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Serum urea, uric acid and creatinine levels in diabetic mellitus patients attending Jos University Teaching Hospital, North central Nigeria

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Abstract

Assay of Serum urea, uric acid and creatinine concentrations are important in the management of chronic diseases such as diabetes mellitus. Diabetes mellitus has an effect on the excretion of uric acid and creatinine in different sexes of diabetes mellitus (DM) patients attending Jos University Teaching Hospital (JUTH). This study also compared between urea, uric acid and creatinine concentration in the serum of diabetic (control group). 150 individuals were recruited for this study, seventy four (74) apparently healthy (non-diabetic) subjects were recruited as control and seventy six (76) diabetic subjects. The diabetic consist of thirty eight (38) male and thirty eight (38) females. The non diabetics consist of equal number of thirty seven (37) females and males respectively. The subjects were enlightened and given informed consents prior to the research. They were fasted overnight (12hr) and 5ml pre-prandial blood were collected from cubital vein in the arm the following morning with a sterile syringe, tourniquet and 75% alcohol and needle and the blood transferred to an Ethylenediaminetetraacetic acid (EDTA) bottle and kept at temperature of 2ºC and later analyzed. The result shows the level of serum (7.9±3.8) and creatinine (200±7.8) uMol/L significantly increased ($p<0.05$) in diabetic subjects. In male diabetic subjects the serum urea (7.4±3.2) uMol/l and creatinine (218±7.9) were significant. There was also a significant increase ($p>0.05$) in the female diabetic subjects. Though the serum uric acid level was higher in male diabetic (243±10.6) than the female diabetic (222±10.8), yet there was no significant difference ($p>0.05$). These values were also higher in male non-diabetic (179±8.4). This study therefore confirms that the assay of serum urea and creatinine concentrations have an important role in the management of diabetic mellitus patients.

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Introduction

Diabetes mellitus is a metabolic disorder of carbohydrate metabolism characterized by raise plasma glucose level (hyperglycemia) and usually resulting from insufficient production of the hormone insulin (type 1) diabetes or an ineffective response of cells to insulin (type 2)(WHO ,2006). Diabetes can be caused by a variety of hormonal and cellular defects which result in elevated blood glucose levels. A normal fasting blood glucose level is less than 110 mg/dl (6.1 mMol) according to the world health Organization (WHO, 2006)   and the European Association for the study of Diabetes (EASD), According to the American Diabetes Association (ADA), normal fasting blood glucose level is maintained in the body by an intricate balance of hormones which work to maintain glucose levels at steady state (WHO, 2006). Matthew Dobson in the 17th century was able to show chemically that the urine of diabetics contained sugar (Rosembloom and Sherman, 1966). Glucose is a metabolic product of carbohydrate taken in the body and stored in the liver in the form of glycogen and converted to glucose by the hormone called glucagon. The hormone insulin maintains the balance between glucose and glycogen in the body by its conversion of excess glucose in the body to glycogen. (Matthew Dobson, 1968). Insulin is produced in the pancreas in the beta cells of the islet of langerhans and can be deficient due to the destruction of beta –cells of the islet of langerhans or there may be inactivity of the counteracting hormones, glucagon (Ireland *et al*., 1980). Diabetes was also defined as the failure of glucose and insulin homeostasis (Richard M *et al*, 1984). The kidney plays an important role in the homeostatic mechanism of the human body o, reduced renal function strongly correlates with increase mobility and mortality. The mechanism of different filtration, re-absorption and secretion are effectors of regulating the body's acid base balance, electrolyte, protein and metabolites such as urea, uric acid and creatinine. Urea is the major non-nitrogen containing metabolic product of protein catabolism in humans. More than 90% of urea excreted through the kidney. While uric acid in human is the major product of catabolism of

purine, nucleotides (adenosine and guanosine). Renal handling of uric acid is complex and involves glomerular filtration and reabsorption in the proximal and distal tubule. Creatinine is a waste product of creatinine metabolism and it is present in all body fluids and secretion and filtration is freely by glomerulus. Therefore in this research, it sought to evaluate the excretory effects of urea, uric acid and creatinine in diabetic mellitus patients attending JUTH, It also sought to compare between diabetes mellitus and non-diabetes mellitus groups.

Materials and method*s*

Sample collection

In this research, 150 individuals comprising seventy – six (76) diabetics and seventy- four (74) non-diabetics of 20-65 years of age were selected for this study. All subjects were given informed consent on the aim of the research prior to the study with respect to the Helsinki declaration. The subjects were asked to fast over night after which 5ml of blood was collected from each of the subjects the following morning by 8:00am. Their upper arm was tied with tourniquet and skin vigorously cleaned with 75% alcohol and allowed to dry. Using a sterile syringe and needle, blood was drawn from suitable vein in the arm. The needle and the syringe were removed and the collected blood sample transferred to a sterile EDTA- bottle and stored in a refrigerator at a temperature of $2^{o}\pm1.0C$ till ready for use.

