

Ministry of Higher Education

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College of Medicine



**The relationship between Diabetes mellitus
and anemia among diabetic patients who
attend Baquba teaching hospital in Diyala,
Iraq**

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Abstract

Background: The World Health Organization defines anemia as a hemoglobin concentration of less than 13 g/dL in men and less than 12 g/dL in women. It should also be noted that, due to the development of diabetes mellitus, the nephropathy may arise, which further undermines the renal production of erythropoietin, positively contributing to an increased anemic framework. We conducted this study to investigate the relation between DM and anemia.

Patients and methods: this is cross-sectional study conducted on the patients attending the consultatory clinic of Baquba teaching hospital. We collected the date from the hospital records and the personal latest investigations regarding RBS and hemoglobin levels.

Results: 100 patients were enrolled in this study, 64 females and 36 males with mean age 51.07 years. Their mean RBS levels were approximately 310 mg/dL and their mean hemoglobin levels was 12.8 g/dL. There was a strong negative correlation between the variables investigated ($P < 0.001$).

Conclusion: There is a strong association between the development of anemia and the glycemc state among the diabetic patients.

Keywords: anemia, Diabetes mellitus, hemoglobin.

Introduction

The World Health Organization defines anemia as a hemoglobin concentration of less than 13 g/dL in men and less than 12 g/dL in women. Hemoglobin and hematocrit values differ little between the healthy elderly population and the younger population. Thus, anemia is not a normal finding in older persons, and hemoglobin concentration should not be adjusted downward in older persons [1]. According to WHO, around half of the cases of anemia in the world are due to iron deficiency anemia (IDA). The reports showed that the prevalence of IDA is 2.5 times that of anemia [2].

Diabetes mellitus (DM) is a metabolic disorder of great impact worldwide. Epidemiological data showed that in 2010 there were 285 million people affected with the disease in the world, and it is estimated that in the year of 2030 we will have about 440 million diabetics. Its worldwide prevalence is increasing fast among developing countries. The type 2 diabetes affects about 7% of the population [3].

Hyperglycemia has a direct relationship with the development of an inflammatory condition showed by the increased expression of proinflammatory cytokines such as IL-6, TNF- α , and NF κ B. Thus, diabetes, as well as hyperglycemia due to its nature, is also an inflammatory disease character. Studies show that the longer the duration of the disease and/or loss of glycemic control, the higher the inflammatory process [4].

The elevation of proinflammatory cytokines plays an essential role in insulin resistance and induces the appearance of cardiovascular complications diabetic micro- and macrovascular, kidney disease and anemia. By increasing especially IL-6, antierythropoietic effect occurs, since this cytokine changes the sensitivity of progenitors to erythropoietin (erythroid growth factor) and also promotes apoptosis

of immature erythrocytes causing a decrease, further, in the number of circulating erythrocytes and consequently causing a reduction of circulating hemoglobin [5].

It should also be noted that, due to the development of diabetes mellitus, the nephropathy may arise, which further undermines the renal production of erythropoietin, positively contributing to an increased anemic framework. According to Escorcio et al. [6] approximately 40% of diabetic patients are affected by kidney diseases. The decreased renal function and proinflammatory cytokines are the most important factors in determining reduction of hemoglobin levels in those patients. The inflammatory situation created by kidney disease also interferes with intestinal iron absorption and mobilization of inventories.

Anemia in diabetic person has a significant adverse effect on quality of life and is associated with disease progression and the development of comorbidities, as obesity and dyslipidemia that are strongly associated with diabetic framework and significantly contribute to increasing the risk of cardiovascular diseases [7].

Aim of study

To identify the association between anemia and diabetes mellitus by demonstrating the association between blood sugar levels and the hemoglobin levels.



Patients and methods

This is cross sectional study. We collected a sample of diabetic patients without regard to the type of diabetes mellitus. We chose our sample from the patient who attended the consultatory clinic in Baquba teaching hospital in the period from July 2022 to December 2022. We collected the data using the hospital records and the personal records of the latest investigations they underwent. We collected data regarding the age, gender, the Random blood sugar levels and the hemoglobin levels. RBS was measured by mg/dL after two hours from the last meal and the hemoglobin by g/dL. Any diabetic patient was eligible to the study and we excluded the infants and neonates and the diabetic patients who have another cause for anemia (e.g., malignancy). The confidentiality of patients was preserved.

