Assessment of the Renal Function among Type 2 Diabetics Attending Specialist Hospital Sokoto Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author FUB designed the study. Author IZW performed the statistical analysis. Author MKD wrote the protocol and managed the analyses of the study. Author MMH managed the literature search and author FUB wrote the first draft of the manuscript. All the authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: To assess the renal function among type 2 diabetics in Sokoto, Nigeria.
Study Design: The cross-sectional study involved 100 diabetic patients and 50 apparently healthy (normoglycaemic) controls.
Place and Duration of Study: General Out Patient Department (GOPD), Specialist Hospital, Sokoto and Chemical Pathology, Faculty of Medical Laboratory Sciences, Usmanu Danfodiyo University, Sokoto, between April, 2015 and September, 2015.
Methodology: Serum glucose was estimated using glucose oxidase method, serum urea using diacetylmonoxime method, creatinine using Jaffes' method, potassium and sodium using Flame photometry (Jenway).
Results: Our results showed that, diabetic subjects were 69 (69%) males and 31(31%) females with

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mean age of 49.32±1.10 and controls (normoglycaemic) subjects with 26.28± 0.68. The mean values for urea and creatinine, was significantly higher ($p<0.05$) in diabetics than in controls (4.30±0.20, 1.02±0.068) and (3.61±0.12, 0.76±0.05) respectively. No statistically significant difference observed ($p>0.05$) in serum levels of potassium and sodium in the diabetics compared to controls. However, no statistically significant difference observed in BMI ($p>0.05$) of the patients (21.14±3.0) compared to controls (22.03±0.02).

Conclusion: It has been observed from this study that, there is a deranged renal function among type 2 diabetics attending Specialists Hospital, Sokoto. It is therefore recommended that assessment of renal function be included in the routine assessment of the diabetics. Hence, clinicians could make treatment and/or preventive measures even before it becomes clinically evident.

1. INTRODUCTION

Type 2 diabetes is a long term metabolic disorder that is characterized by high blood sugar, insulin resistance and relative lack of insulin [1]. Common symptoms include increased thirst, frequent urination and unexplained weight loss. Symptoms may also include increased hunger, feeling tired and sores that do not heal [1]. It primarily occurs as a result of obesity and sedentary life style [2]. Some people are more genetically at risk than others [1]. It accounts to about 90% to 95% of diabetes cases [2]. The prevalence of undiagnosed type 2 diabetes among fulanis in Sokoto metropolis was estimated to be 4.6% [3] and 0.8% among rural fulanis [4].

Early reports suggested that renal failure was an infrequent outcome in type 2 compared to type 1 diabetes. This opinion was based on the observation that a much smaller proportion of type 2 developed ureamia. Furthermore longitudinal studies revealed that the rate of loss of glomerular filtration in patients with type 2 diabetes did not exceed the rate anticipated due to advancing age [5]. Recently, however, the number of patients with type 2 diabetes as co-morbid condition who develop end-stage renal failure and require renal replacement therapy has increased dramatically [6].

Assessment of renal function may be useful for two different purposes. One is to diagnose impaired renal function and the other to detect the presence of a progressive loss of renal function over time [7]. Urea, creatinine, sodium and potassium are the parameters to assess well being of the kidneys. Changes in serum creatinine concentrations more reliably reflect changes in glomerular filtration rate (GFR) than do changes in serum urea concentrations [8,9]. A positive association between the serum electrolytes levels and the development of type 2 has been reported [10]. In this present study, the changes in serum urea, creatinine, potassium and sodium were assayed in type 2 diabetics (on drugs and doctors guide on diatary manipulation) in order to define renal involvement in diabetes. Hence, clinicians could make treatment and/0r preventive measures even before it becomes clinically evident.

2. MATERIALS AND METHODS

2.1 Study Subjects

A total of one hundred (100) adults between the ages of 30 years and above of the target populations were recruited for the study. Fifty (50) apparently healthy (normoglycaemic) age marched individuals were also recruited as controls.

2.2 Informed Consent

Informed consent for inclusion into the study was obtained from each subject using a standard protocol.

2.3 Ethical Consideration

Ethical approval was obtained from the Ethical and Research Committee of the Hospital prior to the commencement of the study. The ethical clearance number for the study is: SHS/SUB/133.

2.4 Sample Size Estimation

Sample size was estimated using the formular: $n = Z^2 Pq/d^2$ as described by Aroaye (2003) [11].

2.5 Blood Collection and Processing

Five milliliters (5mls) of blood sample was taken from each subject into plain tubes by venipuncture. The blood specimens were centrifuged and the sera was carefully drawn into sample bottles and analyzed immediately or stored frozen at -20°C until the time for analysis.

2.6 Anthropometric Measurement

The procedure of Bashar [12] was employed in the anthropometric measurements. Body Mass Index (BMI) was determined using the weight in kilogram (kg) divided by the square of the height in meters, measured using vernier caliper.

2.7 Analytical Methods

Serum Glucose, urea, creatinine, potassium and sodium were estimated using glucose oxidase method, Diacetylmonoxime method, Jaffes' method and Flame Photometry (Jenway) method respectively.

2.8 Statistical Analysis

Statistical analysis was performed using SPSS version 20.0. Data are presented as Mean ± Standard Error of Mean. Comparisons between groups were made using Student's t-test. A p-value of less than or equal to 0.05 ($p \leq 0.05$) was considered statistically significant.

