Original Research Article

COMPARISON OF HAEMOGLOBIN, RDW, RBC VALUES AMONG DIABETES MELLITUS AND NORMAL INDIVIDUALS

ABSTRACT:

Introduction: Diabetes mellitus is a disorder characterized by hyperglycemia. It has been reported that 75% of the primary cause for mortality in diabetes mellitus patients is cardiovascular disease which is caused by hyperglycemia. Erythrocytes of diabetes mellitus patients have a shorter life span than normal. Red cell distribution width (RDW) is a measure of the heterogeneity of the volume of red blood cells. High RDW has various adverse outcomes. The study aims to compare Haemoglobin, RDW, RBC values among diabetes mellitus and normal individuals.

Materials and methods: Blood samples of 20 patients with and without diabetes were collected from outpatients visiting Saveetha dental college and hospitals. The results of the following parameters Haemoglobin, RDW, RBC were analyzed using Independent t Test in SPSS software. The statistical significance(P value) was set at 0.05.

Results: It is evident that there is a higher incidence of diabetes among the male population compared to females which result in higher RBC and Haemoglobin values. The RDW value is also reported to be higher in diabetic patients than non-diabetic patients. For Haemoglobin p=0.984 (>0.05), RDW p=0.180 (>0.05), RBC p=0.680 (>0.05). The p values are >0.05 who is statistically not significant.

Conclusion: The Haemoglobin and RBC, RDW values are higher for diabetic patients than non-diabetic. Higher RDW has various adverse effects such as cardiovascular disease which may cause mortality in diabetes mellitus patients.

KEYWORDS:

Diabetes mellitus, RDW, RBC, Innovative technique, Haemoglobin.

Running Title: A comparative study on hemoglobin, RBC, RDW values between diabetic and normal individuals.

INTRODUCTION:

Hyperglycemia is the key factor in the diagnosis of Diabetes Mellitus. It has been reported that 75% of the primary cause for mortality in diabetes mellitus patients is cardiovascular disease which is caused by hyperglycemia(1). The red cell distribution width (RDW) is a measure of variation in size and volume of red blood cells (RBC) (2). RDW value is frequently used in clinical practice. RDW is provided in most of the hematological examinations. Red cell distribution width (RDW) is associated with morbidity and mortality in coronary artery disease. Red cell distribution width (RDW) is associated with morbidity and mortality in coronary artery disease (3). Previous studies have demonstrated the associations between high RDW values and various adverse health outcomes (4). The adverse outcomes of high RDW values are as follows: increased mortality, increased incidence of

atrial fibrillation, heart failure, and adverse prognosis in patients with heart failure or coronary heart disease (5). A correlation was demonstrated be
tween RDW and low heart rate variability.

The National Health and Nutrition Examination Study (NHANES), reported that high RDW values were associated with increased odds of cardiovascular disease and nephropathy (6). RDW values may be a useful clinical marker of vascular complications in DM. The mechanism by which RDW predicts mortality and other adverse outcomes remains unclear (7–9). The authors of the previous study suggested that chronic hyperglycemia mediates the association between high RDW and cardiovascular disease (10). It has been shown that hyperglycemia has multiple effects on RBC. In diabetes mellitus (DM) patients the lifespan of erythrocytes is shorter than normal (11). In addition to that, it has been reported that RBC counts have increased in pre-diabetic states and decreased in established DM, compared to normal glucose homeostasis (12). The effects of hyperglycemia include glycation of hemoglobin, reduced deformability of RBCs, and reduced RBC lifespan (13). Our team has extensive knowledge and research experience that has translate into high quality publications (14).(15–28) ,(29–33). Our team has extensive knowledge and research experience that has translate into high quality publications (14).(15–28) ,(29–33). This study was conducted to observe the variation between RDW, RBC, and Haemoglobin values among DM and healthy individuals.

MATERIALS AND METHODS:

It is a retrospective study. Blood samples from 20 patients with and without DM visiting Saveetha Dental College were collected. The study was undertaken with the approval of the Institutional Human ethical committee of Saveetha Dental College, SIMATS.IHEC number obtained was IHEC/SDC/UG-OPATH/21/01. Out of 20, 10 were patients with Diabetes Mellitus and 10 were healthy individuals. From the blood samples, the following required parameters such as Haemoglobin, RDW, RBC were evaluated and collected and recorded in the google sheet. The data collected were exported and analyzed using statistical software SPSS version 23 with a significant level of 0.05. The test done was an independent sample t-test and the p values were noted and the results were discussed.

