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A retrospective Study of Comorbidity-Associated Anaemia in Hemodialysis Patients at Tarhuna Teaching Hospital

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دراسة بأثر رجعي لفقر الدم المرتبط بالاعتلال المشترك لدى مرضى غسيل الكلى في مستشفى ترهونة التعليمي

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Abstract

Chronic kidney disease is a condition that affects the body's ability to maintain metabolic, fluid electrolytes, balance and erythropoietin secretion. Hemodialysis is the most common treatment for advanced and permanent kidney failure, but anemia is one of the most common complications.

Materials and Methods: This study was conducted from August 20 to December 20, 2022. It was collected from statistics that were issued by the archive of the (hemodialysis unit, Teaching Hospital of Tarhona), and it aimed to estimate the prevalence of anemia in hemodialysis patients and evaluate its occurrence in both male and female individuals, and data were analyzed by (Microsoft excel version 2010) and SPSS programmer (SPSS version 22). The study involved 117 reported cases that were investigated; males were 73 and females were 44.

It was found that the prevalence of anemia in patients with dialysis is very high by 93.2% (109/117), and their ages range between 13 to 82 years, where the highest percentage of patients with kidney failure is more than 60 years of age (37 cases) out of a total of 117 cases (31.6%). The number of men in this study was 73 by 62.4% and the number of women was 44 by 37.6%. While the percentage of patients taking "Erythropoietin type alpha in addition to Tardyferon tablet is (52.1%), while (47.9%) of them take" Erythropoietin type alpha "only. Patients suffer from 31.6% of diabetes, 62.4% of High blood pressure, 11.1 from cardiovascular disease.
This study concluded that most of the patients suffer from anemia. Oral iron supplementation did not improve patients' hemoglobin levels.
Recommendations: According to the high incidence of anemia among chronic kidney disease, it is highly recommended that routine hemoglobin checks be followed, and it is highly recommended to take iron intravenously instead of orally. It is highly recommended to take vitamin B12 and folic acid.

Keywords: chronic kidney disease, anemia, hemodialysis, erythropoietin, and tardyferon tablet.

الملخص

مرض الكلى المزمن هو ضعف كلوي يؤدي إلى فشل في قدرة الجسم على الحفاظ على التمثيل الغذائي ، والأملاح المعدنية ، والتوازن وإفراز الاريثروبويتين عن طريق الكلى يتناقص.أصبح غسيل الكلى علاجًا عمليًا للفشل الكلوي وهو الطريقة الأكثر شيوعًا المستخدمة لعلاج الفشل الكلوي المتقدم والدائم. يعد فقر الدم أحد أكثر المضاعفات شيوعًا لمرضى غسيل الكلى.

أجريت هذه الدراسة في الفترة من 20 أغسطس إلى 20 ديسمبر 2022 ، وتم جمعها من الإحصائيات الصادرة عن أرشيف وحدة غسيل الكلى بمستشفى ترهونة التعليمي، وهدفت إلى تقدير مدى انتشار فقر الدم لدى مرضى غسيل الكلى وتقييم حدوثه في الأفراد من الذكور والإناث على حد سواء ، وتم تحليل البيانات بواسطة (Microsoft Excel الإصدار 2010) وبرنامج SPSS (الإصدار 22 من SPSS). شملت الدراسة 117 حالة تم الإبلاغ عنها وتم التحقيق فيها, وكان عدد الذكور 73 حالة وعدد الإناث 44 حالة.

تبين أن انتشار فقر الدم لدى مرضى غسيل الكلى مرتفع للغاية بنسبة 93.2٪ (117/109) ، وتتراوح أعمارهم بين 13 إلى 82 عامًا ، حيث كانت أعلى نسبة للمرضى الذين يعانون من الفشل الكلوي تزيد أعمارهم عن 60 عامًا بعدد (37 حالة) من إجمالي 117 حالة أي بنسبة (31.6٪). كان عدد الرجال في هذه الدراسة 73 بنسبة 62.4٪ وعدد النساء 44 بنسبة 37.6%.
فيما كانت نسبة المرضى الذين يتناولون عقار " Erythropoietin type alpha بالإضافة إلى Tardyferon tablet هي (52.1٪) ، بينما (47.9٪) منهم يتناولون عقار "Erythropoietin type alpha" فقط. يعاني المرضى من 31.6٪ من مرض السكري ، و 62.4٪ من ارتفاع ضغط الدم ، و 11.1 من أمراض القلب والأوعية الدموية.

خلصت هذه الدراسة إلى أن معظم المرضى يعانون من فقر الدم ومكملات الحديد عن طريق الفم لم تحسن مستويات الهيموجلوبين لدى المرضى.

ووفقًا لارتفاع معدل الإصابة بفقر الدم بين أمراض الكلى المزمنة ، يوصى بشدة بإتباع فحوصات الهيموجلوبين الروتينية ، ويوصى بتناول الحديد عن طريق الوريد بدلاً من الفم. ويوصى بشدة بتناول حقن فيتامين B12 وحبوب حمض الفوليك.

الكلمات المفتاحية: مرض الكلى المزمن ، فقر الدم ، غسيل الكلى ، إرثروبويتين ، تارديفيرون.

