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Blood Lipids and Electrolyte Profiles of Male and Female Diabetics in Plateau State Nigeria

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Serum lipid profiles (total cholesterol, phospholipids, total lipid) and electrolytes (Sodium ion, Na^{2+}, potassium ion, K^+ chloride ion, Cl^- and bicarbonate ion, HCO_3^-) were determined in 100 diabetics attending the Diabetic Clinic of the Jos University Teaching Hospital and in non-diabetic subjects. All the diabetic patients had significantly higher ($p<0.01$) total cholesterol, phospholipids and total lipids levels than all the non-diabetic subjects. This study also showed a significant increase ($p<0.05$) in the serum levels of K^+ and a non significant increase in the serum levels of HCO_3^- while there was a significant decrease ($p<0.05$) in the serum levels of Na^+ and Cl^- in all diabetics compared to all non-diabetics. There was however, a non-significant difference in the serum levels of these electrolytes between male diabetics and female diabetics. It is therefore concluded that differences in lipids and electrolytes found in diabetics may have a great potential as a diagnostic tool in clinical practice. The non-significant difference in the serum levels of both lipids and electrolytes between male and female suggests that sex plays no important role in the pattern of biochemical response to diabetes mellitus.

Key words: Total lipids, electrolytes, diabetics, anion gap, cholesterol, phospholipids

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INTRODUCTION

In the past few decades significant changes have occurred in the pattern of health and disease in many developing countries including Nigeria. The prevalence of diabetes in African communities is increasing with ageing of the population and lifestyle changes associated with rapid urbanization[1,2]. As malnutrition and communicable diseases come under control non-communicable diseases like diabetes mellitus and hypertension have begun to emerge as major public health problems. Similar to the experience in many other parts of the world, diabetes mellitus is the most common endocrine metabolic disorder encountered in Nigeria[3,4].

Lipids and electrolytes have always played a significant role in a number of diseases and changes in the concentration of these parameters usually give good indications in disease progression in a number of non communicable diseases. Accordingly, this study was undertaken to determine the blood lipids and electrolyte profiles of diabetic patients with a view to providing biochemical parameters that may be helpful in the diagnosis and description of the disease. Furthermore, data obtained here with Nigerian diabetics could serve as a bench mark for comparative purposes with those in the developed countries.

MATERIALS AND METHODS

About 5 mL of blood was obtained by venepuncture from each diabetic patient attending the Diabetes Clinic at the Jos University Teaching Hospital using sterilized disposable syringes and needles. Same amount of blood was also collected from the non-diabetic subjects. The blood was put into centrifuge tubes. This was allowed to clot and then centrifuged at 6,000 rpm for 10 min at room temperature. The serum obtained was pipetted into clean blood sample bottles and analyzed on the day of collection for serum sugar. The remaining was stored frozen and used for the rest of the analysis.

Serum glucose was determined by the glucose oxidase method. The total cholesterol, phospholipids and total lipids were determined using the methods of Leoffler and McDougald[5], Stroeve and Makarova[6], Frings *et al.*[7], respectively. Sodium ion, (Na^+) and potassium ion, (K^+) were determined by the Flame Photometer Technique, Serum bicarbonate($HC0_3^-$) by the method of Segal[8] and chloride ion (Cl^-) by the method of Schales and Schales[9]. Statistical analyses was done by using the student's t-test.

RESULTS AND DISCUSSION

In the present study the total number of subjects studied was 200 comprising 100 diabetics and 100 non-diabetics. The data showed that diabetics subjects had significantly higher levels of the different types of lipids evaluated than the non-diabetics subjects ($p<0.01$). Diabetic females recorded higher cholesterol and total lipid levels than non-diabetic females ($p<0.05$) while the phospholipids concentrations were about the same values in the two groups (Table 1).

Na^+, Cl^- and K^+ levels were significantly higher in diabetics than in non-diabetics (Table 2). There was however no significant difference in the HCO_3^- concentrations between the two groups. The results obtained from this study showed that Diabetes mellitus is associated with an increase in serum glucose and lipids when compared to non-diabetic subjects. The mean serum glucose concentration for all diabetics (12.42±4.07) was significantly higher ($p<0.01$) compared to that of all non-diabetics subjects (4.46±0.33). The increase in the mean glucose concentration of diabetic males (14.03±4.63) relative to their female counterpart (11.39±3.39) was however not significant. The higher serum glucose values observed in the diabetics were expected because, a person is said to be diabetic if the fasting serum glucose is 8 mmol L^{-1} or more[10]. The increased serum glucose level in diabetics arises from the deficiency of insulin, the key hormone in the regulation of glucose metabolism.

