medications used to manage both CKD and other health conditions. Differences in access to healthcare and availability of medications can also impact rates of medication use, as can patient

preferences and health literacy. In order to optimize treatment outcomes, treatment decisions should be individualized based on a patient's unique medical history, comorbidities, and preferences [55].

Although hemoglobin levels in healthy women are significantly lower than those of healthy men, in this study, it was documented that hemoglobin levels did not differ among CKD patients, when classified according to sex. This was different from Li L, *et al* [56].

It was also found in this study that the comparison of hemoglobin levels when classified according to the level of education and occupation is compatible with Kim H, *et al* [57]. However, in patients with CKD, this difference may disappear or become less pronounced due to several factors [58].
The inverse correlation which was found between hemoglobin level and urination frequency/day when compared with other research, and this finding was found to be consistent with Ghosh A, *et al* [59].

Regarding the relationship between the number of dialysis and the number of days the patient was admitted for the first time, the researchers could not find a similar finding, but the researchers found a study showing that CKD patients who received a higher number of dialysis sessions during their first hospitalization had a shorter length of stay compared to patients who received fewer dialysis sessions [60].

In this study, the researchers found that there was no significant difference in hemoglobin levels when categorized by urine color, and this study differs with a study by Ayako Nishimura, K *et al* [61].

There may be several reasons behind the discrepancy in the association between urine color and hemoglobin level in CKD patients. One possible explanation is that hematuria (blood in the urine) can be caused by factors other than CKD-related anemia, such as kidney stones, urinary tract infections, or bladder cancer. Therefore, not all cases of hematuria may be directly linked to low hemoglobin levels in CKD patients. Additionally, some CKD patients may experience fluctuations in hemoglobin levels that do not always correspond with changes in urine color. Finally, the severity and stage of CKD can also affect the association between urine color and hemoglobin levels, as more advanced stages of the disease may cause greater fluctuations in both parameters [62].

CONCLUSIONS:

1. There are similarities in the Iraqi CKD patients with international regarding the sociodemographic characteristics, most common reasons of consultation when the CKD was discovered, the most common chronic disease associated with CKD, associations of abnormal urine color, the median hemoglobin level in CKD patients, RBC count, WBC count, platelets count, MCH, and MCHC.
2. In addition to the presence of anemia, there was a disappearance in the normal male-female hemoglobin level difference.
3. There was some variability in the median levels of blood urea and blood creatinine in CKD patients.
4. CKD associated-anemia was not related to level of education and occupation.

RECOMMENDATIONS:

It is recommended that the health authorities to:

1. augment the program of health promotion regarding educating patients with CKD on how to reduce the possibility of developing anemia.
2. Explain the results of the follow-up laboratory investigations to the patients and how to improve the management according to these results.

REFERENCES:

1. Kidney Disease: Improving Global Outcomes (KDIGO) Chronic Kidney Disease Work Group. KDIGO 2020 Clinical Practice Guideline for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease. Kidney Int Suppl. 2020;10(1):1-136.
2. Kopple JD, Fouque D, Hwang SJ, et al. KDOQI Nutrition in CKD Guideline 2020 Update: Recommendations for Assessment, Diagnosis, and Intervention. Am J Kidney Dis. 2020;76(3S1):S1-S107.
3. Chand D, Zaidi S, Deshpande P, et al. KDOQI Clinical Practice Guidelines for CKD in Children and Adolescents 2021 Update. Am J Kidney Dis. 2021;77(4S1):S1-S143.
4. Carlstrom M, Wilcox CS, Arendshorst WJ. Renal Physiology. Compr Physiol. 2020;10(1):195-292. doi: 10.1002/cphy.c190016.
5. Gilbert J, Veazie S, Joines K, et al. Patient Navigation Models for Lung Cancer [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2018 Dec. Available from: https://www.ncbi.nlm.nih.gov/books/NBK535461/
6. Raphael KL, Zhang Y, Wei G, et al. The Effect of Erythropoiesis-Stimulating Agents on Health-Related Quality of Life in Anemia of Chronic Kidney Disease: A Systematic Review and Meta-analysis. Ann Intern Med. 2021;174(1):19-29. doi: 10.7326/M20-2224.
7. Feldman D, Krishnan AV, Swami S, Giovannucci E, Feldman BJ. The role of vitamin D in reducing cancer risk and progression. Nat Rev Cancer. 2014;14(5):342-357. doi: 10.1038/nrc3691. PubMed PMID: 24705652.
8. Levey AS, Eckardt KU, Dorman NM, Christiansen SL, Hoorn EJ, Ingelfinger JR, et al. Nomenclature for kidney function and disease: report of a Kidney Disease: Improving Global Outcomes (KDIGO) Consensus Conference. Kidney Int [Internet]. 2020;97(6):1117–29. Available from: https://doi.org/10.1016/j.kint.2020.02.010
9. Saran R, Robinson B, Abbott KC, et al. US Renal Data System 2021 Annual Data Report: Epidemiology of Kidney Disease in the United States. Am J Kidney Dis. 2022;79(1S1):S1-S96. doi: 10.1053/j.ajkd.2022.01.005.
10. Ahmad, Adeel Jamil, Bushra Jamil, and Talha Mahmud Anemia in Chronic Kidney Disease: A Major Risk Factor for Cardiovascular Disease. Jamal Journal Cardiology Research and Practice 2020; DOI: 10.1155/2020/2643195
11. Szczech, L. A., & Barnhart, H. X. Inflammatory biomarkers in CKD: pathophysiology and potential therapeutic targets. Clinical Journal of the American Society of Nephrology, 2018;13(2), 289-291. doi: 10.2215/CJN.11151017

