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Evaluation of Some Hematological Parameters in Patients with Diabetes Mellitus Attending Abia State University Teaching Hospital Aba Based on Socio-Demographic Characteristics

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ABSTRACT

The evaluation of lipid profile and some hematological parameters in diabetic patients attending Abia State Teaching Hospital Aba, was carried out. Venous blood samples were collected from 150 participants who gave consent. This comprises 100 diabetic patients as test and 50 healthy subjects as control. The plasma glucose and hemoglobin levels were determined using spectrophotometric methods. Data from this study were analyzed using statistical package for the social sciences (SPSS). Result shows that, platelet (395.44±72.11x109/l), prothrombin time (13.63±0.95secs) levels were higher in study population compared with control (176.18±25.26x10^9/l, 11.85±0.63secs, respectively) ($p<0.05$ in each case). The hemoglobin (124.83±15.01g/l) was lower in diabetic patients compared with control (131.66±10.45g/l) ($p<0.05$). From the findings, management of conditions related to cardiovascular disease, artherosclerotic disease, anemia and stress in diabetics may benefit patients if some hematological parameters are included as part of their routine laboratory investigations.

Keywords*:* hematological parameters, coagulation, platelets, *cardiovascular disease*, diabetes mellitus

INTRODUCTION

Diabetes mellitus (DM), is a group of metabolic disorders in which there is high blood sugar level over a prolonged period and it is commonly referred to as diabetes [1-10]. Frequent urination, increased thirst, and increased hunger are symptoms of high blood sugar [11-16]. Many complications are resulted as a cause of untreated diabetes [17-24]. Diabetic ketoacidosis, hyperosmolar hyperglycemic state, or death are as a result of acute complications. However, cardiovascular disease, stroke, chronic kidney disease, foot ulcers, and damage to the eyes are included as long-term complication [25-30]. There is evidence that each of these dyslipidemia features is associated with increased risk of cardiovascular disease, the leading cause of death in patients with type 2 diabetes [31-35]. Numerous studies have demonstrated an association between LDL size or density and coronary artery disease (CAD). Moreover, recent reports have indicated that LDL particle concentrations, and specifically levels of small dense LDL, are predictive of coronary events and that this is independent of other coronary disease risk factors [30-35].

MATERIALS AND METHODS

STUDY AREA

The study was carried out at Abia State University Teaching Hospital (ABSUTH),Aba city in Abia state,South East of Nigeria.It lies on coordinates of 5º 57´ 0"North and 8º 55´ o" East.It is bordered to the North by Enugu state,to the north-east by Ebonyi state,to the west by Imo state,to the east by Cross-river state,to the south-east and south by Akwa ibom and Rivers states.

ADVOCACY, MOBILIZATION AND PRE-SURVEY CONTACT

With the letter of introduction from the Head of Department,Medical Laboratory Science of Imo State University (appendix 1),I met the gate keeper of Abia State University Teaching Hospital Aba, who helped me to see the Chief Medical Director of the institution,to whom I submitted the letter and he reffered me to the ethical committee of Abia State University Teaching Hospital(ABSUTH) Aba, where I also submitted my research proposal, and after their consideration, approval was obtained.Several meetings were held with the nurses incharge of the diabetic clinic, and clinic days were chosen as the days of sample collection. Consent was sought and obtained from recruited subjects after explaining the purpose of the research to them.

STUDY POPULATION

The size of population was calculated using the method of Aroye 2004 with the formula $n=(z^2pq)/d^2$), and one hundred and fifty(150) subjects were recruited into the study.This comprises fifty(50)non-diabetic subjects as control and one hundred(100) diabetic subjects as test subjects.

SELECTION CRITERIA

1. INCLUSION;Those selected are;
(i) Male and Female subjects of age 18 years to 74years,
(ii) Diabetic patients with blood sugar 10mmol/l and above,
(iii) The subjects that gave their consent.

EXCLUSION; The excluded subjects are;
(i) Male and Female subjects below the age of 18 years
(ii) Subjects of blood sugar below 10mmol/l
(iii)The subjects that did not give consent.

