

## ASSESSMENT OF SERUM ELECTROLYTE ABNORMALITIES IN TYPE II DIABETIC PATIENTS PRESENTING IN GULAB DEVI HOSPITAL, LAHORE

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### Abstract

**Background and Objectives:** Patients with diabetes are more likely to experience electrolyte imbalances, which may be caused by an imbalance in the distribution of electrolytes. Impaired electrolytes balance in diabetics may lead to micro and macro vascular complications. The objective of this study is to investigate disturbances in serum electrolytes including Sodium (Na<sup>+</sup>), Potassium (K<sup>+</sup>) and Chloride (Cl) in Type II diabetics.

**Methods:** This was a descriptive cross-sectional study conducted over a period of 6 months. 3cc blood samples of 100 Type II diabetic patients were collected from diabetic OPD and medicine wards of Gulab Devi Chest Hospital Lahore and processed in Pathology lab of Gulab Devi Educational Complex to assess the electrolyte abnormalities in these patients using a predesigned proforma.

**Results:** Out of 100 samples of type II diabetic patients, there were 65 patients in which serum sodium levels were decreased. The mean levels of fasting blood sugar, serum sodium, potassium and chloride were 267.13±81.814 mg/dl, 130.13±5.408 meq/l, 4.0807±0.486meq/l and 99.053±4.5879 meq/l respectively.

**Conclusion:** In this study, serum sodium levels were significantly decreased in type II diabetic patients, while no significant alteration observed in serum potassium and chloride levels. Serum electrolytes should be routinely measured in diabetics to prevent complications.

**Keywords:** Type II Diabetes Mellitus (DM), Serum Electrolytes.

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**D**iabetes Mellitus (DM) is a syndrome characterized by hyperglycemia due to absolute or relative deficiency of Insulin. It leads to disturbances in carbohydrates, lipids and proteins metabolism.<sup>1</sup> Sedentary life style, poor dietary habits, genetic mutations, lack of regular exercise and obesity are risk factors for

increasing incidence of type II diabetes mellitus.<sup>2</sup> It is a global health concern affecting 425 million people worldwide.<sup>3</sup> Many micro and macro vascular problems of diabetes mellitus are caused by persistent hyperglycemia, which is caused by an insulin deficit or resistance to its action. The chronic hyperglycemia of diabetes mellitus damages, malfunctions, or fails various end organs, including the kidney, heart, blood vessels, neurological system, retina, and urine.<sup>4</sup>

A disturbance in plasma electrolyte balance is referred to as an electrolytes imbalance. Patients with diabetes are primarily affected by this condition because hyperglycemia increases plasma osmolality and impairs renal function. Unbalanced electrolytes cause problems with regular body processes and can potentially be fatal.<sup>5</sup>

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Electrolytes are charged particles play crucial role to maintain homeostasis and normal metabolic reactions. Electrolytes balance is essential to sustain cell membrane function, nerve conduction, muscular contraction and acid base balance.<sup>6</sup> Sodium is primarily responsible for keeping cells fluid retention at balanced level and for absorption of nutrients. Serious effects such as cerebral edema, osmotic demyelination syndrome, and coma can result from abnormal sodium levels. The relationship between serum sodium concentration and serum chloride levels is linear. Normal level of intracellular potassium is essential to maintain several enzymatic reactions. Electrolytes balance is vital to encourage good cardiovascular health.<sup>7,8</sup>

Na<sup>+</sup>/K<sup>+</sup>ATPase pump has primary responsibility to regulate sodium and potassium homeostasis. Insulin is important to activate Na<sup>+</sup>/K<sup>+</sup>ATPase enzyme. Low levels of insulin in diabetes mellitus reduce Na<sup>+</sup>/K<sup>+</sup>ATPase activity with poor sodium and potassium metabolism. Furthermore, hyperglycemia also draws water out of the cells to extracellular space leading to imbalance in electrolytes levels in plasma.<sup>9</sup> An electrolyte imbalance is a severe issue that should be taken seriously, particularly in diabetic patients, as it can impact the management of their disease and raise the risk of complications. Type II diabetes mellitus is considered as a global epidemic that can lead to life threatening complications; routine serum electrolytes measurement can be helpful to check patient's susceptibility to develop complications which may reduce morbidity and mortality related to diabetes.