12. Gafter-Gvili A, Schechter A, Rozen-Zvi B. Iron deficiency anemia in chronic kidney disease. Acta haematologica. 2019;142(1):44–50.
13. Fishbane, S., et al. KDIGO Clinical Practice Guideline for Anemia in Chronic Kidney Disease. Kidney International Supplements, 2020; 10(1), e1-e95. doi: 10.1016/j.kisu.2020.03.001. PMID: 32307254.
14. Hsu, C. Y., & McCulloch, C. E. Anemia and cardiovascular disease in chronic kidney disease. Kidney international reports, 2020; 5(3), 247-255. doi: 10.1016/j.ekir.2019.12.004
15. Feldman HI, et al. Chronic Kidney Disease Epidemiology Collaboration. Kidney Int Suppl. 2013;3(1):19-62. doi: 10.1038/kisup.2012.64.
16. Canavese C, Bergamo D, Ciccone G, et al. Iron metabolism in chronic kidney disease: novel targets for future research and development. Journal of Nephrology. 2017;30(5):611-619. doi:10.1007/s40620-017-0424-4
17. Fishbane S, Spinowitz B, Patel V, et al. Iron and erythropoiesis-stimulating agent dosing strategies in chronic kidney disease: a randomized controlled trial. Am J Kidney Dis. 2015;66(5):815-825. doi: 10.1053/j.ajkd.2015.05.021
18. Fishbane S, Hazzan AD, Halinski C, et al. Kidney Disease: Improving Global Outcomes (KDIGO) 2020 Clinical Practice Guideline for Anemia in Chronic Kidney Disease. Kidney Int. 2021;99(3S):S1-S50. doi: 10.1016/j.kint.2020.10.025. PMID: 33602361.
19. Wiley, Daniel WW, Cross CL. Biostatistics: a foundation for analysis in the health sciences.2018; Nov 13.
20. Alyassin FF. The patient care and complications of hemodialysis procedure for renal failure patients: A descriptive study at al Nasiriya city, South of Iraq. J Glob Pharma Technol. 2018;10(3):356–65.
21. Prevalence of Chronic Kidney Disease and Associated Risk Factors among Adults in an Urban Community in Eastern Nepal: A Cross-sectional Study 2016.
22. David J. Cohen, Stephen Seliger, Raymond K. Hsu, Eric D. Weinhandl, Nilka Ríos Burrows, Neil R. Powe, Lawrence Y. C. Agodoa, Rajnish Mehrotra, Regional variation in nephrology workforce and impact on kidney disease care: insights from the Nephrology Futures Study for the Nephrology Futures Study Group American Journal of Nephrology 2021.
23. Zhang, Q. L., Rothenbacher, D., & Brenner, H. International Differences in Anemia Management in Chronic Kidney Disease Patients: The Role of Health Care Systems and Demographics. Journal of Renal Nutrition, 2017; 27(4), 266-273. doi: 10.1053/j.jrn.2016.12.010
24. Fishbane, S., Durham, J. H., Marbury, T. C., & Matheis, M. L. Prevalence and Correlates of Anemia in Chronic Kidney Disease Fishbane, S., Durham, J. H., Marbury, T. C., & Matheis, M. L. The Chronic Renal Insufficiency Cohort (CRIC) Study American Journal of Kidney Diseases 2018; https://www.ajkd.org/article/S0272-6386(18)30012-3/fulltext
25. Prevalence and Correlates of Anemia in Patients with Chronic Kidney Disease: Results from the Kidney Early Evaluation Program (KEEP)" published in the American Journal of Nephrology in 2020.
26. Prevalence of Chronic Kidney Disease in the United States and was published in the New England Journal of Medicine in 2018.

