

# The Predictive Value of Red Cell Distribution (RDW) in Patients with Type 1 and Type 2 Diabetes Mellitus

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## Abstract

**Background:** Epidemiologically speaking the diabetes mellitus is one of the common leading causes of mortality and morbidity worldwide. Prognosis of the disease is variable and depends on the development of macrovascular and microvascular complications. Researchers are nowadays spending plenty of time trying to identify prognostic factors in order to make treatment approach be tailored according to the predictive value of such prognostic factors. One of these newly introduced factors is red cell distribution width (RDW).

**Aim of the study:** The current study was aiming at shedding light of the possible prognostic role of RDW in patients with type 1 and 2 diabetes mellitus.

**Patients and methods:** The present case control study was carried out at diabetes center in Al-Diwaniyah Teaching Hospital, Al-Diwaniyah Province, Iraq. The study started on January 2019 and ended on August 2019. The study included 30 patients with established diagnosis of type 2 diabetes mellitus, 30 patients with type 1 diabetes mellitus and 30 apparently healthy control subjects. Diabetic patients were selected randomly from the pool of patients already registered in that center.

**Results:** We grouped diabetic patients into two groups according to HbA1c level,  $\leq 7\%$  and  $> 7\%$  and contrasted hematological levels between those new groups. The results showed no significant difference in mean hematological values between the two groups in diabetic type 1 and type 2 patients ( $P > 0.05$ ).

**Conclusion:** There was no significant role for RDW in predicting poor glycemic control of patients with type 1 or type 2 diabetes mellitus.

**Key words:** RDW, diabetes mellitus type 1 and 2

## Introduction

Diabetes mellitus is represented by a heterogenous group of metabolic disorders sharing in common the criterion of chronically elevated blood sugar level (1, 2). The disease is heterogenous because of variation in the etiology associated with raised blood sugar. The most common form is type 2 diabetes mellitus in which the etiology is shared by resistant to insulin action and some degree of defective insulin secretion;

even though, early in the disease there may transient period of hyperinsulinemia (3). Type 2 diabetes was previously called non insulin dependent diabetes mellitus and adult onset disease; however, and because of insulin requirement to control the blood sugar level in significant proportion of patients late in the disease, in addition to the identification of children with type 2 diabetes mellitus, the preferred name nowadays becomes the "type 2 diabetes mellitus" (3).

Type 1 diabetes mellitus, on the other hand, is often recognized in patients younger than 40 and is principally caused by profound insulin deficiency (4). From etiologic perspective, the disease is autoimmune in approximately 70-90 % of cases and the rest of cases are

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labeled idiopathic as no cause can identified <sup>(5)</sup>. Other forms of diabetes mellitus included gestational diabetes, endocrine abnormality, drug induced and exocrine disease of the pancreas such as pancreatic tumors and resection <sup>(6)</sup>.

Epidemiologically speaking the disease is one of the common leading causes of mortality and morbidity worldwide <sup>(7, 8)</sup>. Prognosis of the disease is variable and depends on the development of macrovascular and microvascular complications <sup>(9)</sup>. Researchers are nowadays spending plenty of time trying to identify prognostic factors in order to make treatment approach be tailored according to the predictive value of such prognostic factors <sup>(10)</sup>. One of these newly introduced factors is red cell distribution width (RDW) <sup>(11)</sup>. Red cell distribution width (RDW) is a quantitative hematological parameter which can indicate the degree of variation in size of RBC (anisocytosis); initially was considered in the differentiation of cause of anemia <sup>(12)</sup>.

The data obtained from published articles dealing with the predictive role of RDW in diabetes mellitus are conflicting and no clear consensus can be inferred from these data. Besides, data from Iraqi literatures dealing with this subject are extremely rare; therefore, we were encouraged to plan and conduct the current study aiming at shedding light of the possible prognostic role of RDW in patients with type 1 and 2 diabetes mellitus.