LABORATORY PROCEDURES

The reagents were commercially purchased and the manufacturers' standard operating procedures (S.O.P) were strictly adhered to.

DETERMINATION OF HEMOGLOBIN (cyamethemoglobin method)

ASSAY PROCEDURE; 5mls of Drabkins solution and 0.02mls blood were added into a test-tube, mixed and incubated for 10 minutes. The absorbance was read using colorimeter at 540nm, like wise the standard, after zeroing the instrument with blank solution.

$$\text{Concentration of hemoglobin} = \frac{\text{Abs of test}}{\text{Abs of Std.}} \times \text{concentration of Std}$$

DETERMINATION OF PLATELET [21]

METHODS

Into a test-tube 0.38ml of 1% ammonium oxalate and 0.02ml of blood was mixed and allowed to stand for several minutes. It was loaded into an improved neubauer counting chamber. The chamber was allowed in a Petri dish containing a piece of moist paper for 20 minutes. The cells were counted using microscopy.

$$\text{Platelet count} = \frac{N \times DF \times 109}{A \times D} \text{ per Liter}$$

N=Number of cell counted
DF=Dilution factor
A=Area counted
D=Dept of the counting chamber.

DETERMINATION OF PROTHROMBIN TIME [21].

Method; Into three small test-tubes 100µl of plasma was added and placed in 37°c water bath. 100µl of brain suspension was added into the tubes and allowed to reach 37°c. In the first tube 100µl of calcium chloride solution was added and stop watch was started immediately. The tube was mixed and left in the water bath for 9-10seconds and then removed and watched for formation of clot. At the first sign of clot the stop watch was stopped and time noted. The test was repeated on the other two tubes and control plasma.

Statistical Analysis

All data generated from this study were subjected to statistical analysis using statistical package for the social sciences (SPSS) version 20. Values were expressed as Mean ± SD, at 95% confidence limit. Results are presented in tables.

RESULTS

Table 1: Mean ± SD values of hemoglobin, platelet and prothrombin time of the studied population

Parameters	Diabetic patients (n=100)	Control (n=50)	t-value	p-value
Hemoglobin(g/l)	124.83±15.01	131.66±10.45	-2.884	0.005
Lower 95% C.I.	-11.51	-10.99		
Upper 95% C.I.	-2.14	-2.66		
Platelet(x109/l)	395.44±72.11	176.18±25.26	20.839	0.001
Lower 95% C.I.	198.46	203.34		
Upper 95% C.I.	240.05	235.17		
Prothrombin time (Secs)	13.63±0.95	11.85±0.63	11.920	0.001
Lower 95% C.I.	1.48	1.51		
Upper 95% C.I.	2.07	2.03		

The serum prothrombin time and blood platelet were significantly higher(p=0.001,p=0.001 respectively) in the studied population compared with the control.The blood hemoglobin was significantly lower(p=0.005) in the study population compared with the control (Table 1).

Table 2: Mean ± SD values of hemoglobin, platelet and prothrombin time of the studied population in relation to sex

Parameters	Male patients (n=56)	Female patients (n=44)	t-value	p-value
Hemoglobin(g/l)	127.50±9.20	118.93±9.26	4.607	0.001
Lower 95% C.I.	4.87	4.87		
Upper 95% C.I.	12.25	12.26		
Platelet(x109/l)	392.12±85.40	391.90±77.71	0.013	0.990
Lower 95% C.I.	- 32.61	-32.25		
Upper 95% C.I.	33.04	32.68		
Prothrombin time (Secs)	13.75±0.98	15.88±15.77	-1.012	0.314
Lower 95% C.I.	-6.32	-6.93		
Upper 95% C.I.	2.05	2.66		

The blood hemoglobin level was statistically higher (p=<0.001) in male studied population compared with female studied population. The blood platelet level was not significantly higher (p=0.990) in male studied population compared with female studied population. The serum prothrombin time was not significantly Lower (p=0.314) in male studied population compared to female studied population (Table 2).