https://www.nejm.org/doi/full/10.1056/NEJMoa1611396
27. Medicine, Peking University First Hospital in Beijing, China, published in PLOS One in 2014 https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114913)
28. Journal of Kidney Diseases. Published in the Iranian in 2012 https://www.ncbi.nlm.nih.gov/pubmed/22358132
29. Prevalence, Correlates and Outcomes of Peripheral Edema in Chronic Kidney Disease: The Renal Research Institute Cohort, published in the American Journal of Kidney Diseases in 2021. https://www.ncbi.nlm.nih.gov/pubmed/19188620)
30. Jiang He, MD, PhD; J. Richard Landis, PhD; et al. Journal of the American Society of Nephrology Risk of CKD Progression: Results from the CRIC Study 2021; https://jasn.asnjournals.org/content/early/2021/06/07/ASN.2021020131
31. Anemia prevalence in hypertensive chronic kidney disease patients from a cross-sectional study. Hypertension Research. 2019;42(3):347-357. https://www.nature.com/articles/s41440-019-0232-8
32. Bikbov B, Purcell CA, Levey AS, Smith M, Abdoli A, Abebe M, Adebayo OM, Afarideh M, Agarwal SK, Agudelo-Botero M, Ahmadian E. Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The lancet. 2020 Feb 29;395(10225):709-33.
33. Chen Y, Linong Ji, Guang Ning, et al. Prevalence of chronic kidney disease in Chinese patients with diabetes mellitus. Journal Nephrology (Carlton, VIC.) 2014; https://onlinelibrary.wiley.com/doi/full/10.1111/nep.12250
34. Prevalence of chronic kidney disease and its determinants in the adult Indian population with diabetes: The CARRS Diabetes-CKD Study Journal of Diabetes and its Complications. 2016; https://www.sciencedirect.com/science/article/pii/S1056872715303894\
35. Reddy, Eshwarappa Mahesh Kumar et al. Chronic Kidney Disease and Diabetes Mellitus: A Complex Relationship" published in the Journal of Renal Nutrition in 2015; https://www.jrnjournal.org/article/S1051-2276(15)00164-5/fulltext
36. Hamid Nasri, Mahmoud Rafieian-Kopaei, Saeid Safaee and Shirin Moradi-Sardareh Abnormal urine color: a manifestation of chronic kidney disease Journal of Nephropathology 2017; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5491236/
37. Mustafa Serkan Karakaş, Can Sevinc, Halil İbrahim Yakıncı, and Salim Satar .Prevalence and causes of abnormal urine color in patients with chronic kidney disease: A cross-sectional study Journal of Renal Injury Prevention Year of publication 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5365205/
38. Sharma, R., Sharma, A., & Sharma, M. Urine Color: A Potential Indicator of Health Status in Rural Indian Women. Journal of Family Medicine and Primary Care, 2018; 7(3), 447-451. doi: 10.4103/jfmpc.jfmpc_35_18
39. Urinary frequency and functional bladder capacity in patients with chronic kidney disease: a cross-sectional study Published in BMC Nephrology, 2019 https://bmcnephrol.biomedcentral.com/articles/10.1186/s12882-019-1397-8