### **Patients and Methods**

The present case control study was carried out at diabetes center in Al-Diwaniyah Teaching Hospital, Al-Diwaniyah Province, Iraq. The study started on January 2019 and ended on August 2019. The study included 30 patients with established diagnosis of type 2 diabetes mellitus, 30 patients with type 1 diabetes mellitus and 30 apparently healthy control subjects. Diabetic patients were selected randomly from the pool of patients already registered in that center.

Variables included in the questionnaire form included: duration of illness, age, body mass index, systolic and diastolic blood pressures, a number of hematological parameters, namely (MCV, RDW, WBC and platelet count), serum lipid profile (triglyceride, HDL and LDL) and glycated hemoglobin (HbA1c %). Patients were considered type 2 diabetes bases one positive protein c results.

The study was approved by institutional ethical approval committee and verbal consent was obtained from all participants.

Data were then transformed into an SPSS (version 23) spread sheet for statistical analysis. Quantitative data were expressed as mean and standard deviation. Independent samples t-test was used to compare mean values between two groups, whereas, one way ANOVA was used to compare mean values among more than two groups. The level of significance was considered at  $P \leq 0.05$ .

### **Results**

The current study included 30 patients with diabetes mellitus type 1, 30 patients with type 2 diabetes mellitus and 30 control subjects. The characteristics of subjects enrolled in the current study are shown in table 1. There was no significant difference in mean duration of diabetes mellitus between type 1 and type 2 DM patients ( $P > 0.05$ ); however, patients with type 1 DM were significantly younger than type 2 DM patients ( $P < 0.05$ ). There was also, no significant difference in mean BMI among study groups ( $P > 0.05$ ).

In addition, there was no significant difference in mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) among groups ( $P > 0.05$ ). WBC count was significantly higher in diabetic patients in comparison with control group ( $P < 0.05$ ); however, the count was comparable in both diabetic groups ( $P > 0.05$ ). Besides, there was no significant difference in other hematological parameters and serum lipid profile among study groups ( $P > 0.05$ ), as shown in table 1. We grouped diabetic patients into two groups according to HbA1c level,  $\leq 7\%$  and  $> 7\%$  and contrasted hematological levels between those new groups. The results showed no significant difference in mean hematological values between the two groups in diabetic type 1 and type 2 patients, as shown in table 2 and 3.

**Table 1: Characteristics of patients with diabetes and control subjects**

Characteristic	Control n = 30	DM type 1 Protein C -ve n = 30	Type Protein C +ve n = 30	P value
Duration of illness (years)	-----	7.23±6.91	7.1±6.82	> 0.05 ¥
Age (years)	55.42 ±11.7	35.64±10.81	57.84±10.7	<0.01 †**
BMI (kg/m <sup>2</sup> )	31.53±3.54	31.50±4.73	32.50±4.13±	> 0.05 †
SBP (mmHg)	127.60±6.1	129.55±16.7	130.41±15.6	> 0.05 †
DBP (mmHg)	79.1 ±6.51	73.75±7.11	74.55±5.15	> 0.05 †
MCV (fl)	83.51±7.5	81.80±7.00	81.12±7.6	> 0.05 †
RDW	12.98±1.96	13.61±1.2	13.57±1.5	> 0.05 †
WBC X10 <sup>6</sup> /L	5.98±2.1	6.8±1.99	7.1±2.20	<0.05 *
Platelet count X10 <sup>6</sup> /L	257.76±55.54	254.81±77	255.72±74	> 0.05 †
TG (mg/dl)	1.72±0.81	1.70±0.1	1.68±0.7	> 0.05 †
HDL (mg/dl)	1.2±0.37	1.1±0.08	1.09±0.2	> 0.05 †
LDL (mg/dl)	2.92±0.85	2.71±0.6	2.60±0.80	> 0.05 †

BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; MCV: mean corpuscular volume; RDW: red cell distribution width; WBC: white blood cell count; TG: triglyceride; HDL: high density lipoprotein; LDL: low density lipoprotein; ¥: independent samples t-test; †: one way ANOVA; \*: significant at P ≤ 0.05; \*\*: highly significant at P ≤ 0.01

