



EVALUATION OF GLYCOSYLATED HEMOGLOBIN AND ELECTROLYTE STATUS IN DIABETIC KETOACIDOSIS

A JULIUS¹, *J PRAVEEN KUMAR², RCHIDAMBARAM³, RSRI KUMAR⁴, M DEEPA⁵.

¹Dept. of Biochemistry, Sri Balaji Dental College, Chennai, Tamilnadu. ²Research scholar (D11MS016) Bharath University, Chennai, Tamil Nadu.

³Dean, ⁴Research associate, SLIMS, Puddicherry, ⁵Dept. of Biochemistry, FIMS, Kadapa.

*Corresponding author email: jpraveen007@yahoo.com

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ABSTRACT

Background: The present study was conducted to evaluate glycosylated hemoglobin and electrolyte status in Diabetic ketoacidosis subjects compared with controlled type II diabetes mellitus. **Methods:** Totally 100 subjects were included in this study (75 known DKA subjects and 25 controlled type II Diabetes Mellitus subjects). 5ml of venous blood samples are collected from subjects, Biochemical parameters performed Fasting blood sugar, Post prandial blood sugar by Glucose oxidase and peroxidase method, Glycosylated hemoglobin by Ion exchange High performance liquid chromatography, serum electrolytes levels are estimated by Ion selective electrode method. **Results:** The serum levels of FBS, PPBS, HbA1c levels are high in DKA compared with controlled Type II DM. the serum levels of sodium are significantly decreased in DKA compared with controlled Type II DM. The serum levels of potassium and chloride are high in DKA compared with controlled Type II DM. **Conclusion:** We concluded that electrolyte imbalance is high in DKA due to hyperglycemic hyperosmolality and insulin deficiency frequently leads to electrolyte imbalance. HbA1c, FBS, PPBS levels are elevated in DKA due to uncontrolled hyperglycemia.

KEYWORDS: Peroxidase method, Fasting blood sugar, HbA1c, Glycosylated hemoglobin.

INTRODUCTION

Diabetes mellitus is estimated to have around 87 million people effected with Diabetes mellitus by the year 2030^[1]. Diabetes Mellitus and Diabetic ketoacidosis is characterized by chronic hyperglycemia which results from defective insulin action and secretion. The consequences of Diabetes are numerous ranging from metabolic imbalance, blood vessel degradation, causing dilutional effect on electrolytes ^[2, 3].

Electrolyte plays an important role in many processes, such as controlling fluid levels, acid-base balance, nerve conduction, blood clotting and muscle contraction. Electrolyte imbalance resulting from kidney failure, dehydration, fever and vomiting has been suggested as one of the contributing factors towards complications observed in diabetes and other endocrine disorders ^[4].

Electrolyte imbalance might also occur due to inhibition of the rennin-angiotensin-aldosterone system which plays a key role in the regulation of fluid and electrolyte balance. This enzyme system has been reported to be affected in many endocrine and cardiovascular diseases particularly Diabetes ^[5].

Fasting Blood Sugar (FBS) and Post Prandial Blood Sugar (PPBS) both are common methods to estimate blood glucose levels but HbA1C is a gold standard in analysis of patient's status that indicates the average blood glucose during past three months which is essential to ensure the optimal care of Diabetes Mellitus ^[6, 7].

MATERIALS AND METHODS

Seventy five DKA subjects (45 males and 30 females) and 25 Type II controlled DM (15 males and 10 females) patients with

age ranges from 50- 60 years were used for this study. The study was carried out for three months at Fathima Institute of Medical Sciences and Research, A.P. The samples were collected from outpatient and inpatient of General Medicine and General Surgery departments. 5 ml of venous blood samples are collected from the patients and spun in centrifuge at 3000 RPM for 5 Minutes. Plasma and serum samples are separated in to different tubes for electrolyte, HbA1c, FBS, PPBS estimation.

Fasting blood glucose and Post prandial blood glucose are estimated by enzymatic colorimetric end point (Glucose oxidase and Peroxidase) method [8]. HbA1c are estimated by Ion Exchange High Performance liquid Chromatography [9]. Serum Electrolytes (sodium, potassium, chloride) are estimated by Ion selective electrode method.