Introduction:

Chronic kidney disease (CKD) is a gradual impairment of kidney function, requiring early detection to reduce the need for kidney replacement or hemodialysis in end-stage renal disease patients (Almansour NA et al., 2019). CKD, the leading cause of death globally, has reached 843.6 million people in 2017, largely due to rising risk factors like obesity and diabetes (Jager KJ et al., 2019). Over 2 million patients worldwide are on dialysis, with the number expected to rise to over 5.4 million by 2030 (Liyanage T et al., 2015). CKD significantly impacts quality of life and immediate life expectancy, yet fewer scientific trials have been conducted for kidney illnesses compared to other common medicinal conditions (Chatzimanouil MKT et al., 2019).

End-stage renal disease (ESRD) patients often have comorbid conditions like diabetes and hypertension and are at risk for renal-related issues like calcium and phosphate imbalances, vitamin D deficiency, anemia, and secondary hyperparathyroidism (Beto J et al., 2019; Isakova T et al., 2017; Ngai M et al., 2014). The collected data can significantly impact patients' well-being and health outcomes, while maintaining dialysis by oneself can be aggressive and cause additional pain and discomfort (Shettigar R et al., 2021). Anemia is a condition characterized by reduced red blood cell numbers and altered morphology, with a hemoglobin level under 13 g/dL in men and 12 g/dL in women (WHO, 2015). Anemia, affecting over 1.93 billion people globally, is characterized by a decrease in erythrocyte mass, blood Hb, and hematocrit, with regular values varying by age and gender (Kassebaum NJ and GBD 2013 Anemia Collaborators, 2016) (Lukito W and Wahlqvist ML, 2020). Anemia in CKD patients is linked to high hospitalization rates and increased mortality risk. Erythropoiesis stimulating agents (ESA) are being explored for treating CKD-associated anemia (CKD-AA) and preventing kidney fibrosis in early stages (Habas E et al., 2022). Anemia in HD patients can be influenced by factors such as erythropoietin (EPO) deficiency, condensed erythrocyte lifecycle, blood loss, chronic swelling, iron, copper, vitamin B12, and aluminum excess (Lee KH et al., 2021). A population-based medicinal folder found that anemia in CKD patients increases risks of severe hospitalization, death, and cardiovascular complications, affecting both dialyzed and non-dialyzed patients (Toft G et al., 2020). EPO deficiency and iron deficiency are primary causes of anemia in HD patients. ESA administration improves renal anemia outcomes, but serum hepcidin's role in iron treatment is debated (Babitt JL and Lin HY, 2012; Batchelor EK et al., 2020; Wilhelm-Leen ER and Winkelmayer WC, 2015). The study evaluates anemia in patients with HD in Tarhouna, Libya, focusing on pathological changes, disturbances, and proportion of anemia among hemodialysis patients, considering risk factors.

Materials and Methods: The study reported in section 3.1 investigates the prevalence and frequency of anemia among hemodialysis (HD) patients through a retrospective approach conducted at the hemodialysis unit in the Teaching Hospital of Tarhona, Libya. The study commenced on August 20, 2022, and concluded on December 20, 2022. The primary focus was to identify the presence of anemia within the patient population and explore its relationship with various study variables. The dependent variable was anemia, while the independent variables included age, gender, weight, hypertension, diabetes mellitus (DM), cardiovascular disease (CVD), family history, and the type of medication prescribed. The criteria for inclusion in the study were that all participants must be currently receiving hemodialysis, with no exclusions made to eligible individuals. The target population consisted of 117 HD patients, comprising 73 men and 44 women, whose ages ranged from 13 to 82 years old. Data was collected from the HD unit's archives alongside interviews and questionnaires. Statistical analysis of the gathered data was performed using the Statistical Packages for Social Sciences (SPSS), ensuring all results were validated at a significant level, defined as a p-value of less than 0.05. This detailed approach aims to provide insights into the prevalence of anemia and its associations among the HD patient population in the specified region.

Results: presentation and analysis of data: The questionnaire was adopted as a tool for collecting data and information to determine the differences in the effect of the drugs "erythropoietin Alfa and tardiferon" on some diseases such as diabetes, kidney failure, and anemia. The questionnaire includes general information and the demographic characteristics of the individuals targeted for the study.

presentation and analyze patient data In order to identify some of the characteristics of the study samples, some characteristics such as age, gender, and weight were analyzed, and the following is a detailed presentation of these characteristics:

Demographic characteristics:
1- distribution of sample individuals according to age

Table (1): The repetitive distributions and percentages of the sample individuals on the basis of age

Age	Frequency	Percent %
Less than 30 years	14	12
30 to less than 40	26	22.2
40 to less than 50	26	22.2
50 to less than 60	14	12
60 year and more	37	31.6
Total	117	100

The data set out in the above table relating the distribution of the sample individuals on the basis of age indicated that (12%) of the sample were aged less than 30 years, and (22.2%) of the sample were aged 30 to less than 40 years, and (22.2%) of the sample were aged 40 to less than 50 years, and (12%) of the sample were aged 50 to less than 60 years , and (31.6%) of the sample ranged in age from 60 years and more.