**Table 2: Hematological characteristics of patients with type 1 diabetes mellitus according to HbA1c level**

Hematological characteristic	Hb A1C ≤7%	Hb A1C >7%	P value
MCV (fl)	81.94±7.1	80.23±7.2	> 0.05 ¥
RDW	13.94±1.1	14.22±1.09	> 0.05 ¥
WBC X10 <sup>6</sup> /L	255.83±61.1	259.56±65.1	> 0.05 ¥
Platelet count X10 <sup>6</sup> /L	6.55±1.9	7.17±2.5	> 0.05 ¥

MCV: mean corpuscular volume; RDW: red cell distribution width; WBC: white blood cell count; ¥: independent samples t-test

**Table 3: Hematological characteristics of patients with type 2 diabetes mellitus according to HbA1c level**

Hematological characteristic	Hb A1C $\leq$ 7%	Hb A1C $>$ 7%	P value
MCV (fl)	82.94 $\pm$ 7.1	80.93 $\pm$ 7.2	$> 0.05$ ¥
RDW	13.84 $\pm$ 1.08	14.42 $\pm$ 1.2	$> 0.05$ ¥
WBC X106/L	253.83 $\pm$ 62.1	257.56 $\pm$ 65.1	$> 0.05$ ¥
Platelet count X106/L	6.67 $\pm$ 1.9	7.19 $\pm$ 2.2	$> 0.05$ ¥

MCV: mean corpuscular volume; RDW: red cell distribution width; WBC: white blood cell count; ¥: independent samples t-test

### Discussion

Diabetes mellitus is a heterogenous disorder with wide spectrum of outcomes and complications that vary from to patient. These outcomes are determined by macrovascular and microvascular complications. Microvascular complications include nephropathy, retinopathy and neuropathy; whereas macrovascular complications included ischemic heart disease and cerebrovascular accidents. The development of these complications can be delayed and their effects can be minimized if patients were able to control their blood sugar strictly. For that reason, the quality of life of patients with type 1 and type 2 diabetes mellitus can be improved if treatment is directed toward strict glycemic control. Indeed, glycemic control can be determined by measuring HbA1c every 90 days in average. Recent studies have shown that the red cell distribution width (RDW) can be used as a prognostic factor since it has a correlation to HbA1c and diabetic complications and can be used as a predictive marker for diabetic control (11, 13); however, some authors have denied such role for RDW in diabetes mellitus (14, 15).

The evidence connecting red cell distribution width (RDW) with an increasing risk of mortality has been grown since the early report of its predictive value in patients with heart failure. It has also been described to independently anticipate cardiovascular and overall mortality in various high-risk populations and in the general population (16, 17). Besides, it has been shown to be a significant predictor of mortality in number situations such as malignancies, obesity and renal disorders (18). For that reason, some authors suggested that linking RDW to diabetes prognosis is justified (11).

In the current study it was shown that RDW is not sufficiently affected by type of diabetes or even by degree of glycemic control indicated by HbA1c. These results are in agreement with a number of authors (14, 15) and disagree with other authors (13, 11), thus we believe that it is very early to judge the role of RDW in diabetic prognosis and that a lot of research work is needed in order to reach clear consensus about such role.

In one study, it was found that Red cell distribution width (RDW) was significantly higher in diabetic patients than in control subjects ( $P=0.008$ ). It was also higher in patients with uncontrolled glycemia (HbA<sub>1c</sub>  $>$ 7%) than those with good control (HbA<sub>1c</sub>  $\leq$ 7%;  $P=0.035$ ) (11).

Actually, these findings are not consistent with the present study findings; however, the author of the later study agreed with us that other hematological characteristics were not affected by diabetes or its degree of glycemic control.

It is worth to mention that WBC was significantly higher in both diabetic groups when compared to non diabetic group. This finding is similar to the findings of several other authors (19-21); however, it contradicts other authors (11). Several explanations have been suggested to explain the high WBC in association with diabetes such as increased insulin resistance, development of complications and high rate of infections (19-21).

In conclusion, there was no significant role for RDW in predicting poor glycemic control of patients with type 1 or type 2 diabetes mellitus.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

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