Original Research Article

heamatological parameters of type2 diabetic patients attending Igbinedion University Teaching Hospital Okada, Edo State, Nigeria

ABSTRACT

Diabetes is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. This study was carried out at the Igbinedion university teaching hospital using 69 known diabetes individual attending the clinic and 69 non diabetes individual as control. A total of 138 individuals comprising of sixty-nine known diabetes individuals patients and sixty-nine non diabetic individuals were enrolled for the study. 37 (52.9%) were female and male constitute 33 (47.1%) for the non-diabetic, while 40 representing 57.1% were female and 30 (42.9%) were male. Ethical approval from the institution was sought prior to commencement of study. All phase of quality assurance was maintained; 5ml of whole blood was collected into an ETDA anticoagulated bottle and haematological parameters such as PCV, WBC, RBC and Platelet were conducted for all individuals, and RBC indices were calculated. Result obtained had a mean PCV, of 35.04±66.6, 34.63±47.2., 10.09±2.33., 11.24 ± 1.63., 3.99 ± 0.77., 4.41 ± 0.67., 7.07 ± 3.63., 7.20 ± 2.30.,262.56 ± 102.75., 204.27 ± 90.28 for control and diabetes respectively. Hb, RBC were statistically significant with P. value <0.05. The Red cell indices had MCV and MCHC having P- value <0.05 and were statistically significant. A logistic regression performed to determine the independent variables that significantly associated with diabetes using age and MCHC had an odd ratio of being diabetic is about 2.51 times likely for a unit in MCHC level with other variable held at control. This study showed a statistically significant variation in some hematological parameters of diabetic patients compared to control group .Low platelet and alteration to red cell morphology as seen MCV and MCHC among diabetic patients was found to be a mild public health problem. Therefore, routine screening of hematological parameters should be considered for proper management of diabetic patients.

Introduction

Diabetes mellitus (DM) is one of the most common non-communicable diseases affecting people around the world (1) and a metabolic disorder of chronic hyperglycemia characterized by disturbances to carbohydrate, protein, and fat metabolism resulting from absolute or relative insulin deficiency with dysfunction in organ systems (2). The disease has spread across regions, with rise in prevalence as reported by the International Diabetes Federation (IDF) with 425 million persons living with DM worldwide, with nearly 50% of these undiagnosed (3). The developing economies of Africa and Asia contribute a significant fraction of this figure. There is also a rising burden from the complications of DM alongside the ever-increasing prevalence of the disease (4). We now see high rates of DM-related amputations, cerebrovascular disease, heart-related problems, and kidney disease in populations that were not previously known for these challenging health problems. In Nigeria however, with a population of over 158 million people, is the most populous country in Africa and accounts for one sixth of Africa's population. Approximately 50% of Nigerians are urban dwellers and the country with cultural diversity among the ethnic groups (5). Health care delivery as seen in most facilities is at best sub-optimal with hematological parameters seldom measured in diabetic patients. Some of these, such as white blood cell (WBCs) count and hematocrit (HCT) level, have been shown to be associated with insulin resistance and incident T2DM (6). Hematocrit is positively correlated with hyperinsulinemia and other risk factors associated with insulin resistance such as high blood pressure, elevated serum triglycerides, low HDL cholesterol, and central obesity. Evidence from epidemiological studies suggests an association between total WBCs or leukocyte count, a non-specific marker of inflammation, and diabetes risk (7,8). The aim of this study is to determine the haematological parameters of diabetic patients .

Subjects and Methods

Study population

The study population included a convenience sample of males and females with T2DM, aged 40-60 years from patients seeking medical care at the Igbinedion University Teaching Hospital Okada, Edo State. A total of 69 known patients with T2DM and 69 healthy subjects with no history of diabetes and their fasting blood glucose (BG) levels were lower than 120 mg/dl were included. They were matched for age, gender and socio-economic conditions and they had no concurrent acute illnesses.

Data collection

A structured interview was conducted to collect data using a specially prepared questionnaire. All interviews were conducted face to face by the primary investigator who would explain the questions that participants may find difficult. Questions were simple questions consisting of a yes/no answers. All participants gave an informed consent prior to participation. All subjects were anonymized and a numerical system was used to identify both the patients and the corresponding samples obtained. Subjects fasted overnight for 8 hours overnight during which no treatment (insulin or hypoglycemic drugs) were taken. Lifestyle habits and medical history were documented. HCT, whole blood hemoglobin concentration, WBCs, MCHC, MCH, RBCs, MCV, lymphocytes, neutrophils and Platelet analyses of blood samples collected into test tubes with EDTA anticoagulant were performed on fully-automatic analyzer hematological analyzer (Mythic 18, Hungary).

Study duration

This study was a two month duration commencing from July 2022 to August 2022, samples were analysed in the hematology laboratory immediately after collection.

