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Evaluation of Puberty Disorders in Children with Type 1 Diabetes Mellitus Compared to Healthy Children in Zahedan During 2013–2022

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Abstract

Introduction and Objective: Diabetes mellitus is a widespread metabolic disorder of increasing concern globally. This study aims to evaluate the prevalence and characteristics of puberty disorders (early or delayed puberty) in children with Type 1 Diabetes Mellitus and compare them to healthy children.

Methods: This retrospective cross-sectional study examined the medical records of 192 patients with Type 1 Diabetes Mellitus who visited Ali Asghar Clinic in Zahedan between 2013 and 2022. A control group of healthy children was also included. Data such as age, gender, body mass index (BMI), and HbA1c levels were collected using a researcher-developed checklist. Puberty stages were determined by a pediatric endocrinologist, and data were analyzed using SPSS version 20.

Results: The participants' mean age was 8.45 ± 2.63 years, and 63.2% were male. No significant difference was observed in puberty disorders (early or delayed puberty) between the diabetes group and the control group regarding age, gender, BMI, or HbA1c levels (P > 0.05).

Conclusion: This study found no significant relationship between Type 1 Diabetes Mellitus and puberty disorders in children. Further research with larger sample sizes and longer follow-ups is recommended.

Key words: *puberty, type 1 Diabetes mellitus, pediatric*

Introduction

Diabetes mellitus is a chronic metabolic disease, one of the leading concerns for public health in the 21st century. Type 1 Diabetes Mellitus (T1DM) is caused by autoimmune destruction of pancreatic beta cells, leading to insufficient insulin production and elevated blood glucose levels.

The chronic nature of this disease can lead to several complications, including growth and developmental issues in children. Insulin plays a vital role not only in glucose regulation but also in growth and puberty. A deficiency in insulin can disrupt the timely onset of secondary sexual characteristics and puberty progression. Puberty disorders in diabetic children can manifest as either early or delayed puberty.

Delayed puberty refers to the absence of any signs of puberty by the age of 13 in girls and 14 in boys. Early puberty, on the other hand, is defined as the onset of puberty before the age of 8 in girls and 9 in boys. Given the increasing prevalence of Type 1 Diabetes Mellitus among children and the potential for puberty disorders in this group, investigating these complications

is crucial.

The goal of this study is to identify the prevalence of puberty disorders in children with Type 1 Diabetes Mellitus and compare it with that of healthy children.

General Goal

To determine and compare the prevalence of puberty disorders (early and delayed puberty) in children with Type 1 Diabetes Mellitus who visited Ali Asghar Clinic in Zahedan with that of healthy children during the years 2013–2022.

Early Puberty: The onset of puberty signs (such as breast development in girls or testicular growth in boys) before the age of 8 in girls and before the age of 9 in boys.

Delayed Puberty: The absence of any signs of puberty by 13 years of age in girls or 14 years in boys.

Type 1 Diabetes Mellitus (T1DM): An autoimmune disorder leading to the destruction of pancreatic beta cells, causing reduced or absent insulin production and subsequent hyperglycemia.

This study was a descriptive-analytical-cross-sectional study with a retrospective time frame.The study population in this study was the files of patients with type 1 diabetes who referred to Ali Asghar Clinic in Zahedan.

The study was conducted after the approval of the proposal in the Research Council of the Faculty of Medicine and the steps of obtaining the code of ethics and obtaining permission from the Vice-Chancellor for Research of the University. The relevant permission and letters of introduction were submitted to the authorities of Ali Ibn Abi Taleb Hospital of Zahedan. This study was a descriptive-analytical-cross-sectional study and retrospective in terms of time frame. The study population in this study was the files of patients with type 1 diabetes who referred to Ali Asghar Clinic of Zahedan and the control group that was matched with these patients during the years 1392-1401. The inclusion criteria for diabetic patients included having diabetes mellitus according to clinical tests and confirmation by a pediatric endocrinologist that the patient files were complete. The exclusion criteria for the

