ALTERATIONS OF SOME HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN TYPE II DIABETIC PATIENTS ATTENDING IMO SPECIALIST HOSPITAL, UMUGUMA, OWERRI, NIGERIA

Aloy-Amadi Oluchi C.[1*], Osineke Favour C.[1], Akogu Okechukwu[2], Akujobi Augustine U.[2], Emeka-Obi Obioma R.[3], Chinekezi Nnamdi E.[1]

[1]Department of Medical Laboratory Science, Imo State University, Owerri, Nigeria.
[2]Department of Optometry, Imo State University, Owerri, Nigeria.
[3]Department of Haematology, College of Medicine, Federal University of Technology, Owerri, Imo State, Nigeria.
Corresponding Author: Aloy-Amadi Oluchi C., Email: oluchialoy@yahoo.com

Abstract: Diabetes mellitus is a heterogeneous group of metabolic disorder characterized by high blood glucose level (hyperglycemia) with alterations in carbohydrate, lipid, and protein metabolism resulting from defects in insulin secretion and/or action. This study was aimed at determining the levels of white blood cell, fibrinogen, urea and creatinine in type II diabetes mellitus patients attending Imo Specialist Hospital Umuguma, Owerri. A cross-sectional study was carried out from the month of July to September, 2023 and all eligible subjects who gave a written informed consent for the study were enrolled in the study. The study population consisted of 50 diabetes mellitus patients and an equivalentno of age - matched apparently healthy, non-diabetes mellitus subjects served as the controls. The procedure was carried out at the Imo Specialist Hospital Umuguma, Owerri. The results of the tests were analyzed using SPSS version 21. The mean values of WBC (10372.00±3026.48)cells/μl and fibrinogen (351.67±98.20) mg/dl were significantly increased in diabetics when compared to controls (6659.20±1968.37)cells/μl and (220.99±73.91)mg/dl (p=0.000 and p=0.001). The mean values of urea (55.28±33.24)mg/dl and creatinine (1.92±1.63) mg/dl were significantly increased in diabetics when compared to controls (23.30±9.38)cells/μl and (0.75±0.37)mg/dl (p=0.001 and p=0.000). There was no significant difference in the mean values of WBC (10068.97±2817.05) cells/μl, Fibrinogen (346.36±96.08) mg/dl, urea (61.31±39.22) mg/dl and creatinine (2.28±1.95) mg/dl in male diabetics when compared to female diabetics (10790.47±3318.72) cells/μl, (359.01±102.99) mg/dl. (46.95±20.69) mg/dl and (1.43±0.88) mg/dl (p=0.411, p=0.657, p=0.133 and p=0.070). There was a significant non - positive correlation of WBC with urea and creatinine in diabetics (r=0.02, p=0.885; r=0.09, p=0.163 and r=0.16, p=0.259). Type II Diabetes mellitus is associated with a significant increase in white blood cell, fibrinogen, urea and creatinine. Therefore, routine screening of these indices is recommended to minimize diabetes mellitus-related complication.
Keywords: Diabetes mellitus; White blood cell; Fibrinogen; Urea; Creatinine

1 INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by high blood glucose levels, which result from defects in insulin secretion, action, or both [1]. Over time, Diabetes can lead to blindness, kidney failure, and nerve damage. These types of damage are the result of damage to small vessels, referred to as micro vascular disease. Diabetes is also an important factorin accelerating hardening and narrowing of the arteries (atherosclerosis), leading tostrokes, coronary heart disease, and other large blood vessel disease [2]. Diabetes affects approximately 17 million (about 8% of the population) in Nigeria.

One third or more of the diabetes mellitus patients develop Diabetic Nephropathy (DN) with progressive deterioration of renal function and structure in their lifetime [3]. Diabetic Nephropathy is the leading cause of endstage renal disease (ESRD) worldwide. The earliest clinical evidence of DN is theappearance of low but abnormal levels (30 to 300 mg/day) of albumin in the urine, referred to as Microalbuminuria [4].