Statistical analysis

Statistical package of social sciences (SPSS) version 25 was used to analyze the data. We expressed the qualitative data frequencies and the quantitative data by arithmetic mean and standard deviation. Pearson correlation was used to identify the association between the variables when $P < 0.05$ considered significant.

Results

100 patients were enrolled in this study. The percentage of gender is demonstrated in table 1.

Table 1. The gender percentages

Gender	Frequency	Percent
Female	64	64%
Male	36	36%
Total	100	100%

Their age information is demonstrated in table 2.

Table 2. The age information of the sample

Mean	51.07
Median	53.00
Std. Deviation	13.999
Minimum	8
Maximum	80

Their blood sugar levels are demonstrated in table 3.

Table 3. RBS levels measured in mg/dL

Mean	310.4583
Median	293.3250
Std. Deviation	94.60455
Minimum	202.54
Maximum	658.19

Their hemoglobin levels are demonstrated in table 4.

Table 4. hemoglobin levels measured in g/dL

Mean	12.816
Median	12.800
Std. Deviation	1.6763
Minimum	8.3
Maximum	16.4

We found strong correlation between the Hb level and the RBS level in our sample when r is equal to 1. And $P < 0.001$.

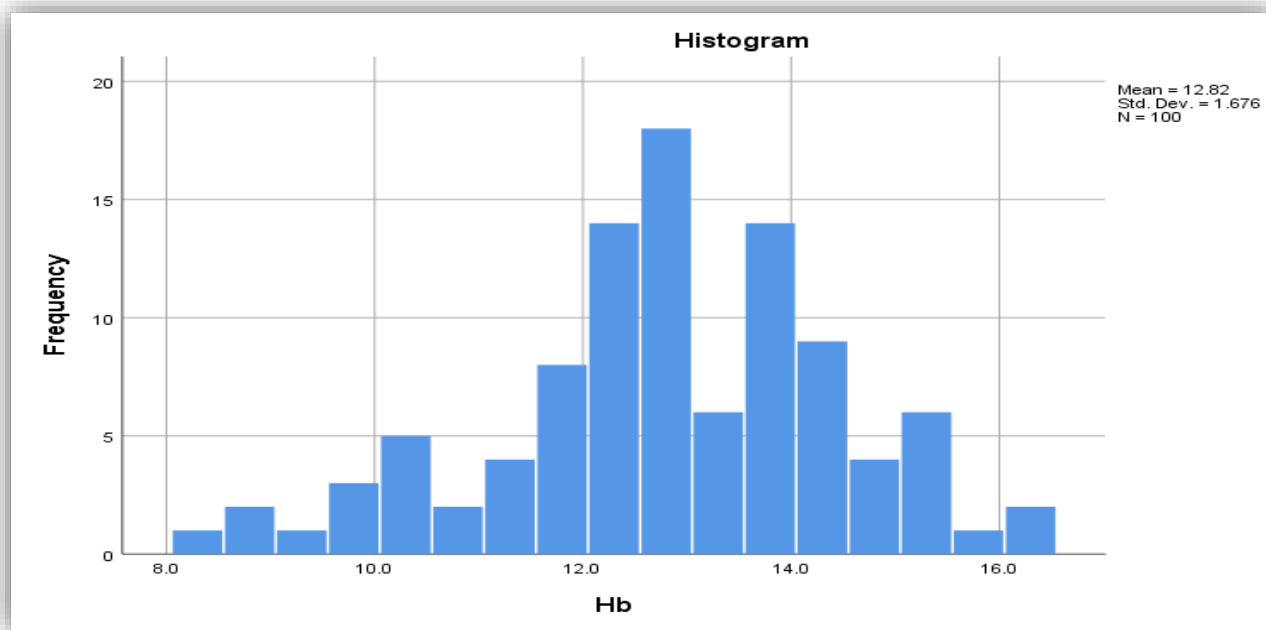


Figure 1. frequency of the hemoglobin levels.

