Haematological Profile of Diabetes and Non-Diabetes Patients in Abuja, Nigeria

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Abstract: **-Diabetes mellitus, has over the years become a very serious global public health challenge and a complex disease characterized by chronic hyperglycemia that leads to long-term macrovascular and microvascular complications.The purpose of this study is to investigate changes in some hematological parameters in patients with diabetes mellitus and compare the results with non-diabetic individuals that will serve as the control. This is a hospital-based case control study carried out within Abuja, Federal Capital of Nigeria. The Samples were processed and analyzed in the Defence Reference Laboratory, Asokoro, Abuja. Venipuncture was performed on each patient.Complete Blood Count was performed using the 2ML EDTA blood tubes using the Sysmex platform while Fasting blood sugar was performed using the 2ML Fluoride Oxalate blood tube, these assays were performed using an automated Chemistry analyser (Selectra Pro S). The data were analysed using SPSS (Statistical Package for the Social Science) for Windows version 25. No statistically significant difference between the diabetic and non-diabetic groups respecting gender, PLT CT and MCH whereas there were statistically significant differences between the groups respecting; FBS, PCV, WBC, RBC, MCHC, and MCV (*P*<0.05). Only LUM (x10^{9}L) and MONO (x10^{9}L) were insignificantly different between diabetic and non-diabetic groups. This study revealed that unrecognized anemia exists in diabetic patients. The severity of anemia may be greater in subjects with retinopathy. It is suggested that the hematological parameters should be evaluated and treated periodically in diabetic patients to reduce the load, of ocular morbidity due to retinopathy.**

Keywords: **Diabetics, Heamatological parameter, Fasting Blood Sugar, Anaemia, Blood count**

I. INTRODUCTION

Diabetes mellitus (DM) is a general term for heterogeneous disturbances of metabolism, the most common finding in diabetes is chronic hyperglycaemia. Hyperglycemia can quickly become life-threatening if it is not managed and controlled, Diabetes is a common community-based disease among Nigerians [1].

Diabetes mellitus has over the years become a very serious global public health challenge and a complex disease characterized by chronic hyperglycemia that leads to long-term macrovascular and microvascular complications. Diabetes mellitus and the complications it brings is a major cause of early disease and death worldwide, diabetes has been declared an international public health issue because it has a major and deleterious impact on both individual and national productivity[2]. Diabetes and uncontrolled hyperglycemia are known to play a significant role in the development of cardiovascular disease (CVD) since the Framingham study. Diabetic patients face a lot of challenges having access to proper and adequate diagnosis and treatment, this contributes further to high mortality rates from diabetes and also increase to the prevalence of diabetes mellitus and its complication in sub-Saharan Africa [3].

In Nigeria, diabetes is a common community-based disease, Nigeria has the highest prevalence of diabetes in Africa [1], and the prevalence varies from 0.65% in rural Mangu village to 11.0% in urban Lagos [4].There is a paucity of data on the effect of T1D on the haematological parameters in Nigerians with T1D diabetes. The aim of this study was to investigate changes in some haematological parameters in patients with T1D in Sokoto, North Western Nigeria and to compare the results with non-diabetics.

There has been a lot of systemic review on the heamatological profile in the diabetics in many parts of the world, but there seems to be a paucity in this same study in our locality. There also has been a lot of research work being carried out on the heamatological changes in the diabetics worldwide, but there is a dearth of information in literature pertaining to the heamatological changes in diabetes mellitus patients in Nigeria, suggesting that the association between the heamatological indices with diabetes mellitus has not been exclusively studied and reviewed in this part of the world. There is, therefore, an indication that more and more studies on this subject matter need to be carried out in this part of Africa to improve the diagnosis of diabetes mellitus and give diabetic patients opportunity to a better life and also give a better understanding to the preventions and management of this condition.

II. MATERIAL AND METHOD

This is a hospital-based case-control study carried out within Abuja, Federal Capital of Nigeria. The Samples were processed and analysed in the Defence Reference Laboratory, Asokoro, Abuja. A total of two hundred (200) participants were recruited for this study which consists of one hundred (100) diabetic patients and one hundred (100) apparently healthy nondiabetic Control participants. Out of the one hundred (100) diabetic patients, sixty (60) were female while forty (40) were males. The Controls Participants consists of 52 females and 48 males. Subjects' bio-data such as name, age, and gender were obtained. A unique number was assigned and the name decoded for confidentiality purposes.

Only confirmed diabetic and non-diabetic patients who agreed to give informed consent were recruited for this study. Patients with hematologic diseases, hepatic failure, renal failure, heart failure, acute illness, chronic diseases like chronic infections, alcohol abuse, that are on medication that would influence the platelet function, and those with atherosclerotic diseases were not included in the study. Ethical clearance was obtained from the Nigerian Ministry of Defence Health Research Ethics Committee (MODHREC), Abuja and informed consent were obtained from each subject before participation in this study.