3. RESULTS AND DISCUSSION

3.1 Results

A total of 150 subjects (100 diabetics and 50 controls) were enrolled for this study. Diabetic subjects were 69 (69%) males and 31 (31%) females, with mean age ± standard error of mean of 26.28 ± 0.68 and 49.32 ± 1.10 for control and diabetes respectively. Socio-demographic characters of the subject are presented in Table 1.

Table 2 shows the serum glucose, creatinine, urea, sodium and potassium concentrations of the diabetic patients and controls. The results showed that with the exception of serum potassium and sodium; the concentrations of the other analytes were significantly higher ($p<0.05$) in diabetic patients than in controls. However, no statistically significant difference ($p>0.05$) observed in serum potassium and sodium of diabetics when compared to controls. Comparison of renal function parameters

between genders is presented in Table 3. The results showed that with the exception of serum creatinine which is statistically significant ($p<0.005$), the concentrations of all other analytes were not significant across the gender ($p>0.05$). However, no statistically significant difference observed in BMI ($p>0.05$) of the patients (21.03±3.0) compared to controls (22.03±0.02).

Table 1. Socio-demographic characteristics of the study subjects

Variables	Non-diabetics	Diabetics
Gender		
Male	69(69%)	28(56%)
Female	31(31%)	22(44%)
Educational background		
No formal	39(39%)	2(4%)
Primary	17(17%)	5(10%)
Secondary	10(10%)	12(24%)
Tertiary	34(34%)	31(62%)
Tribe		
Hausa	58(58%)	37(74%)
Yoruba	13(13%)	8(16%)
Igbo	7(7%)	3(6%)
Igbira	6(6%)	2(4%)
Zuru	2(2%)	0(0%)
Igala	4(4%)	0(0%)

%= percentage of Participants within a variable.

Table 2. Anthrophometric and biochemical parameters (Mean ± SEM) in diabetics and controls

Parameter	Controls (n=125)	Diabetics (n=127)
Age (years)	26.28 ± 0.68	49.32 ± 1.10**
FBG (mmol/l)	4.47 ± 0.08	7.604 ± 0.31*
Urea (mmol/l)	3.61 ± 0.12	4.30 ± 0.20*
Creatinine (mmol/l)	0.76 ± 0.05	1.02 ± 0.068*
Sodium (mmol/l)	135.99 ± 0.44	134.54 ± 0.51**
Potassium (mmol/l)	4.02 ± 0.05	4.06 ± 0.06**
BMI (kg/m^2)	22.03±0.02	21.14±0.34**

*FBG= Fasting Blood Glucose, n= number of subjects, mmol/L= Milimole per liter, *= statistical significance ($p \leq 0.05$)), **= Not statistical significance ($p \geq 0.05$).*

3.2 Discussion

In this study the fasting blood glucose, urea and creatinine were found to be significantly higher in diabetic patients than in controls. This demonstrated that serum urea and creatinine increased as the serum glucose increases. This is in agreement with the report of Bauza, [13] which suggests that hyperglycemia is one of the major risk factors of progressive renal malfunction. An increase in serum urea levels is seen when there is damage to the kidney or the

kidney is not functioning properly. A research conducted by Anjaneyulu et al. [14], demonstrated that increased serum urea and creatinine in type 2 diabetics indicate progressive renal damage. Another report of Alder et al. indicated that raised plasma creatinine and urea levels in type 2 diabetics may indicate a pre-renal problem such as volume depletion [15]. Judkay (2007) also in his study suggested higher creatinine levels in type 2 diabetics may be due to impaired function of the nephrons [16]. It has also been shown that a progressive decrease in renal function in male and female diabetic patients from age of 40 years and beyond is as a result of increased urea and creatinine levels [17].

Table 3. Comparison of parameter between the genders among type 2 diabetics

Parameter	Male (n=45)	Female (n=55)
Age (years)	48.75 ± 1.83	49.71 ± 1.37**
FBG (mmol/l)	7.94 ± 0.44	7.37 ± 0.42**
Urea (mmol/l)	3.87 ± 0.22	4.58 ± 0.30**
Creatinine mmol/l)	0.81 ± 0.31	1.16 ± 0.11*
Sodium (mmol/l)	134.49±0.92	134.57±0.59**
Potassium(mmol/l)	4.31 ± 0.10	3.96 ± 0.73**

*FBG= Fasting Blood Glucose, n= number of subjects, *= statistically significant, **= not statistical significance (p≥0.05).*

Serum levels of urea and creatinine can be used as prognostic markers and predictors of renal damage in type 2 diabetics [18]. Effective control of blood sugar levels can stop progression of renal involvement in type 2 diabetes and thus remarkably reduce the mortality and morbidity associated with the disease [19]. Estimation of renal function tests is sensitive that it can now be considered as an adjunct in the management and long duration treatment of the disease [20].

In this study, normal serum levels of potassium and sodium was observed in patients when compared to controls. This is not in agreement with the findings of Saydah et al. in which serum sodium levels increased in type 2 diabetics [21].

The current study further indicated that no positive relationship observed across the gender as regards to blood glucose, urea, sodium and potassium. However, males have significantly higher serum creatinine levels than females. This is in agreement with the findings of Anjaneyulu et al. [14]. This probably is because of the presence of creatinine in the muscle as waste product and males have increased muscle mass compared to females.

4. CONCLUSION

It could be concluded from the present study that there is deranged renal function in type 2 diabetics attending Specialist Hospital Sokoto. It is therefore recommended that assessment of renal function be included in the routine assessment of diabetics. Hence, clinicians could make treatment and/or preventive measures even before it becomes clinically evident.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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