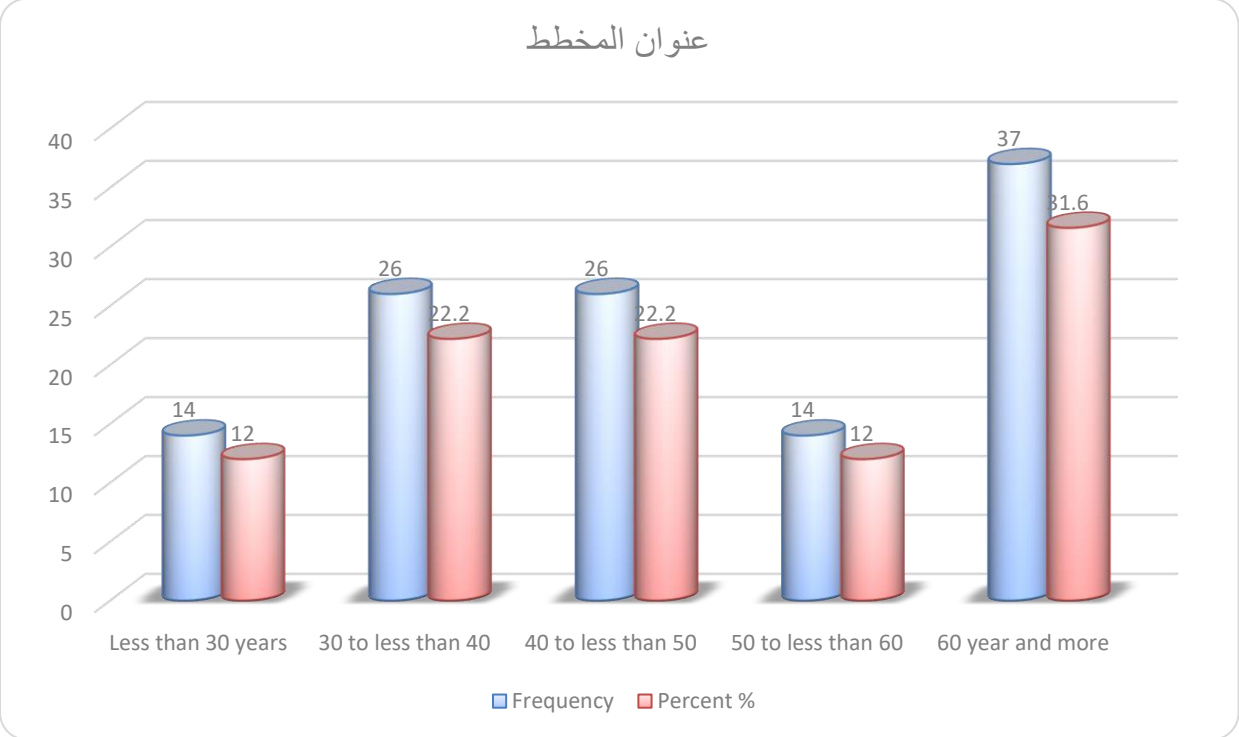

Figure (1) repetitive Distribution and percentage of sample individuals on the basis of Age.

2- Distribution of sample individuals on the basis of Gender:

Table (2) : repetitive distribution and percentage of the sample individuals on the basis of gender:

Gender	Number	Percentage
Male	73	62.4
Female	44	37.6
Total	117	100

According to the data set out in the above table, regarding the distribution of the sample individuals on the basis of gender, it was found that 62.4% of the patients were male and 37.6% were female.

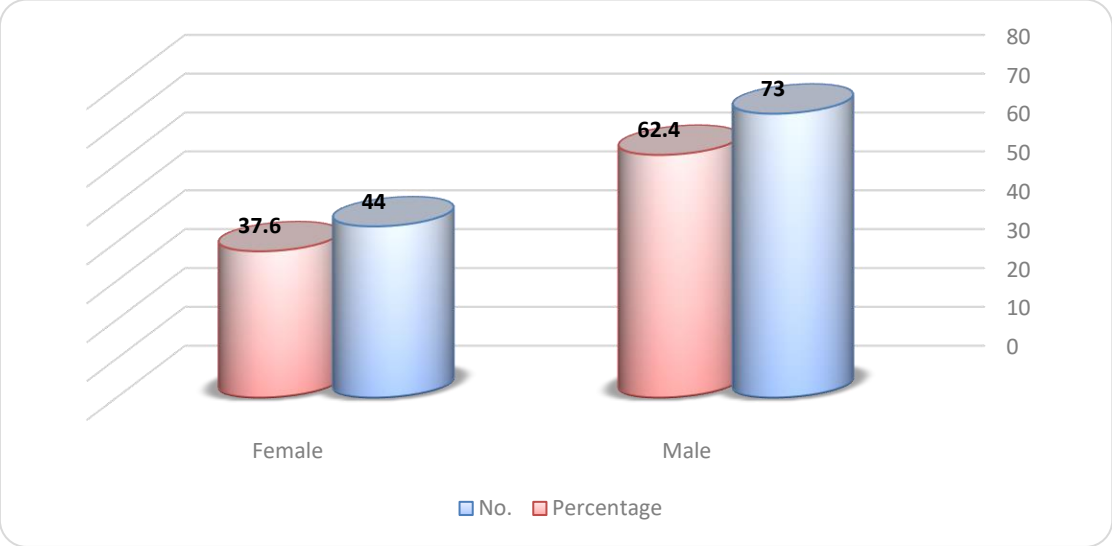

Figure (2) Repetitive Distribution and percentage of sample individuals on the basis of gender.

