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Research Paper

Study of Some Inflammatory Markers in Diabetic Subjects

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ABSTRACT: *Study of some inflammatory markers in diabetic subjects selected from Igbo, Ika, Ijaw and Isoko tribes of Delta state, Nigeria. The Study Design followed a Case-control, observational study. The research was carried out in Federal Medical Center, Asaba, Delta State, in Febuary 2022. 100 subjects (20 diabetic and 5 non diabetic from each of the four tribes; age range; 28-74 years) Venous blood was collected for the assay of Fasting blood sugar (FBS), Ferritin, IL-6, C-reactive protein, Glycated haemoglobin (Hb1ac) and adiponectin. Results obtained were statistically analysed. Results from this study showed that the diabetic subjects from all the tribes had significantly raised levels of C-reactive protein, ferritin, IL-6, FBS and HbA1c compared to the control., indicating a derangement probably due to inflammation. IL-6 and ferretin levels in male for the studied population was significantly higher than in the female subjects.*

KEYWORDS: *Diabetes mellitus (DM), fasting blood sugar (FBS), Glycated haemoglobin (Hb1ac), Type 2 Diabetes mellitus (T2DM), C-reactive protein (CRP), Interleukin 6 (IL-6).*

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I. INTRODUCTION

Diabetes, as defined by the World Health Organization, is a condition characterized by persistent hyperglycemia caused by insulin insufficiency or insulin resistance [1]. According to Hippisley-Cox [2], diabetes is a major cause of blindness, end-stage renal disease, lower limb amputation, cardiovascular disease, delayed wound healing, infection susceptibility, neuropathology, and impotence in diabetic individuals [3]. Diabetes mellitus (DM) is a major cause of mortality and disability globaly, this raises concerns about the financial burden it places on both people and society as a whole [4]. Endocrinology and Metabolism Society of Nigeria (EMSON) reported in 2022 that over 10 million Nigerians are living with diabetes and warned that if preventive measures are not applied, the numbers are expected to double by 2030 [5].

The percentage of people living with Type 2 Diabetes mellitus (T2DM) keeps increasing [1]. Thus, is becoming increasingly important to identify biomarkers that can help, identify those at risk of developing T2DM, facilitate strategies to prevent and postpone disease development, thus resulting in a reduction in disease burden and populations at risk of developing T2DM [4]. Notable contributions have been made to the factors that contributes to this rising trend in Types 2 Diabetes [6].

II. MATERIALS AND METHODS

1. Study Area: This research was done in Delta State, Nigeria (Figure 1). Samples were collected from subjects attending clinic at Federal Medical Centre, Asaba and General Hospitals in Agbor & Bomadi Delta State, Nigeria. Participants were people from Ijaw, Urhobo, Ikah and Igbo ethinic groups residing in Delta State. Nigeria's Delta State capital, Asaba, is located on a terrace of the lower Niger River, with geographical co-ordinates of 6°11′52.23″N, 6°43′42.48″E. Asaba serves as a link between western, eastern, and northern Nigeria through the Asaba Niger Bridge, which connects East and West, and the Niger River in the north.

Figure 1: Map of Delta state Nigeria, showing Ethnic and Local Government Area [7].

2. Research Design: This is a case-control observational study, to evaluate HbA1c, Fasting blood sugar, C reactive protein, Ferretin, Interleukin 6, Adiponectin in obese/T2D subjects from selected ethnic groups in Delta State. Through questionnaire the bio-data and medical history of the subjects were obtained. Some other parameters like weight, height and waist circumference were obtained using a calibrated weighing scale, and a measuring tape.

3. Sample Size

Sample size for this study was determined using the Cochrane formula:

$$N = \frac{Z^2 pq}{d^2}$$ [8]

N = the desired sample size
Z = The Standard Normal deviate usually set at 1.962 corresponding to the 95% Confidence level
p = The SNPs Prevalence rates. (Minor Alleles Frequency of SNPs set at >0.02) [9].
q = 1- p
d = degree of accuracy desired set at 0.05
Minimum Size – 30
By adding 10% of non-respondent = 33. Therefore, total sample size is 33.
However, this study used 100 subjects, with 20 subjects selected from each of the four ethnic groups in Delta State, and 20 control subjects.

