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# Familial Type 1 Diabetes in Children: A Multiple Correlation Study in Tobruk, Libya

Brijesh Kumar<sup>1</sup>, Saeed H.Ali<sup>2</sup>, Salem Zaed<sup>3</sup>, Alkadafe Y.R Agelah<sup>4</sup>

Lecturer, Department of Medical Laboratory, Faculty of Medical Technology, Tobruk University, Tobruk, Libya<sup>1</sup>

Assistant Professor, Department of Paediatrics, Faculty of Medicine, Tobruk University, Tobruk, Libya<sup>2</sup>

Assistant Lecturer, Department of Medical Laboratory, Faculty of Medical Technology, Tobruk University,  
Tobruk, Libya<sup>3</sup>

Assistant Lecturer, Department of Medical Laboratory, Faculty of Medical Technology, Tobruk University,  
Tobruk, Libya<sup>4</sup>

**ABSTRACT:** We have studies consecutive three years on diabetes in children in different families in Tobruk, Libya. In 2008, 2009 and 2010, we have studies on 12, 10 and 6 families whose childrens reported diabetes. We analysed the patients with different clinical and laboratory parameters. We also examine their correlation in between fasting blood sugar and body mass index for the confirmation of diabetes. All patients of type 1 diabetes register at Tobruk Medical Centre, living within the district of Tobruk, were invited to attend clinic for a review of their diabetes and medications. All patients were child (ie, local born people) and were aged  $\leq 15$  years. A fasting blood glucose test (FBG) was performed in individuals between 5.6 and 6.9 mmol/l. We also analysed the patients with clinical parameters of polyuria, polydipsia, DKA, polyphasia and family history for the confirmation of diabetes. There was a very strong correlation between the patients and their family. In 2008, 2009 and 2010, the percentage of the family relation with patients were 70%, 50% and 66.6%. The average fasting plasma sugar found in 2008, 2009, 2010 was 266.6mg/dl, 286.3mg/dl and 186.1mg/dl. The diabetic ketoacidosis (DKA) found in 2008, 2009 and 2010 was 50%, 58.5% and 16.6%. The excess body weight (BMI  $\geq 25$ -29.9 kg/m<sup>2</sup>) in 2008, 2009 and 2010 was 10%, 16.6% and 50%. This study was based on the children and their family. Polyuria, polydipsia, DKA and weight loss are the most common presenting symptoms. Laboratory and clinical data indicates that family history was responsible for the appearance of the clinical symptoms of diabetes in childrens.

**KEYWORDS:** Type 1 diabetes (T1D); Diabetic ketoacidosis (DKA); Body mass index (BMI), Fasting blood glucose (FBG).

## I. INTRODUCTION

Type 1 diabetes (T1D) is a chronic autoimmune disease, characterized by irreversible autoimmune destruction of the insulin secreting  $\beta$ -cells of the islets in the pancreas. The disease transpires worldwide, usually develops at a younger age, while it may progress at any age. The symptoms seem when the  $\beta$ -cell mass gets reduced by approximately 90% leading to severe insulin deficiency and hyperglycaemia. The latter is due to hepatic overproduction of glucose by glycogenolysis and gluconeogenesis and decreased cellular uptake of glucose from the circulation. In the absence of insulin, there is also an increase in fat breakdown and fatty acid oxidation, resulting in the excessive production of ketones. If not treated, these metabolic disturbances lead progressively to central nervous system depression, coma and death. Therefore, T1D requires lifelong treatment with exogenous insulin for survival.

The prevalence of diabetes has increased in an epidemic in whole world over the last two decades. T1D is the second most common chronic disease throughout childhood and the most familiar form of diabetes in children (1.7 of 1000 children) around the world. It has been estimated to increase from 4.4 million in 2000 to approximately 5.4 million in 2010 worldwide[1]. The rate of incidence of the disease is always increasing in many countries; the highest being in northern Europe, particularly in Finland (37.4/ 100,000 per year) and Sweden (34.6/ 100,000 per year)[2]. The lowest prevalence has been reported from the Zunyi province of China (0.1/ 100,000 per year)[3]. The occurrence of childhood diabetes in Benghazi region of Libya has been reported 2% of 12568 cases[4].



## II. METHODOLOGY

The study was conducted under expert paediatricians. 10, 12 and 6 family of type 1 diabetes were selected in 2008, 2009 and 2010. All patients on type 1 diabetes register at Tobruk Medical Centre, living within the district of Tobruk, were invited to attend clinic for a review of their diabetes and medications. All patients were child (ie, local born people) and were aged  $\leq 15$  years. Informed consent from all patients and local ethics committee approval for the study were obtained. All patients were clinically diagnosed by expert paediatrician and then after venous blood samples were collected after a 12-h fasting period from the antecubital vein to plasma glucose. Blood glucose was measured by a glucose oxidase method by using kit (BD-GB-Glucose).

Physical examination was carried out by the authors. The weight of the subject was measured to the nearest kilogram with a Hanson type bathroom weighing scale. The height was measured to the nearest centimeter. The body mass index (BMI) was calculated and recorded. Classification by BMI was done according to the recommendations of the WHO expert committee for the classification of overweight[5].