3- distribution of sample individuals according to the Weight .

Table (3): The repetitive distributions and percentage of the sample individuals on the basis of weight :

Weight	Frequency	Percent %
Less than 50 kilo	13	11.1
50 to less than 60	28	23.9
60 to less than 70	29	24.8
70 to less than 80	27	23.1
80 kilo and more	20	17.1
Total	117	100

The data in the above table related to the distribution of respondents based on weight indicated that (11.1%) of the sample weighed less than 50 kilograms, and (23.9%) of the sample weighed from 50 to less than 60 kilos, and (24.8%) of the sample weighed between 60 and less than 70

kilos, and (23.1%) of the sample weighed from 70 to less than 80 kilos, and (17.1%) of the sample weighed 80 kilos or more.

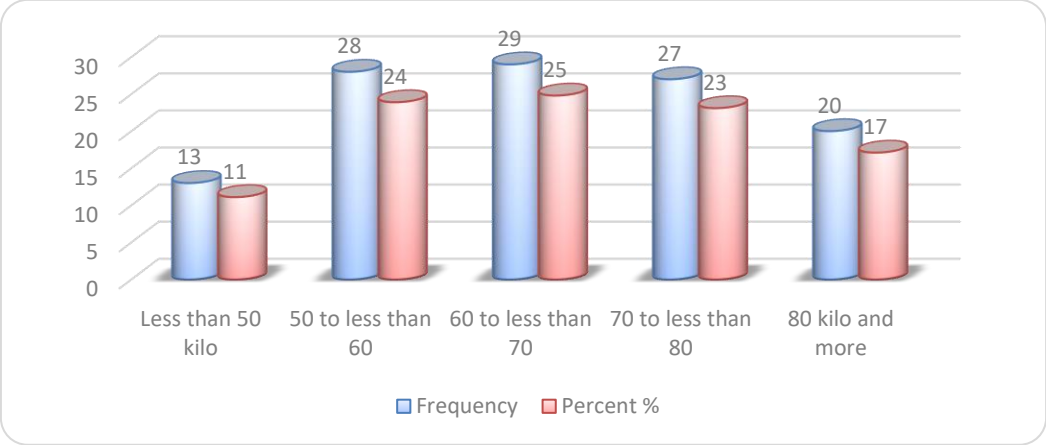

Figure (3) repetitive Distribution and percentage of sample individuals on the basis of weight.

4- Type of medication used

Table (4): The repetitive distributions and percentage of the sample individuals on the basis of pharmaceutical used:

Type of medication. used	Frequency	Percent %
Erythropoietin type alpha - Tardyferon tablet (iron)	61	52.1
Erythropoietin type alpha	56	47.9
Total	117	100

Table Number (4) shows that (52.1%) of the patients use the drug "Erythropoietin type alpha—Tardyferon tablet (iron)", while (47.9%) of them use the drug " Erythropoietin type alpha ".

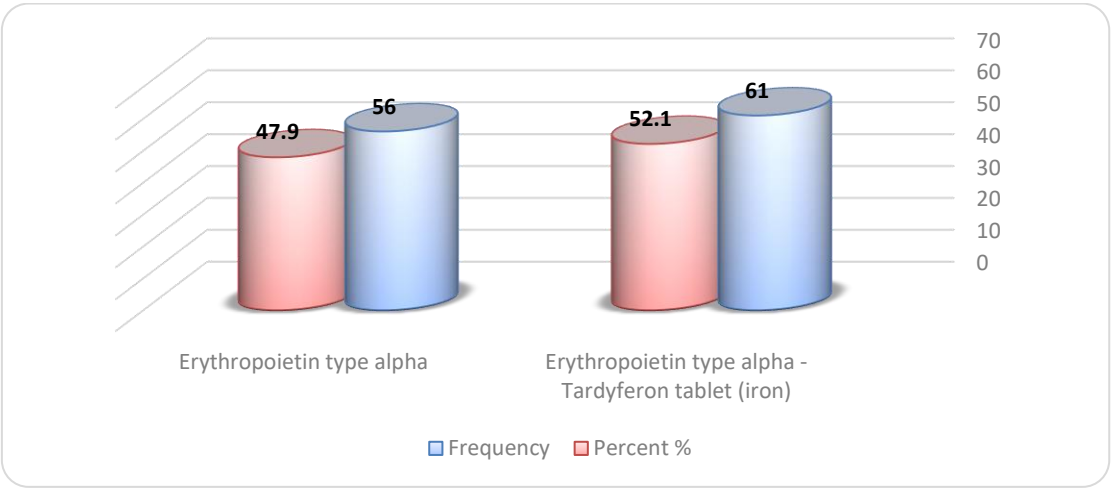

Figure (4) repetitive Distribution and percentage of sample individuals on the basis of pharmaceutical used.

5. Diabetes mellitus

Table (5): The repetitive distributions and percentage of the sample individuals on the According to the incidence of Diabetes mellitus:

Diabetes mellitus	Frequency	Percent %
No	80	68.4
Yes	37	31.6
total	117	100

From Table Number (5) it was found that (68.4%) of the respondents didn't suffer from diabetes, while (31.6%) suffer from diabetes.