4. Sampling Method:

A multistage sampling technique was used to choose the subjects. Participants were grouped into sections based on duration of pathogenesis (1-5years, 6-10years,11-15years,16-20years).

5. Selection Criteria

i. Inclusion Criteria: Individuals who are of the selected tribes in Delta State aged at least 21 years and above, diagnosed with T2D for at least one year. Controls: Five (5) individuals from each of the selected tribes Ika, Urhobo, Ijaw, Igbo with no history of diabetes, and are non-obese and having a fasting blood glucose of less than 6.5mmol/l.

ii. Exclusion Criteria:

a. Individuals not from the selected tribes.
b. Critically ill subjects.
c. Pregnant female.

6. Sample Collection: From each subject, venous blood was collected using standard veni-puncture technique, 2ml was dispensed into fluoride-oxalate bottle for the assay of FBS and Hb1ac another 5ml was dispensed into plain bottle. All the tubes were appropriately labelled, after allowing the sample in the plain tube to retract, it was centrifuged. The analysis was performed within one week of collection at the Federal Medical Centre, Asaba.

i. ***Fasting Blood Sugar (FBS):*** FBS was performed using glucose oxidase method.
Principle: After enzymatic oxidation in the presence of glucose oxidase, glucose is measured. Under the catalysis of peroxidases, the generated hydrogen peroxide combines with phenol and 4-aminophenazone to create a red-violet quinoneimine dye as an indicator.
ii. ***Glycosylated Haemoglobin (HbA1c):*** Quantitative determination of glycosylated Haemoglobin in blood was done using the modified Ion Exchange Resin method with kit from INTECO Diagnostics, UK (Trivelli *et al*., 1971).

7. Laboratory Analysis

i. Serum C- Ferretin (Human Ferritin (FTL) ELISA Kit) ZOO

Principle: 96-well plates have been precoated with a ferritin-specific antibody and blocked. After adding standards or test samples to the wells, a biotinylated detection antibody specific to ferritin is added, and the wells are then washed with wash buffer. After adding streptavidin-Peroxidase Complex, unbound conjugates are removed using wash buffer. The enzyme reaction between streptavidin and peroxidase is then seen using TMB. Streptavidin-Peroxidase catalyzes TMB to create a blue product, which becomes yellow when an acidic stop solution is added. The amount of ferritin collected in a plate is closely correlated with the density of yellow hue.

ii. Interlukin 6 (Bio-Inteco ELISA Kit): Sandwich enzyme immunoassay is the test principle used in this kit. An antibody specific to interleukin 6 (IL6) has been pre-coated on the microtiter plate included in this kit. Next, standards or samples are added with a biotin-conjugated antibody specific for Interleukin 6 (IL6) to the corresponding microtiter plate wells. Each microplate well is then filled with horseradish peroxidase (HRP)-conjugated avidin, and the mixture is incubated. Only the wells containing Interleukin 6 (IL6), biotin-conjugated antibody, and enzyme-conjugated. The addition of TMB substrate solution causes the color of the avidin to change. Avidin will show a color shift. A sulphuric acid solution is added to stop the enzyme-substrate reaction, and the color change is measured spectrophotometrically at 450 nm ± 10 nm. The O.D. of the samples is then compared to the standard curve to determine the concentration of Interleukin 6 (IL6) in the samples.

iii. Adiponectin (Bioassay ELISA Kit)

Principle: The plate has an antibody against human adiponectin pre-coated on it. Once added, the sample's adiponectin binds to the antibodies coated on the wells. After that, adiponectin in the sample is bound by the addition of biotinylated human adiponectin antibody. After that, the biotinylated Adiponectin antibody binds to the streptavidin-horseradish peroxidase. During a wash step, unbound streptavidin-Horseradish Peroxidase is removed following incubation. Following the addition of the substrate solution, colour develops in proportion to the concentration of human Adiponectin. Adding of an acidic stop solution ends this reaction, and the absorbance is analysed at 450 nm.

