Study of Hypoalbumina Between Kidney Failure, Diabetic Patients and Healthy People in Gharyan City: A Descriptive Study

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دراسة نقص الألبومين في الدم بين مرضي الفشل الكلوي، مرضي السكري والأصحاء في مدينة غريان: دراسة وصفية

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Abstract:

Albumin is the main protein found in the blood, and is the most abundant protein. It is manufactured in the liver and is a major factor in preventing blood fluids from leaking from the blood vessels to the body's tissues, as well as a link to vital compounds in the bloodstream and transporting them to the body's organs. However, a deficiency in the level of albumin in the bloodstream leads to increased permeability of the blood vessels, which leads to inflammation in the body and chronic liver disease or chronic kidney failure and some other diseases, and results in symptoms, the most important of which are swelling in the feet and face. This study was conducted to compare the deficiency of protein albumin in the blood by conducting a serum albumin analysis at Gharyan Central Hospital. This study included 90 cases divided into 30 cases with kidney failure, 30 cases with diabetes, and 30 healthy cases (control group), with ages ranging from 18 years to 80 years in the period from 3/2/2020 to 12/1/2021. The results obtained were compared using statistical methods, which showed through P-values that there is a weak direct relationship between age and albumin levels in people with kidney failure and healthy people (albumin levels increase with age), and also a weak inverse relationship between age and albumin levels in diabetes (albumin levels decrease with age). The results also showed significant differences, meaning that there is a difference between the average albumin levels in the three groups (kidney failure, diabetes, healthy people) by comparing the results obtained with the reference values, as it was found that the albumin levels in kidney failure were all at the reference value, while in diabetic patients and the healthy group, most of the readings were at the reference value for albumin.

Keyword: Albumin deficiency, Diabetes, Kidney failure, Healthy group, Gharyan.

الملخص

الألبومين هوا لبروتين الأساسي الموجود في الدم، ويعد أكثر بروتينات وفرة. يتم تصنيعه في الكبد ويشكل عاملا أساسيا في منع خروج سوائل الدم من الأوعية الدموية ألي أنسجة الجسم، وكذلك يعد رابطا لمركبات الحيوية في تيار الدم ونقلها إلى أعضاء الجسم. لكن النقص في مستوي ألبومين في تيار الدم يؤدي إلي زيادة نفاديه الأوعية الدموية مما يؤدي ألي حدوث التهابات في الجسم والإصابة بأمراض الكبد المزمنة أو فشل الكلي المزمن وبعض الأمراض الأخرى، وينتج عنه أعراض أهمها تورم في القدمين والوجه. أجريت هذا الدراسة لمقارنة نقص البروتين ألبومين في الدم من خلال إجراء تحليل مصل الألبومين في مستشفى غريان المركزي. تضمنت هذه الدراسة 90 حالة مقسمه بين 30 حالة مصابين بالفشل الكلوي، و30 حالة مصابين بالسكري، و30 حالة من أصحاء (مجموعة التحكم)، حيث تتفاوت أعمارهم ما بين 18 سنة إلى 80 سنة في الفترة الزمنية ما بين 2020/3/2 الي 2021/1/12. تمت المقارنة بين النتائج المتحصل عليها باستخدام أساليب إحصائية والتي أوضحت من خلال قيم P-value انه توجد علاقة طردية ضعيفة بين العمر ونسبة الألبومين لدي الأشخاص المصابين بفشل الكلوي والأشخاص الأصحاء (زيادة نسبة الألبومين مع زيادة العمر)، وأيضا، جود علاقة عكسية ضعيفة بين العمر ومرضي السكري (نقص في نسبة الألبومين مع زيادة العمر). أظهرت النتائج أيضا وجدو فروق معنوية بمعني وجود اختلاف بين متوسطات نسبة الألبومين لدي المجموعات الثلاثة (فشل الكلوي، داء السكري، الاصحاء) وذلك من خلال مقارنة نتائج المتحصل عليها مع القيم المرجعية حيث تبين أن نسبة الألبومين في الفشل الكلوي كانت كلها عند القيمة المرجعية، أما في المرضي السكري ومجموعة الأصحاء كانت أغلب القراءات عند القيمة المرجعية للألبومين.

الكلمات المفتاحية: نقص الالبومين، مرضي السكري، مرضي الفشل الكلوي، مجموعة أصحاء، غريان.