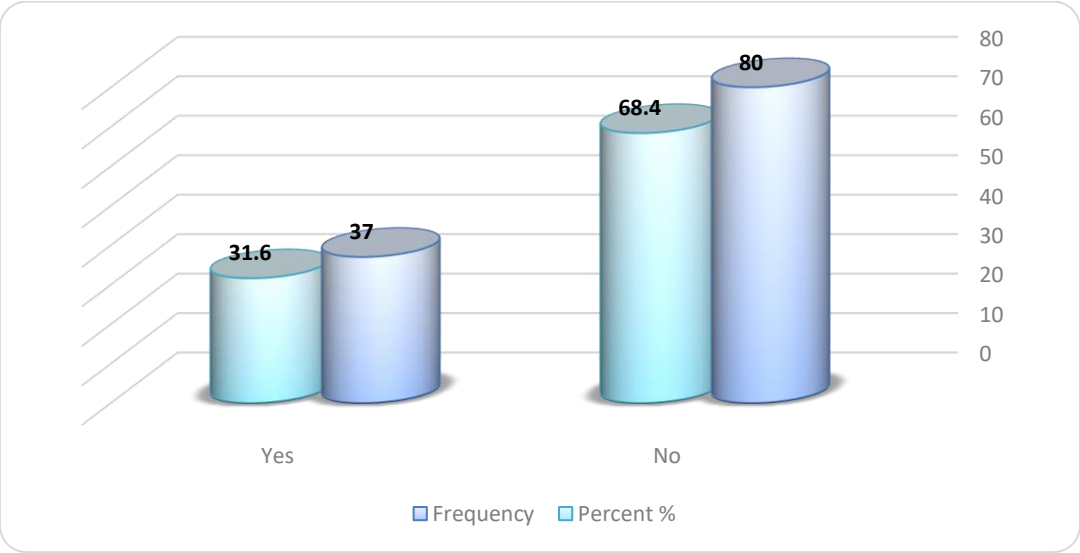

Figure (5) Frequency distribution and percentage of respondents based on the incidence of diabetes**.**

6. Hypertensive

Table (6): The repetitive distributions and percentage of the sample individuals on the according to the incidence of hypertensive:

hypertensive	Frequency	Percent %
No	44	37.6
Yes	73	62.4
total	117	100

From Table Number (6) it was found that (37.6%) of the respondents didn't suffer from hypertensive, while (62.4%) suffer from hypertensive.

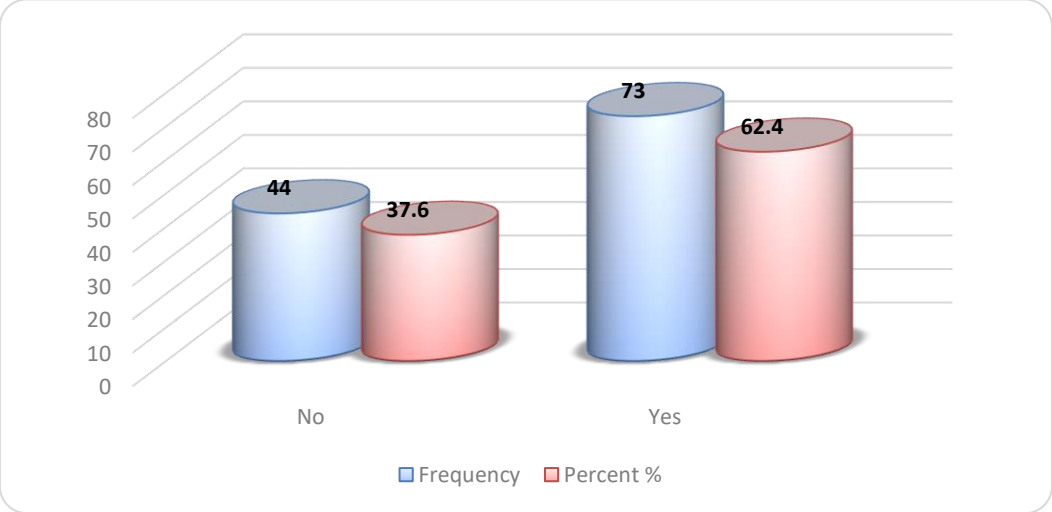

Figure. (6) Frequency distribution and percentage of respondents based on the incidence of hypertensive**.**

7. Cardiovascular disease

Table (7): The repetitive distributions and percentage of the sample individuals on the according to the incidence of Cardiovascular:

Cardiovascular	Frequency	Percent %
No	104	88.9
Yes	13	11.1
total	117	100

From Table Number. (7) it was found that (88.9%) of the respondents didn't suffer from Cardiovascular, while (11.1%) suffer from Cardiovascular.