RESULTS:

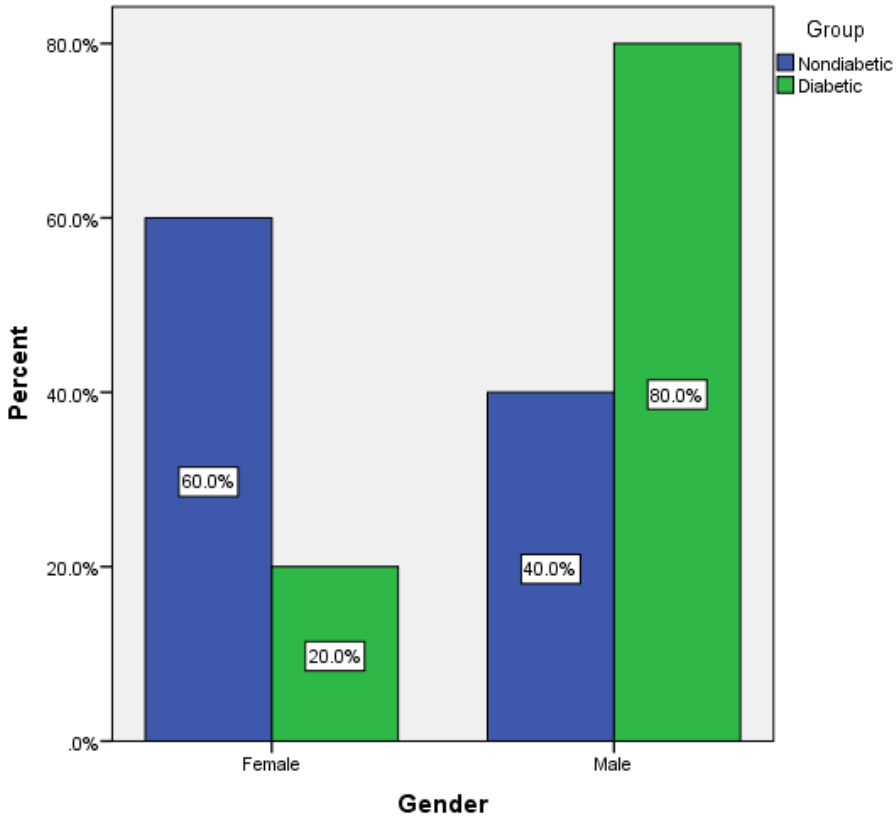

Figure 1: The bar graph represents the gender in which blue denotes the Nondiabetic group, whereas green denotes the diabetic group. The X-axis represents gender, Y-axis represents the percentage of the population.

