The effect of hyperglycemia on osmolality in the Thi–Qar Governorate patients

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Abstract: 40 Samples were collected, from February 2019 until the April 2019. The average age for the two groups (A and B) was between 30 – 50 years old. 20 samples with diabetes (group B), 20 samples of people non-diabetes control groups (group A).

Both, the serum Sodium, Potassium, Urea and Glucose were estimated for all groups A and B respectively. The result indicated the presence of relative increase (P<0.05) of sodium, potassium, urea and glucose concentrations in (group B) as compare with (group A).

Finally, the results showed a relative increase (P <0.05) in osmolality concentration in (Group B) as compared with (Group A).

Keywords: Osmolality, hyperglycemia, Urea, Sodium, Potassium.

Introduction
Diabetes mellitus (DM) is a complex endocrine metabolic disorder associated with hyperglycemia which, commonly leads to alterations in the functions of several organs in the human body such as kidneys, eyes, nerves, gastrointestinal, hepatobiliary organs [1,2]. The increase in blood glucose if prolonged is reduced to the vibrancy of tissue and spoiled by various subjects of the body, and the complaint shows various difficulties and complications at the level of blood vessels (hypertension, arterial hardness, angina, and heart clot...the brain), vision disorder, kidney disorder, gum and teeth troubles, coma [3]. In general, Diabetes is a chronic disease caused by a defect in the secretion or function of insulin in the body, and insulin is a hormone produced by pancreas and helps body cells consume glucose from blood. When insulin is lacking, most glucose remains in the bloodstream rather than being used or stored, so the body does not get enough energy. The disorder in the metabolism of sugar and the failure in insulin secretion results in a range of clinical features that characterize diabetes: Frequent urinary and water drinking, high eating, weight loss and fatigue, high sweat, nausea [4,5]. Diabetes is due to either the pancreas not producing enough insulin (type 1) or because cells of the body do not respond properly to the insulin that is produced (type 2) [6]. Osmolality is a measure of solute concentration, defined as the number of osmotically active particles (osmoles) per kilogram of water [7]. The osmolality of human plasma is tightly regulated and averages at 285 - 295 mosmol/kg H2O [8]. Serum or plasma osmolality can be measured by freezing point depression or, as is done in clinical routine, can be calculated using formulas including the common osmotically active constituents of serum/plasma (sodium, chloride, glucose,
and urea) [9]. For practical purposes, plasma-based osmolality (millimole/L) of sodium, potassium, urea, and glucose can be calculated from the following equation [10].

\[
\text{Serum Osmolality} = (2 \times (\text{Na} + \text{K}) + (\text{Urea} / 2.8) + (\text{Glucose} / 18)
\]

Sodium is a key element that the body needs to maintain good health and is naturally present in most foods. Most people say sodium and salt are one thing How to explain that a diet with reserved sodium salt requires a reduction in the amount of salt in food sodium is the positive ion that is the primary in fluids outside the body including plasma [11]. Sodium plays a key role in maintaining osmotic blood pressure, and which affects blood circulation and the function of the kidneys in the nervous system Normal sodium level in the blood (135 – 145 mmol/l) [12,13]. The main positive potassium in cells and its blood measurement is one of the most important and accurate measurements in the extreme importance of potassium effect on the heart muscle the normal level of potassium in blood or plasma (3.5 - 5 mmol/l) [14,15].

Materials and Methods

40 Samples were collected, from February 2019 until the April 2019. The average age for the two groups (A and B) was between 30 – 50 years old. 20 samples with diabetic patients (group B), 20 samples of people non-diabetes control groups (group A).

The collection Blood Samples

The samples from the venous blood have been drawn of for people with diabetic patients and non-infected people by using sterile medical syringes.

Laboratory Investigation

Samples are placed in anti-clotting test tubes and left at laboratory temperature for (20 minutes) in the centrifuge at (3000 rpm) for the purpose of separating blood from its components and then separating serum for biochemical tests.

