

## **Factors associated with poor glycaemic control among children with type 1 diabetes at Zawia province**

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### **ABSTRACT :**

Type 1 Diabetes Mellitus (T1DM) is a rapidly growing problem in Libya . Its long term complications are devastating for individuals and families and impose a considerable burden to health care systems. Maintaining strict glycaemic control in type 1 diabetics has been shown to greatly reduce the incidence and progression of long term complications.

Various risk factors have been found to be associated with poor glycaemic control. Children and adolescents with T1DM in Zawia and north-west region have previously been found to have very poor glycaemic

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control and a high prevalence of associated complications. Identification of factors associated with poor control in our setting is critical in order to institute appropriate interventions that will result in improved metabolic control and subsequently prevent complications that may associated with T1DM.

### **Objectives:**

To determine the mean glycaemic control and identify factors associated with poor control in children and adolescents with T1DM.

### **Materials and Methods:**

A retrospective study was carried out at the diabetes clinic for children and adolescents at Zawia Teaching Hospital. One hundred Children and adolescents attending the clinic were enrolled into the study.

### **Results:**

One hundred participants were recruited into the study (46% males). The mean HbA1c was 11.1 %. Children aged less than 10 years were found to have a significantly better glycaemic control (9.83%) as compared to with more than 10 years olds (11.46%) . Seventy eight percent (78%) of patients had good adherence to insulin while good adherence to self blood glucose monitoring regimen (BGM) 28%. Younger children had better adherence to all treatment modalities and had optimal caregiver involvement in diabetes related tasks. Adherence to insulin injections was better in children who had optimal caregiver involvement in the task of injecting insulin. Younger age, having the mother as the primary caregiver.

### **Conclusions:**

Children and adolescents with T1DM in Zawia have very poor glycaemic control. Factors associated with poor control include older age, a caregiver other than the mother and poor comply with insulin therapy,

shortage in insulin supply, poor adherence to BGM, lack of physical activities and regular follow up to diabetic clinic . In order to improve metabolic control, more frequent BGM should be encouraged. Emphasis needs to be put on adherence counseling and active participation of caregivers in diabetes related tasks of their children. Close follow up of the adolescents is necessary as this group is the most vulnerable to poor control.

**Key wards** : Type 1 diabetes mellitus (T1DM); risk factors; glycemic control; HbA<sub>1c</sub>

### **Introduction:**

Glycaemia in children with type 1 diabetes is difficult to manage long-term and this may lead to severe short term and long-term health consequences, such as, diabetic ketoacidosis, infections, renal failure, blindness, as well as heart and cerebrovascular disease . Intensive glycemic control is of sufficient to prevent diabetes related complications.<sup>1,2</sup> Wide glycemic variability may contribute to development of diabetic complications<sup>3,4</sup>. One study found that diabetes patients who had episodes of both hypoglycemia and hyperglycemia were at greater risk of in-hospital mortality.<sup>5</sup> Glycemic control in children with T1DM is dependent on many factors that may influence their lives, community, institutional and personal environments,

and is significantly associated with age, race/ethnicity, duration of diabetes, type of insulin taken, obesity, psychological variables, and family support, although most studies examined cross-sectional associations.<sup>6</sup>

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Glycaemic control should be assessed by periodic measurement of glycosylated hemoglobin (HbA1c) levels.

The target levels for blood glucose excursions should be individualized, especially in younger children, to avoid frequent hypoglycemia. Optimum glycaemic control can be achieved by intensive monitoring blood glucose levels frequently and adjust their treatment accordingly. When the child is old enough, he/she should be encouraged for self-monitoring of blood glucose (SMBG). Today, diabetes is recognized as a primarily self-managed disease.