iv. CRP Elisa Test principle: The CRP ELISA test kit is based on the principle of a solid phase enzyme-linked immunosorbent assay. The assay system utilizes a unique monoclonal antibody directed against a distinct antigenic determinant on the on the CRP molecule. This mouse monoclonal anti-CRP antibody is used for solid phase immobilization (on the microtiter wells). A goat anti-CRP antibody is in the antibody-enzyme (horseradish peroxidase) conjugate solution. The test sample is allowed to react simultaneously with the two antibodies, resulting in the CRP molecules being sandwiched between the solid phase and enzyme-linked antibodies. After 45-minute incubation at room temperature, the wells are washed with water to remove unbound labelled antibodies. A TMB reagent is added and incubated for 20 minutes, resulting in the development of blue colour.

8. Statistical Analysis: Data obtained was categorised based on duration of Type-2 diabetes, age and sex. Utilizing GraphPad Prism, version 8.0.2 (California, USA), Student's statistical t-test at P =.05, Mean, Standard deviation and significant differences in the study population of Type 2 diabetic (T2D) and non-diabetic participant was evaluated.

III RESULTS AND DISCUSION

1. **Mean±SD of Metabolic and inflammatory Parameters of T2Diabetic Subjects and control:** Table 3.1 below shows the Mean±SD of Metabolic and inflammatory Parameters of Diabetic Subjects and control The summation values of these parameters FBS, HbA1c, Adiponectin, BMI CRP, FERRITIN and IL-6 in all tribes for subjects and controls values was compared, significant differences was noted for all parameters compared except in Adiponectin.

Table 3.1: Mean±SD of Metabolic and inflammatory Parameters of Diabetic Subjects and control:

Parameters	Ijaw	Isoko	Ika	Igbo	Control	Fvalue	pvalue	Remark
FBS (mmol/L)	9.10±3.25a	7.72±3.51a	7.03±3.20a	9.10±3.14a	4.98±0.66b	7.039	<0.0001	S
HbA1c (%)	9.02±1.54a	8.13±1.75ac	8.96±1.49a	10.18±2.05ad	6.77±0.99b	13.97	<0.0001	S
Adiponectin (mg/L)	6.11±2.15	5.43±1.73	5.72±1.32	7.46±1.85	10.30±2.72	0.948	0.4399	NS
CRP (mg/L)	8.26±6.36a	3.90±3.99b	5.14±4.75a	4.55±4.01a	2.95±2.18b	4.094	0.0042	S
Ferritin (ng/L)	356.0±250.7a	224.3±152.9a	133.3±97.44b	193.3±188.2a	197.4±143.1a	3.546	0.0097	S
IL-6 (ng/L)	6.98±2.84a	9.09±5.36a	7.17±2.47a	11.67b±8.29b	4.60±2.59a	5.897	0.0003	S

Keys: S=Significant, NS=Not Significant, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6. Values within same row with different superscripts (a, b), (c, d) differ significantly when various tribes were compared against each other ($p \leq 0.05$)

2. **Mean±SD of Metabolic and inflammatory Parameters of T2D with Varying Duration of DM:** Tables 3.2 below shows Mean±SD of Metabolic and inflammatory Parameters of T2D with Varying Duration of T2D Subjects were stratified into ages (1-5, 6-10, 11-15, 16-20,) depending on duration in years of becoming diabetic. No difference was found in all immunological and metabolic parameters.

Table 3.2: Mean±SD Mean±SD of Metabolic and inflammatory Parameters of T2D with Varying Duration of T2D

Parameters	1-5 yrs	6 -10 yrs	11 -15 yrs	16 -20 yrs	Fvalue	pvalue	Remark
FBS (mmol/L)	8.11±3.41	8.27±2.88	8.32±3.56	7.35±3.37	0.417	0.7413	NS
HbA1c (%)	8.84±1.86	8.85±1.39	9.59±2.08	9.46±1.95	0.833	0.479	NS
Adiponectin (mg/L)	6.66±2.48	4.25±3.23	6.93±1.07	9.88±2.95	0.872	0.459	NS
CRP (mg/L)	5.78±5.29	7.12±5.65	2.39±2.25	4.51±3.46	2.373	0.0769	NS
Ferritin (ng/L)	261.1±232.3	242.2±262.1	139.6±110.2	114.4±53.05	1.657	0.1834	NS
IL-6 (ng/L)	8.73±4.75	7.34±3.14a	7.83±4.43	13.83±11.88b	2.629	0.0562	NS

Keys: S=Significant, NS=Not Significant, BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6, Values within same row do not differ significantly when compared against each other ($p \leq 0.05$).