Data Analysis:

Data were analysed using SPSS for windows version 20, average value were calculated and expressed in mean and standard deviation (Mean±SD). Comparison of mean difference was done using independent sample t-test and p-value less than 0.05 ($p<0.05$) was considered statistically significant. The actual p-

values were reported in the tables but the p-value as low as 0.0001 were expressed as p-value less than 0.001 ($p<0.001$).

Results

A total of 138 individuals comprising of sixty-nine known diabetes individuals patients and sixty-nine non diabetic individuals were enrolled for the study. 37 (52.9%) were female and male constitute 33 (47.1%) for the non-diabetic, while 40 representing 57.1% were female and 30 (42.9%) were male (see Table 1).

The mean age for the diabetic versus non diabetic individual is as shown in table 2 and is statistically significant ($p< 0.05$)

Table 3 is the mean comparison of the haematological parameters of the patients and the control. Platelets, PCV values were higher in the control subject and not statistically significant with p-value $p>0.05$, were as slight elevation in the mean value for WBC count and also not statistically significant Haemoglobin (Hb) and RBC for control versus diabetic subjects were statistically significant. Table 4 shows the Leukocyte differentials, Monocytes and granulocyte were elevated but not statistically significant when compared with the mean value for control against diabetic subjects. The red blood cell indices is as shown in Table 5. A statistically significant value ($p<0.05$) was observed for the mean cell haemoglobin concentration (MCHC) for the control and the diabetic subjects. In the total number of patient with diabetic, a logistical regression (n=69) was performed. Table 6 it is shown that the odd of being diabetic is about 2.51 time likely for a unit in MCHC value with other variables are held constant.

Table 1: Gender distribution of the study population

		Frequency (%)	
Variable	Category	Non-diabetic	Diabetic
Gender	Female	37 (52.9)	39 (57.1)
	Male	34 (47.1)	30 (42.9)
	Total	69 (100)	69 (100)

The table showed the gender distribution of the study population. The total number of the subjects were 138, consisting of 69 apparently healthy and 69 diabetics patients. 37 (52.9%) of the apparently healthy subjects were female while 34 (47.1%) were male. The gender distribution of the diabetic patient were 39 (57.1) and 30 (42.9%) for female and male respectively.

Table 2: Mean age comparison between non-diabetics and Diabetics patients

Variable	**No**	**Age (Mean±SD**	**t-test**	**p-value**
Non-diabetic	69	37.7±17.3	2.8	0.006
Diabetic	69	44.7±11.7		

The table showed the average age of the non-diabetic and diabetic subjects. The average age of the diabetic patient (44.7±11.7) was higher than the control subject (37.7±17.3). The mean different was statistically significant ($p<0.05$).

Table 3: Mean comparison of the Haematological profile of the Patients and the control

Variables	Control(n=69)	Diabetics (n=69)	t-test	p-value
PCV	35.04±6.68	34.63±4.72	0.42	0.67
HB	10.09±2.33	11.24±1.63	3.41	0.001
RBC	3.99±0.77	4.41±0.67	3.51	0.001
WBC	7.07±3.63	7.20±2.30	0.22	0.83
PLATELET	262.56±102.75	204.27±90.23	1.47	0.14

The table showed the average value (Mean±SD) of the haematological profiles. Seen in the table, the average haemoglobin (HB), and red blood cell (RBC), of the diabetic subject was higher than the non-diabetic subjects. The mean comparison of the RBC and HB level showed that the parameter was statistically significantly higher ($p<0.05$) in the diabetics than non-diabetics. The PCV, platelet level was higher in the control subject, but the difference in the mean between the control and the diabetic was not statistically significant ($p>0.05$). The White blood cell (WBC) of the diabetic was higher than the control, but the mean difference was not significant ($p>0.05$)

Table 4: Leukocytes differentials

Variables	Control	Diabetics	t-test	p-value
Lymphocytes	38.56±1404	36.49±13.77	0.88	0.38
Monocytes	6.39±1.85	6.46±2.79	0.18	0.86
Granulocytes	54.97±14.92	57.14±14.80	0.86	0.39

The mean difference between the diabetic and non-diabetics' leukocytes differential parameters was not significant ($p>0.05$)

Table 5: Red Blood Cell Indices

Variables	Control	Diabetics	t-test	p-value
MCV	86.00±13.41	80.87±9.80	2.58	0.01
MCH	25.76±3.71	25.91±2.40	0.3	0.77
MCHC	29.41±1.60	32.27±2.41	8.55	<0.001

The MCV of the non-diabetic (86.00±13.41) was significantly higher than the diabetics (80.87±9.80) but in contrast, the MCHC level of the diabetic (32.27±2.41) was significantly ($p<0.05$) higher than non-diabetic (29.41±1.60). There was no statistical significant difference ($p>0.05$) in the MCH level of the non-diabetic (25.76±3.71) and the diabetic (25.91±2.40)

Table 6: Multivariate analysis of the associated predictor of the diabetics status

