Original Research Article

# Biochemical Analysis among Patients of Diabetes Keto Acidosis

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**Abstract:**

**Background:** The prevalence of diabetes is rising rapidly worldwide, particularly in India, where type 2 diabetes accounts for over 90% of all cases. Diabetic ketoacidosis (DKA) remains one of the most common diabetes-related emergencies, and despite advancements in management and more standardized care, it continues to result in significant morbidity and mortality.

**Material & Methods:** The present cross sectional, prospective study was carried out at department of General Medicine, at our tertiary care hospital. The study duration was of one year from January 2023 to December 2023. A sample size of 100 was calculated at 95% confidence interval at 10% acceptable margin of error. All patients who were diagnosed with type 2 diabetes patients experiencing DKA were enrolled from indoor department by simple random sampling.

**Results:** In the present study, Out of the total study participants mean HbA1c (%) levels were $9.1 \pm 1.6$ and mean value of random blood sugar was $568.89 \pm 40.23$ mg/dL, the mean value of serum sodium was $132.7 \pm 6.9$ meq/L, mean value of serum potassium was $4.8 \pm 0.6$ meq/L, mean value of serum bicarbonate was $11.3 \pm 1.1$ meq/L, mean value of serum calcium was $9.7 \pm 0.2$ mg/dL, mean value of serum magnesium was $1.82 \pm 0.4$ meq/L, mean value of serum osmolarity was $294.7 \pm 10.3$, mean value of anion gap was $45.4 \pm 7.2$ and mean value of serum creatinine was $1.4 \pm 0.9$ mg/dL.

**Conclusion:** We concluded from the present study that diabetic ketoacidosis (DKA) as a serious metabolic complication, even in cases of type 2 diabetes. Patients presented with higher random blood sugar (RBS), elevated serum osmolality, and lower pH levels, which directly correlated with poorer outcomes.

**Keywords:** Diabetes ketoacidosis, Type 2 diabetes, Biochemical profile.

## Introduction

The prevalence of diabetes is rising rapidly worldwide, particularly in India, where type 2 diabetes accounts for over 90% of all cases [1]. Diabetic Ketoacidosis (DKA) is a severe diabetes complication where the lack of insulin leads to high blood sugar, ketone buildup, and metabolic acidosis, requiring urgent medical attention. Diabetic ketoacidosis (DKA) remains one of the most common diabetes-related emergencies, and despite advancements in management and more standardized care, it continues to result in significant morbidity and mortality [2]).

DKA typically occurs due to an absolute or relative insulin deficiency. While it is more frequently observed in individuals with type 1 diabetes, it can also affect those with type 2 diabetes and less common diabetes variants [3]. In fact, the "Expert Committee on the Diagnosis and Classification of Diabetes Mellitus" [4] reported that hospitalizations for DKA have increased over the past two decades, likely due to the rising prevalence of type 2 diabetes [5].

Research suggests that there are distinct biochemical differences between DKA cases in type 1 and type 2 diabetes patients [6]. With the increasing frequency of DKA in type 2 diabetes patients, questions arise about whether the biochemical characteristics of these patients have changed when they present to the emergency department [7].

Therefore, this study aims to investigate the biochemical parameters of type 2 diabetes patients experiencing DKA characterized by blood sugar above 250 mg/dL having ketonuria and a anion gap above 12.

**Materials & Methods**

The present cross sectional, prospective study was carried out at department of General Medicine, at our tertiary care hospital. The study duration was of one year from January 2023 to December 2023. A sample size of 100 was calculated at 95% confidence interval at 10% acceptable margin of error by epi info software version 7.3. In this prospective study patients of age of both the genders were enrolled for the study. All patients who were diagnosed with type 2 diabetes patients experiencing DKA were enrolled from indoor department by simple random sampling. Institutional Ethics Committee Clearance was obtained before start of study and written and informed consent for the procedure was obtained from all the patients. Strict confidentiality was maintained with patient identity and data and not revealed, at any point of time.

Upon admission, all the baseline parameters for diabetic ketoacidosis (DKA) were recorded, including random plasma glucose, urea, electrolytes, creatinine, and white blood cell count. Additionally, HbA1C levels and, in selected cases, blood culture and sensitivity tests were conducted. Urine analyses for sugar, ketone bodies, routine microscopy, and in certain cases, urine culture and sensitivity were performed. Chest X-rays and

ECGs were carried out based on clinical necessity. All data were entered in the MS office 2016 spread sheet and Epi Info v7. Data analysis was carried out using SPSS v22. Qualitative data was expressed as percentage (%) and Pearson's chi square test was used to find out statistical differences between the study groups and sensitivity, specificity, positive predictive value and negative predictive value were calculated. If the expected cell count was < 5 in more than 20% of the cells then Fisher's exact test was used. All tests were done at alpha (level significance) of 5%; means a significant association present if p value was less than 0.05 and highly significant if p value less than 0.01.