Table 3: Mean ± SD values of hemoglobin, platelet and prothrombin time of the studied population in relation to age group

Parameters	35-44 (years)	45-54 (years)	55-64 (years)	65-74 (years)	f-value	p-value
Hemoglobin (g/l)	119.50±7.62	125.83±8.93	124.16±11.89	123.17±9.71	0.963	0.414
Lower 95% C.I.	114.04	121.96	119.86	119.83		
Upper 95% C.I.	124.95	129.68	128.44	126.50		
Platelet(x109/l)	350.50±96.51	402.87±89.45	415.62±62.43	382.03±56.67	2.658	0.053
Lower 95% C.I.	281.46	364.18	393.11	362.56		
Upper 95% C.I.	419.53	441.54	438.13	401.49		
Prothrombin time (Secs)	13.48±1.19	13.45±0.92	13.79±0.91	13.65±0.95	0.653	0.583
Lower 95% C.I.	12.62	13.04	13.46	13.32		
Upper 95% C.I.	14.33	13.84	14.11	13.97		

There were no significant progressive increase(p=0.414; p=0.053 and p=0.583 respectively) in hemoglobin, platelet and serum prothrombin time of 1year to 4 years of studied population in relation to age group (Table 3).

Table 4: Mean ± SD values of hemoglobin, platelet and prothrombin time of the studied population in relation to weight

Parameters	53-64kg (n=25)	65-74kg (n=75)	t-value	p-value
Hemoglobin(g/l)	122.68±11.52	124.21±9.69	-0.653	0.515
Lower 95% C.I.	-6.19	-6.19		
Upper 95% C.I.	3.12	3.12		
Platelet (x109/l)	344.44±81.96	410.94±63.07	-4.223	0.001
Lower 95% C.I.	-97.75	-97.75		
Upper 95% C.I.	35.25	35.25		
Prothrombin time (Secs)	13.37±0.99	13.72±0.92	-1.604	0.112
Lower 95% C.I.	-0.78	-0.78		
Upper 95% C.I.	0.08	0.08		

The blood hemoglobin level was not significantly lower (p=0.515) in 55-64kg weight compared to 65-74kg weight of the studied population. The blood platelet level was significantly lower (p=0.001) in55-64kg weight compared to 65-74kg weight of the studied population. The serum prothrombin time was not significantly lower (p=0.112) in 55-64kg weight compared to 65-74kg weight of the studied population (Table 4).

DISCUSSION

The significantly lower levels of hemoglobin in studied population compared with the control (Table 1), may be due to a decreased amount of hemoglobin molecules, as in anemia, or by decreased ability of each molecule to bind oxygen at the same partial pressure of oxygen. Furthermore, this could be as a result of diabetic neuropathy, increase levels of adrenal glycation end products (AGEs), chronic inflammatory activity, erythropoietin hypo-responsiveness effects of oxidative stress and anti-diabetic medication as well as poor diet. To a small extent, hemoglobin A, slowly combines with glucose at the terminal valine (an alpha aminoacid) of each β chain [22]. The resulting molecule is often referred to as HbA1c, a glycosylated hemoglobin. The binding of glucose to amino acids in the hemoglobin takes place spontaneously (without the help of an enzyme) in many proteins, and is not known to serve a useful purpose. However, as the concentration of glucose in the blood increases, the percentage of Hb A that turns into Hb A1c increases. In diabetics whose glucose usually runs high, the percent Hb A1c also runs high [23].

CONCLUSION

Also, hemoglobin was lower in studied population, which are not to the advantage of the patients. Low hemoglobin has increase susceptibility of the kidney to nephropathy causing failure of the kidney to produce adequate erythropoietin responsible for production of erythrocytes. Therefore, in managing

these conditions in addition to aneamia and chronic atrial fibrillation or venous thromboembolism, it will be of benefit to diabetic patients if lipid profile, platelet, hemoglobin and prothrombin time tests are included in laboratory investigation.

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