Introduction

Albumin is one of the most important and abundant proteins in blood plasma, as it constitutes about 55% of plasma proteins, which is equal to 3.8-5.1 g/100 cm3 of plasma [1]. It is a single peptide chain consisting of 585 amino acids in a spherical structure, and the molecular weight of albumin is about 69 kDa and it has a half-life of 21 days [2]. Albumin is produced mainly in the liver at a rate of 12 g per day, which constitutes 25% of the total protein production in the liver, as about 40% of it remains in the blood circulation, with part of it about 60% moving from the blood vessels to the interstitial space [2]. The concentration of intact albumin in the blood serum is 3.5-5.5 g/dL and the total serum albumin level is 55-9.0 g/dL. Factors that stimulate albumin synthesis include the action of hormones such as insulin and growth hormone, while albumin production is inhibited by cytokines during inflammation such as interleukin-1 and interleukin-6 [3-6].

Albumin has several physiological roles, the most important of which is maintaining pressure inside the blood vessel chambers to prevent fluid leakage into the extravascular spaces and tissues. In addition, albumin acts as a low-affinity, high-capacity carrier for many different internal and external compounds in body, such as hormones (insulin, thyroid hormones, cortisol, testosterone, and others) [7,8]. Also, albumin is considered one of the most important extracellular antioxidants, as it represents approximately three-quarters of the antioxidant capacity of plasma.

On the other hand, One of the most important undesirable effects during an imbalance in the percentage or amount of albumin in the blood is the increase in fluids, which leads to pulmonary edema, and the exacerbation of edema occurs due to the leakage of albumin in the interstitial space, the change of heart muscle contraction due to calcium deficiency, increased blood loss due to the effect of antibodies, impaired secretion of water and sodium through the kidneys, and the altered immune response [5]. Moreover, hypoalbuminemia is the condition in which there is a decrease in the levels of albumin in the blood, which is less than normal levels, and often this condition occurs following a decrease in the production of albumin in the liver, which may result from an injury to the liver cells and damage to their ability to produce albumin or may result from a decrease in the consumption of amino acids that constitute the basic units of blood proteins due to diet and chronic liver diseases such as chronic viral hepatitis and other conditions that lead to cirrhosis of the liver, which is the most common cause For low levels of albumin in the blood, another condition that causes low levels of albumin in the serum is renal diseases during which albumin is excreted in the urine in large quantities, a condition called nephrotic syndrome [9-10].

Signs and symptoms of hypoalbuminemia appear in the form of swelling, especially in the feet and face, delayed wound healing, signs of dehydration, slow heartbeat, low blood pressure, hypertrophy of the heart muscle, liver, spleen and goiter [9,11]. Hypoalbuminemia is a common occurrence and may be results from several different factors, the most important of which is the health status of the person.

There are many researchers conducted on the study of hypoalbuminemia in the blood and its relationship to diabetes and kidney failure. Therefore, this study aims specifically to compare the percentage of hypoalbuminemia in the blood between diabetics, kidney failure patients and a group of healthy people in the city of Gharyan.

Material and methods

Serum albumin test was performed on a group of cases at Gharyan Central Hospital from (2/3/2020) to (12/1/2021), where the total number of study cases was 90 cases divided into 30 cases of people with kidney failure, including 15 males and 15 females, 30 cases of diabetics divided into 15 males and 15 females, and 30 cases of healthy people (control group) also divided into Up to 15 males and 15 females, ranging in age from 18 to 80 years.

Examine albumin with serum:

A sample of blood with a size of 0.5-1 mm is taken from the person to be examined the percentage of albumin in his blood and then place it in a tube of gell-clot activator and next the screen master examination device analyses the sample, as it only requires entering data and pressing the button. The device pulls the sample and analyses it in the presence of certain solutions and then the results appear. This test aims to measure the level of albumin protein in the blood serum and examine the functions of the kidneys or liver, which would indicate a defect in the functions of these organs [9].

Results

The statistical program (SPSS) was used in this research, and also a set of descriptive statistical indicators, which include the arithmetic mean, standard deviation, coefficient of variation, torsion coefficient, and kurtosis.

Table (1): Descriptive Statistics of the Study Variables.