The body mass index (BMI) is calculated ( $BMI = w/h^2$ ;  $w$  = weight in kg,  $h$  = height in meter). Overweight and obesity were defined using the current World Health Organisation definitions: underweight: BMI  $< 18.5$  kg/m<sup>2</sup>, normal weight: BMI 18.5–24.9 kg/m<sup>2</sup>, overweight (preobese): BMI 25–29.9 kg/m<sup>2</sup>, obese: BMI 30–34.9 kg/m<sup>2</sup>, class 2 obese: BMI 35–39.9 kg/m<sup>2</sup>, class 3 (morbid)obese: BMI  $\geq 40$  kg/m<sup>2</sup>. [6]

## III. RESULTS AND DISCUSSION

There were 10, 12 and 6, childrens diagnosed with type 1 diabetes in their family in 2008, 2009 and 2010. All the patients were confirmed diabetes by clinical and laboratory methods, where the  $p=0.072$  and 95% CI=6.56, 9.51. Table 1 shows the clinical characteristic of patients in 2008, 2009, and 2010. In this regards maximum patients were suffering with polyuria, polydipsia and DKA. Weight loss were found in less than 41% of patients in 2008 and 2009. Polyphasia was observed in 20% of patients in 2008.

Table 2 shows the average fasting plasma glucose and family history of the patients. In 2008, 2009 and 2010, the average fasting of plasma glucose concentration was 266.5, 286.3 and 186.1 mg/dl. The family history of the patients with their family was 70%, 50% and 66.6% in 2008, 2009 and 2010.

Table 3 illustrate the distribution of BMI in patients. The BMI category (25-29.9) of the pre-obese patients in 2008, 2009 and 2010 has been found 10%, 16.5% and 50%, whereas obese patients was 10% and 16.6% in 2008 and 2009. The 95% CI of BMI was 1.5960, 2.2611 and  $p$ -value has been found non-significant 0.683 ( $P > 0.05$ ).

Table 4 explain the detail of all the parameters of patients for the development of type 1 diabetes in childrens. It shows that age factor (CI: 6.56, 9.51,  $p=0.072$ ) and family history (CI: 1.20, 1.58,  $p=0.626$ ) along with higher value of plasma glucose concentration is directly related to their family history of type 1 diabetes in childrens. Statistical analysis was performed using One-Way ANOVA, SPSS Statistics version 16.

Type 1 diabetes is very serious and challenging disorder to recover due to the unawareness in the family. The number of the study participants conferred with history of polyuria, polydipsia and weight loss. These symptoms can be accepted by the parents; hence, consciousness is important to avoid complications. The time period of symptoms recovered in the present age group was less compared to those reported from other studies [7]. These findings are consistent with other reported studies worldwide [7,8]. The existence of DKA at first presentation in the contemporary cohort is comparatively higher than that reported from Sweden (12.8%), Finland (19%) and UK (25%) [9,10]. Family history is an important risk factor for development of T1D [11]. Significant family history of T1D was found in the current study which is more than that reported from Saudi Arabia and Libya [12,13]. This study was restricted to only one centre in Libya, it may not stand for all type 1 diabetes paediatric patients in the country. Therefore, the overall numbers of all type 1 diabetes in Libyan children could not be fully described.



Characteristics	2008 n=10	2009 n=12	2010 n=6
Fasting Plasma Glucose(average)	266.5	286.3	186.1
Family history	7(70%)	6(50%)	4(66.6%)

(1)

Clinical characteristics	2008 n=10(%)	2009 n=12(%)	2010 n=6(%)
Polyurea	7 (70)	8(66.6)	4(66.6)
Polydipsea	7 (70)	7 (58.3)	3(50)
DKA	5(50)	7 (58.3)	1(16.6)
Polyphasia	2(20)	0	0
Weight loss	4(40)	5(41.6)	0

(2)

BMI Category ( Kg/m <sup>2</sup> )	Type 1 diabetes mellitus		
	2008 n=10(%)	2009 n=12(%)	2010 n=6(%)
< 18.5	4(40)	5(41.6)	2(33.5)
18.5-24.9	4(40)	3(25)	1(16.6)
25-29.9	1(10)	2(16.6)	3(50)
≥ 30	1(10)	2(16.6)	Nil
30-34.9	Nil	Nil	Nil
35-39.9	Nil	Nil	Nil
≥ 40	Nil	Nil	Nil

(3)

Characteristics	T1D,2008 N=10(%)	T1D2009 N=12(%)	T1D2010 N=6(%)	95%CI	p-value
Age (years)				6.56, 9.51	0.072
1-7	3 (30)	5 (41.7)	4 (66.7)		
8-15	7 (70)	7 (58.3)	2 (33.3)		
Gender					
Male	4 (40)	6 (50)	4 (66.7)	4.30, 4.69	0.615



Female	6 (60)	6 (50)	2 (33.3)		
Plasma Sugar (average),mg/dl	266.5	286.3	186.1	216.22, 299.34	0.168
BMI < 18.5	4(40)	5 (41.6)	2 (33.5)	19.46, 24.18	0.683
18.5-24.9	4 (40)	3 (25)	1 (16.6)		
25-29.9	1 (10)	2 (16.6)	3 (50)		
≥ 30	1 (10)	2 (16.6)	0		
30-34.9	Nil	Nil	Nil		
35–39.9	Nil	Nil	Nil		
≥ 40	Nil	Nil	Nil		
Polyurea	7 (70)	8(66.6)	4(66.6)	1.13, 1.50	0.985
Polydipsea	7 (70)	7(58.3)	3(50)	1.20, 1.58	0.736
DKA	5(50)	7(58.3)	1(16.6)	1.33, 1.73	0.259
Polyphasia	2(20)	0	0	1.82, 2.0	0.155
Weight loss	4(40)	5(41.6)	0	1.49, 1.86	0.177
Family History	7(70%)	6(50%)	4(66.6%)	1.20, 1.58	0.626

(4)

**Table:** (1) Average Fasting plasma sugar and family history, (2) Clinical characteristics of patients, (3) Distribution of BMI in patients, (4) Overall detail of patients.

#### IV. CONCLUSIONS

T1DM is a serious, debilitating disease, with life-threatening complications, in addition to its health provision and resource implications. This study was based on the children and their family. Family history was found more prevalent than DKA in this study which might be related to genetic factors.

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