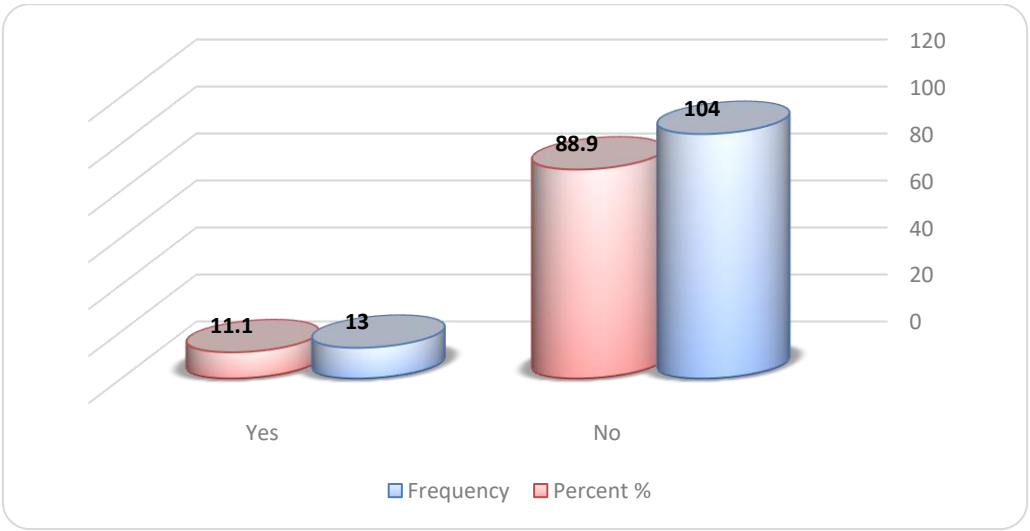

Figure (7) Frequency distribution and percentage of respondents based on the incidence of Cardiovascular.

8. Family history of kidney failure

Table (8): The repetitive distributions and percentage of the sample individuals on the according to the incidence of family history of kidney failure:

Family history of kidney failure	Frequency	Percent %
No	108	92.3
Yes	9	7.7
total	117	100

From Table Number. (8) it was found that (92.3%) of the respondents didn't suffer from kidney failure, while (7.7%) suffer from kidney failure.

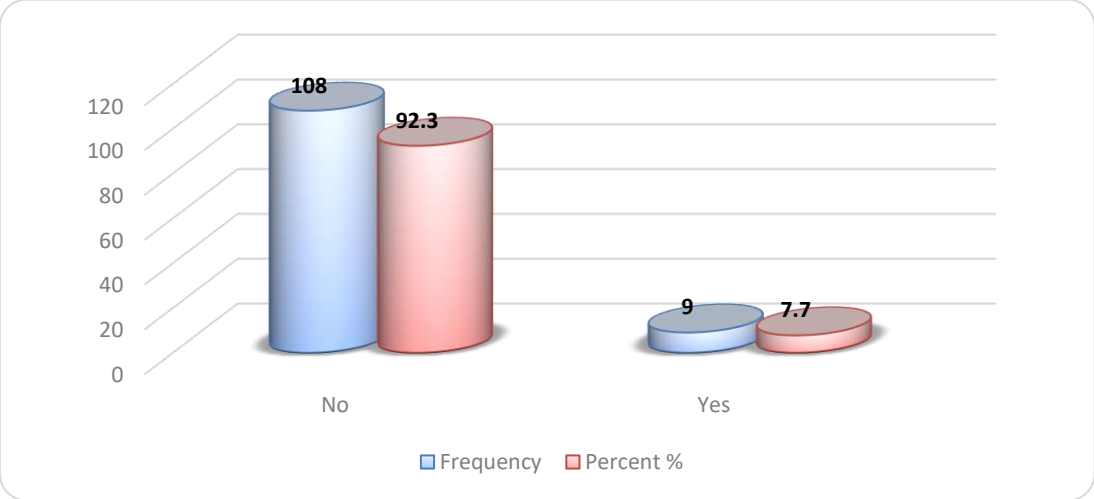

Figure (8) Frequency distribution and percentage of respondents based on the incidence of kidney failure

The effect of drugs used (Erythropoietin type alpha, Tardyferon tablet (iron), and Erythropoietin type alpha) on disease (diabetes mellitus, hypertension, cardiovascular disease, and family history of kidney failure)

1. The effect of drugs used (Erythropoietin type alpha, Tardyferon tablet (iron), and Erythropoietin type alpha) on diabetes mellitus

Table (9): Chi2 test for the effect of drugs used on Diabetes mellitus

			Diabetes mellitus		Total	p-value
			No	Yes		
drug	Erythropoietin type alpha	Number.	42	19	61	0.533
		percentage	68.9%	31.1%	100.0%	
	Erythropoietin type alpha - Tardyferon tablet (iron)	Number.	38	18	56	
		percentage	67.9%	32.1%	100.0%	
Total		Number.	80	37	117	
		percentage	68.4%	31.6%	100.0%	
Chi-Square value calculated 0.013			df = 1		Chi-Square tabular = 3.84	

P-value <0.05 "Significant" , P-value <0.01 "Highly significant" , P-value > 0.05 "non-Significant"

From Table Number (9) it was found that the majority of those who use the drug (erythropoietin type alpha), with a percentage of (68.9%), do not have diabetes, and also the majority of those who use the drug (erythropoietin type alpha-Tardyferon tablet (iron)), with a percentage of (67.9%) do not have diabetes. This indicates that there were no differences in the effects of the two drugs on infection. The value of the p-value was (0.533), which is greater than (0.05), and this is confirmed by the calculated value of the chi square test (0.013), which is greater than its tabular value (3.84).

