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Growth Parameters in Children with Type I Diabetes Mellitus: A Cross-Sectional Study

Iqra Farooque [a], ***Hina Sabbir*** [a], ***Nida Amin*** [b]

[a] MBBS, FCPS(Pediatrics), Faisalabad Medical University

[b] Assistant Professor Optometry Department, The University of Faisalabad

Correspondence: Nidaa4644@gmail.com

ABSTRACT

Background and Objectives: A comprehensive understanding of the physiological processes leading to regular growth during childhood and adolescence is necessary to enable physiological growth during this critical stage of development and the achievement of a suitable final height, especially of those changes that arise in these populations at high risk of growth impairment. To determine the mean of growth parameters of children presenting with type I diabetes mellitus in a tertiary care hospital.

METHODOLOGY: A total of 568 children aged 1-18 years of either gender presenting with T1D were included. Patients with celiac disease (on EGD), hypothyroidism (TSH>5mIU) and eating disorders were excluded. Then children underwent anthropometric measurements like height in centimeters by using measuring tape and weight in kilograms on weighing machine.

RESULTS: The mean age in this study was 9.58 ± 2.88 years, with a range of 1 to 18 years. Among the patients, 296 (52.11%) were between the ages of 1 and 9. Diabetes mellitus lasted 6.33 ± 2.04 years on average. With a male to female ratio of 1.7:1, 358 (63.03%) and 210 (36.97%) of these 568 patients were male. Patients in my study had an average height of 111.09 ± 21.47 cm. The weight was 30.31 ± 5.65 kg on average.

CONCLUSION: This study concluded that the mean of growth parameters of children presenting with type I diabetes mellitus is quite low.

KEYWORDS: Type-I diabetes mellitus, height, weight

INTRODUCTION

Diabetes mellitus (DM) comes in three primary forms: Type I diabetes, also known as insulin-dependent diabetes mellitus or juvenile diabetes; Type II diabetes, also known as non-insulin-dependent diabetic mellitus or adult-onset diabetes; and gestational diabetes, which happens when pregnant women without a history of diabetes acquire elevated blood glucose levels (1).Diabetes mellitus affects 10–14% of people worldwide.2. High blood glucose in the setting of insulin resistance and relative insulin shortage is a hallmark of diabetes mellitus type 2, formerly known as noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. This contrasts with diabetes mellitus type 1, where the pancreatic islet cells are destroyed, resulting in a complete lack of insulin. (2).

According to US death certificates from 2010, diabetes mellitus was the sixth most common cause of death (3). According to a 2012 study by Ramachandran and colleagues, about 7.2 million persons in Pakistan had diabetes mellitus, with a prevalence of 7.7% in rural areas and 10.6% in urban areas. Proper care of type 1 diabetes (T1D), a chronic condition that typically manifests in childhood, can prevent both short-term and long-term problems. Growth is still inadequate in children with type 1 diabetes despite improvements in medical care; this is probably due to persistent metabolic disruption associated with traditional microvascular diabetic problems (4).

The age at which T1D first manifests, its length, and metabolic control all affect a child's growth. It has been shown that children exhibit a smaller stature in adulthood, and a loss in height has been noted throughout the course of the disease (5).

The attainment of a suitable final height and physiological growth during this crucial stage of development require a thorough understanding of the physio

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logical processes that lead to regular growth during childhood and adolescence, particularly those changes that occur in these populations at high risk of growth impairment.

According to reports, T1D has a detrimental impact on linear growth when it comes to poor metabolic regulation and the length of the condition. Although therapy has been optimized, it is unknown if a slight growth deficit still exists (6).

According to one study, the mean height of T1D children (n=125) was lower than that of healthy children (n=125), measuring 128.3±24.3 cm versus 133.6±24.7 cm. This difference was not statistically significant (p>0.05), and the mean weight of T1D children was lower than that of healthy children, measuring 29.2±15.3 kg versus 31.3±15.4 kg (p>0.05) (6).

Finding the average growth characteristics of children with T1D who were admitted to a tertiary care hospital was the motivation behind this investigation. According to published research, the mean height and weight difference between children with T1D and healthy children was minimal. However, the difference was negligible. Furthermore, the literature had no additional studies or local data. Therefore, the purpose of this study was to evaluate the growth indicators in children with diabetes. Based on the study's findings, some useful suggestions for enhancing the development of diabetic children can then be given to these specific individuals (7).

