



# Assessment of Hematological Parameters and Glycated Hemoglobin of Diabetic Patients in Zliten Center for Diabetes

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## ABSTRACT

### Keywords:

Hematological Parameters,  
Glycated Hemoglobin, Diabetic  
Patients, Zliten.

Diabetes mellitus (DM) is a complex disease characterized by chronic hyperglycemia that leads to long term macrovascular and microvascular complications. Several studies have shown that DM affects the morphology and functioning of red blood cells, white blood cells and platelets, which is reflected as aberrations in routine hematological parameters. The main objective of this study was to assessment of hematological parameters and glycated hemoglobin of diabetic patients in Zliten center for diabetes. This study was directed from march 2022 to September 2022 on 400 diabetic patients (220 male, 55%) and (180 female, 45%), with a mean age of 40 years. The results of this study show that, the prevalence of anemia in this study was (50%). The mean of hemoglobin (HB) in female was 9g\dl, while the mean of HB in male was 10g\dl. The average of Mean Cell Volume (MCV) in female was 75fl., Whereas was in male 77fl., and the mean of Mean Cell Hemoglobin (MCH) was in female 23pg., Although was in Male 24pg. Average of White blood cells (WBCs) count in these patients were 12\mcL in male while were 11\mcL in female and mean of lymphocytes in male were 28%, mean of lymphocytes in female were 26%, mean of neutrophils in male were 58% and mean of neutrophils in female were 55% respectively. The mean of Glycated Hemoglobin (HbA1c) in female was 8%, while the mean of HbA1c in male was 9%.

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## Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels due to defects in insulin secretion, insulin action, or both. The management of diabetes involves regular monitoring of various parameters, including hematological parameters and glycated hemoglobin (HbA1c), which provide critical insights into the patient's overall health and glycemic control [1].

Hematological parameters refer to the components of blood that can be measured through laboratory tests. These include red blood cells (RBCs), white blood cells (WBCs), hemoglobin levels, hematocrit, and platelet counts. In diabetic patients, these parameters can be affected by several factors including increased production of reactive oxygen species (ROS) and the formation of advanced glycation end products (AGEs) as a result of the long-term hyperglycemia. Increased production of ROS resulting in oxidative stress, which is implicated in tissue damage and hematological changes such as RBC dysfunction, PLT hyperactivity, and endothelial dysfunction [2,3].

HbA1c is a crucial biomarker used to assess long-term

glycemic control in individuals with diabetes. It reflects the average blood glucose levels over the previous two to three months by measuring the percentage of hemoglobin that has glucose attached to it [4].

Higher HbA1c levels are associated with an increased risk of microvascular complications such as retinopathy, nephropathy, and neuropathy, as well as macrovascular complications like cardiovascular disease. The American Diabetes Association recommends maintaining an HbA1c level below 7% for most adults with diabetes; however, individualized targets may be set based on patient-specific factors such as age, comorbidities, and duration of diabetes [5,6].

Hematological changes have been observed in T2DM patients. Current diabetes management guidelines do not recommend periodic monitoring of hematological parameters. Although studies on the hematological parameters of diabetic patients in various areas produced contradictory results. Some studies found that there is no statistically significant difference between diabetic patients and healthy controls in terms of RBC indices, WBC count, and platelet count [14,19], while the other

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study showed that RBC, WBC, and PLT indices are significantly higher in diabetic patients than controls [7-9]. Therefore, the main objective of this study was to Assessment of hematological parameters and Glycated hemoglobin of diabetic patients in Zliten Center for Diabetes

**Methods**

**Study design and setting**

This was a retrospective descriptive study, conducted in from March 2022 to September 2022 on 400 diabetic patients (220 Male, 55. %) and (180 Female, 45. %), with a mean age of 40 years.

