

## DIABETIC KETOACIDOSIS: More cases seen during summer vacation

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### ABSTRACT

**Objectives:** We noticed increased number of cases admitted with diabetic ketoacidosis in King Abdul-Aziz University Hospital in the last summer vacation. The objective was to review those cases and to find the possible predisposing factor.

**Methodology:** This was a retrospective study reviewing the files of all cases admitted with DKA in the last summer (July, August, September, 2008) in King Abdul-Aziz university hospital and we looked for a predisposing factors for DKA.

**Results:** Thirty seven patients with diabetes were admitted in the last summer suffering from DKA, compared with only 13 cases admitted (p-value 0.0012) admitted in the previous three month with similar diagnosis.

**Conclusion:** The incidence of DKA in summer vacations increased significantly mainly due to medical condition, lack of compliance due to the changes in sleep pattern in vacations and life stress.

**KEY WORDS:** Diabetic Ketoacidosis, Pre-disposing factors.

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### INTRODUCTION

Diabetes ketoacidosis DKA represents one of the extreme in the spectrum of marked decompensate diabetes. DKA is still one of the important cause of morbidity and mortality among patients with diabetes.<sup>1,2</sup> The annual incidence of DKA from population - based studies is estimated to range from 4 to 8 episodes per 1000 patient admission with

diabetes.<sup>3</sup> DKA is a consequence of absolute or relative insulin deficiency resulting in hyperglycemia and an accumulation of ketone bodies in the blood, with subsequent metabolic acidosis. DKA is generally categorized by the severity of the acidosis, with mild DKA defined as a venous pH >7.3 and bicarbonate >15 mmol/l; moderate DKA as a pH 7.1 -7.2 with a bicarbonate 5-15 mmol/l; and severe DKA as a pH <7.1 and bicarbonate <5. DKA is a potentially life-threatening condition. In the United States, the overall mortality for a child with DKA is 1-3%.<sup>4</sup>

In King Abdul Aziz University Hospital, we used to receive 4-6 cases monthly suffering from DKA except during the summer of 2008 when a higher incidence of DKA has been reported. The objective of this study was to detect the pre-disposing behind 37 summer DKA cases. During the previous three months from March

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to May 2008 only 13 patients had visited the hospital with DKA.

Usually in Jeddah a lot of summer activities take place. These activities include long distance traveling, sea and water activities, family gatherings and marriage celebrations. As a matter of Arabic hospitality several kind of food are presented to guests on these occasion. Diabetic patient might attend more than one occasion per day. Arabic foods main contents are carbohydrate, fat and protein rich. The preferred components are rice, lamb meat, and full fat milk. The warmth of Arabic family relationship let patient's indulge on such occasion in over eating forgetting the concept of healthy diet and life style compliance. All these factors were considered in this retrospective analysis.

## METHODOLOGY

All patients admitted in medical ward in King Abdul-Aziz University Hospital during June, July and August 2008 with diagnosis of DKA were reviewed. Where sex, age, disease onset and types of treatments they received were analyzed. We looked for the possible precipitating factors for each case.

*Statistical Method:* Patient demographics including means, confidence interval and standard deviation were studied. Predicted factors were tested using multinomial test to check the

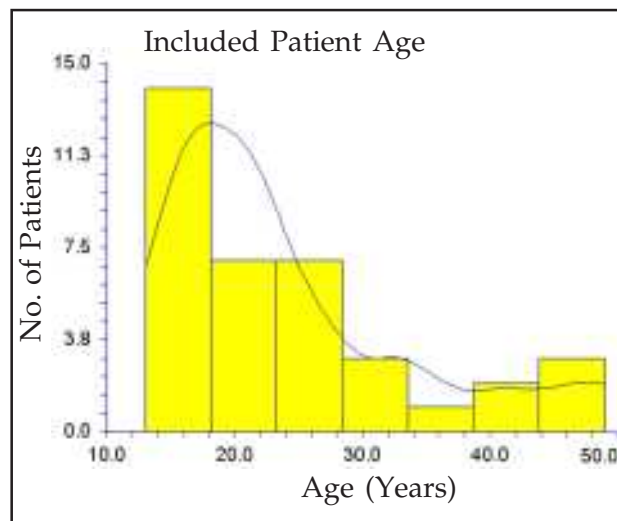


Fig-1: Patient Age Distribution.

difference between the presence and absence in the cohort.

Laboratory markers for DKA are presented in simple descriptive statistics in addition to multinomial test for severity strata. This is to show the impact size of severity. These strata are based on blood reference ranges for each variable.<sup>5,6</sup>

Correlation tests with days of hospitalization will take place including the laboratory markers, patient age and other demographics.

## RESULTS

The total number of patients enrolled in the study were thirty seven. The majority of patients were female with a very high statistical significance. The observed mean patient age was  $23.92 \pm 9.98$  years. The age distribution is presented in the age histogram (Fig-1). The majority of patients were females below 30 years of age, the age of higher fertility and childbearing (Table-I).