Descriptive Statistics / Study Variables		Arithmetic mean	Standard deviation	Coefficient of variation%	Torsion coefficient	Kurtosis
Kidney failure	lifetime	49.47	19.95	28.2	0.08	1.42-
	Albumin percentage	4.53	0.403	8.89	0.15-	2.15
Diabetics	lifetime	50.43	11.997	23.79	0.03	1.22-
	Albumin percentage	4.92	0.665	13.51	0.34-	0.04
Healthy	lifetime	45.67	12.26	26.85	0.48	0.31-
	Albumin percentage	4.44	0.797	17.94	0.24	0.41-

Through the results in Table (1), it was found that the average age of people with kidney failure ranges between 19.95± 49.47 years, while the average of albumin was 0.403 ± 4.53 g/dL. The average age of people with diabetes, it ranges between 11.997 ± 50.43 years. And the average of albumin was 0.665 ± 4.92 g/dL. The average age of healthy people was between 12.26 ± 45.67 years and the average of albumin was 0.797 ± 4.44 g/dL. It was also noted that the coefficient of variation for the ages of people with diabetes was (23.79%), which is more homogeneous compared to the coefficient of difference for the ages of people with kidney failure and healthy people, which were respectively (28.2% and 26.85%). For the percentage of albumin, it was found that the coefficient of difference for people with kidney failure is (8.89%) which is more homogeneous compared to people with diabetes and healthy people. As for the degree of torsion, It was discovered that the torsion coefficient for people with kidney failure was (-0.15) and people with diabetes was (-0.34), that have a negative torsion, which indicates that the distribution is slightly twisted to the left, but for healthy people, it was found that the torsion coefficient was (0.24), which is a simple positive torsion, and therefore it must be ensured whether the data follow the normal distribution or not, Which will be confirmed by the Shapiro-Wilk test at a level of 5% significance and this test is more powerful than other statistical tests in determining whether the data follow the normal distribution or not, and Table (2) shows that.

Table 2: The Results of Shapiro-Wilk Test for Normal Distribution.

Variables	Kidney failure	Diabetes	Healthy
P-value	0.246	.0366	.0206

From the results in Table (2), it was noted that the (p-value > 0.05) of the albumin ratio for people with kidney failure, diabetes and healthy people. Thus, they follow the normal distribution. This was confirmed by the histogram graph in Figure (1). It was found that the curve of the probability density function in relation to the value of albumins for people with kidney failure, diabetics and healthy people

was the same, and therefore it follows the normal distribution and this is confirmed by the Shapiro-Welk test where p-value>0.05.
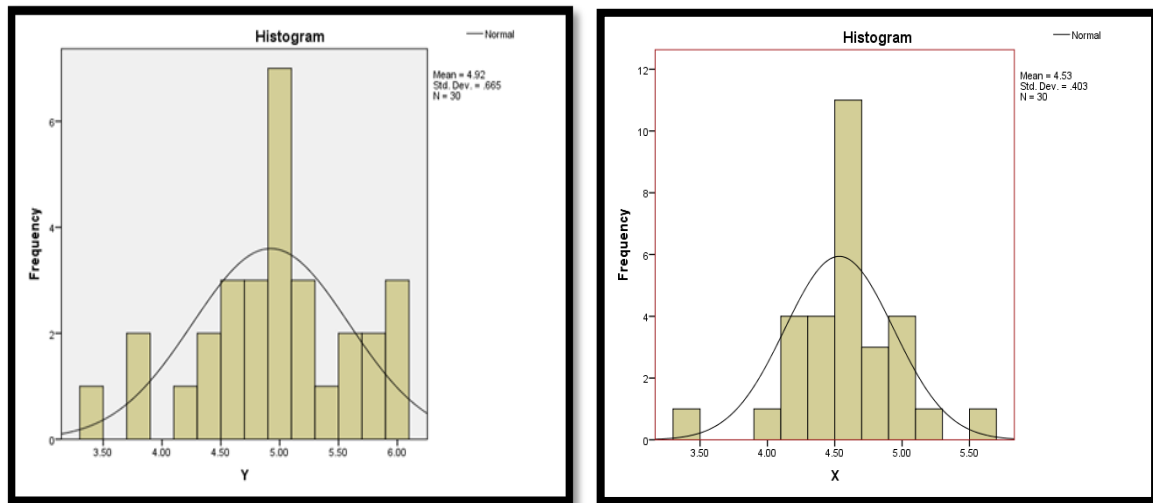

Figure (1): Histogram of the albumin ratio.