Biochemical Investigation

Serum Sodium, Potassium, Urea and Glucose were determined by using Cobas C111 device.

Results

The table one showed the results of the statistical analysis of the study indicated the presence of relative increase P<0.05 to concentrations estimate (Sodium, Potassium, Urea, Glucose and Osmolality) in the (Group B) compared with (Group A) non-diabetes standard control.

| Table (1) Effect of hyperglycemia on Na+, K+, Urea and osmolality concentrations compared with standard group |
|-----------------|-----|-----|-----|-----|-----|
| K              | Na  | Urea | Glucose | mOsm |
| SD  MEAN       | SD  MEAN | SD  MEAN | SD  MEAN | SD  MEAN |
|----------------|-------|-------|----------|--------|
| Group A        | 0.08  | 3.77  | 2.86     | 133.7  | 7.37   | 24.6   | 14.33  | 99.4   | 5.36   | 284.2  |
| Group B        | 0.25  | 4.199 | 3.29     | 141.1  | 10.44  | 31.09  | 72.07  | 251.2  | 7.37   | 315.7  |
### Discussion

The results showed an increase in the level of sugar in the serum of people with diabetes when compared to the control group, due to a defect in the secretion or function of insulin in the body. Insulin is a hormone that is excreted by pancreatic gland and helps body cells consume glucose from the blood and when insulin is lacking most glucose remains in the bloodstream rather than being used or stored, so the body does not get enough energy required [3]. The results also indicated that there is a significant increase in the urea level in the blood serum of people with diabetes when compared to the control group, which can be attributed to a defect in the metabolism of amino acids and protein in the blood. The College is responsible for the disposal and control of body waste, and the regulation and control of the proportion of ions and body fluids. The College is responsible for the release of certain hormones to the body. The outside of the body the urine returns with the blood-shedding waste [11]. Urea the chemical is the excreta, which is the main metabolite of the protein in the body and the protein in the body and the residues are the excreta of the body by kidney, any problem in the kidney function leads to a high urea ratio in the blood and diabetes is considered one of the causes of renal failure. The results also showed a relative increase in the sodium concentration in blood in people with diabetes when compared to the control group.
group. This can be attributed to the fact that sodium is a positive ion (the chemical element carrying the positive charge) primarily in fluids outside of cells including plasma. Sodium plays a key role in maintaining the osmotic pressure of blood and the subsequent regulation of fluid exchanges between and outside the blood vessels, and the transmission into cells or loss of the body leads to a decrease in the volume of fluid outside the cells, which affects blood circulation. The function of the kidneys and the nervous system but in the current study the cause of sodium rise can be to break up a portion of the cells, which causes sodium to not move into the cells and therefore remain in the bloodstream, which corresponds to what was stated in [12]. The study also showed a rise in potassium concentration in people with diabetes when compared to uninfected persons, which can be attributed to cell breakup in the body, which increases the concentration of potassium in the bloodstream as potassium is present in large amounts within cells, which is consistent with a study [13]. Finally, results showed a significant increase in the plasma pressure of people with diabetes when compared to the control group, which can be attributed to the fact that sodium, potassium, urea, and glucose are responsible for the internal and external balance of cells and the results show the rise of each of these tests. This results in a higher osmotic pressure in the body as the osmotic pressure is responsible for the entry and exit of liquids and dissolved substances from and into cells and when this pressure malfunctions, the cells are damaged by either a contraction or explosion and this explanation applies to [8]. We also conclude that the rise in osmotic pressure (Hypertonic) the water will come out of the cell to the outside center, causing the plasma membrane to contract, causing the so-called "plasmid" that causes cell drying and destroying the plasma membrane. This is believed to occur in pancreas cells as a result of the rise in osmotic pressure outside the cell, causing them to contract contraction and destruction of the plasma membrane. The result is a reduced insulin hormone secretion in the body that forms the amount of glucose in the blood but when the availability of insulin in the body is low, the glucose in the blood is high.

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