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## Research Article

# The Relation between Demographic Factors, Family History, Concomitant Autoimmune Diseases and Glycemic Control in Children with Type 1 Diabetes, A Cross-Sectional Study

### Abstract

**Background:** Type 1 diabetes mellitus (T1DM) is a common disease which causes acute and chronic complications such as diabetic ketoacidosis, retinopathy, nephropathy, and atherosclerosis. Improvement in glycemic control can prevent these complications.

**Objectives:** This study aimed to assess the role of demographic factors, family history of diabetes and concomitant autoimmune diseases on glycemic control in children with T1DM in the south of Iran.

**Materials and Methods:** One hundred children with T1DM who were referred to a pediatric diabetes subspecialty clinic were enrolled in the study. Patients with type 2 and other types of diabetes and the ones whose diabetes type was not clinically clear were excluded from the study. After taking history and physical examination, data collection forms about the participants' demographic factors were filled out.

Hemoglobin A1C (HbA1C) level, total Immunoglobulin A (IgA), anti-tissue transglutaminase IgA, T4 and thyroid stimulating hormone were measured. Descriptive statistics were applied for analysis of the data.

**Results:** Older patients had significantly higher HbA1c levels (P-value= 0.023) According to linear regression model, HbA1C level increases up to about %12 per year. Other factors such as sex, parental education, and family history of diabetes and concomitant autoimmune diseases (hypothyroidism and celiac disease) had no significant relationship with HbA1C level.

**Conclusions:** As the patient grows, his/ her glycemic control worsens. Therefore, more strict efforts should be made as to education, more expert visits and more social aids in order to protect from short term and long term complications.

## Introduction

T1DM is considered as a chronic common disease which involves about one in every 400 to 600 adolescents [1]. T1DM has long-term complications and it may affect the eyes, kidneys and autonomic and peripheral nervous system. However, pathophysiology of these complications is not clear. It seems that hyperglycemia plays an important role in this regard [2]. Patients with T1DM are at higher risk of developing other autoimmune diseases such as autoimmune thyroiditis and celiac disease [3,4]. Glycemic control improvement in a child with T1DM leads to a delay in starting and also decreasing the development of micro-vascular diabetes complications [5]. Diabetes needs a constant medical care and personal control by the patient to prevent its short-term complications and decrease the risk of long-term ones [6]. Concerning the American Diabetes Association guidelines, optimal (HbA1C) level in childhood and adolescence is below 7.5%. Acquisition of this glycemic target in children with T1DM is a hard challenge [5]. Several studies have been conducted

on the effects of different factors on controlling blood sugar level in children with T1DM in different countries and have shown different results. Although methods of controlling the blood sugar level and demographic factors are different in Iran, there is a need to investigate and analyze this issue in our country.

## Objective

This study was conducted to find out the effect of several environmental factors on the control of T1DM.

## Materials and Methods

This study was carried out on 100 children with T1DM who had referred to a pediatric diabetes subspecialty clinic were affiliated to Shiraz University of Medical Sciences from May 2014 to January 2015. Inclusion criteria were type I diabetes mellitus definitely diagnosed based on World Health Organization (WHO) definition [7], aged between 1 and 18 years old, and being diagnosed with disease for more than 1 year, to rule out the effect of honeymoon period.

After taking informed consent from the parents, for each patient, data collection form which included demographic information (date of birth, sex, residency, and parents' education), age and time of diagnosing diabetes, the way the disease appeared (with or without diabetic ketoacidosis), related diseases, and family history of any type of diabetes was completed. Then, at follow up, levels of HbA1C, total Immunoglobulin a (IgA), anti-tissue transglutaminase IgA, T4, and Thyroid Stimulating Hormone (TSH) of all patients were checked and their levels were recorded. SPSS version 18 was used for data analysis. One-way ANOVA was applied for comparing the parents' education, family history, and related diseases. Independent T-test was used to find the differences in sex and Pearson correlation for age. For all analyses,  $P$  value of  $<0.05$  was considered as statistical significance.

This study was approved by Ethical Committee of Shiraz University of Medical Sciences.

## Results

Totally, the questionnaires were filled out for 100 (48 boys, and 52 girls) children with T1DM with the mentioned criteria. The patients' ages range was 4-18 years with a mean of  $10.67 \pm 3.85$  years. The majority of patients were 7 to 12 years old (57%). In terms of father's education, 66% of the fathers had high school diploma or below diploma. Only 3% of them were illiterate and others had university degrees. Regarding mother's education, 78% had high school diploma or below diploma, and just 2% were illiterate, and the rest had university degrees. 55% of the patients has positive family history of diabetes (type I and II), of 10% were related to first-degree relatives, 40% to second-degree relatives and 5% to third-degree relatives. 85% of the patients had no concomitant diseases other than diabetes. On the other hand, 2% had hypothyroidism, 2% had celiac disease, and 11% had other diseases such as iron deficiency anemia and glucose 6 phosphate dehydrogenase deficiency.

As seen in Table 1, HbA1C level increased significantly with advancing aging ( $p$ -value = 0.023). According to linear regression model, HbA1C level increased up to 0.117% per year. Certainly, this relationship is weak because of the irrelevancy of some data.

Table 2 shows that HbA1C mean is higher among girls, but this difference is not significant statistically.

As seen in Tables 3-6, there was no significant relationship between the parents' education, concomitant diseases (hypothyroidism and celiac disease) and family history of diabetes with HbA1C level.