Pearson's correlation coefficient was used to determine the type of relationship between the study variables in terms of strength and direction, through the table (3) it was noted that, there was a difference in the correlation coefficient between each two variables in terms of strength and direction, it means there is a weak direct correlation between the age and the percentage of albumin for people with kidney failure, it was also found that the relationship between age and the percentage of albumin for people with diabetes for all study variables is greater than 5%, this means that the correlation between each pair (P.value) is inverse and weak, and the value is insignificant.

Table (3): Correlation and P-value between age and the rest of the study variables.

Albumin Percentage	Lifetime	
	Correlation Coefficient (r)	Relationship Morale (p)
Renal Failure	0.189	0.31
Diabetics	0.11-	0.56
Healthy	0.094	0.62

The results were also compared with the reference values, where through the figures (2,3,4) it was noted that the readings of the percentage of albumin for patients with kidney failure are all within the limits of the reference value (except for one only), while the readings of the percentage of albumin for diabetics and healthy people, were within the limits of the reference value.
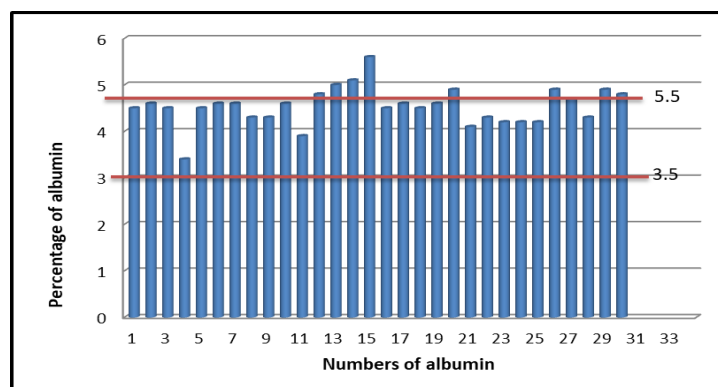

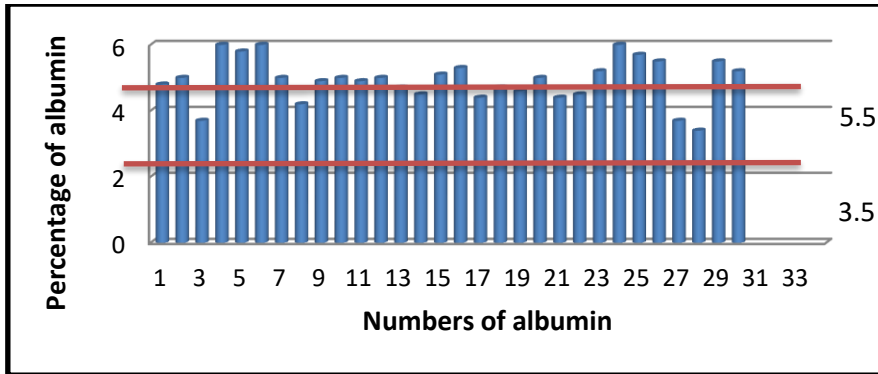**Figure (2):** Percentage of albumin in blood serum for patients with kidney failure and limits of its reference value.

Figure (3): Percentage of albumin in blood serum for diabetics and limits of its reference value.
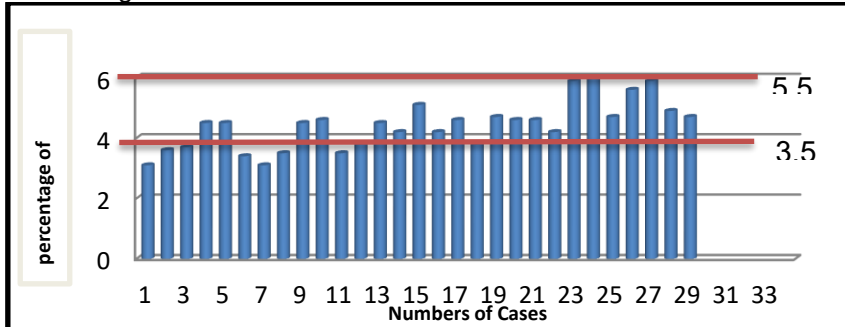

Figure (4): Percentage of albumin in blood serum for healthy people and limits of its reference value.