study also included having another chronic or metabolic disease, malnutrition, taking corticosteroids or undergoing Growth Therapy treatment, and incomplete patient records. In the control group, the inclusion criteria included not having type 1 diabetes and its confirmation by a specialist physician, consent to be examined by a pediatric endocrinologist, and completion of the information form. The exclusion criteria for the control group included taking corticosteroids or undergoing malnutrition treatment, having another metabolic or chronic disease, taking Growth Therapy, and not consenting to be examined by a pediatric endocrinologist, and completion of the information form. In this study, the records of patients referring to Ali Asghar Clinic (AS) and the information forms in the control group in the years 2013-2014 were studied based on the inclusion and exclusion criteria and the aforementioned sampling method. Then these files were reviewed and information on age, gender and HBA1C levels were extracted from their files and recorded in an information form. Puberty examination in children was performed by a pediatric endocrinologist and recorded in the files. Then the information forms were compared in the control group and the diabetic patient group. Finally, this information will be analyzed by SPSS version 26 statistical software. After the end of data collection, the final results of the project were written in the form of a thesis. After data collection, data were analyzed using IBM-SPSS v.20 software and data entry into the computer.

The research was conducted with permission from the Vice Chancellor for Research, Zahedan University of Medical Sciences and with the approval of the research committees with the code IR.ZAUMS.REC.1401.234.

FINDINGS

In this study, 192 patients with type 1 diabetes who referred to Ali Asghar Clinic in Zahedan during the years 1392-1401 were examined.

Gender frequency distribution 45.8 percent of the patients were male and 54.2 percent were female.

Table 1: frequency of stage of puberty (Tanner)

Stage puberty (tanner)	Number	%
1	70	36.5
2	63	32.8
3	37	19.3
4	10	5.2
5	12	6.3

The results of the independent t-test showed that there was a significant difference between the two groups of patients and controls in terms of the mean body mass index (p=0.04). However, the two groups were homogeneous in terms of other variables.

The results of Fisher's exact test showed that there was no significant association between puberty disorders (precocious puberty, delayed puberty) and type 1 diabetes in either men or women (p>0.05).

Table 2: relation between puberty disorder and sex

Stage puberty	Sex	Number (%) patient	Number (%) control	P value
Precocious	Female	4(50%)	5(62.5%)	P= 0.9
Precocious	Male	4(50%)	3(37.5%)	
Delay	Female	11(37.9%)	10(37%)	P=0.99
Delay	Male	18(62.1%)	17(63%)	
Normal	Female	29(49.2%)	29(47.5%)	P=0.99
Normal	Male	30(50.8%)	32(52.5%)	

The results of Fisher's exact test showed that there was no significant relationship between puberty disorders (precocious puberty, delayed puberty) and type 1 diabetes in individuals aged 8 to 12 years or 12 to 18 years (p>0.05).

The results of Fisher's exact test showed that there was no significant relationship between puberty disorders (precocious puberty, late puberty) and type 1 diabetes neither in underweight individuals (body mass index less than 18) nor in individuals with a body mass index of 18 or more (p>0.05).

Table 3: relation between the mean Hb A1C levels and tanner stage

Stage puberty (tanner)	HBA1C (SD)	P value
1	10.52 + 3.30	
2	10.27 _+2.24	
3	10.27 1.87	P=0.71
4	11.30 2.31	
5	9.4 2.8	

The results of one-way analysis of variance showed that there was no significant difference between the mean Hb A1C levels in patients with different maturation stages (P>0.0).

DISCUSSION

The aim of this study was to investigate the average score of the characteristics of an effective clinical instructor from the perspective of medical students in the clinical course at Ali Ibn Abi Taleb Hospital in Zahedan in 1402. 192 patients and referring individuals were examined (96 patients with type 1 diabetes and

96 healthy individuals). 45.8% of the participants in the study were male, and the average age of the individuals was 12.29 ± 2.63. The results also showed that there was no significant relationship in determining and comparing the frequency of puberty disorders (precocious puberty, late puberty) according to age, gender, and body mass index in type 1 diabetes patients referring to Ali Asghar (AS) Clinic in Zahedan and the control group. The results of the one-way analysis of variance test showed that the average Hb A1C level in the There was no significant difference between the groups with different stages of puberty.

The study by Ozah et al. in 2023 was conducted in India with the aim of evaluating the onset of puberty and puberty disorders in Indian children and adolescents with type 1 diabetes. This cross-sectional study included 399 children and adolescents aged 6 to 23 years with type 1 diabetes.

Blood glucose control and insulin sensitivity were poor in adults. The age of onset of puberty in individuals with type 1 diabetes was similar to that of healthy Indian children with poor blood glucose control and insulin resistance in adults. Puberty disorders were significantly lower despite suboptimal blood glucose control. The results of this study are in line with our study showing that puberty disorders in individuals with Hb A1C were not significantly different from the control group.