3. **Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with Varying Duration of T2D against Control Subjects:** Table 3.3 below shows Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with Varying Duration of T2D against Control Subjects. Subjects were stratified into ages (1-5, 6-10, 11-15, 16-20,) depending on duration in years of becoming diabetic.The summation values of these parameters FBS, HbA1c, Adiponectin, CRP, FERRITIN, and IL-6 in all tribes according to the stratified ages for subjects was compared against the control. Significant differences were noted for FBS, HbA1c, CRP, IL-6, while in Adiponectin, no significant difference was found.

Table 3.3: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with Varying Duration of T2D against Control Subjects.

Parameters	Control	1-5 yrs	6 -10 yrs	11 -15 yrs	16 -20	Fvalue	pvalue	Remark
FBS (mmol/L)	4.92±0.65a	8.11±3.41b	8.27±2.88b	8.32±3.56b	7.35±3.37a	5.168	0.0008	S
HbA1c (%)	6.57±0.99a	8.84±1.86b	8.85±1.39b	9.59±2.08b	9.46±1.95b	9.027	<0.0001	S
Adiponectin (mg/L)	5.15±1.96	6.65±2.48	4.25±3.23	6.94±1.07	9.88±2.95	0.681	0.6068	NS
CRP (mg/L)	2.33±2.09a	5.79±5.29b	7.12±5.65b	2.39±2.25a	4.51±3.46a	4.064	0.0044	S
Ferritin (ng/L)	262.7±133.9	261.1±232.3	242.2±212.1	139.6±110.2	114.4±53.05	1.550	0.1941	NS
IL-6 (ng/L)	3.91±2.88a	8.73±4.75b	7.34±3.14a	7.83±4.43a	13.83±11.88b	5.877	0.0003	S

Keys: S=Significant, NS=Not Significant, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6. PostHoc (Dunnett's Multiple Comparison test): Values within same row with different superscripts differ significantly compared against the control ($p \leq 0.05$)

4. **Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at Varying Age (years) Intervals:** Tables 3.4 shows the Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at Varying Age (years) Intervals Subjects in all tribes was stratified according to age (31-40, 41-50, 51-60, 61-70, 71-80) sum of parameters for the age iuwidth for the immunologic was obtained. Level of significance was measured using P value, non was significant.

Table 3.4: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at Varying Age (years) Intervals

Parameters	31 -40 yrs	41-50 yrs	51 - 60yrs	61 -70 yrs	71 – 80 Yrs	Fvalue	Pvalue	Remark
FBS (mmol/L)	7.98±2.90	9.03±3.85	8.56±3.38	8.15±3.37	5.20±1.44	1.155	0.337	NS
HbA1c (%)	8.86±1.98	9.23±1.94	9.19±1.52	9.09±1.89	8.15±1.57	0.349	0.843	NS
Adiponectin (mg/L)	5.429±2.22	5.51±2.13	8.09±2.69	6.90±1.53	3.03±2.38	0.367	0.831	NS
HOMA-IR	5.21±3.19	4.43±2.95	4.83±4.96	3.98±2.85	4.501±1.97	0.460	0.764	NS
BMI	28.65±5.68	29.76±7.15	28.16±6.03	27.04±5.90	24.78±2.85	0.829	0.510	NS
CRP (mg/L)	4.81±4.80	6.80±5.56	6.23±4.99	5.44±5.36	2.20±1.85	0.840	0.504	NS
Ferritin (ng/L)	248.2±255.1	236.9±258.5	270.4±201.5	194.5±184.4	111.3±57.46	0.581	0.678	NS
IL-6 (ng/L)	7.70±2.07	8.35±6.41	10.28±5.04	9.09±7.59	9.40±1.69	0.492	0.742	NS

Keys: S=Significant, NS=Not Significant, BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6. PostHoc (Tukey's Multiple Comparison test): Values within same row do not differ significantly compared against the control ($p \leq 0.05$).

5. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D in Different Sexes: Table 3.5 shows the mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D in Different Sexes. Subjects were seperated based on sex (male, female) sum of the individual Metabolic, Parameters was taken, the Mean±SD was evaluated for significance using P-value FERRETIN, IL-6while other parameters were insignificant.

Table 3.5: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D in Different Sexes.

Parameters	Female	Male	Tvalue	Pvalue	Remark
FBS (mmol/L)	8.26±3.36	8.12±3.24	0.188	0.851	NS
HbA1c (%)	8.88±1.74	9.21±1.95	0.805	0.423	NS
Adiponectin (mg/L)	5.87±8.66	6.58±9.30	0.350	0.726	NS
CRP (mg/L)	5.61±4.88	5.27±5.04	0.289	0.7726	NS
Ferritin (ng/L)	175.0±144.9	291.1±245.6	2.412	0.0182	S
IL-6 (ng/L)	7.44±3.59	10.38±6.99	2.439	0.0170	S

Keys: S=Significant, NS=Not Significant ($p \leq 0.05$), FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6.

6. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 31 – 40 Age (Years) Intervals. Tables 3.6 shows the Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D in Different Sexes T2D at 31 – 40 Age (Years) Intervals was compared with the control for same parameters remarkable level of significance was found in FBS, HbA1c, Adiponectin, and IL-6, other parameters compared were insignificant.

Table 3.6: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 31 – 40 Age (Years) Intervals

Parameters	Control	Subject	Tvalue	pvalue	Remark
FBS (mmol/L)	4.50±0.46	7.98±2.90	2.639	0.013	S
HbA1c (%)	5.98±1.15	8.86±1.98	3.114	0.004	S
Adiponectin (mg/L)	13.20±2.36	5.43±4.21	2.352	0.026	S
CRP (mg/L)	3.30±2.98	4.81±4.80	0.670	0.5084	NS
Ferritin (ng/L)	95.80±65.96	248.2±255.1	1.309	0.2015	NS
IL-6 (ng/L)	2.10±1.78	7.70±2.07	5.600	<0.0001	S

Keys: S=Significant, NS=Not Significant (p≤0.05), BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, HOMA-IR=Insulin Resistance, CRP= C-Reactive Protein, IL-6= Interleukin 6, TCHOL=Total cholesterol; TG=Triglyceride; HDL=High Density Lipoprotein; LDL=Low density Lipoprotein.

7. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 41 – 50 Age (Years) Intervals: Tables 3.7 shows the Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 41 – 50 Age (Years) Intervals. This was compared with the sum total for control for same parameters remarkable level of significance was found in FBS, HbA1c, CRP and IL-6, other parameters compared were insignificant.

Table 3.7: Mean±SD of Metabolic Parameters of Subjects with T2D at 41 – 50 Age (Years) Intervals

Parameters	Control	Subject	Tvalue	pvalue	Remark
FBS (mmol/L)	4.99±0.55	9.03±3.85	3.265	0.0033	S
HbA1c (%)	6.95±0.59	9.23±1.94	3.597	0.001	S
Adiponectin (mg/L)	6.57±3.17	4.26±3.79	1.603	0.122	NS
CRP (mg/L)	1.58±1.28	6.80±5.54	2.606	0.017	S
Ferritin (ng/L)	181.3±137.7	236.9±258.5	0.563	0.579	NS
IL-6 (ng/L)	4.73±2.79	8.35±6.41	1.513	0.145	S

Keys: S=Significant, NS=Not Significant (p≤0.05), BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6,

8. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 51 – 60 Age (Years) Intervals: Tables 3.8 shows the Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 51 – 60 Age (Years) Intervals. Comparative results between controls and subjects in terms of age interval (51-60) for Metabolic no significant difference was noted for FBS, BMI, Ferretin while HBAIC, adiponectin, CRP and, IL-6 were significant.