Previous studies done to evaluate electrolyte imbalance in diabetics showed different results.<sup>10,11</sup> In this study we aimed to assess electrolyte imbalance in our population.

## METHODS

It was a cross-sectional descriptive study carried out over the period of six months. The study was conducted at the Pathology Lab of Gulab Devi Educational Complex, Lahore. 100 patients with diagnosed type II Diabetes Mellitus at Gulab Devi Teaching Hospital were included in this study after

ethical consideration and consent. One hundred samples were collected by consecutive sampling. Patients aging between 30-60 years, both males & females with more than 5 years history of Type II diabetes were included in the study. Patients with other serious comorbidities like End stage renal failure, Chronic liver disease and Acute Myocardial Infarction were excluded from the study.

Three cc clotted blood sample of type II diabetic patients was collected from diabetic OPD and medicine ward of Gulab Devi Chest Hospital Lahore and processed for serum electrolytes measurement in Pathology lab of Gulab Devi Teaching Hospital Lahore.

Tables and charts were used to analyze the qualitative data. For the quantitative data, descriptive statistics such as mean, median, mode, minimum, maximum, and standard deviation were used. The mean and SD were used to express descriptive statistics. SPSS 26 was used to statistically analyze the data.

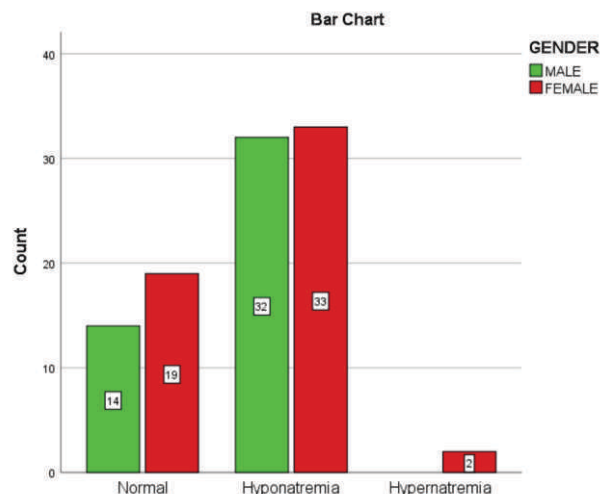
## RESULTS

100 diagnosed Type II diabetic patients (54 females and 46 males) were enrolled in this study age between 30 to 60 years with mean±SD of 49.06±12.3. Out of 100 patients 61 patients had diabetes mellitus for 5-10 years, 32 patients for 11-15 years and 7 patients for 16-20 years. 76 patients out of 100 have family history of diabetes mellitus. The range of fasting blood glucose level of these patients was 158 mg/dl to 553 mg/dl with mean±SD 267.13±81.81 (Table 1 and Fig 2) Decreased Serum sodium levels were observed in 65 patients (Fig 1), having mean±SD of 132.32±6.48. Serum chloride levels were slightly increased in some patients, having mean±SD of 99.05±4.588, serum potassium levels were also slightly increased in some patients, having mean±SD of 4.08±0.487 as shown in table 1.

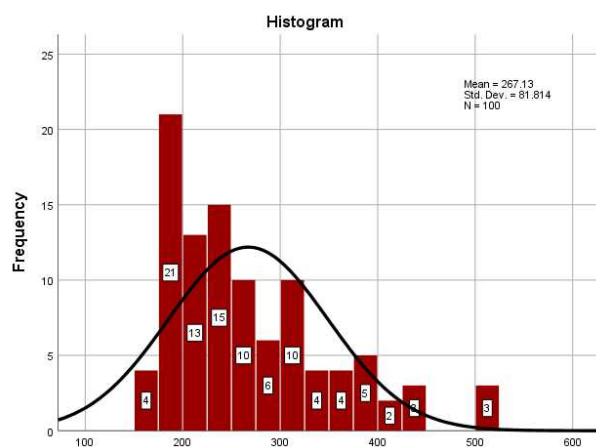
**Table 1:** Descriptive Statistics of Biochemical Parameters