Inclusion criteria

Patients with risk factors for chronic kidney disease such as diabetes mellitus, sicke cell anemia and, congestive heart failure and family history of endocrine disorder were recruited in this study while those with non-clinical evidence of diabetes mellitus were also recruited.

Area of study

This research was conducted in Jos University Teaching Hospital, Plateau State North Central Nigeria which lies between longitude6.9°E and latitude 6.02°C with a population of 900,000 resident based on 2006 National Census. (www.en.wikipedia,org)

Ethical Clearance

Ethical clearance was obtained from the Human Research Ethical Committee of the College of Medicine of the University of Jos, Plateau State Nigeria.

Method of Estimation of Serum Glucose

The serum glucose level of the subjects were analyzed using the standard method of Trinder, 1969; Mod Bau Minger, 1974.

Method of Estimation of Serum Urea

The serum levels or concentration were analyzed using the standard method of Diacetylmonoxine and Natelson, 1965, Modified Match *et al*, 1965.

Estimation of Serum Uric Acid and Creatinine

This was estimated using the method of Caraway, 1955 while serum creatinine level was estimated using the standard method of Ani *et al*, 2017.
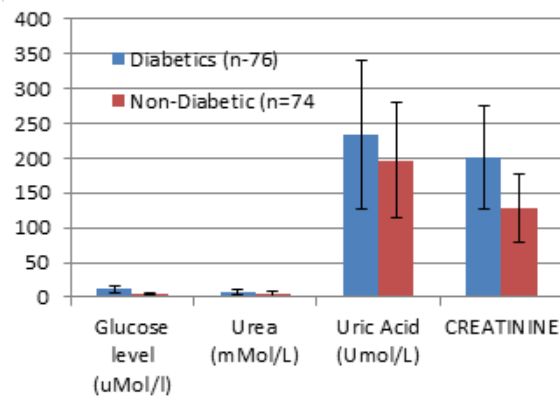
Statistical Analysis

The data were presented as Mean ± Standard Deviation (SD). They were analyzed using statistical software (Graphpad Prism 7). P values less than 0.05 were considered significant (p<0.05).

Results and discussion
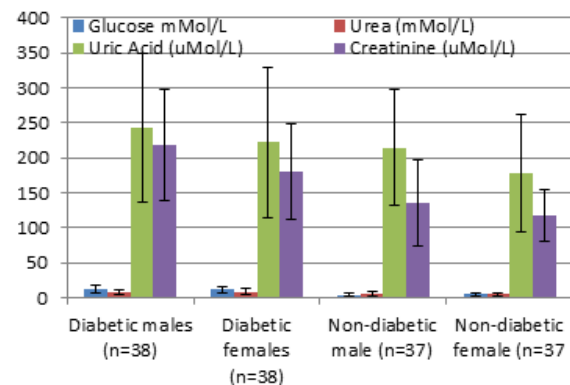
Fig 1 .Bar chart representing the result of the mean± SD of the parameters of both diabetic and non-diabetics Fig 2. Histogram showing the Mean± Standard deviation of the parameters for both diabetic and non- diabetic gender biased.

This research evaluated and compared the results of the level of serum uric acid, urea and creatinine levels in diabetic and non-diabetic mellitus patients attending Jos University Teaching Hospital in North Central Nigeria. Fig I shown above depicts the result of the parameters of diabetic and non- diabetic patients. From the results obtained, it was observed that there was a significant increase in the level of urea and creatinine in diabetic patients and this correlates with the report of Burtis and Ashwood (2001) who reported an increase in urea and creatinine in cases of diabetic nephropathy.

Fig. 1. Bar chart representing the result of the mean± SD of the parameters of both diabetic and non-diabetics.

The statistical analysis shows that though there were significant increase in the serum creatinine, urea, uric acid and glucose levels, yet no significant difference (p>0.05) was observed. An appreciable difference was observed between the male diabetic and non-diabetic as shown in figure II. The female diabetic and non-diabetic also showed an appreciable difference. Though, there was no statistical significance difference between them (p<0.05). The serum uric acid concentration was higher in the diabetic than in the non- diabetics and there was no significant difference (p>0.05) between them compared to the control.

Fig. 2. Histogram showing the Mean± Standard deviation of the parameters for both diabetic and non- diabetic   gender biased.

The increase in the serum urea, uric acid and creatinine level may be an implication of general disease (Tadashi *et al.*, 2015) like renal insufficiency which can cause increased creatinine and uric acid level as a result of reduction of blood flow to the kidneys. Renal artery stenosis also decreased blood flow to the kidney.

It could also lead to increased blood pressure, fluid retention and heart problem.

Conclusion

The level of serum urea and creatinine increased in diabetic subjects (Male and female). This study therefore recommends a frequent clinical diagnosis and estimation of serum urea and creatinine to help in the management of diabetes mellitus patients.

Acknowledgement

Conflict of Interest

None to declare.

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