Objectives:

The objective of the study was:

"To determine the mean of growth parameters of children presenting with type I diabetes mellitus in a tertiary care hospital."

METHODOLOGY

Study Design: Descriptive, cross-sectional.

Setting: Unit III, Department of Pediatric Medicine, Allied Hospital, Faisalabad.

Duration Of Study: 10th February 2020 to 9th August 2020 (7).

Sample Size: Sample size of 568 children; with 95% confidence level, 0.02 absolute precision taking mean height as 128.3±24.3cm in T1D children.

Sample Technique: Non-probability, consecutive sampling (8)

Sample Selection:

a. Inclusion Criteria:

- Children of age 1-18 years of either gender presenting with T1D (as per operational definition).

b. Exclusion Criteria:

- Children with celiac disease (on EGD), hypothyroidism (TSH>5mIU) and eating disorders (on medical record) (9).

Data Collection Procedure:

568 children fulfilling the inclusion criteria were recruited from OPD of the Department of Pediatrics, Allied Hospital, Faisalabad. Informed consent was obtained from parents. Demographic details like name, age and sex were also obtained (9). Then children underwent anthropometric measurements like height in centimeters by using measuring tape and weight in kilograms on a weighing machine (as per operational definition). All this information (age, gender, place of living, duration of DM, control of diabetes (yes/no), education of parents (illiterate/primary/middle/matric & above), socioeconomic status of parents (poor/middle/upper), height and weight) was recorded on proforma (attached) (9).

Statistical Analysis:

The collected data was entered and analyzed using SPSS version 21.0 (10). Mean and SD were calculated for quantitative variables like age, duration of DM height and weight. Frequency and percentage were calculated for categorical variables like gender of child, place of living (rural/urban), control of diabetes (yes/no), education of parents (illiterate/primary/middle/matric & above), socioeconomic status of parents (poor/middle/upper) (11).

Data was stratified for effect modifier like age, gender, duration of DM, place of living (rural/urban), control of diabetes (yes/no), education of parents (illiterate/primary/middle/matric & above), socioeconomic status of parents (poor/middle/upper) and independent sample t-test was used. P-value≤0.05 was considered as significant (12).

RESULTS

Age range in this study was from 1 to 18 years with mean age of 9.58 ± 2.88 years. Majority of the patients i.e. 296 (52.11%) were between 1 to 9 years of age as shown in Table I. Mean duration of diabetes mellitus was 6.33 ± 2.04 years (Table II) (13).

Out of these 568 patients, 358 (63.03%) were male and 210 (36.97%) were females with male to female ratio of 1.7:1 (Figure I) (14).

Distribution of patients according to place of living and diabetes mellitus status is shown in Table III & IV respectively. Distribution of patients according to education of parents and socioeconomic status is shown in Table V & VI respectively.

In my study, mean height of patients was 111.09 ± 21.47 cm. Mean weight was 30.31 ± 5.65 kg (Table VII) (13).

Stratification of mean height with respect to age, gender, duration of DM, place of living, control of

diabetes, education of parents and socioeconomic status of parents is shown in Table VIII. Table IX has shown the stratification of mean weight with respect to age, gender, duration of DM, place of living, control of diabetes, education of parents and socioeconomic status of parents (14).

Table-I: Distribution of patients according to Age (n=568).

Age (in years)	No. of Patients	%age
1-9	296	52.11
10-18	272	47.89
Total	**568**	**100.0**

Mean ± SD = 9.58 ± 2.88 years

Table-II: Distribution of patients according to duration of diabetes mellitus (n=568).

Duration of diabetes (years)	No. of Patients	%age
≤5 years	200	35.21
>5 years	368	64.79

Mean ± SD = 6.33 ± 2.04 years

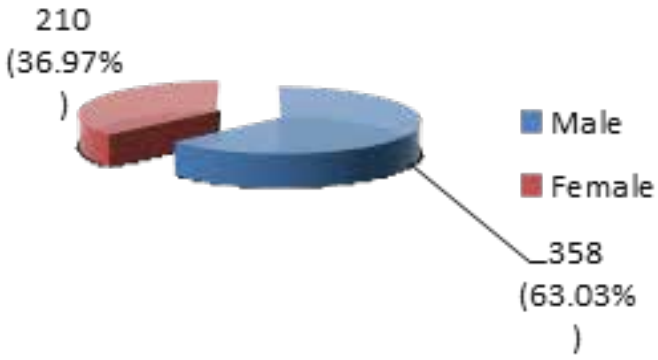

Figure I: Distribution of patients according to Gender (n=568).

