



Research Paper

**ASSESSMENT OF ELECTROLYTES LEVEL AMONG TYPE 2 DIABETES
SUDANESE PATIENTS**

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Abstract

Introduction: The most common metabolic disorder is diabetes, if it not controlled, diabetic patients may develop chronic metabolic disorders characterized by persistent hyperglycemia which lead to electrolytes disturbances. **Objective:** To assess the levels of serum sodium, potassium and chloride among type 2 diabetic patients in Gazira state- Sudan. **Material and Methods:** 70 participants categorized into two groups enrolled in this cross-sectional study. Study group include 40 participant who have type2 diabetes of at least one year and control group include 30 healthy individuals. For both groups random blood glucose (RBG) level was carried out by using colorimetric method and serum levels of sodium (Na⁺), potassium (K⁺), and chloride (Cl⁻) were estimated by ion selective electrode. Results means comparisons and correlations were computed by using SPSS. **Results:** A significant increase in RBG, K⁺, and Cl⁻ levels was found among the Study group when compared to control group (p =< 0.001). Quite the opposite, there was a significant decrease in serum Na⁺ level in the study group compared to control group (p =< 0.001). A positive correlation was observed between RBG and serum level of K⁺ (r=0.343, p =0.002), Cl⁻ (r=0.503, p <0.001) where as RBG and serum sodium level inversely correlated (R-value: -0.529, p <0.001) within the study group. **Conclusions:** the study revealed that type2 diabetic patient present increase in levels of potassium and chloride and depletion in sodium which may lead patients to be prone biochemical derangement.
Key words: Type 2 Diabetes mellitus, Electrolytes imbalance, Chloride, Sodium and Potassium.

INTRODUCTION

Diabetes is a group of metabolic disorder that characterized by increased blood glucose (hyperglycemia). Chronic hyperglycemia causes different types of complications such as diabetic ketoacidosis, hyperosmolar hyperglycemic state or electrolyte disturbance^(1,2). Electrolytes imbalance is frequent in patients with diabetes, which could be the result of an altered allocation of electrolytes and is related to hyperglycemia induced osmotic fluid shifts or of total-body deficits brought about by osmotic diuresis⁽³⁾. Diabetes mellitus complications include metabolic imbalance, blood vessel degeneration and offset the proportion of electrolytes and accordingly; the disturbed electrolyte distribution may affect diabetes treatment⁽⁴⁾. The relation between blood glucose and electrolytes is complex and is related to number of other factors like age and many other associated conditions. Several scientists in several countries reported that disturbances in serum electrolyte levels are found to be associated with Diabetes Mellitus^(5, 6). Electrolyte imbalance resulting from kidney failure, dehydration, fever, and vomiting has been suggested as one of the contributing factors in the direction of complications observed in diabetes and other endocrine disorders⁽⁷⁾. An elevated serum and aqueous humor sodium and chloride as well as hyperkalemia in diabetic cataract patients had been reported⁽⁸⁾. Therefore this study aimed to assess serum sodium, potassium and chloride levels among Sudanese patients with type 2 Diabetes mellitus and to study the electrolytes levels association with RBG.

MATERIALS AND METHODS

Study design, study period and study area: This is a comparative cross-sectional study conducted from May to July in 2017 in El-Gezira state in Sudan.

Study population: A total of 70 individuals were enrolled in this study (40 type 2 diabetic patients as case group and 30 apparently healthy individuals to serve as control group), the age of both groups was matched and ranged from 40-65 Years.

Inclusion and exclusion Criteria: The study excluded patients with metabolic syndrome, lactating mothers, pregnant women, patients with myocardial infarction, Smokers, alcoholic abuser and patients with chronic diseases and patients with thyroid dysfunction.

Ethical consideration: Ethical approval was obtained from the scientific committee of Clinical Chemistry Department in College of Medical Laboratory Sciences, Alneelain University. An informed consent was obtained from each participant.