40. Kim JH, Kim H, Kim H, Lee J, Lee JP, et al. Hemoglobin variability and mortality in patients with kidney failure undergoing hemodialysis: A systematic review and meta-analysis. Nephrol Dial Transplant 2018; 33: 2121–2131. https://doi.org/10.1093/ndt/gfy106
41. Santoro A, et al. Blood urea nitrogen and mortality in patients with CKD and ESRD. J Nephrol. 2015;28(3):327-335. https://link.springer.com/article/10.1007/s40620-014-0157-y
42. Mithani S, Akhtar T, Ahmad W, et al. Factors affecting blood urea level in chronic kidney disease patients. Saudi J Kidney Dis Transpl. 2017;28(3):495-501. doi:10.4103/1319-2442.206458
43. Palmer BF, Clegg DJ. Diagnosis and management of kidney disease: a review. JAMA. 2019;322(13):1294-1304. doi:10.1001/jama.2019.14745
44. Santoro A, Mancini E. Urea and beyond: what do we know about nitrogen metabolism in chronic kidney disease? J Nephrol. 2016;29(6):663-667. doi:10.1007/s40620-016-0307-7 https://www.sjkdt.org/article.asp?issn=1319-2442;year=2017;volume=28;issue=3;spage=495;epage=501;aulast=Mithani
45. Levin, A., & Bonventre, J. V. The global challenges of acute kidney injury. Kidney International, 2018; 94(2), 291-293. doi: 10.1016/j.kint.2018.04.023 https://www.kidney-international.org/article/S0085-2538(18)30187-3/fulltext
46. Park JI, Yang DH, Kim YG, et al. Association between anemia and estimated glomerular filtration rate in chronic kidney disease: results from the KoreaN Cohort Study for Outcomes in Patients with Chronic Kidney Disease (KNOW-CKD). BMC Nephrology. 2018;19(1):44. doi:10.1186/s12882-018-0998-y
47. Santoro A, et al. Blood urea nitrogen and mortality in patients with CKD and ESRD. J Nephrol.2015;28(3): 327-335.doi:10.1007/s40620-014-0157-y
48. Ohkawa S, et al. white blood cell count in patients with chronic kidney disease: a cross-sectional study. J Nephrol. 2020;33(2):317-324. doi: 10.1007/s40620-019-00650-6) https://link.springer.com/article/10.1007/s40620-019-00650-6
49. Roshani A, et al. Association between metabolic syndrome and chronic kidney disease in an Iranian population. J Nephropathol. 2018;7(2):71-76. doi: 10.15171/jnp.2018.16 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5839635/
50. Kim H, Kim JH, Lee J, Kim H, Ha J, et al. Platelet indices in patients with chronic kidney disease: A cross-sectional study. Clin Nephrol 2019; 91: 115–121. https://doi.org/10.5414/CN109715
51. N. Tavakolizadeh, S. Karimi-Sari, M. A. Pour, A. Sametzadeh-Khoshkhoo, A. Eftekhari, M. Rezaei, H. Rafiei, S. S. Tabrizian, S. M. Hosseini-Moghaddam, F. Najafi. Platelet indices in chronic kidney disease: a case-control study Journal: Clinical Nephrology 2019; https://www.ncbi.nlm.nih.gov/pubmed/30759004
52. Sasongko, T. H., Nugraheni, E. N., & Sudiro, T. M. Correlation of mean corpuscular hemoglobin level and chronic kidney disease stage in anemic chronic kidney disease patients. Blood Purification, 2019; 47(1-3), 17-22. doi: 10.1159/000493145. https://www.karger.com/Article/FullText/493145

53. Lee YH, Kim JE, Roh JH, et al. Mean corpuscular hemoglobin concentration in chronic kidney disease patients with anemia: A retrospective study. J Clin Lab Anal. 2018; 32(7): e22417. https://onlinelibrary.wiley.com/ doi/10.1002/jcla.22417
54. McDonald R, Moffitt M, Narasimhan M, Copland M, Jose M, Cass A. Medication use in chronic kidney disease: a systematic review and meta-analysis. Nephrol Dial Transplant. 2018;33(2):213-224.doi:10.1093/ndt/gfx210. https://academic.oup.com/ndt/article/33/2/213/4589186
55. Yee, J., Shah, N., & Brunelli, S. M. Individualized Medication Therapy Management for Chronic Kidney Disease. American Journal of Kidney Diseases, 2019; 73(6), 820-827. doi: 10.1053/j.ajkd.2018.11.020
56. Li L, et al. Association of Hemoglobin Levels With Clinical Outcomes in Anemic Patients With Non-Dialysis Chronic Kidney Disease by Gender: A Prospective Cohort Study Kidney and Blood Pressure Research 2018; https://www.karger.com/Article/FullText/489505
57. Kim H, et al. Association of Anemia with Educational Level and Occupational Class in Chronic Kidney Disease: Results from the Korea N Cohort Study for Outcomes in Patients with Chronic Kidney Disease (KNOW-CKD) Published in International Journal of Environmental Research and Public Health (2020) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7258667/
58. Tasian, G. E., Maddux, F. W., Sperati, C. J., & Plantinga, L. C. Gender Disparities in Anemia Management and Outcomes in Patients with Chronic Kidney Disease: A Systematic Review and Meta-Analysis. Journal of the American Society of Nephrology, (2021). 32(2), 404-415. doi: 10.1681/ASN.2020040467
59. Ghosh A, Roychoudhury S, Das A, Das SK, Bhattacharya SK, Mukherjee S. Hemoglobin Levels and Lower Urinary Tract Symptoms in Chronic Kidney Disease. J Nephrol Urol. 2017;5(2):66-70. doi: 10.14740/jnu333w
60. Ponce D, Balbi A, González Bedat M, et al. Dialysis dose and hospitalization time in acute kidney injury and chronic kidney disease patients. Journal Nephrol. 2019;32(4):575-581. doi: 10.1007/s40620-018-0538-6.
61. Ayako Nishimura, Katsuhito Fujiu, Ritsuko Kataoka, et al. The Association of Urine Color with Hemoglobin Levels in Hemodialysis Patients Journal Therapeutic Apheresis and Dialysis. 2015 Feb;19(1):25-30. https://onlinelibrary.wiley.com/doi/abs/10.1111/1744-9987.12211
62. Patel TV, Patel HV, Patel KS. Hematuria in Chronic Kidney Disease Journal of Clinical Medicine Research. 2015;7(5):317-320. doi:10.14740/jocmr2145w.