2. The effect of drugs used (Erythropoietin type alpha - Tardyferon tablet (iron) and Erythropoietin type alpha) on hypertensive

Table (10): Chi^2 test for the effect of drugs used on hypertensive

			hypertensive		Total	p-value
			No	Yes		
drug	Erythropoietin type alpha	Number.	24	37	61	0.416
		percentage	39.3%	60.7%	100.0%	
	Erythropoietin type alpha - Tardyferon tablet (iron)	Number.	20	36	56	
		percentage	35.7%	64.3%	100.0%	
Total		Number.	44	73	117	
		percentage	37.6%	62.4%	100.0%	
Chi-Square value calculated 0.164		df = 1	Chi-Square tabular = 3.84			

P-value <0.05 "Significant" , P-value <0.01 "Highly significant" , P-value > 0.05 "non-Significant"

From Table Number (10) it was found that those taking the drug (erythropoietin type alpha) who did not suffer from hypertension were (39.3%), while those taking the drug (erythropoietin type alpha - Tardiferon tablet (iron)), and they did not suffer from hypertension; their percentage was (35.7%), which indicates that there were no differences in the effect of the two drugs on hypertension; the p-value was (0.416). It is greater than (0.05), and this is confirmed by the calculated value of the chi-square test (0.164), which is greater than its tabular value (3.84).

3. The effect of drugs used (Erythropoietin type alpha - Tardyferon tablet (iron) and Erythropoietin type alpha) on Cardiovascular disease

Table (11): Chi^2 test for the effect of drugs used on Cardiovascular disease

			Cardiovascular disease		Total	p-value
			No	Yes		
drug	Erythropoietin type alpha	Number.	56	5	61	0.226
		percentage	91.8%	8.2%	100.0%	
	Erythropoietin type alpha - Tardyferon tablet (iron)	Number.	48	8	56	
		percentage	85.7%	14.3%	100.0%	
Total		Number.	104	13	117	
		percentage	88.9%	11.1%	100.0%	
Chi-Square value calculated 1.096		df = 1	Chi-Square tabular = 3.84			

P-value <0.05 "Significant" , P-value <0.01 "Highly significant" , P-value > 0.05 "non-Significant"

From Table Number (11) it was found that those taking the drug (erythropoietin type alpha) who did not suffer from cardiovascular disease were (91.8%), while those taking the drug (erythropoietin) type alpha-Tardiferon tablet (iron)), and they did not suffer from cardiovascular disease, their percentage was (85.7%), and this indicates that there were no differences in the effect of the two drugs on cardiovascular disease, and the p-value was (0.226). It is greater than (0.05), and this is confirmed by the calculated value of the chi-square test (1.096), which is greater than its tabular value (3.84).

4. The effect of drugs used (Erythropoietin type alpha - Tardyferon tablet (iron) and Erythropoietin type alpha) on Family history of kidney failure

Table (12): Chi^2 test for the effect of drugs used on Family history of kidney failure

			Family history of kidney failure		Total	p-value
			No	Yes		
drug	Erythropoietin type alpha	Number.	56	5	61	0.554
		percentage	91.8%	8.2%	100.0%	
	Erythropoietin type alpha - Tardyferon tablet (iron)	Number.	52	4	56	
		percentage	92.9%	7.1%	100.0%	
Total		Number.	108	9	117	
		percentage	92.3%	7.7%	100.0%	
Chi-Square value calculated 0.046 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant" , P-value <0.01 "Highly significant" , P-value > 0.05 "non-Significant"

From Table Number (12) it was found that those taking the drug (erythropoietin type alpha) who did not suffer from kidney failure were (91.8%), while those taking the drug (erythropoietin) type alpha-Tardiferon tablet (iron)), and they did not suffer from kidney failure, their percentage was (92.9%), which indicates that there were no differences in the effect of the two drugs on kidney failure, and the p-value was (0.554). It is greater than (0.05), and this is confirmed by the calculated value of the chi-square test (0.046), which is greater than its tabular value (3.84).

5. The effect of drugs used (Erythropoietin type alpha - Tardyferon tablet (iron) and Erythropoietin type alpha) on anemia

Table (13): Chi^2 test for the effect of drugs used on anemia

			anemia (HGB)		Total	P-value
			No	Yes		
drug	Erythropoietin type alpha	Number.	5	56	61	0.719
		percentage	8.2%	91.8%	100.0%	
	Erythropoietin type alpha - Tardyferon tablet (iron)	Number.	3	53	56	
		percentage	5.4%	94.6%	100.0%	
Total		Number.	8	109	117	
		percentage	6.8%	93.2%	100.0%	
Chi-Square value calculated 0.37 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant" , P-value <0.01 "Highly significant" , P-value > 0.05 "non-Significant"

From Table Number (13) it was found that those taking the drug (erythropoietin type alpha) who did suffer from anemia were (91.8%), while those taking the drug (erythropoietin type alpha-Tardiferon tablet (iron)) and they did suffer anemia, their percentage was (94.6%), and this indicates that there were no differences in the effect of the two drugs on anemia, and the p-value was (0.719). It is greater than (0.05), and this is confirmed by the calculated value of the chi-square test (0.37), which is greater than its tabular value (3.84).

9. Occurance of anemia Among Patients:

Table (14): The repetitive distributions and percentage of the sample individuals on the According to the incidence of anemia:

			No	**Yes**	**Total**
Anemia	Male	Number	4	69	73
		percentage	3.4%	59%	100.0%
	Female	Number	4	40	44
		percentage	3.4%	34.2%	100.0%
Total		Number	8	109	117
		percentage	6.8%	93.2%	100.0%

According to the data set out in the above table, regarding the distribution of the sample individuals on the basis of anemia, it was found that 59% of the patients were male and 34.2 % were female.