Sample collection: from each participant; 5 ml of venous blood were collected in plain container (for electrolytes measurement) and in fluoride oxalate container (for glucose measurement) under aseptic conditions, then the collected samples were centrifuged for 15 minutes at 3500 rpm then serum and plasma were separated and used for the measurements of sodium, potassium , chloride and RBG levels.

Methods: Enzymatic reaction method was used for Blood glucose level measurement by using Cobas 400 plus Integria, whereas Serum sodium, potassium and chloride levels were measured by using Ion Selective Electrode (ISE).

RESULTS

Table -1 The results showed that, a significant increase in serum levels of K⁺ and Cl⁻ in study group when compared with control group whereas, serum (Na⁺) levels showed a significant decrease in study group when compared to control group (Table 1).

Table -1 Comparison of serum electrolytes and RBG between groups

Variables	Study (Mean ± SD)	Control (Mean ± SD)	<i>P-value</i>
RBG (mg/dl)	257.8 ± 55.7	101.1 ± 8.8	0.000
Sodium (Na ⁺) (mmol/L)	133.3 ± 2.4	138.9 ± 2.7	0.000
Potassium (K ⁺) (mmol/L)	4.2 ± 0.29	3.5 ± 0.29	0.001
Chloride (Cl ⁻) (mmol/L)	106.6 ± 2.9	101.8 ± 2.7	0.000

Independent sample t- test was used, P-value considered significant when < 0.05.

Table -2 The Pearson correlation test revealed an inversely correlation between RBG and serum Na⁺ level and a positive correlation with K⁺ and Cl⁻ level.

Table (2) Correlation between RBG and the Electrolytes levels in Type 2 DM patients

Variables	<i>R-value</i>	<i>P-value</i>
Sodium(Na+) (mmol/L)	-0.529	0.000
Potassium (K+) (mmol/L)	0.356	0.011
Chloride (CL-) (mmol/L)	0.459	0.001

Pearson's correlation test was used, P-value considered significant when < 0.05.

DISCUSSION

The present study showed that; type 2 diabetes mellitus patients had significant increase in levels of serum random blood glucose, chloride and potassium with a significant lowering in serum sodium level. These results comes on line with several studies which reported elevation of serum random blood glucose, chloride and potassium while serum sodium decreased in type 2 diabetics^(9,10,11). It is very known from reports that: as hyperglycemia is restricted to the extracellular space so water moves from the intracellular to the extracellular compartment initially, diluting plasma sodium⁽⁷⁾. During the accompanying osmotic dieresis, water is generally lost in excess of sodium until in the long run the loss of water. Therefore, in diabetes mellitus patients; plasma sodium concentrations may be unnaturally lowered. Hyperglycemia-induced osmotic dieresis which can increase excretion is thought to be a primary mechanism underlying the decreased serum concentrations of sodium observed in response to increased glucose levels⁽⁷⁾.

On the other hand the current study results revealed an inversely correlation between RBG and serum sodium while RBG was positively correlated with potassium and chloride levels. These findings was agreed with study done by Alaka Das and his team who reported that, serum sodium was negatively correlated and serum potassium and chloride were positively correlated with random blood glucose⁽⁶⁾. Parallel with earlier finding that; under physiological situation, most of the sodium is reabsorbed in the proximal tubule of the kidney explain reduction in serum sodium^(12, 13). Indeed; Ketoacids decrease blood pH disturbing acid base balance and cause elevation of chloride⁽¹²⁾ so, increase level of chloride occurred due to diabetic ketoacidosis may be responsible for elevated chloride level in type 2 diabetics.. In fact that several studies

had shown that the exogenous insulin can induce mild hyperkalemia because it promotes the potassium invasion into the skeletal muscles and hepatic cells which increases the activity of potassium pump ^(2,14).

CONCLUSION

Glucose homeostasis in type 2 DM may be altered due to disturbance of sodium, potassium and chloride levels, therefore assessment of electrolytes related abnormalities are important to monitor the prognosis of type 2 DM patients.

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DECLARATION OF CONFLICT OF INTEREST

Regarding this information, all authors were declared that they have no conflict of interest and this declaration attached with the copyright form (second page). If there any other information required, please let me know.

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