Parameters n=100	Mini-mum	Maxi-mum	Mean±SD	Me-dian	Mode
FBS mg/dl	158	523	267.13±81.814	247.00	210
Na+ meq/L	121.0	144.0	130.13±5.408	129.00	126.0
K+ meq/L	3.00	5.57	4.0807±0.486	4.10	4.10
Cl- meq/L	88.0	110.0	99.053±4.5879	99.0	98.0

FBS=Fasting blood glucose, Na+ = Serum sodium, K+ = Serum Potassium, Cl- = serumchloride.



**Figure 1:** Bar chart for Critical Ranges of Serum Sodium



**Figure 2:** Histogram of Fasting Blood Glucose

**DISCUSSION**

Diabetes mellitus (DM) is a metabolic disease marked by persistently high blood sugar levels and impaired metabolism of carbohydrates, proteins, and lipids. The primary causes of these abnormalities are

decreased insulin production by pancreatic  $\beta$  cells and/or insulin resistance in target cells, including fat, liver, and skeletal muscles. Patients with diabetes are more likely to experience several serious health issues.<sup>12</sup>

In between metabolism and cellular processes such as electrical gradients and enzyme activity, electrolytes are essential. Serum contains several electrolytes, such as potassium, sodium, and chloride. Diabetes-related electrolyte imbalances are typically complex in nature. Electrolyte imbalance is primarily caused by a number of patho-physiological reasons, including acute sickness, co morbid diseases, gastrointestinal absorption capacity, pharmaceutical drugs, coexisting acid-base disorders, and other diseases, particularly renal disease.<sup>13</sup> Because of the complexity of the interaction between blood glucose and electrolytes and the potential impact that an imbalance may have on the development and management of diabetes mellitus, much attention has been paid to this relationship.

In this study 100 diagnosed Type 2 diabetic patients (54 females and 46 males) were included. Out of 100 patients 65 have low levels of sodium while 2 patients have elevated sodium levels. In the present study population we did not observe significant changes in serum potassium and chloride levels. Similar results have been established by Khalid et al.<sup>14</sup> Hyponatremia is the most frequent electrolyte imbalance discovered in this investigation. Because glucose is osmotically active, it sucks water out of cells, causing dehydration and dilution of sodium. Although not very significant, potassium and chloride levels have been favorably associated with fasting blood glucose.

While contrary to other studies which showed imbalance in serum potassium and chloride levels alongwith hyponataemia, no significant imbalance present in potassium and chloride in this study.<sup>15,16</sup> Diverse research may differ because of differences in dietary practices, DM severity, co-morbid illnesses, and patient heterogeneity.

Hyponatremia has been linked to higher mortality rates in hospitalized patients, according to a prior research.<sup>17</sup> In hyperglycemic conditions, it is important to note that corrected sodium levels, which have been adjusted for the dilutional effect of hyperglycemia, might be a valuable tool for treatment monitoring.

Although fasting blood glucose and serum electro-

lytes were not statistically significantly correlated in this investigation, the multifactorial origin of electrolyte imbalance suggests that a cause-specific treatment is necessary to minimize risk. We can conclude that in type II diabetes mellitus, monitoring the prognosis of individuals with this condition requires evaluation of anomalies related to electrolytes. It is advised to do more multicenter studies with larger sample sizes in order to accurately analyze the relationship between diabetes and electrolyte imbalance.

## CONCLUSION

Present study showed importance of measuring imbalance of electrolytes in type II diabetic patients. Hyperglycaemia in diabetes mellitus causes alterations in serum electrolytes mainly sodium significantly. Timely diagnosis and management of electrolytes imbalance in diabetics helps to decrease complications of diabetes mellitus and decrease morbidity and mortality related to diabetes mellitus. Therefore, serum electrolytes measurement in diabetics should be done as part of routine patient care.

## Ethical Approval:

The ethical Approval for this study was obtained from Institute of Allied Health Sciences, Ghulab Devi Educational Complex, Lahore,

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