Table-III: Distribution of patients according to control of diabetes (n=568).

Control of diabetes	No. of Patients	%age
Yes	389	44.71
No	179	55.29
Total	568	100.0

Table-IV: Distribution of patients according to place of living (n=568).

Place of Living	No. of Patients	%age
Rural	244	44.71
Urban	324	55.29
Total	568	100.0

Table-V: Distribution of patients according to education of parents (n=568).

Education of parents	No. of Patients	%age
Illiterate	96	16.90
Primary	72	12.68
Middle	229	40.32
Matric & above	171	30.11

Table-VI: Distribution of patients according to socioeconomic status of parents (n=568).

socioeconomic status of parents	No. of Patients	%age
Poor	111	19.54
Middle	209	36.80
Upper	248	43.66

Table-VII: Mean of growth parameters of children presenting with type I diabetes mellitus (n=568).

Growth parameters	Mean ± SD
Height (cm)	111.09 ± 21.47
Weight (kg)	30.31 ± 5.65

Table VIII: Stratification of height with respect to age, gender, duration of DM, place of living, control of diabetes, education of parents and socioeconomic status of parents.

Variables		Height (cm) Mean ± SD	P-value
Age (years)	**1-9**	94.90 ± 15.04	**0.0001**
	10-18	128.71 ± 10.98	

Gender	**Male**	118.18 ± 18.23	**0.0001**
	Female	99.0 ± 21.22	
Duration (years)	**≤5**	92.27 ± 15.66	**0.0001**
	>5	121.32 ± 16.78	
Controlled	**Yes**	111.62 ± 20.04	**0.385**
	No	109.93 ± 24.31	
Place of living	**Rural**	113.39 ± 20.44	**0.026**
	Urban	109.35 ± 22.09	
Education	**illiterate**	123.44 ± 16.36	**0.072**
	Primary	121.38 ± 2.95	
	Middle	104.52 ± 22.52	
	Matric & above	108.63 ± 22.57	
Socioeconomic status	**Poor**	104.29 ± 23.66	**0.009**
	Middle	115.01 ± 19.99	
	Upper	110.83 ± 20.95	

Table IX: Stratification of weight with respect to age, gender, duration of DM, place of living, control of diabetes, education of parents and socioeconomic status of parents.

Variables		**Weight (kg)** Mean ± SD	**P-value**
Age (years)	**1-9**	26.88 ± 5.01	**0.0001**
	10-18	34.04 ± 3.55	
Gender	**Male**	32.35 ± 4.94	**0.0001**
	Female	26.83 ± 5.05	
Duration (years)	**≤5**	27.0 ± 5.74	**0.0001**
	>5	32.10 ± 4.71	
Controlled	**Yes**	30.60 ± 4.92	**0.066**
	No	29.66 ± 6.94	
Place of living	**Rural**	30.97 ± 6.10	**0.014**
	Urban	29.80 ± 5.23	
Education	**illiterate**	33.25 ± 4.14	**0.873**
	Primary	35.32 ± 2.83	
	Middle	28.66 ± 6.02	
	Matric & above	28.75 ± 4.80	
Socioeconomic status	**Poor**	28.03 ± 5.92	**0.0001**
	Middle	31.36 ± 5.72	
	Upper	30.44 ± 5.16	

DISCUSSION

The chronic condition known as type 1 diabetes mellitus (T1DM) has well-established short- and long-term effects.One hundred The so-called Mauriac syndrome, which severely impairs growth and development, is one of the long-term effects. This entity is now rare due to significant advancements in diabetes care. In fact, certain research conducted in the past ten years have reported beneficial growth features in children with diabetes. However, other nations worldwide, including Austria, Brazil, the Czech Republic, Germany, and Sudan, have recorded growth slowing during the epidemic. (2)