The bicarbonate level in 5.1% of patients was higher than 23 mmol/L (p-value <0.00001),

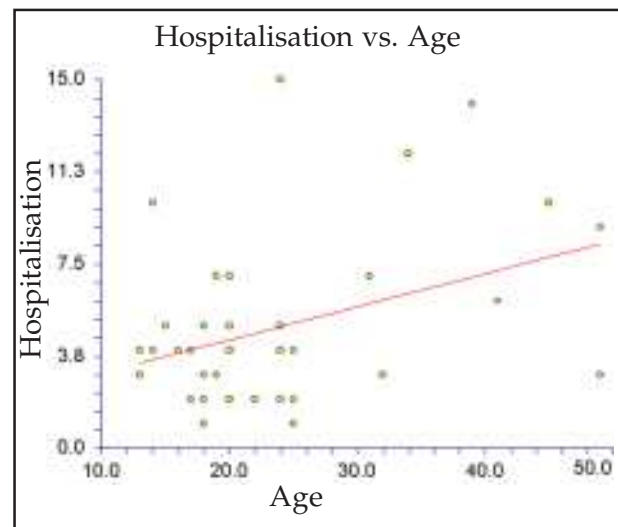


Fig-2: Correlation between hospitalization and Age

Estimated Model

$$(1.7345162067719) + (.134263164236655) * (\text{Age})$$

The estimated slope is 0.1343. The lower limit of the 95% confidence interval for the slope is 0.0242 and the upper limit is 0.2443. The estimated intercept is 1.7345. The lower limit of the 95% confidence interval for the intercept is -1.1125 and the upper limit is 4.5815. (Slope p-value 0.0182)

Table-I: Patient Demographics and Laboratory Results

		Female	Male	Total
Count <sup>1</sup>		32	5	37
Diabetes Mellitus Type <sup>2</sup>	Type 1	81.1%	10.8%	91.9%
	Type 2	5.4%	2.7%	8.1%
Age (years)	Mean±SD	23±8.32	29.8±17.63	23.92±9.98
Disease Onset (years)	Mean±SD	6.63±3.82	6.18±2.76	7.11±4.29
pH	Mean±SD	7.2±0.17	7.18±0.07	7.2±0.16
pCO <sub>2</sub>	Mean±SD	5.99±7.33	4.21±1.33	5.75±6.84
HCO <sub>3</sub>	Mean±SD	11.01±5.83	11.98±4.34	11.23±5.61
Hb A1C	Mean±SD	11.06±2.87	11.07±1.41	11.06±2.65
Hospitalization (days)	Mean±SD	04.78±3.44	06±3.87	4.95±3.47
Financial <sup>3</sup>	Positive	16.2%	5.4%	21.6%
Social <sup>4</sup>	Positive	21.6%	0.0%	21.6%
Medical <sup>5</sup>	Positive	45.9%	5.4%	51.4%
Lack of Compliance <sup>6</sup>	Positive	29.7%	8.1%	37.8%
Stress <sup>7</sup>	Positive	37.8%	0.0%	37.8%

<sup>1</sup>P-value for difference between male and females < 0.00001 <sup>2</sup>P-value for difference between type 1 and type 2 < 0.00001 <sup>3</sup>P-value for difference between positive and negative = 0.000556 <sup>4</sup>P-value for difference between positive and negative = 0.000556 <sup>5</sup>P-value for difference between positive and negative = 0.869417 <sup>6</sup>P-value for difference between positive and negative = 0.138982 <sup>7</sup>P-value for difference between positive and negative = 0.138982

pCO<sub>2</sub> Level in 13.51% of patients was higher than 5.9 kPa (p-value < 0.00001) and 2.7% of patients was higher than 7.45 in their pH values (p-value < 0.00001).

A correlation was identified between the hospitalization and patient age. This correlation showed a significant increase of hospitalization days with age. Figure 2 illustrates the linear regression analysis for age and hospitalization. No other relationship can be established between any laboratory variable with hospitalization. In addition no relationship can be figured with gender or predisposing cause versus hospitalization or laboratory markers. All were treated by insulin except four new cases. (Table-II)

The predisposing factors including financial, social, medical, lack of compliance and stress

Table-II: Patient Therapy

Treatment	Count	Percent
Insulin	29	80.56
Insulin Oral	3	8.33
New patients	4	11.11

were also evaluated. The highest incidence was of the medical problems but without a statistical significance. Deeper analyses for predisposing factors showed that 45.95% of patients had a combination of two predisposing factors (p-value 0.000014) (Table-III).

## DISCUSSION

Diabetic ketoacidosis is a state of inadequate insulin levels resulting in high blood sugar and accumulation of organic acids and ketones in the blood. It is also common in DKA to have

Table-III: Predisposing Causes Combinations

Cumulative Predisposing causes	Percent	Cumulative Percent
0	5.41%	5.41
1	35.14%	40.54
2	45.95%	86.49
3	10.81%	97.30
4	2.70%	100.00

Chi-Square = 27.7297 with df = 4  
Probability Level = 0.000014

severe dehydration and significant alterations of the body's blood chemistry. DKA is usually seen in people who have Type-1 diabetes. Most often, these diabetics are younger than 25 years, but the condition may occur in diabetics of any age. Generally males and females are equally affected.<sup>7</sup>

Data collected had shown less impact of social factors involvement than that was previously expected. The main predisposing factor was the medical causes followed by stress and lack of compliance. Although these three factors are not statistically significant but this might require larger population studies in order to prove that it is statistically significant. The combination of more than one factor/cause may change the global idea. The majority of patients have combination of more than two causes of DKA. The impact of medical condition is higher in combination with other causes since the majority of patients have some medical condition.

Another important point is that most of study population was females. It can be figured out that during summer females are having several family commitments causing higher level of stress and aggravating their medical conditions especially if they are taking care of children. The severity of DKA has increased with age and with disease onset which might be reverted to family commitments as well.

One of the interesting points is that financial cause is the least recorded with higher statistical significance provided that a statistical significance is high. Financial causes are contributing to some extent might have been expected before this retrospective evaluation.

The findings of this study highlighted the importance of patient education which should be improved for females in order to pay more attention to monitor their diabetes. During summer school vacation mothers are having several commitments and they should take care of themselves in addition to their family.

It can be concluded that national Saudi hospitality habits are not very dangerous if patient is able to manage the predisposing factors or causes of ketoacidosis. The main factors for DKA during summer are medical patient condition, lack of compliance and life-style stress.

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