**Data collection**

Patient data was collected from the patient's file from the archive room. The CBCs were tested for each individual involved in this study. Sysmex-KX-21N hematology auto analyzer (Sysmex, USA) was used in the diagnostic lab of Misallata central hospital. The CBCs were measured to screen blood status. The following parameters were measured from CBC result; RBCs count  $\times 10^3/\mu\text{l}$ , HGB g/dl, MCV fL. and MCH pg. However, the 2ml of collected blood samples of each patient were tested by Sysmex-KX-21N to measure CBCs.

**Data interpretation**

Anemia was defined using the World Health Organization (WHO) definition. The normal number of WBCs in the blood is 4000 to 11000 WBCs per microliter ( $\mu\text{L}$  or  $\text{m}\mu\text{L}$ ) or cubic millimeter ( $\text{mm}^3$ ) of blood (4.0 to 11.0  $\mu\text{mL}$ ). The normal range of neutrophils in health is 40-80%, and the normal range of lymphocytes is 20-40%.

**Data analysis**

Data were entered and analyzed by the Microsoft Excel Worksheet. Normality test was done to check the data. Percentages, cross tabulation, means and standard deviations were produced and calculated.

**Results**

The present study included 400 diabetic patients (220 Male, 55%) and (180 Female, 45%), with a mean age of 40 years (Table 1).

The prevalence of anemia in this study was (50%) as shown in (Table 2).

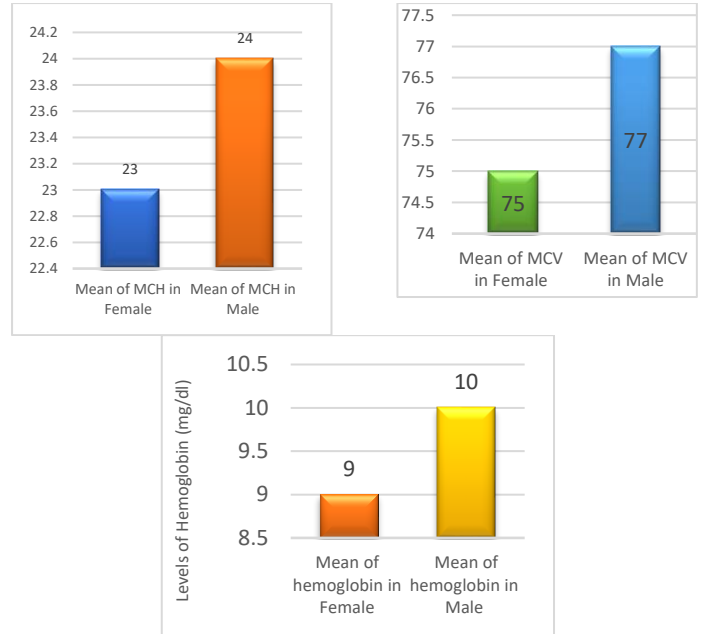
**Table 1. Distribution of the sample according to the incidence of gender:**

Gender	frequency	Percentage %
Males	220	55%
Females	180	45%
Total	400	100%

The mean of hemoglobin (HB) in female was 9g\dl, while the mean of HB in male was 10g\dl. The average of MCV in female was 75fl., whereas was in male 77fl., and the mean of MCH was in female 23pg. Although it was in Male 24pg, as shown in figure 1.

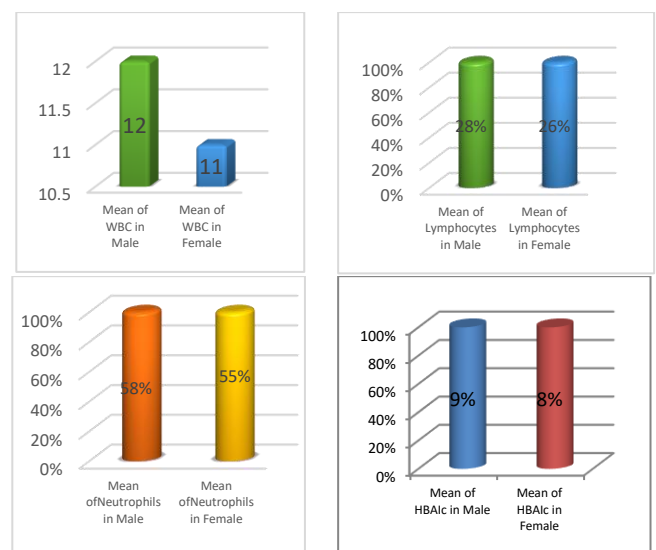
**Table 2. Distribution of the sample according to the incidence of anemia.**