A study by Ethel Kedner and colleagues in Chile in 2020 aimed to investigate puberty in patients with type 1 diabetes. This study was conducted by reviewing research in this field. As a result of this study, it is observed that puberty occurs in adolescents with type 1 diabetes at a similar age compared to healthy peers. The results of this study were consistent with our study. 40 A study by Palmer et al. in Germany in 2017 aimed to investigate the interaction of puberty development and metabolic control in adolescents with type 1 diabetes. Using a large multicenter database, longitudinal data of 1294 patients were analyzed. Inclusion criteria: complete height and HbA1c records from the ages of seven to 16 years. Exclusion criteria: Other major chronic diseases and medications,

T1DM duration less than three months, and initial BMI less than the 3rd or 97th percentile. Even with impaired growth velocity, both sexes reach normal height by age 16, which is consistent with population height. Worsening metabolic control is inconsistent with gender and is associated with gender-related changes in growth velocity. However, it appears that the almost unanimous majority of boys and girls with T1DM reach normal height by age 16. The results of this study are also consistent with our study, showing that age and gender are not influential indicators in the rate of puberty disorders in individuals with type 1 diabetes and controls. A study by Pereira et al. in 2015 in Brazil examined the development of puberty in children with type 1 diabetes mellitus before puberty. In this study, 131 children with diabetes were studied, 61 of whom were girls and 70 of whom were boys. Factors such as metabolic control, HbA1C level, duration of disease, and BMI in children with type 1 diabetes before puberty were measured. This study concluded that the onset of puberty is delayed in children with a longer duration of disease compared to children with a shorter duration of disease. Also, menarche occurs earlier in girls with a higher BMI. The results of this study were not consistent with our research, which could be due to the racial differences in the children studied and the difference in sample size between the two studies.

In 2014, Ham and colleagues studied the relationship between puberty development and metabolic control in adolescents with type 1 diabetes. In this study, by examining the DPV (diabetes patienten Verlaufsdaten) database, 9920 patients with type 1 diabetes were identified who had diabetes onset before the age of 7.5 years and were over 15.5 years old at the time of the study. According to the results of this study, increased HbA1C affects and reduces growth rate in girls and boys with diabetes. Results: Accurate disease control requires a lot of effort from the patient, family, and health care system; However, with more careful control of the disease, the risk of complications and disorders of puberty, such as height development and metabolic control, is reduced.

The results of the study were conducted in a cross-sectional study and were not consistent with this study, but the difference shows that more follow-up studies should be conducted to learn about the complications of diabetes in Iranian patients. In a case-control study conducted by Abdollah and colleagues in Egypt in 2014, they examined puberty in type 1 diabetic patients. In this study, 20 boys diagnosed with type 1 diabetes between the ages of 14 and 18 and 20 healthy individuals were selected with age matching. In 25% of patients, the delay in puberty was such that no signs of puberty were observed in them. Also, growth parameters (height, weight, BMI) were lower in the patient group than in the control group. Considering the results of the study of type 1 diabetes, which showed delayed puberty and growth disorders compared to the control group, the results of this study were not in line with our study, which could be due to the difference in the sample size of the subjects studied. In 2012, Samara Boustani and her colleagues in France studied the prevalence of hirsutism and menstrual disorders in obese adolescent girls and adolescent girls with type 1 diabetes despite different hormonal profiles. In this study, 96 obese adolescent girls and 78 adolescent girls with type 1 diabetes were studied. As a result of these studies, a high prevalence of hirsutism and menstrual disorders was observed in obese adolescent girls and adolescent girls with type 1 diabetes. Puberty, theralecta, and menarche occur at a younger age in obese girls compared to adolescent girls with type 1 diabetes, and hirsutism also occurs in obese girls. and girls with type 1 diabetes are related to hyperandrogenism and free androgen index (FAI). This study has shown that hirsutism and menstrual disorders are highly prevalent in obese girls and girls with type 1 diabetes. The results of this study were not consistent with our research and no difference in the stages of puberty was observed in the patients. This study compared body mass index, which requires further investigation in domestic studies. 5 - 2 - Final conclusion Based on the results of the study, it can be concluded that personal characteristics, communication skills and evaluation skills are considered the most important characteristics of effective teachers. Therefore, teachers and instructors should improve these characteristics and abilities, considering that the cultural context and characteristics of the environment Educational conditions can have an impact in this category.

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