Discussion: CKD is a significant global public health issue characterized by kidney damage and function markers. The study assessed the prevalence of anemia among HD patients in the Tarhuna region of Libya, involving 117 patients receiving HD. The study revealed a male-dominated population (62.4%), consistent with a female-dominated 37.6%, which aligns with a Ghanaian study's findings (Amoako Y. A. *et al*., 2014). Male prevalence of CKD may be attributed to higher prevalence of risk factors like hypertension, smoking, and alcoholism in males. The study found that the majority of patients were over 60 years old, with 37 cases out of 117 (31.6%), which contradicts a previous Ghanaian study (Amoako Y. A. *et al*., 2014). The study's differences in age and gender may be attributed to genetic or social differences among the Libyan and other publics. The study found a low family history of ESRD, with 7.7% reporting it, which differs from Freedman et al.'s (22.8%) reported case (Freedman B. I. *et al*., 2005). The ability of patients to accurately identify a positive family history is crucial for this outcome. The study found that 93.2% of 109 people in this study had anemia, with males having a higher prevalence than females, consistent with previous Tanzanian studies. (Kilonzo, 2010; Juma, 2012). The study's high anemia prevalence may be influenced by differences in anemia definition, population, survey period, methodology, care quality, policy, and strategic factors. The study found that a majority of patients (52.1%) use Tardyferon tablets (iron) and erythropoietin type alpha for anemia treatment, while 47.9% use erythropoietin type alpha, with no significant difference in anemia effects. Oral iron supplementation can cause constipation and swelling, affecting treatment devotion and efficiency. Reduced gastrointestinal absorption in HD patients also contributes to these issues (Vaziri N. D. *et al*., 2016). HD patients' oral iron levels are lower than intravenous due to increased hepcidin levels, which hinder iron absorption and reprocessing through the reticuloendothelial system. (Besarab A. and Coyne D. W., 2010).

The study displayed that there were no differences in the effects of the two drugs (Erythropoietin type alpha, Tardyferon tablet (iron), and Erythropoietin type alpha) on diabetes, hypertension, and cardiovascular disease. And it was found that 31.6% of those targeted in this study suffered from diabetes. The result agrees with a study that was conducted in Libya by Elamouri J. (2021) of 35.2%. The study found a cardiovascular disease incidence of 11.1% and a high blood pressure prevalence of 62.4%, which differs from the study (Elamouri J., 2021)'s 22.2% high blood pressure prevalence.

Conclusion:

Based on the research findings, the following conclusions were drawn:
1. There are no significant differences in the effects of Erythropoietin type alpha (with Tardyferon tablet, which contains iron) compared to Erythropoietin type alpha alone on diabetes, as evidenced by a P-value of 0.533, which exceeds the 0.05 threshold for statistical significance.
2. Similarly, the analysis indicated that hypertension does not show differing effects between the two drugs, with a P-value of 0.416, again greater than 0.05.
3. No significant variations were observed regarding cardiovascular diseases between the drug types, supported by a P-value of 0.226, which remains above the 0.05 mark.
4. The impact on kidney failure also showed no differences, with a P-value recorded at 0.554, comfortably surpassing the significance limit.
5. The study further found no difference in the effects on anemia, with a P-value of 0.719, well above the 0.05 threshold.
6. In terms of drug usage among the patient cohort, 52.1% utilized Erythropoietin type alpha with Tardyferon (iron), in contrast to 47.9% who used Erythropoietin type alpha alone.
7. Prevalence rates indicated that 31.6% of the subjects in the study were diabetic.
8. Additionally, it was revealed that 62.4% of the participants were hypertensive.
9. Cardiovascular issues were noted in 11.1% of those studied.
10. Lastly, a significant 93.2% of the targeted patients suffered from anemia, with males constituting 59% and females 34.2%.
This comprehensive summary consolidates the study's findings, reflecting on the effectiveness of the drugs evaluated and illustrating the health conditions prevalent among the patient group.

Recommendations:

Upon concluding this study, several recommendations emerged for improving the health and management of anemia in hemodialysis patients in Libya. First, it is essential to conduct further research with a larger and diversified sample size across various regions in Libya to accurately assess the prevalence of anemia among hemodialysis participants. Moreover, a comprehensive study is advised to explore the relationship between dietary iron intake and hemoglobin levels specifically in hemodialysis patients. In addition, a comparison study between oral and intravenous iron administration ought to be performed to evaluate the relative benefits for patients. Given the high prevalence of anemia associated with chronic kidney disease, it is strongly recommended that regular hemoglobin checks become a standard practice. Attention must also be given to dietary sodium intake, which should not exceed 1-2 grams per day to avoid fluid retention and elevated blood pressure. Patients are encouraged to minimize excessive use of medications and pain relievers, as these can be detrimental to kidney function; it is vital that any medications taken meet health standards for storage and use. Lifestyle modifications such as maintaining a balanced diet, drinking adequate amounts of clean water,

avoiding smoking, and engaging in regular exercise are imperative for patient health. Lastly, it's highly recommended that patients ensure adequate intake of vitamin B12 and folic acid to support their health.

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