The purpose of this study was to ascertain the average growth parameters of kids who were diagnosed with type I diabetes. The study's participants ranged in age from 1 to 18, with a mean age of 9.58 ± 2.88 years. Most patients, or 296 (52.11%), were in the 1–9 age range. The male to female ratio of these 568 patients was 1.7:1, with 358 (63.03%) being male and 210 (36.97%) being female. The average height of the patients in my study was 111.09 ± 21.47 cm. A mean weight of 30.31 ± 5.65 kg was recorded. According to one study, T1D children's mean height (n=125) was lower than that of healthy children (n=125), measuring 128.3±24.3 cm versus 133.6±24.7 cm. This difference was not statistically significant (p>0.05), and their mean weight was less as compared to healthy children i.e. 29.2±15.3kg vs. 31.3±15.4kg, although insignificant (p>0.05) (14).

In subsequent years, more than 30 studies on the growth of children with type 1 diabetes have produced contradictory findings. In 2002, DiLiberti et al. conducted a meta-analysis of the pertinent data and came to the conclusion that the children with diabetes were taller when they were diagnosed. They attributed this finding to the parents' greater stature (14). But according to Poyrazoglu et al.109, there was no discernible overall height decrease and the diabetic children's final heights between 1970 and 1987 were in line with their desired heights. Our knowledge of T1DM and the standard of its management have greatly improved since the early 1990s.

Bognetti et al. discovered that in children and teenagers diagnosed between 1989 and 1992, height SDS considerably decreased even within the first three years of the condition. In a similar vein, Donaghue et al.103 discovered that T1DM patients identified between 1974 and 1991 had lost height SDS by the fifth year of their illness (15).

Brown et al. and other authors showed that children with T1DM diagnosed between the ages of five and ten were taller at the outset of the disease than their healthy peers, but they did not detect any appreciable differences in patients with earlier or later onset. The mean height standard deviation (SDS) of 22,651 German and Austrian children with type 1 diabetes upon diagnosis was considerably greater than the average for the healthy population, according to a recent study by Bonfing et al. (16).

Several studies have examined the growth pattern in children prior to the start of type 1 diabetes as a risk factor for the disease's development considering these findings (17). Increased early growth may be linked to disease risk in European populations, as evidenced by a retrospective study by the EURODIAB Study Group that found that T1DM patients had significantly higher height standard deviations (SDS), weight SDS, and body mass index (BMI) SDS than healthy children, with the largest differences occurring between the ages of one and two. Furthermore, several recent investigations have verified that a quick increase in height, weight, and BMI during early childhood appears to be connected to the emergence of islet autoimmunity and the later onset of type 1 diabetes in children (15).

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Bizzarri et al., on the other hand, examined 104 prepubertal children and verified that they were taller when they were diagnosed with type 1 diabetes; however, they did not discover any association between height (or BMI) and the age at which the condition began. The authors propose that the growing insulinopenia during the prediabetic era may have enhanced IGFBP-3 proteolysis, which in turn may have raised IGF-I availability, as a potential mechanism to explain the increased height of children at the outset of T1DM. The authors of the same study indicated that height velocity following a diagnosis of type 1 diabetes was directly connected with pancreatic beta cell residual activity, as measured by C-peptide levels, and that metabolic control, as expressed by HbA1c levels, influenced the growth pattern. Numerous studies have demonstrated that children with type 1 diabetes exhibit decreased height, SDS, and growth.

One well-known and comprehensible cause of stunting is the limited access to food that children in low socioeconomic circumstances experience. Patricia Silva discovered similar results in a study conducted in Ethiopia, which similarly has a high stunting incidence (47%) (18). Author discovered a correlation between stunting and a low socioeconomic status.

Another study conducted in Uganda by Kikakunda

found a correlation between stunting and both the parent's educational attainment and the family's low socioeconomic standing. These findings are comparable to those of this investigation (17-20).

CONCLUSION

The mean growth characteristics of children with type I diabetes mellitus are quite poor, according to the study's findings. Therefore, we advise parents of children with type 1 diabetes to teach their children about healthy eating to improve the growth characteristics.

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Authors Contributions:

Iqra Farooque and Hina Sabbir: Substantial contributions to the conception and design of the work. Design of the work and the acquisition.

Nida Amin: Drafting the work. Final approval of the version to be published.

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