The American Diabetes Association (ADA) published the target age-specific Hg A1c as follow: <6 years, 7.5%-8.5%; from 6 to 12 years,  $\leq 8\%$ ; from 13 to 18 years,  $\leq 7.5\%$ .<sup>7</sup> Achieving glycaemic targets in children with T1DM poses a difficult challenge. Increasing the intensity of diabetes management is, however, only one method of improving metabolic control.<sup>8</sup>

Family support and involvement of parents and guardians in the care of diabetic children and adolescents has been found to promote adherence and hence

result in better glycaemic control. A study by Anderson et al to investigate relationships between parental involvement in diabetes related tasks and glycaemic control found that more parental involvement in BGM improved adherence and this translated to better glycaemic control.<sup>9</sup> A study from Portugal found that support for female diabetics and those of lower social class resulted in higher adherence and better metabolic control while family conflict predicted poor glycaemic control in patients of upper social class.<sup>10</sup>

Age of the patient, age at onset of DM and diabetes duration have been

found to be significantly associated with glycaemic control. Older age and longer duration of DM was associated with poorer control in studies from UK and France.<sup>12</sup>

Self monitoring of blood glucose (SGM) is recommended 3 to 4 times a day for diabetics on intensive treatment. Less frequent blood glucose monitoring has been found to be a predictor of poor glycaemic control. A study in Denmark

showed improved glycaemic control with more frequent self monitoring of blood glucose. Similarly, in Sudan, self monitoring in type 1 diabetics was associated with significantly better glycaemic control.<sup>13</sup>

Injection into lipohypertrophied injection sites can lead to problems with glycaemic control. Evidence indicates that insulin absorption can be significantly delayed, leading to erratic glycaemic control and unpredictable hypoglycaemia.<sup>14</sup>

Good glycaemic control in children and adolescents with type 1 diabetes has been associated with better quality of life and reduced or delayed development of long term complication. The aim of this study was to assess the glycemic control as measured by hemoglobin A1c in a group of children with type I diabetes mellitus in Zawia province, and to identify the factors related to poor glycemic control among these children.

## **Methods:**

A retrospective study was carried out at the diabetes clinic for children and adolescents at Zawia Teaching Hospital Between May 2005 and July 2007. Definite diagnosis of T1DM according to the definition of the World Health Organization.<sup>15</sup>

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One hundred Children and adolescents of age 2-18 years with at least 1-year duration of the disease and without chronic-associated diseases like hypothyroidism or cealiac disease, attending the clinic were enrolled into the study .

The data was collected from the patient's file, which include age sex of patient , age at onset of disease, duration of the disease, type and frequency of insulin injection, checking of blood glucose, and regular clinic attendance for follow up.

Injection of insulin at the site lipohyperatrophy whether present or absent. The average (mean) value of HbA1c value for each patient was calculated from the reading of last year of follow up .

Insulin adherence was determined by the number of insulin doses:

Good  $\rightarrow \geq 3$  doses

Poor -  $\leq 2$  missed doses

Self glucose mentoring BGM Good -  $\geq 2$  times a day

Poor - none

Availability of insulin: This was assessed by determining the frequency of missed : never missed or missed .

### Results:

There were 100 patient included in the study all children and adolescents with type 1 diabetes had been diagnosed for at least one year.

The mean age was 12.3. years, 42 % older than 10 years old and 46% were males. The mean duration of diabetes was 6.74 years. Most of the children (78%) were on a multiple daily insulin injection regimen,

and diabetes specific characteristics of study participants are summarized in table.

The mean HbA1c was 11.1 %. Children aged less than 10 years were found to have a significantly better glycaemic control (9.83%) as compared to with more than 10 years olds (11.46%) . however There was no difference in the mean HbA1c between

males and females. Children with mothers as the primary caregivers had a significantly lower mean HbA1c as compared to those whose caregivers were a father, a sibling or another family member.