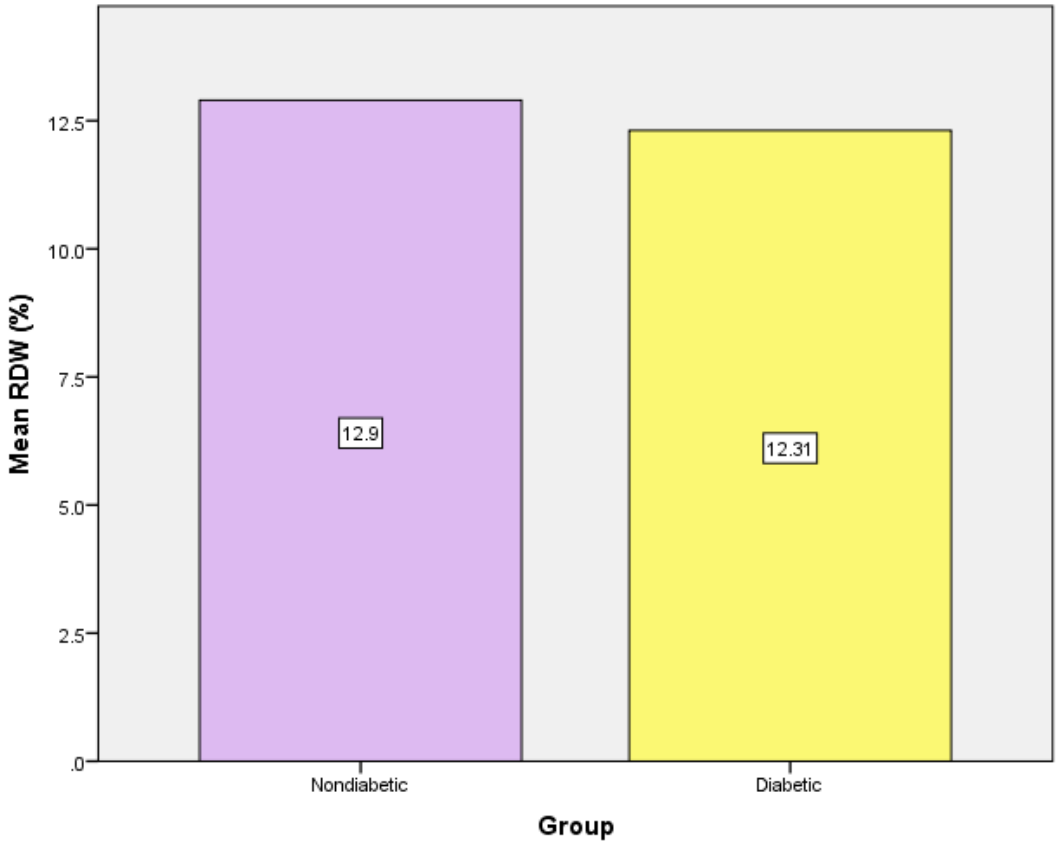

Figure 2: The bar graph represents the mean value for RDW in which Purple denotes the Nondiabetic group, whereas yellow denotes the diabetic group. The X-axis represents the group, the Y-axis represents the mean of RDW.

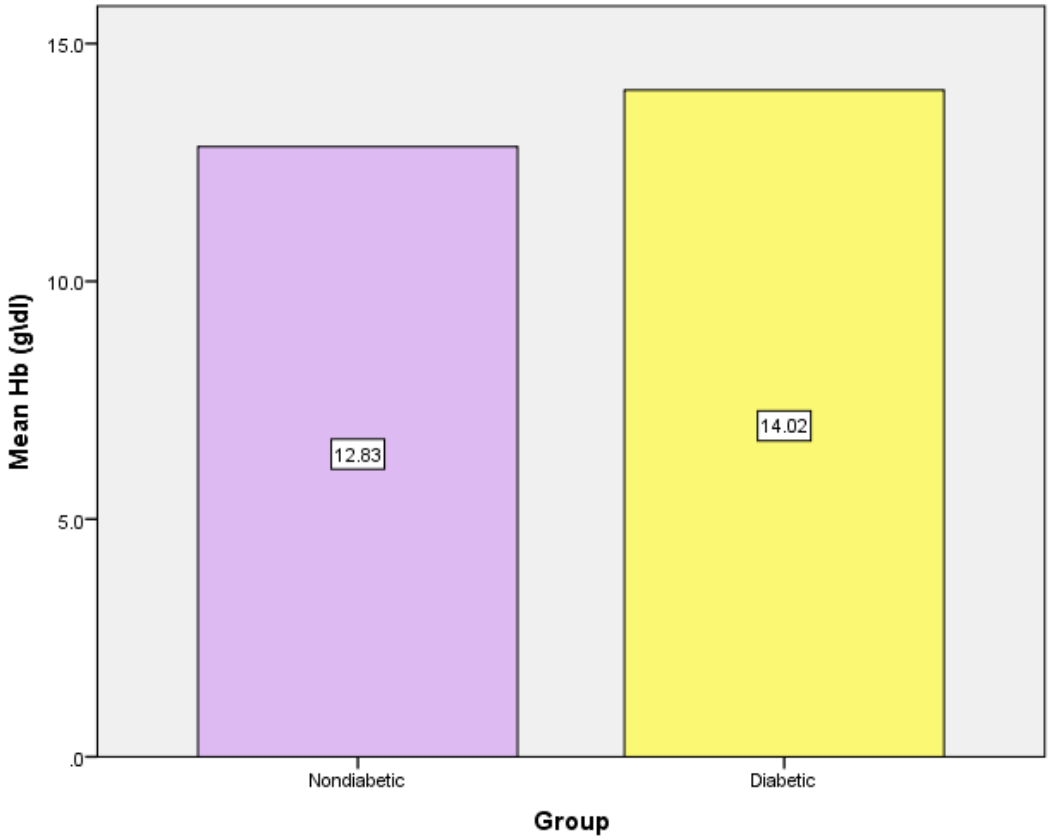

Figure 3: The above bar graph represents the mean value of Haemoglobin in which purple denotes the nondiabetic group, yellow denotes the diabetic group. The X-axis represents the group, the Y-axis represents the mean of Haemoglobin.