**Results**

In the present study, we enrolled 100 patients who were diagnosed with type 2 diabetes patients experiencing DKA and admitted in inpatient department of General Medicine of our tertiary care hospital during the study duration. Out of the total 59% were males and 41% were females. Study participants were aged from 34 years to 65 years of age with the mean age of the Study participants was 52.1 ± 6.8 years. Out of the total study participants mean HbA1c (%) levels were 9.1 ± 1.6 and mean value of random blood sugar was 568.89 ± 40.23 mg/dL. (Table 1)

**Table 1: Distribution of study participants according to study parameters.**

| Parameters | No. of patients |
|---|---|
| Male | 59% |
| Female | 41% |
| Mean age | 52.1 ± 6.8 years |
| Mean HbA1c (%) | 9.1 ± 1.6 |
| Means RBS | 568.89 ± 40.23 |

In the present study, out of total study participants the mean value of serum sodium was 132.7 ± 6.9 meq/L, mean value of serum potassium was 4.8 ± 0.6 meq/L, mean value of serum bicarbonate was 11.3 ± 1.1 meq/L, mean value of serum calcium

was 9.7 ± 0.2 mg/dL, mean value of serum magnesium was 1.82 ± 0.4 meq/L, mean value of serum osmolarity was 294.7 ± 10.3, mean value of anion gap was 45.4 ± 7.2 and mean value of serum creatinine was 1.4 ± 0.9 mg/dL. (Table 2)

**Table 2: Mean values of study parameters among participants.**

| Parameters | Mean values |
|---|---|
| Serum sodium | 132.7 ± 6.9 |
| Serum potassium | 4.8 ± 0.6 |
| Serum bicarbonate | 11.3 ± 1.1 |
| Serum calcium | 9.7 ± 0.2 |
| Serum magnesium | 1.82 ± 0.4 |
| Serum osmolarity | 294.7 ± 10.3 |
| Anion gap | 45.4 ± 7.2 |
| Serum creatinine | 1.4 ± 0.9 |

**Discussion**

In the present study, we enrolled 100 patients who were diagnosed with type 2 diabetes patients experiencing DKA and admitted in inpatient department of General Medicine of our tertiary care hospital during the study duration. Out of the total

59% were males and 41% were females. Study participants were aged from 34 years to 65 years of age with the mean age of the Study participants was 52.1 ± 6.8 years. Out of the total study participants mean HbA1c (%) levels were 9.1 ± 1.6 and mean value of random blood sugar was 568.89

± 40.23 mg/dL. Similar findings were reported in a study conducted by P M Adhikari et al among patients with diabetes mellitus presented with diabetes ketoacidosis and found similar results to present study [8].

In the present study, out of total study participants the mean value of serum sodium was 132.7 ± 6.9 meq/L, mean value of serum potassium was 4.8 ± 0.6 meq/L, mean value of serum bicarbonate was 11.3 ± 1.1 meq/L, mean value of serum calcium was 9.7 ± 0.2 mg/dL, mean value of serum magnesium was 1.82 ± 0.4 meq/L, mean value of serum osmolarity was 294.7 ± 10.3, mean value of anion gap was 45.4 ± 7.2 and mean value of serum creatinine was 1.4 ± 0.9 mg/dL. Similar findings were reported in a study conducted by V K Matoo et al among patients with diabetes mellitus presented with diabetes ketoacidosis and found similar results to present study. The range of biochemical alterations observed upon admission included blood glucose levels ranging from 9.7 to 51.1 mg/dL, with a mean of 19 ± 4.6 mg/dL. Potassium levels varied between 3.0 and 6.9 mg/dL, averaging 5.8 ± 1.2 mg/dL, while sodium levels ranged from 132 to 148 mg/dL, with a mean of 138 ± 7.5 mg/dL. Urea levels spanned from 4.67 to 26.17 mg/dL, with an average of 11.3 ± 2.9 mg/dL. The arterial pH values ranged from 6.9 to 7.34 [9].

Similar findings were reported in a study conducted by Waleed H Albuali et al among patients with diabetes mellitus presented with diabetes ketoacidosis and found similar results to present study. They reported the rate of newly diagnosed Type 1 diabetes mellitus (DM) presenting with diabetic ketoacidosis (DKA) was 41.7%. Among these, 61.6% had severe DKA, while 38.4% had moderate DKA. We observed a significant increase in heart and respiratory rates in patients who were newly diagnosed with DKA and those with severe DKA (p < 0.001) compared to known Type 1 DM cases presenting with DKA. Additionally, biochemical indices such as HbA1c, random blood sugar, serum osmolality, blood urea nitrogen, creatinine, chloride, lactate, and anion gap were notably higher in patients with severe DKA and newly diagnosed Type 1 diabetes (p ≤ 0.05) [10].

## Conclusion

We concluded from the present study that diabetic ketoacidosis (DKA) as a serious metabolic complication, even in cases of type 2 diabetes. Patients presented with higher random blood sugar (RBS), elevated serum osmolality, and lower pH levels, which directly correlated with poorer outcomes. These findings underscore the severity of DKA in type 2 diabetes and highlight the importance of early detection and management to improve patient prognosis. The results of present study cannot be generalized on general population because of small sample size. Further elaborative studies needed to explore the topic.

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