Anemia	Frequency	Percentage %
Normal	200	50%
Abnormal	200	50%
Total	400	100%



**Figure 1. HB, MCV, MCH results among the involved patients.**

An average of WBC count in these patients were 12  $\mu\text{mL}$  in Male while were 11  $\mu\text{mL}$  in female and mean of lymphocytes in male were 28%, mean of lymphocytes in female were 26%, mean of neutrophils in male were 58% and mean of neutrophils in female were 55% respectively. The mean of Glycated hemoglobin (HbA1c) in Female was 8%, while the mean of HbA1c in Male was 9% as shown in figure 2.



**Figure 2. WBC results among the involved patients.**

## Discussion

Diabetes is a major public health problem worldwide. Global burden of diabetes is increasing and is expected to be around 366 million by 2030 [10]. Anemia is common in diabetes, potentially contributing to the pathogenesis of diabetes complications [11]. This study included 400 diabetic patients (220 male, 55%) and (180 female, 45%), with a mean age of 40 years. It was found that, the prevalence of anemia in our study population was (50%) and HB in Female was 9g\dl, while the mean of HB in male was 10g\dl. The average of MCV in female was 75fl., whereas was in male 77fl., and the mean of MCH was in female 23pg., although was in Male 24pg. An average of WBC count in these patients were 12\ mcL in male while were 11\ mcL in female, and the mean of lymphocytes in male were 28%, mean of lymphocytes in female were 26%, mean of neutrophils in male were 58% and mean of neutrophils in female were 55% respectively. HbA1c in female was 8%, while the mean of HbA1c in male was 9%. The percentage of anemia noted in our study was similar to the values reported in the national nutrition survey in Sri Lanka in 2009 [12].

Investigations to find an inflammatory biomarker as an indicator of diabetes complications have been under consideration for some years. Numerous biomarkers have been investigated. Many of the researchers have already shown that inflammatory processes play a part in the pathogenesis of diabetes and its complications [13]. Navarro JF proposed that activated innate immunity and inflammation are relevant factors in the pathogenesis of diabetes, with convincing data that type 2 diabetes includes an inflammatory component proved that elevated systemic neutrophil count is associated with the presence and severity of retinopathy as well as diabetes. This result indicates that systemic subclinical inflammation is related with retinopathy, and neutrophil-mediated inflammation may play an important role in the pathogenesis of retinopathy [14].

In this study, elevated WBC count was significantly associated with the worsening of glucose metabolism. In a study in Africa, it was found that WBC counts increased with increasing numbers of metabolic syndrome components in both men and women [15]. Leukocyte count can reflect the inflammatory situation of the whole body showed correlation between leukocyte count and diabetic complications in diabetic patients [16]. Therefore, leukocyte count can be a cost-benefit laboratory test that can identify diabetic individuals at high risk for micro- and macro vascular complications and can be used to prevent such patients from the possibility of morbid crises. Several studies have suggested an association between increased WBC count, diabetes mellitus and development of vascular complications in diabetics [16,17].

## Conclusion

Hematological parameters and glycated hemoglobin were found to be significantly higher among diabetic patients. This is a reflection of poor glycemic control and prolonged duration of exposure to high levels of glucose. MCV and

MCH were reduced in diabetic patients in this study. The results also show that the morphological changes in the RBC's are highly present in the diabetic patients. These changes may have direct impact on erythrocyte function and may contribute to patient complex pathology.

These parameters are easily measurable and conclude by suggesting that diabetic patients should undergo routine hematological profile checkup which may indicate the status of diabetic control and hence indicate towards the impending complications associated with aberrations in hematological parameters.

**Conflict of interest.** Nil

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