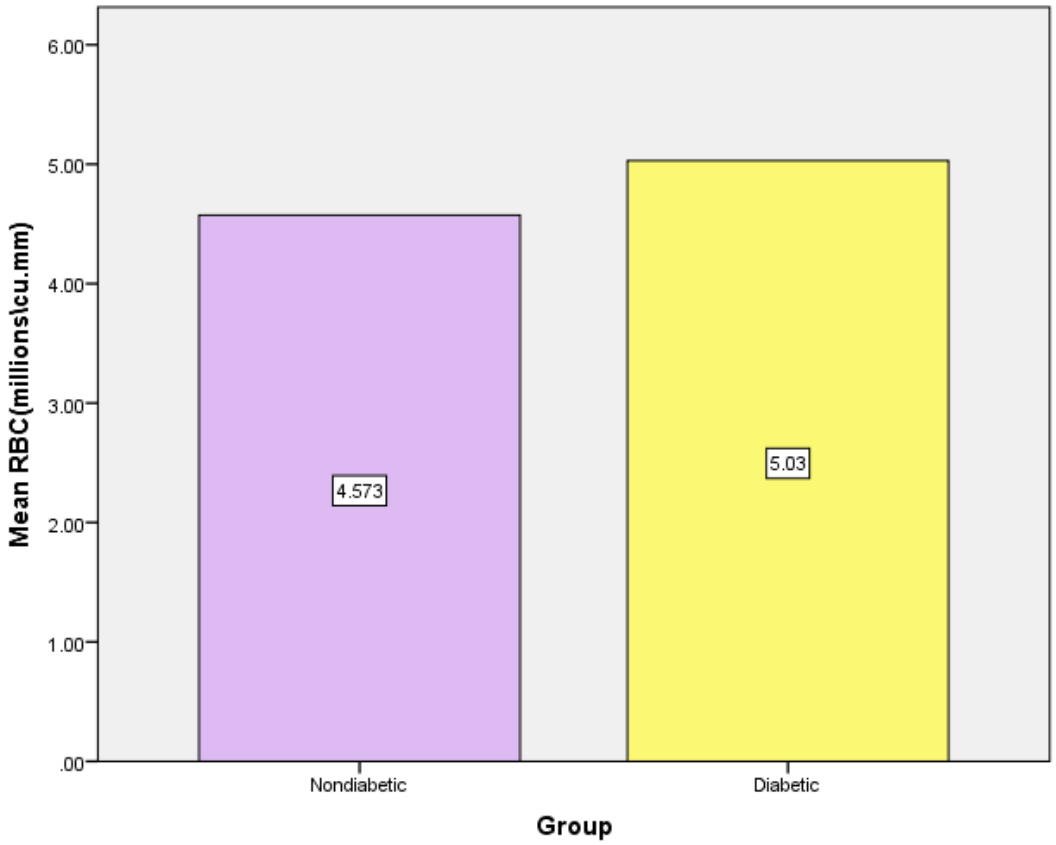

Figure 4: The above bar graph represents the mean value of RBC in which purple denotes the nondiabetic group, yellow denotes the diabetic group. The X-axis represents the group, the Y-axis represents the mean of RBC.

DISCUSSION:

As shown in figure 1, among the study participants in the non-diabetic group, female participants were higher at 60% than male participants at 40%. Among the diabetic group male were higher 80% than female 20%. It was found that males were more prevalent to Diabetes Mellitus than females. This finding is well correlated with the previous studies, that the males are more commonly affected by Diabetes Mellitus than females(34,35).

Figure 2 represents the mean value of RDW. When the RDW value was observed it is higher in the non-diabetic group than the diabetic group. In a previous study increased red blood cell distribution width (RDW) has been associated with adverse outcomes in heart failure and stable coronary disease in diabetes mellitus (36). It was found that the RDW (Red cell distribution width) is an indicator of the major complications of diabetes mellitus.

The bar graph of figure 3 represents the mean value of Haemoglobin. From the graph, it is obvious that Haemoglobin levels in the diabetic group are elevated when compared to the non-diabetic group. A previous study reported that the erythrocyte membrane of diabetic patients contains increased amounts of cholesterol (37), saturated fatty acids, and lipid peroxidation products (LPP) like malondialdehyde (MDA) 7-oxo cholesterol, and 7-keto-cholestasis (38–40). Also decreased amounts of phospholipids and polyunsaturated fatty acids have been reported.

Figure 4 represents the mean value of RBC, in which the RBC value of diabetic is higher than a non-diabetic.When the results were compared and analysed statistically by using the independent sample t-test , the parameters Haemoglobin, RDW, RBC were showed that there is no significant difference between the control and test groups as the p-values for Haemoglobin is 0.98($p > 0.05$), RDW is 0.18 ($p > 0.05$), RBC is 0.68 >0.05 statistically not significant. The findings obtained in our study were correlated with the previous studies by khalid et al and Auzannaeau et al in different countries (41,42).

The limitations of this study were, the demographic details of the study population were not matching each other. As the male population in the diabetes mellitus group were higher than the females. This led to biased results that the hemoglobin and RBC values of the diabetes mellitus (Test) group were higher than the normal healthy (control) population. The sample size of the study population is also small to obtain proper results. In future, further studies may be done to overcome these limitations and to obtain unbiased results.

CONCLUSION:

From the study even though it is not statistically significant, since the male population was higher the values of RBC, Haemoglobin, and RDW values were also higher in the diabetes mellitus individuals. RDW is a measurable biomarker that could improve risk assessment for individuals at risk of developing DM. Further studies have to be conducted to obtain unbiased results.

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