In addition, to compare the percentage of albumin for kidney failure patients, diabetics and healthy people, the One-Way Anova test was used to test whether there was equality in the three averages below the level of significance of 5%, and the results were as follows.

Table (4): Table of Variance analysis

ANOVA					
XYZ					
	Sum of Squarea	Push	Mean Square	F	P-value
Between Groups	3.906	2	1.953	4.723	0.011
Within Groups	35.974	87	413.	-	-
Total	39.880	89	-	-	-

Through the table (4), it was found that the P-value is equal to 0.011, which is smaller than the value of 5%, and this indicates that there are significant differences, means there were difference between the averages of the three groups, and to mark the source of the difference, multiple comparisons were used (test of the least significant difference LSD) and its results were shown in Table (5). Through the results, it is clear that the source of the difference is the percentage of albumin for diabetics (2).

Table 5: Test of the lowest significant difference LSD.

Multiple Comparisons						
Dependent Variable: XYZ						
LSD						
					Confidence Interval 95%	
code (I)	code (J)	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
1.00	2.00	-.39000*	.16603	.021	-.7200	-.0600
	3.00	.09000	.16603	.589	-.2400	.4200
2.00	1.00	.39000*	.16603	.021	.0600	.7200
	3.00	.48000*	.16603	.005	.1500	.8100
3.00	1.00	-.09000	.16603	.589	-.4200	.2400
	2.00	-.48000*	.16603	.005	-.8100	-.1500

*. The mean difference is significant at the 0.05 level.

Discussion

The results of this study indicate that there is a weak correlation between age and the percentage of albumin in people with kidney failure and healthy people, meaning that the older the age, the higher the percentage of albumin increases by a small percentage because the value of the correlation coefficient was very small, and perhaps this is due to the reason mentioned in one of the previous studies, as it indicated that an increase in the level of albumin is associated with inflammatory disorders or chronic inflammation, as some types of proteins, including albumin, rise when the body fights an infection or inflammation, as well as there are advanced cases of chronic kidney disease and liver disease. Therefore, its production increases in a liver where albumin protein acts as a carrier of substances such as enzymes, hormones, supplements and immune globulin (antibodies) and transferred to the place of infection, and inflammation increases the depletion of capillaries and the escape of albumin in the blood, thus increasing the total volume of albumin in the blood.

There is also a weak inverse relationship, in people with diabetes and this explains the decrease in the level of albumin when they increase in age, which means, age does not affect the increase of albumin in people with diabetes, and the reason for the lack of albumin is mostly indicated by the results of previous studies is that people with diabetes have an increased risk of developing non-alcoholic fatty liver disease (cirrhosis), which is the most common cause of low albumin levels in the blood, following the death of hepatocytes and damage to the liver's ability to produce, which leads to an increase in glycogen in the liver, which is common among diabetes patients.

In addition, the results showed significant differences, means that, there is a difference between the arithmetic mean of albumin percentage in the three groups (kidney failure, diabetes mellitus, and healthy people). Most of the albumin levels were within the limits of the reference value for people with diabetes. There are 5 samples from 30 samples are higher than the reference value. There is a study proved that the decrease in the percentage of albumin in the blood is an inherited trait in the families of diabetic patients who have low albumin levels as a result of losing it through urine, as the normal kidneys do not lose albumin, but if the kidneys are damaged, the filter system in the kidneys does not work well and allows large proteins such as albumin to leak into the urine, where it is lost. Albumin in the urine is associated with a gradual deterioration in the kidneys, which causes kidney failure.

Conclusion

Albumin is the major serum protein, and has multiple important physiological functions in the body. In this paper, a comparison was made between the lack of albumin protein in the blood of people with renal failure and diabetes and a healthy group for both males and females in the city of Gharyan. The results showed, there are significant differences between the average albumin levels in the three groups. There is a weak direct relationship between age and albumin levels in people with kidney failure and healthy people, and also there is a weak inverse relationship between age and albumin levels in the diabetes. Therefore, people with renal failure and diabetes are recommended to conduct a continuous analysis of the percentage of albumin in the blood.

Acknowledgments

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