Table 3.8: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 51 – 60 Age (Years) Intervals.

Parameters	Control	Subject	Tvalue	Pvalue	Remark
FBS (mmol/L)	5.70±1.13	8.56±3.37	1.159	0.2674	NS
HbA1c (%)	6.25±1.48	9.19±1.51	2.563	0.0236	S
Adiponectin (mg/L)	7.50±0.14	3.48±1.33	4.155	0.0011	S
CRP (mg/L)	1.37±0.64	6.23±4.99	2.337	0.0327	S
Ferritin (ng/L)	279.5±105.6	270.4±201.5	0.102	0.9196	NS
IL-6 (ng/L)	4.13±1.77	10.28±5.04	2.862	0.0113	S

Keys: S=Significant, NS=Not Significant (p≤0.05), BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, CRP= C-Reactive Protein, IL-6= Interleukin 6.

9. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 61 – 70 Age (Years) Intervals: Tables 3.9 shows Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 61 – 70 Age (Years) Intervals Comparative results of controls and subjects (61-70 age) years, for Metabolic parameters no significant difference was found in all parameters compared.

Table 3.9: Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 61 – 70 Age (Years) Intervals

Parameters	Control	Subject	Tvalue	Pvalue	Remark
FBS (mmol/L)	5.30±0.28	8.15±3.37	1.175	0.2521	NS
HbA1c (%)	6.40±2.12	9.09±1.89	1.925	0.0667	NS
Adiponectin (mg/L)	3.10±1.56	3.38±1.46	0.260	0.7968	NS
Insulin (uIU/ml)	17.95±2.89	12.42±9.30	0.824	0.4186	NS
CRP (mg/L)	1.58±0.62	4.993±5.13	1.314	0.1985	NS
Ferritin (ng/L)	158.8±105.5	183.0±174.2	0.269	0.7892	NS
IL-6 (ng/L)	6.93±2.74	9.13±7.05	0.613	0.5441	NS

Keys: S=Significant, NS=Not Significant ($p \leq 0.05$), BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, HOMA-IR=Insulin Resistance, CRP= C-Reactive Protein, IL-6= Interleukin 6.

10. Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 71 – 80 Age (Years) Intervals: Tables 3.10 shows the Mean±SD of Metabolic and Inflammatory Parameters of Diabetic Subjects with T2D at 71 – 80 Age (Years) Intervals was compared with controls for Metabolic parameters. CRP, IL-6, were significant. Other parameters compared was insignificant.

Table 3.10: Mean±SD of Metabolic and Inflammatory Parameter of Diabetic Subjects with T2D at 71 – 80 Age (Years) Intervals.

Parameters	Control	Subject	Tvalue	pvalue	Remark
BS (mmol/L)	4.75±1.06	5.20±1.43	0.384	0.7202	NS
HbA1c (%)	5.80±1.27	8.15±1.57	1.810	0.1445	NS
Adiponectin (mg/L)	3.65±0.77	3.02±0.37	1.420	0.2285	NS
CRP (mg/L)	1.15±0.64	9.40±1.69	6.328	0.0032	S
Ferritin (ng/L)	135.5±153.4	111.3±57.46	0.306	0.7747	NS
IL-6 (ng/L)	8.60±2.12	9.40±1.69	0.509	0.6374	S

Keys: S=Significant, NS=Not Significant ($p \leq 0.05$), BMI=Body Mass Index, FBS=Fasting Blood Sugar, HbA1c= Glycated Haemoglobin, HOMA-IR=Insulin Resistance, CRP= C-Reactive Protein, IL-6= Interleukin 6.

IV CONCLUSIONS

The findings from this investigation shows significantly raised levels of inflammatory markers in diabetes subjects than in the control group, indicating a derangement of these parameters probably due to inflammation. IL-6 and ferretin levels in male for the studied population was significantly higher than in the female subjects. Based on age and duration of disease, no significant differences were observed in the biochemical parameters among subjects.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

Ethical approval was sought and obtained from the Ethical Committee of Federal Medical Centre, Asaba, Delta State, Nigeria. Informed consent of the participants involved was also obtained using the consent form.

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