Variable	B	p-value	OR (95%CI)
AGE	0.035	0.02	1.04 (1.00-1.07)
SEX(Male)	-0.74	0.11	0.48 (0.19-1.20
HB	-0.11	0.49	0.89 (0.65-1.23
RBC	0.37	0.39	1.45 (0.62-3.36)
MCV	0.001	0.95	1.001 (0.97-1.04)
MCHC	0.92	<0.001	2.51 (1.75-3.61)
Constant	-29.86	<0.001	-

A logistic regression was performed to determine the independent variables that significantly associated with the diabetic status while other variables are held. Independent variables that showed statistical significant association in bivariate analyses were included in the model. The logistic regression model was statistically significant, $\chi^2(6) = 72.1$, $p<.001$. The model account for 53.7% (Nagelkerke R^2) of the variance in diabetic: Age and MCHC are the variables that were significantly associated with diabetics while other variables were held constant. Given a one unit increase in age, the relative risk of being diabetic would be 1.04 times more likely when the other variables in the model are held constant. The odd of being diabetic is about 2.51 times likely for a unit in MCHC level with other variable held constant.

OR

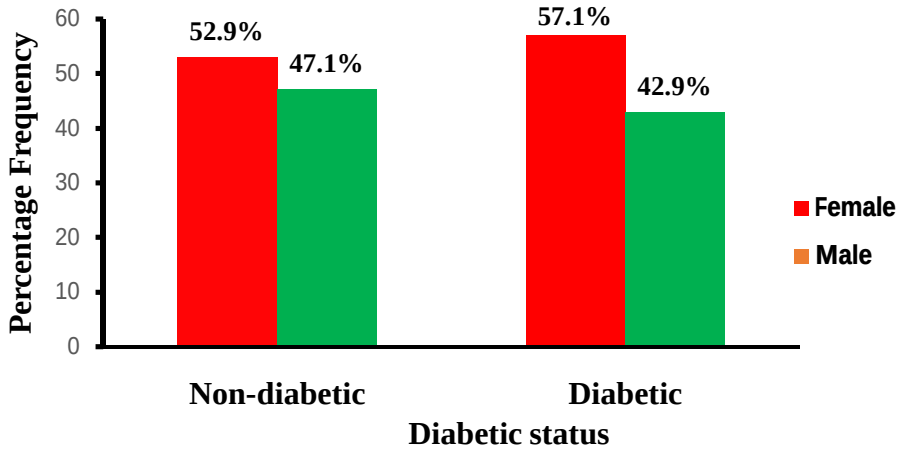

Figure 1: **Gender distribution of the study population**

Discussion

Haematological changes are a common phenomenon in diabetic and its complication constitutes a recognizable burden on patients care. In this study there was a statistically significant difference in the mean for RBC and haemoglobin concentration for diabetic subjects as compared to the control. Also there was an elevated WBC count with slight Monocytosis as well as granulocytes but were not statistically significant. This finding is in line with studies conducted in parts of Africa Libia, (9).

The rise in RBC observed in diabetic subjects might be as result of persistent hyperglycemia creating an influx of glucose thereby resulting in RBC adhering together. These changes in RBC can also influence blood viscosity that affects microcirculation in diabetes. This tendency is associated in insulin resistance and results to stimulation of erythroid progenitors leading increased RBC count (10). Low hemoglobin concentration is associated with a more rapid decline in glomerular filtration rate than that of other kidney diseases (11). Hemoglobin concentration is closely associated with diabetic profiles. Anemia in patients with diabetes increases susceptibility of the kidney to nephropathy, although the precise mechanism remains unknown. It is widely accepted that patients with diabetes are more vulnerable to the effects of anemia (12). In this study, there is an elevated total WBC count which is a classical marker of

inflammation and suggests an association between WBC count and diabetes risk (13). An elevated WBC count with lowered platelets count as compared to control subjects is not in line with studies carried out in Western Nigeria (14). Reasons of this could be associated with the age of the subject, control subjects, have a low mean age of 37.7 in relation to diabetics patients of 44.7 and also being on treatment to control diabetes.

Thrombocytopenia was not observed in this study, although there was reduced platelet count in relation to the control subjects and the value was not statistically significant and is in line with previous studies in which there is no significant difference the mean platelet count between individuals with diabetes and control (15). Although diabetes is associated with metabolic cellular disorder and many increase the risk of thrombotic and vascular complication if not managed properly (16). Likewise the total leucocytes differential such as lymphocytes, monocytes and granulocytes showed no statistical significance with $p>0.05$ compared to control subjects. This finding was in line with studies done in Calabar (17).

Conclusion

The findings in the present study have implications for diabetes management in that they appear to indicate a need for routine full blood counts for all diabetic patients. Early detection and management of anemia as well as elevated WBC count in diabetic patients at the primary care setting would be cost effective, will help in reducing diabetic complications, reduce hospital admissions and maintain optimum health.

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