Venipuncture was performed on each patient; 2ml of venous blood was collected in EDTA for complete blood count and another 2ml of venous blood was collected in fluoride oxalate blood tube for fasting blood sugar all these samples were collected using the vacutainer system. All blood tubes and worksheets were labeled with the patient's unique number, consisting of four digits, this number was used for the participants throughout the study to facilitate processing, analyzing and tracking of both the specimen and the results and to maintain confidentiality.Fasting blood glucose using plasma was assayed using Selectra pro S automated chemistry analyser with glucose oxidase technique. Complete Blood Count was performed using the 2ML EDTA blood tubes using the Sysmex platform while Fasting blood sugar was performed using the 2ML Fluoride Oxalate blood tube, these assays were performed using an automated Chemistry analyser (Selectra Pro S). All samples were assayed at the Defence Reference Laboratory Asokoro Abuja, Nigeria.

The data were analysed using SPSS (Statistical Package for the Social Science) for Windows version 24. Comparison of mean between two groups was analysed using one-way Analysis of variance. A statistically significant difference was considered at p-value less than 0.05 ($p<0.05$).

III. RESULTS

A. Socio-demographic parameters of diabetic patients

A total of 100 diabetic patients (40 males, 60 females; mean age 53.6±10.8) and 100 controls (48 males, 52 females; mean age 36.7±8.0) were selected to participate in the study. The demographical and attitude data of patients are presented in Table I while the comparison of diabetic and non-diabetic groups regarding demographical, clinical, and hematologic parameters are shown in Table II.

B. Comparison of heamatological and Differential cell count parameters between diabetic and non-diabetic groups

Majority of the diabetic patients were married (98.0%), employed (43.0%), and had a minimum of secondary education (64.0%). Forty-one percent were overweight, 92.0% have known their diabetic status for at least 3 years and the majority were taking Metformin (94.0%) for not less than 3 years (55.0%) while 58.0% do a periodic medical checkup. The majority did not do any regular exercise, neither smoke nor consume alcohol (Table I).

There was no statistically significant difference between the diabetic and non-diabetic groups respecting gender, PLT CT and MCH whereas there were statistically significant differences between the groups respecting; FBS, PCV, WBC, RBC, MCHC, and MCV. The values of FBS, WBC, and MCHC were significantly higher in diabetics than in controls whereas PCV, HB, RBC, and MCV were significantly higher in non-diabetics ($P<0.05$) (Table II). As shown in Table III, only LUM ($x10^9L$) and MONO ($x10^9L$) were insignificantly different between diabetic and non-diabetic groups.

Table I:Socio-demographic parameters of diabetic patients only

Variable (n = 100)	Parameter	Frequency	Percent
Sex	Male	40	40.0
	Female	60	60.0
Marital status	Married	98	98.0
	Unmarried	2	2.0
Employment status	Employed	43	43.0
	Trading	42	42.0
	Unemployed	15	15.0
Education	Primary	36	36.0
	Secondary	17	17.0
	Post-secondary	47	47.0
Weight (BMI)	Normal	59	59.0
	Overweight	41	41.0
Duration of diabetes	0-2years	8	8.0
	3-5 years	40	40.0
	>5 years	52	52.0
Types of Drug Taken	Glibenclamide	6	6.0
	Metformin	94	94.0
Duration of drug	< 1year	45	45.0
	3 - 5 years	53	53.0
	5 – 10 years	2	2.0
Periodic medical checkup	Yes	58	58.0
	No	42	42.0
Regular exercise	Yes	3	3.0
	No	97	97.0
Smoke cograte	Yes	3	3.0
	No	97	97.0
Consume alcohol	Yes	24	24.0
	No	75	75.0

Table II:Demographical and Haematological parameters of diabetes and control group

Parameter	Diabetic (n =100)	Control (n=100	P value
Gender (F/M)	60/40	52/48	0.159
FBS (Mmol/L)	8.12 ± 0.51	5.07 ± 0.06	<0.001*
PCV (%)	38.20 ± 0.64	42.30 ± 0.43	<0.001*
HB (g/dL)	12.97 ± 0.19	13.80 ± 0.15	0.001*
WBC ($x10^9$/L)	6.44 ± 0.25	5.66 ± 0.16	0.008*
RBC ($x10^{12}$/L)	4.79 ± 0.07	5.05 ± 0.07	0.009*
PLT CT ($x10^9$/L)	243.24 ± 9.05	260.80 ± 6.78	0.122
MCHC (g/dL)	33.79 ± 0.14	32.62 ± 0.11	<0.001*
MCH (pg)	27.28 ± 0.27	27.56 ± 0.24	0.440
MCV (fL)	80.72 ± 0.72	84.46 ± 0.61	<0.001*