In addition, an estimated additional 12 million people in Nigeria have diabetes and don't even know it. Diabetes is the third leading cause of death in Nigeria after heart disease and cancer [5]. Diabetes, the most common Non - communicable disease in Nigeria, is having an increasing impact on rates of morbidity and mortality. The spread of sedentary lifestyles and adoption of western dietary habits that is high in refined carbohydrates and fat-are driving an increase in the number of people with obesity-related type 2 diabetes. Knowledge of the diabetes epidemic in Nigeria is limited, and the most recent data come from a small-scale study indicated a prevalence of 3.4%, but recent research estimates about four millions, around 95% of whom have type 2 diabetes mellitus [6].

Haematological parameters includes the red blood cell, white blood cell, Platelets, etc. Elevated white blood cell count (WBC) is a classical inflammatory marker andis associated with several cardiovascular disease risk factors and diabetes [7].

The association of increased MPV, PDW, PCT and platelet count with diseases related to endothelial dysfunction and inflammation as metabolic syndrome, diabetes, coronary artery disease and malignancy have been shown [8].
Altered level of many hematological parameters such as red blood cells (RBCs), white blood cells (WBC), and the platelet function has been observed in patients with the diabetes [9].

2 MATERIALS AND METHODS

2.1 Study Area

The study was carried out at Imo State Specialist Hospital, Umuguma, Owerri, Imo State. The hospital is located at along Owerri Port-Harcourt road, Imo State. Owerri occupies a geographical land mass of 184 km² and a population of 195,652 at the 2006 census. The area under study has a tropical climate and two main seasons namely: rainy and dry seasons. The rainy season starts from March and ends about September while the dry season starts from October and end by March. It has an average minimum temperature of 22.5ºC and a maximum temperature of 35.5 ºC. Her annual humidity is 74.3%, annual average rainfall is 240.6mm. The citizens are traders apart from farming as a major occupation in the community, a good number are civil servants. This population is made up of 62,990 males and 64,223 females [10].

2.2 Study Design

A cross-sectional study was carried out from month of July to September, 2023 andall eligible subjects who gave a written informed consent were enrolled in the study. The study population consisted of 50 diabetes mellitus patients, and equivalent number of age – matched apparently healthy subjects (50) who served as the controls.The procedure was carried out at Imo state Specialist Hospital Umuguma, Owerri, and the results of the tests were analyzed using SPSS version 21.

2.3 Method of Recruitment

A total of one hundred subjects (50 patients and 50 controls) were recruited for the study. The study participants who completed the questionnaire and gave a written informed consent were enrolled in the study.

2.4 Sample Collection

Eight millilitres of venous blood sample was collected at the ante-cubital vein aseptically, 3ml was dispensed into Ethylenediaminetetraacetic acid containers, while 5ml was dispensed into plain containers. The EDTA and plain containers were properly labeled with the subjects' name, sample number and date ofcollection. The blood dispensed into the EDTA containers were stored in the refrigerator at 4^0C while the serum was stored in a freezer at -20^0C prior to use.

2.5 Ethical Consideration

The study was approved by the ethics committee of Imo State Specialist Hospital Umuguma ad subjects who gave a written informed consent were enrolled in the study.

2.6 Laboratory Analysis

The white blood cells (WBCS) count was determined using the manual method. Fibrinogen was estimated spectrophotometrically. Serum Creatinine was estimated using the Jaffe-Slot method, while Serum urea was determined using the Diacetyl monoxime method.

2.7 Statistical Analysis

Statistical analysis was performed using SPSS version 21. The results were analyzed using students t-test, and Pearson regression analysis was used for correlations. The level of significancewas set at $p < 0.05$.