The mean serum levels of total cholesterol, phospholipids and total lipid for all diabetics were

Table 1: Mean±SD of serum lipids concentrations in both diabetics and non-diabetics

	Lipid (mg/100 mL)		
	Cholesterol	Phospholipids	Total lipid
All non-diabetic subjects	189.83±55.49	161.00±28.36	578.39±77.03
All diabetic patients	268.87±62.75**	216.53±53.64**	718.31±128.29**
Non diabetic males	181.00±39.57	165.00±37.42	541.46±70.52
Diabetic males	249.47±59.99*	218.93±44.77**	677.11±124.91*
Non diabetic females	198.68±71.92	157.00±31.15	615.32±70.49
Diabetic females	281.22±62.64*	215.00±59.56*	744.52±126.19*
Diabetic males	249.47±59.99	218.93±44.77	677.11±124.91
Diabetic females	281.22±62.64^{NS}	215.00±59.56^{NS}	744.52±126.19^{NS}

* Significant at $p<0.05$, ** Significant at $p<0.01$, ^{NS} Non-significant

Table 2: Mean±SD of serum electrolytes concentrations in both diabetic and non diabetic subjects

	Electrolyte (mmol L^{-1})				
	Na^+	K^+	Cl^-	HCO_3^-	Anion-Gap
All non-diabetic subjects	139.30±3.40	4.11±0.53	109.80±21.49	25.40±3.13	17.74±15.35
All diabetic patients	137.75±5.28*	4.51±0.48*	104.75±10.35*	25.92±2.81^{NS}	13.69±9.27^{NS}
Non-diabetic males	140.00±2.45	4.00±0.65	128.80±31.38	24.40±1.52	16.32±14.65
Diabetic males	137.29±5.24^{NS}	4.58±0.47*	102.14±6.90^{NS}	25.93±2.56^{NS}	13.65±8.78^{NS}
Non-diabetic females	138.60±4.34	4.22±0.42	106.80±5.63	26.40±4.16	19.16±17.63
Diabetic females	138.05±5.41^{NS}	4.47±0.49^{NS}	106.41±11.89^{NS}	26.09±3.04^{NS}	13.72±9.77^{NS}
Diabetic males	137.29±5.24	4.58±0.47	102.14±6.90	25.93±2.51	13.65±8.78
Diabetic females	138.05±5.41^{NS}	4.47±0.49^{NS}	106.41±11.89^{NS}	26.09±3.04^{NS}	13.72±9.77^{NS}

* Significant at $p<0.05$, ^{NS} Non- significant

significantly higher ($p<0.01$) than those of non-diabetics. In the same vein, diabetic males showed a significant increase ($p<0.05$) in serum lipid level compared to the non-diabetic males. In the female category, diabetic females similarly showed a significant increase ($p<0.05$) in the levels of these lipid parameters. These observed increases in serum lipids associated with Diabetes mellitus are in agreement with the findings of Simpson *et al.*[11], Stroeve and Makarova[6], Ononogbu[12]. In diabetes, many factors may affect blood lipid levels, the most important of which probably is insulin deficiency, which plays an important role in the regulation of intermediary metabolism[13].

Present results revealed a significant increase ($p<0.05$) in the serum levels of K^+ and a non-significant increase in the serum levels of HCO_3^- while there was a significant decrease ($p<0.05$) in the serum levels of Na^+ and Cl^- in all diabetics relative to all non-diabetic subjects. The increase in the levels of K^+ observed in this study agrees with the work of Leonard and John[14], Ito *et al.*[15]. While decrease in the concentration of Na^+ and Cl^- also agrees with that reported by Leonard and John[14], Dod[16]. The low concentration of Na^+ in the diabetics may be due to hyperglycemia which causes an increase in the osmotic pressure of plasma and/or due to the effect of diabetic ketoacidosis. There was a non-significant difference in the anion gap between diabetics and non-diabetic subjects whether sex is considered or not. The most frequent use of the anion-gap clinically is in the differential diagnosis of metabolic acidosis. Diabetic ketoacidosis is usually accompanied with anion-gap values exceeding 25; this is due to excessive formation of ketoacids. The non-significant differences in the serum levels of both lipids and electrolytes probably suggested that sex plays no important role in the pattern of biochemical response to Diabetes mellitus.

From the foregoing, changes in the concentrations of the various lipids and electrolytes in particular may have great potential as a diagnostic tool in clinical practice in Nigeria. Accordingly, estimations of serum electrolytes may be essential in the diagnosis of patients particularly in diabetic ketoacidosis.

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