**Table 1:** Correlation between age and HbA1c among patients with Type 1 diabetes mellitus.

	HbA1c (%)	age
Pearson Correlation	1	0.227
P value		0.023
Number	100	100

**Table 2:** Correlation between sex and HbA1c among patients with Type 1 diabetes mellitus

Sex	Number	Mean HbA1C	p-value
Male	48	$8.31 \pm 2.00$	0.78
Female	52	$8.42 \pm 1.98$	

**Table 3:** Correlation between father's education and HbA1c among patients with Type 1 diabetes mellitus.

Father education	Number	Mean HbA1C	p-value
Illiterate	3	$8.43 \pm 1.44$	0.95
Primary school to high school diploma	38	$8.41 \pm 2.35$	
High school diploma	28	$8.55 \pm 1.66$	
Associate degree	6	$8.16 \pm 2.49$	
Bachelor degree and upper	25	$8.14 \pm 1.71$	

**Table 4:** Correlation between mother's education and HbA1c among patients with Type 1 diabetes mellitus.

Mother education	Number	Mean HbA1C	p-value
Illiterate	2	$9.7 \pm 0.14$	0.38
Primary school to high school diploma	44	$8.45 \pm 2.33$	
High school diploma	34	$8.39 \pm 1.56$	
Associate degree	6	$6.93 \pm 1.01$	
Bachelor degree and upper	14	$8.46 \pm 2.00$	

**Table 5:** Correlation between family history and HbA1c among patients with Type 1 diabetes mellitus.

Family history	Number	Mean HbA1C	p-value
First-degree relative	10	$7.96 \pm 1.95$	0.72
Second-degree relative	40	$8.38 \pm 1.81$	
Third-degree relative	5	$7.64 \pm 0.58$	
Without family history	45	$8.52 \pm 2.23$	

**Table 6:** Correlation between associated diseases and HbA1c among patients with Type 1 diabetes mellitus.

Related diseases	Number	Mean HbA1C	p-value
Hypothyroidism	2	$9.35 \pm 0.35$	0.85
Celiac disease	2	$7.70 \pm 0.14$	
Other diseases	11	$8.20 \pm 2.02$	
Without any diseases except T1DM	85	$8.38 \pm 1.98$	

In children with T1DM, who had hypothyroidism, mean HbA1C was  $9.35 \pm 0.35$  that is significant clinically but non-significant statistically as compared to other diabetic children.

## Discussion

In this study, the only effective factor on glycemic control and HbA1C level was the patients' ages, so that older ones had higher HbA1C and poorer glycemic control. Several studies have revealed this issue. According to similar studies done in Japan [8], United States of America [9] and Scotland [10], HbA1C was significantly higher in adolescents than younger children. It may occur due to psychosocial problems such as independence from the family, decreasing physical activities, hormonal changes like high resistance to insulin during puberty [11] and to some extent due to progressive nature of the disease.

Based on this study, sex had no effect on glycemic control. Similar studies carried out in Egypt [5] and Japan [8], confirmed that issue. Pathophysiologically, sex is not a risk factor for poor glycemic control. But a few studies revealed that the mean of HbA1C in girls was significantly higher than boys [12].

Positive family history had no impact on glycemic control in our study. Also, the study done in Egypt [5], confirmed that point. However, another study in Italy indicated that HbA1C was lower in

children whose first-degree and second-degree relatives had diabetes [13]. This difference between patients of our country and Italy may show that our patients have not enough information about their diseases; therefore, they cannot share their knowledge and attitude with other relatives suffering from diabetes.

In fact, due to frequent history of diabetes among families, education regarding their diseases improves the outcome of other related patients.

According to this study there was no significant relationship between the parents' education and glycemic control in children with T1DM. Another study in Saudi Arabia indicated that mothers with higher education had diabetic children with better glycemic control [14]. In addition, another study in Portugal showed a significant relationship between low education of parents and poor glycemic control [15]. Highly educated parents can be more oriented to the symptoms and complications of T1DM compared to less educated parents and it can be effective for better control of the disease. However, in our country highly educated parents are usually busy and they may have less time to take care of their diabetic children leading to lack of control of T1DM. It seems that in our region, these effects cause education as a non-effective factor for blood sugar control.

Only 2 out of 100 patients in our study had hypothyroidism. Mean HbA1c in these hypothyroid patients was higher than other patients but this difference was not significant. Of course, this low number of cases makes the statistical analysis unreliable. Based on a study done on 330 children with T1DM in 2015, autoimmune thyroid disease causes poorer glycemic control [16]. Moreover, according to a systematic review conducted on the relationship between autoimmune thyroiditis and T1DM in 2013, there was a relationship between non-treated hypothyroidism and poor control of blood sugar in patients with T1DM. But in another study done on 148 patients with T1DM in 2009, no difference was found in blood sugar control among patients with autoimmune thyroiditis and those without it [17,18].

Therefore, the effect of thyroid disease on glycemic control in patients with T1DM is not clear and it requires more studies to be confirmed.

In this study, there was no significant relationship between celiac disease and HbA1C in children with T1DM. Another study carried out on children with T1DM in 2012 showed that there was no difference between patients who have diabetes as well as celiac disease and the ones who had no celiac disease regarding glycemic control [19]. This issue was also confirmed in the systemic review done on the relationship between celiac disease and T1DM in 2015 [20].

## Conclusion

Blood sugar control in patients with T1DM will worsen the patient ages. Therefore, with advancing age, patients need more education and medical and psychosocial aids.

However, blood sugar control is not related to sex, family history of diabetes, and parents' education.

## Limitations

The number of participants was limited. Therefore, more studies with higher number of participants are needed to determine the effective factors on glycemic control among patients with type 1 diabetes.

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## Author Contributions

Concept and design: Hossein Moravej, Mahmmood goodarzi. Acquisition of data: Hossein Moravej, Mahmmood goodarzi. Analysis and interpretation of data: Hossein Moravej, Zohreh Karamizadeh. Critical revision of the manuscript for important intellectual: content: Hossein Moravej, Zohreh Karamizadeh.

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