3 RESULTS

3.1 Mean Values of WBC and Fibrinogen in Diabetics versus Controls

The mean values of WBC (10372.00±3026.48)cells/μl and fibrinogen (351.67±98.20) mg/dl were significantly increased in diabetics when compared to controls (6659.20±1968.37)cells/μl and (220.99±73.91)mg/dl (t=7.27, p=0.000 and t=7.52, p=0.001).

Table 1 Mean Values of WBC and Fibrinogen in Diabetics versus Controls (Mean±SD)

Parameter	Test N=50	Control N=50	t-value	p-value
WBC	10372.00±3026.48	6659.20±1968.37	7.27	0.000*
(cells/μl)				
Fibrinogen(mg/dl)	351.67±98.20	220.99±73.91	7.52	0.001*

KEY: WBC: White blood cell; *: Significant

3.2 Mean Values of Urea and Creatinine in Diabetics versus Controls

The mean values of urea (55.28±33.24)mg/dl and creatinine (1.92±1.63) mg/dl were significantly increased in diabetics when compared to controls (23.30±9.38)cells/μl and (0.75±0.37)mg/dl (t=6.55, p=0.001 and t=4.94, p=0.000).

Table 2 Mean Values of Urea and Creatinine in Diabetics versus Controls

Parameter	Test	Control	t-value	p-value
Urea (mg/dl)	55.28±33.24	23.30±9.38	6.55	0.001*
Creatinine(mg/dl)	1.92±1.63	0.75±0.37	4.94	0.000*
KEY				

KEY: WBC: White blood cell; *: Significant

3.3 Comparison of the Mean Values of WBC, Fibrinogen, Urea and Creatinine in Male versus Female Diabetics

There were no significant difference in the mean values of WBC (10068.97±2817.05) cells/μl, Fibrinogen (346.36±96.08) mg/dl, urea (61.31±39.22) mg/dl and creatinine (2.28±1.95) mg/dl in male diabetics when compared to females (10790.47±3318.72) cells/μl,(359.01±102.99) mg/dl. (46.95±20.69) mg/dl and (1.43±0.88) mg/dl (t=0.83, p=0.411, t=0.45, p=0.657, t=1.53, p=0.133 and t=1.85, p=0.070).

Table 3 Comparison of the Mean Values of WBC, Fibrinogen, Urea andCreatinine in Male versus Female Diabetics

Parameter	Test	Control	t-value	p-value
WBC (cells/μl)	10068.97±2817.05	10790.47±3318.72	0.83	0.411
Fibrinogen(mg/dl)	346.36±96.08	359.01±102.99	0.45	0.657
Urea (mg/dl)	61.31±39.22	46.95±20.69	1.53	0.133
Creatinine (mg/dl)	2.28±1.95	1.43±0.88	1.85	0.070

3.4 Correlation of Fibrinogen with WBC, Urea and Creatinine in the Diabetics

There were a non- significant positive correlation of fibrinogen with WBC, urea and creatinine in diabetics (r=0.02, p=0.885; r=0.09, p=0.163 and r=0.16, p=0.259).

Table 4 Correlation of Fibrinogen with WBC, Urea and Creatinine in the Diabetics

Variable	N	R	p-value
WBC (cells/μl)	50	0.02	0.885
Urea (mg/dl)	50	0.09	0.163
Creatinine (mg/dl)	50	0.16	0.259

KEY: WBC= White Blood Cell

4 DISCUSSION

Diabetes mellitus is a heterogeneous group of metabolic disorder characterized by high blood glucose level (hyperglycemia) with alteration in carbohydrate, lipid, and protein metabolism resulting from defects in insulin secretion and/or action [11]. Hospital based studies in various parts of Nigeria have shown diabetes mellitus as the third commonest cause of end stage renal disease following chronic glomerulonephritis and hypertensive nephrosclerosis [12].