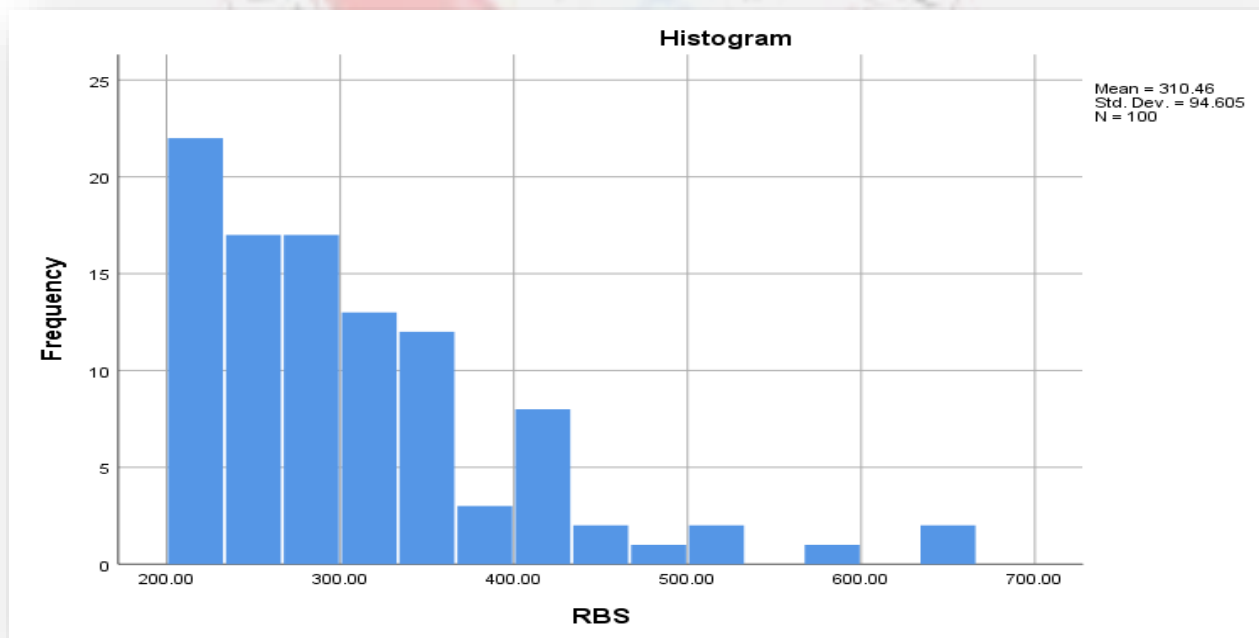


Figure 2. frequency of RBS levels.

Discussion

Often, chronic diseases, such as DM, are accompanied by mild-to-moderate anemia, often called anemia of inflammation or infection or anemia of chronic disease [8]. *Andrews and Arredondo* [9] determined the presence of anemia in type 2 diabetic patients as well as evaluating the expression of genes related to inflammation and immune response.

Adipose tissue has more recently been recognized as a metabolically active organ system linking the endocrine and immune systems; furthermore it is the source of a variety of cytokines. Higher baseline BMI remained a predictor of additional adjustments for blood pressure level and the presence or absence of diabetes mellitus. Similar to TNF-alpha, IL-6 is a proinflammatory adipokine that correlates with body weight and insulin resistance [10].

The increased inflammatory activity in adipose tissue of obese patients favors the production of hepcidin that in anemia of chronic disease is increased during infection and inflammation, causing a decrease in serum iron level through a mechanism that limits the availability of iron. The association of higher iron stores with diabetes and insulin resistance has been repeatedly confirmed by many investigators. Ferritin levels were found to predict a higher rate of diabetes in prospective studies and case-control cohorts [11-12].

In our study we found a strong relationship between Diabetes mellitus and the development of anemia through our investigation about the correlation of between random blood sugar levels in the serum and the hemoglobin levels. We found a strong negative correlation between the investigated variables and $P < 0.001$.

Kidney impairment, chronic inflammation and nutritional deficiencies associated with DM are some the most important underlying causes of anemia. DM

is the leading cause of chronic kidney disease (CKD) globally. CKD leads to impaired iron metabolism and reduced production of erythropoietin leading to reduced production of red blood cells. There is an inverse relationship between declining estimated glomerular filtration rate and the prevalence of anemia [13].

Our findings agree with the findings of *Craig et al.* [14], who found a significant decrease Hb levels among diabetic patients. Also agree with the findings of *Ranil et al.* [15], “ Every tenth individual in a population of diabetes mellitus could be anemic”. And finally, our findings are consistent with the findings of *Olum et al.* [16] who found an increased prevalence of anemia among diabetic patients.

The main limitation of our study the uncertainty of the patients about their glycemic state.



Conclusion and recommendations

There is a strong association between the development of anemia and the glycemic state among the diabetic patients and we recommend conducting more studies about this topic and especially about the relation between hemoglobin level and other inflammatory mediators.



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