Values are presented in Mean ± Std error mean (SEM) *-Significant at p<0.05. FBS = WBC = White Blood Cell count, RBC = Red blood cell count, HB = Haemoglobin, MCV = Mean corpuscular volume, MCH = Mean corpuscular hemoglobin, MCHC = Mean corpuscular haemoglobin concentration, PLT CT = Platelets, PCV = Packed cell volume, FBS - Fasting Blood Sugar

Table III: Differential cell count parameters of diabetic and non-diabetic

Parameter	Diabetic (n =100)	Control (n=100	P value
Neu ($x10^9$/L)	3.42 ± 0.21	2.51 ± 0.11	<0.001*
Neu (%)	50.81 ± 1.15	43.92 ± 1.08	<0.001*
LYM ($x10^9$/L)	2.48 ± 0.07	2.42 ± 0.08	0.589
LYM (%)	40.23 ± 1.03	43.11 ± 0.90	0.037*
MONO ($x10^9$/L)	0.46 ± 0.04	0.46 ± 0.01	0.977
MONO (%)	7.08 ± 0.55	8.30 ± 0.21	0.040*
EOS ($x10^9$/L)	0.08 ± 0.01	0.27 ± 0.05	0.001*
EOS (%)	1.36 ± 0.12	4.02 ± 0.67	<0.001*
BAS ($x10^9$/L)	0.01 ± 0.00	0.04 ± 0.00	<0.001*
BAS (%)	0.15 ± 0.36	0.65 ± 0.04	<0.001

LYM = Lymphocytes, Neu = Neutrophils, MONO = Monocyte, EOS = Eosinophil, and BAS = Basophil

IV. DISCUSSION

Diabetes mellitus continues to be a major health problem worldwide [5]. Recent studies have reported the role of hematological parameters in contributing to vascular injury in diabetic patients[5]. Thus, the aim of this study was to investigate the haematological profile of diabetes mellitus in Nigeria, a developing country in which diabetes is majorly screened and managed by the determination of fasting plasma glucose.

A total of 100 diabetic patients and 100 non-diabetic controls were screened in the study. The mean age of the diabetic group was 53 years and the majority of the DM patients were on Metformin drug for treatment or the disease.

C. Comparison of heamatological and Differential cell count parameters between diabetic and non-diabetic groups

There was no statistically significant difference between the diabetic and non-diabetic groups respecting gender, PLT CT and MCH whereas there was statistically significant difference between the groups respecting; FBS, PCV, WBC, RBC, MCHC, and MCV. There was a very high significant difference in the mean values of fasting blood glucose (FBC) in diabetic patients and control groups. This might be as a result of poor glycaemic control or may be due to inadequate production of enough insulin or due to insulin intolerance in the diabetics as compared to the non-diabetic group[5–7]. Similar to the findings of some previous studies, WBC and MCHC were found to be significantly higher in the diabetic group than in the non-diabetic group[7–9]. On the other hand, the mean values of PCV, HB, RBC, and MCV were significantly higher in controls than in diabetics while no significant difference was found in the mean values of platelets and Mean corpuscular hemoglobin between the groups. These findings are in agreement with the reports of [9]. The findings of this study on PCV, HB, and RBC are similar to the findings of Kothari & Bokariya[6]but the contracts their report on MCHC in which the mean value reported for control was more than the mean value seen for subjects[6].

Higher WBC count has been described as an indicator of chronic inflammation which is associated with microvascular complications in type 2 diabetes patients [10]. Also, Elevated WBC count even within normal range has been reportedly associated with micro and macrovascular complications [7].

As reported in some previous studies, the decrease in RBC, MCV and PCV levels in the in the diabetics group with significant increase in MCHC levels when compared with the non-diabetics may be as result of hematotoxic effects associated with toxic substances on bone marrow depression caused by damage to multiple classes of hematopoietic cells and a variety of hematopoietic functions[9, 11, 12].

In diabetes mellitus, the lifespan of RBC may be decreased as a result of disturbances in the hematopoietic milieu (such as chronic hyperglycemia and hyperosmolarity). These disturbances can cause an increased internal viscosity and increased membrane rigidity in the red blood cells and cause a decrease in the number of RBC [10].

V. CONCLUSION

The facts from this study revealed that unrecognized anemia exists in diabetic patients. The severity of anemia may be greater in subjects with retinopathy. It is suggested that the hematological parameters should be evaluated and treated periodically in diabetic patients to reduce the load, of ocular morbidity due to retinopathy.

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