The current study revealed that the mean value of WBC was significantly increased in diabetics when compared to controls. Higher WBC count has been described as an indicator of chronic inflammation which is associated with microvascular complications in type 2 DM. Also, Elevated WBC count even within the normal range has been reportedly associated with micro andmacrovascular complications [13]. Evidence from epidemiological studies suggests an association between the WBC count, a non-specific marker of inflammation, and diabetes risk. The result of this study is in agreement with the study carried out by Al-Khoury *et al., (*2016) who found out that white blood cell are independent predictor of diabetes mellitus [14]. They further stated that elevated WBC is a classical inflammatory marker and reveals association of inflammation with impaired glucose metabolism and insulin resistance and diabetes mellitus.

The present data from the study showed that the mean value of fibrinogen was significantly increased in diabetics when compared to controls. The various possible mechanisms for hyperfibrinogenemia in diabetics could be that a procoagulant state often exists in people of diabetes. There is an increase in a number of coagulation factors such as plasminogen activator inhibitor 1, von- Willebrand factor, fibrinogen, factor VII and thrombin antithrombin complexes particularly in association with macrovascular and microvascular disease and glycemic control [15]. Plasma levels of lipoprotein (a) [Lp(a)] are elevated in people with diabetes, particularly those with poor glycemic control. The Lp(a) molecule is formed by the assembly of at least two major proteins, a molecule of apoB100 covalently linked to a molecule of apolipoprotein (a) [APO(a)] by a single disulfide bridge[16]. It is structurally similar to low density lipoprotein (LDL) in protein and lipid composition, the essential difference between the two being APO(a). APO (a), a glycoprotein structurally similar to plasminogen, the precursor of plasmin has the capacity to bind to fibrin and to membrane protein of endothelial cells and monocytes. This inhibits plasminogen binding and plasmin generation which leads to decreased fibrinolysis and delays thrombolysis and contributes to the accumulation of Lp (a) and fibrin at the sites of vascular injury. Lp (a) has a major role in diabetes and its vascular complications by decreasing fibrinolysis and thus increasing plasma fibrinogen levels. The result of this study is in consonance with thereport by Bembde *et al.,* (2012) [17].

In the present study**,** the mean values of creatinine and urea were significantly increased in diabetic patients when compared to controls. Increase in the levels of serum creatinine and urea indicates the progression towards diabetic nephropathy, increased serum creatinine levels in diabetics clearly indicate prolonged hyperglycaemia which causes irretrievable damage to nephrons of the kidney [18]. Serum creatinine is filtered by the glomerulus, therefore, serum creatinine level is used as an indirect measure of glomerular filtration. As glomerular filtration rate (GFR) diminishes, there is a rise in plasma concentrations of serum creatinine. Raised serum creatinine and reduced GFR has become fairly reliable indicators of kidney dysfunction. The result of this study isin agreement with the report by Kamal (2018) [19], but a study carried out by Harita *et al.,* (2009) hypothesized that, lower serum creatinine is associated with an increased risk of type 2 diabetes, which might reflect a lower volume of skeletal muscle. Various factors such as skeletal muscle size, diet, exercise and treatment regimen may be the reason behind the disparity in result. Serum levels of creatinine and urea can be used as prognostic markers and predictors of renal damage in diabetic patients [21]. Effective control of blood sugar levels can stop progression to diabetic nephropathy and thus remarkably reduce themorbidity and mortality associated with this metabolic disease.

There was no significant difference in the mean values of WBC, Fibrinogen, urea and creatinine in male diabetics when compared to female diabetics. The result clearly indicates that sex is not a predisposing factor in diabetes. The finding from this study is in agreement with the study carried out by Bembde *et al*. (2012) [22].

Lastly, there was a significant non-positive correlation of WBC with urea and creatinine in diabetics. Thus there is no link between fibrinogen with renal disorder [23]. The result agrees with the study reported by Aktas *et al*. (2014) [24].

5 CONCLUSION

Type II Diabetes mellitus is associated with a significant increase in white blood cell, fibrinogen, urea and creatinine. Therefore, routine screening of these indices is recommended to minimize diabetes mellitus-related complications.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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