STATISTICAL ANALYSIS

Paired ‘T’ – test were used to compare two groups and the levels of significance was achieved if $P < 0.05$.

RESULTS

Table I. shows the status of mean \pm SD and P value of FBS, PPBS, HbA1C. In both DKA and controlled Type II DM.

Sl. no	Parameters	Diabetes ketoacidosis	Controlled Type II DM	‘P’ value
1.	FBS (mg/dl)	300.12 \pm 20.04	198.81 \pm 15.20	0.04
2.	PPBS (mg/dl)	416.15 \pm 16.11	280.61 \pm 12.03	0.05
3.	HbA1C (%)	10.40 \pm 0.9	6.24 \pm 0.88	0.02

Table II:- shows the status of mean, standard deviation and P value of Serum Electrolytes. In both DKA and controlled Type II DM.

Sl. no	Parameters	Diabetes ketoacidosis	Controlled Type II DM	‘P’ value
1.	Sodium (mEq/l)	130.09 \pm 1.96	140.22 \pm 1.89	0.07
2.	Potassium (mEq/l)	6.89 \pm 0.41	4.91 \pm 0.31	0.02
3.	Chloride (mEq/l)	114.06 \pm 1.20	102.06 \pm 1.41	0.03

Significant Findings: In DKA and controlled Type II DM the ‘P’ value of FBS, PPBS, HbA1C, potassium, chloride are significant ($P < 0.05$), but the level of sodium is not significant (‘P’ value > 0.05). So except sodium remaining all the parameters are elevated ($P < 0.05$) in DKA compared with Type II controlled DM.

DISCUSSION

Diabetes Mellitus is characterized by high blood glucose levels or hyperglycemia, it is a result of insulin deficiency (or) the body’s inability to use insulin. Electrolyte imbalance in diabetes is due to elevated blood glucose, body tries to rid itself of the excess blood glucose by increasing urinary output. Increased urination produces water and electrolyte loss, which impairs the body’s electrolyte balance. In DM the cells become more starved for glucose for their energy needs, the body tries to compensate by providing another energy source i.e. fatty acids, the fatty acid metabolism can lead to a buildup of byproduct called ketones, which can disturb the acids and base balance relationship and causes Diabetic ketosis [10].

In the present study sodium levels decreased in DKA compared with controlled Type II DM, because physiologically sodium is reabsorbed in proximal tubule of kidney and excessive urination due to uncontrolled hyperglycemia is know to be mechanical causes of decreased sodium [11].

Serum chloride levels were elevated in DKA compared with controlled Type IIDM, this might be due diabetic ketoacidosis. Ketoacidosis causes reduction in Blood pH which further disturbs acid-base balance and leads to the elevation of chloride [12].

In DKA the combination of insulin deficiency and hyperglycemia induced hyperosmolality frequently leads to hyperkalemia [13]. Insulin promotes potassium entry in to cells, when circulating insulin is lacking in DKA, potassium moves out of the cells, thus raising plasma potassium levels even in the presence of total body potassium deficiency further more an elevation in plasma osmolality causes osmotic water movement]from the cells in to the extracellular fluid, which is paralleled by potassium movement out of the cells [14, 15].

FBS and PPBS levels are elevated in DKA compared with controlled Type II DM due to uncontrolled hyperglycemia. HbA1C is formed through the non-enzymatic binding of circulatory glucose in the blood contribute to more binding and consequent higher levels of HbA1C. HbA1C reflects average plasma glucose over the previous 3 months [16]. HbA1c levels are

elevated in DKA compared with controlled type II DM due to uncontrolled hyperglycemia.

CONCLUSION

Electrolyte imbalance is high in Diabetic Ketoacidosis due to hyperglycemic hyper-osmolality and insulin deficiency frequently leads to electrolyte imbalance. HbA1c, FBS, PPBS levels are elevated in DKA due to uncontrolled hyperglycemia.

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