Seventy eight percent (78%) of patients had good adherence to insulin while good adherence to self blood glucose monitoring regimen (BGM) was 28%. Younger children had better adherence to all treatment regimes and had optimal caregiver involvement in diabetes related tasks. Adherence to insulin injections was better in children who had optimal caregiver involvement in the task of injecting insulin. Younger age, having the mother as the primary caregiver.

Shorter duration of disease was associated with significantly lower HbA1c levels. Children who had T1DM for less than 5 year had a mean HbA1c that was 1.5% lower than those with disease for longer duration. . The patient with multiple daily injections regimes have lower HA1C that was 1.9 % lower than in those with less than two doses regime.

Adherence to the insulin regimen was found to be good in majority of study participants (78 %). Reasons cited for poor adherence include forgetfulness and inconvenience in injecting insulin at school and other public places

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Only 35 %of children reported good adherence to the SGM and the most common reason for poor self GM was unavailability of glucometer strips.

Injection of insulin at hyper atrophied sites did not have effect on glycemic control .

**Table: demonstrates the characteristics of all patients included in the study attending pediatric diabetes follow up in al zawia hospital. (n= 100)**

	Total n=100	Mean HA1 <sub>c</sub>
Age: 2- <10 years	58	9.83 %
10- < 18 years	42	11.46%
Sex : Male	46	10.2 %
Female	54	11.9 %
Duration of T1DM :		
>1- 5 years	55	10.3%
> 5	45	11.8%
Care giver :		
Mother	76	10.7%
other	24	11.82%
Insulin therapy:		
Good	78	10.8
Poor	22	12.7
Self glucose mentoring		
Good	28	9.9%
Poor	72	11.8%
Lipohyperatrophy:		
Absent	77	11.5%
Present	23	11.7%



## Discussion:

Management of T1DM in children and adolescents is a challenge for health care workers patients and their families. Current management standards focus on optimizing glycaemic control to reduce the risks of long term complications. The mean glycaemic control in this study was 11.1%, this is a higher than that was reported by others; from Northern Ireland (8.8%) Scotland ( 8.9%), France ( 9.0%) and Denmark.( 9.1) .<sup>16,17</sup>

Younger age has consistently been found to be associated with better glycemetic control in other study.<sup>12,18</sup>

Adolescents with T1DM especially females have been reported to have poor glycaemic control by many studies.<sup>9</sup> The poor glycaemic control with increasing age as demonstrated in the current study may be due to the onset of puberty and the contribution of pubertal hormones. In addition, psychological and social stressors in this age group may result in poor compliance to treatment.

This study demonstrates significantly lower mean HbA1c (10.7%) in children whose primary caregiver was the mother as compared to 11.82% in those who had a primary caregiver other than the mother.

This could be explained by the primary responsibility of the mother to care for sick children in our societies. The mean duration of diabetes in our population was 6.74 years. Children with duration of < 5 year had significantly better mean HbA1c compared to those with duration > 5 year.. This is consistent with many studies findings which have reported diabetes duration as a significant predictor of HbA1c.<sup>12,18,19</sup>

In the current study, majority of the children (78%) were on a multiple insulin injection regime.

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This study demonstrate the importance of daily self glucose mentoring in glyceimic control, as indicated in the study of Anderson et al.<sup>9</sup>

### **Conclusion:**

Glycaemic control in children and adolescents with T1DM attending the Zawia teaching Hospital very poor despite measures to improve insulin availability and self monitoring of blood glucose at home. Factors associated with poor control include older age, a caregiver other than the mother and poor comply with insulin therapy, shortage in insulin supply, poor adherence to BGM, lack of physical activities and regular follow up to diabetic clinic . In order to improve metabolic control, more frequent BGM should be encouraged. Emphasis needs to be put on adherence counseling and active participation of caregivers in diabetes related tasks of their children. Close follow up of the adolescents is necessary as this group is the most vulnerable to poor control.

Clinicians need to be aware of factors associated with poor glycaemic control, so that more effective measures can be implemented to prevent deterioration in diabetes management.

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