

Association of Type 1 Diabetes Mellitus with Body Mass Index

Type 1 Diabetes Mellitus with Body Mass Index

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ABSTRACT

Objective: In the developing countries particularly Southeast Asian countries like India and Pakistan, majority of the young population is underweight and malnourished. We saw the association of type 1 diabetes mellitus or IDDM with body mass index (BMI) in children and adolescents.

Study Design: Case control study

Place and Duration of Study: This study was conducted at the National Institute of Blood Disease and Bone Marrow Transplantation (NIBD), Hospital Karachi, Pakistan from September 2018 to February 2019.

Materials and Methods: Cases were 1-16-year-olds of either gender with uncontrolled IDDM (HbA1C > 7.5%) on therapy for at least six months. Controls were non-diabetic healthy youngsters with mild symptoms including cough, fever, and illness. The principal researcher informed parents and recruited clinic patients who met selection criteria. Age, gender, weight, height, and BMI were collected during the first visit. Normal BMI is 18.5-24.9 kg/m², high BMI is 25 kg/m², and underweight is 18.5 kg/m². A proforma had all data. The institution ethics board allowed the research. All data was confidential.

Results: Seventy diabetic children (cases) and seventy healthy. There were matched controls for age and gender. Out of all, 13/70(18.5%) controls and 10/70(14.3%) cases had normal BMI, 53/70 (75.7%) controls and 57/70(81.4%) cases were underweight and only 3/70 (4.3%) cases and 4/70(5.7%) controls were overweight. Most of the cases 65(92.8%) had poor glycemic control with mean HbA1C of 10.5±2.5%. No any children were obese in the present study. The correlation coefficient was r=0.32 and Cohen kappa showed poor agreement between high BMI and type1 diabetes with k=0.25.

Conclusion: Most of the children (cases) were underweight and had poor glycemic control despite of taking regular insulin regimen; there was no association of BMI with type 1 diabetes mellitus.

Key Words: Type 1 diabetes mellitus, body mass index, HbA1C, children, adolescents.

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INTRODUCTION

One of the most prevalent long-term diseases of children, type 1 diabetes mellitus (T1DM), is a chronic, multi-organ metabolic condition characterised by absolute insulin insufficiency. It affects around one in every 400 children under the age of 15 years¹.

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The pathophysiology of T1DM involves the destruction of insulin producing beta cells in the pancreas, resulting in the inability to produce insulin and to metabolize glucose. It is well established that obesity is one of the main risk factors for type 2 diabetes mellitus development (T2DM)². However, the evidence for an association link BMI and T1DM is unclear. The purpose of this study was to investigate the association of T1DM with BMI in children and adolescents in the developing countries particularly Southeast Asian countries like India and Pakistan. The study was conducted in a tertiary care hospital in Karachi, Pakistan³. Cases were children and adolescents diagnosed with T1DM and on treatment for at least six months while the controls were age and sex matched non-diabetic children. The BMI was calculated using the World Health Organization (WHO) growth reference⁴. The results of the study showed that most of the cases were underweight and had poor glycemic control despite of taking regular insulin regimen. Furthermore, there was no association of BMI with type 1 diabetes mellitus as the correlation coefficient was r=0.32 and Cohen kappa showed poor agreement between high BMI and type1 diabetes with k=0.25. This

study found that most of the children and adolescents diagnosed with T1DM were underweight and had poor glycemic control despite of taking regular insulin regimen. Furthermore, there was no association of BMI with type 1 diabetes mellitus⁵. These results suggest that nutritional status may not be an important factor in the development of T1DM in children and adolescents. Exploring the connection between this population's dietary condition and T1DM will need further study⁶.

MATERIALS AND METHODS

This study conducted in the pediatrics clinic National Institute of Blood disease and Bone Marrow Transplantation (NIBD), Hospital Karachi, Pakistan, from September 2018 till 28 February 2019. Cases were subjects of 1-16 years of either gender diagnosed with uncontrolled IDDM according to HbA1C > 7.5 % and on treatment for at least six months. Controls were age and gender matched non diabetic healthy children presenting in clinic with minor complaints like cough, fever and flu. All patients fulfilling the selection criteria were enrolled from clinic after taking informed consent from parents by the primary researcher. At initial visit demographic and anthropometric information was recorded, comprising of age at diagnosis, gender, weight, height and BMI. BMI of 18.5-24.9 kg/m²

considered as normal, BMI more than 25kg/m² considered as high BMI and <18.5 kg/m² considered as underweight. All information was entered in a proforma. The study was started after approval of institute ethical board. All information retrieved was kept confidential.

Data Analysis: Data was collected on Performa. Mean standard deviation for continuous variables like age, weight (kg), height (cm), BMI and HbA1C were calculated. Descriptive analysis was done. The data was stratified according to age, gender, weight and duration of diabetes to look for any confounding factor or effect modification on the outcome of interest by applying chi square test. Odds ratio was calculated. P value of 0.05 was taken as significant. Data analysis was done on SPSS version 19.

RESULTS

our Study consists of 70 children diagnosed with type 01-diabetes (cases) 70 healthy gender and age matching controls. The demographic characteristics are presented in table 1. In cases group most of the patients 65(92.8%) had poor glycemic control with mean HbA1C level was 10.9±2.5%, out these only 3(4.6%) were overweight, 54(83%) were underweight and 8(12%) had normal BMI.

Table No.1: Demographic characteristic of cases and controls.

	Cases (n=70)	Controls (n=70)	P value
	Mean± SD or n (%)	Mean± SD or n (%)	
Age (years)	8.3±3.8	8± 3.8	
Males	36(51.4%)	36(51.4%)	0.735
Female	34(48.5%)	34(48.5%)	0.735
Weight	26.32±13.07kg	27.87±13.92kg	0.498
Less than 50 th centile weight	58(82.8 %)	53(75.7 %)	0.297
More than 50 th centile weight	12(17.1%)	17(24.3 %)	0.297
Height	124.07±22.18cm	124.94±22.66cm	0.819
Mean BMI	16.20±3.41kg/m ²	16.72±3.72kg/m ²	0.394
Normal BMI	10(14.3%)	13(18.5%)	0.494
Underweight	57(81.4%)	53(75.7%)	0.41
Overweight	3(4.3%)	4(5.7%)	0.698

Table No.2: Stratification of duration of diabetes with glycemic control of cases.

Duration of diabetes	HbA1C	Case(n=70)	P value	OR (95% CI)
one year	Uncontrolled diabetes (HbA1c>7.5%)	28	0.287	3.2(0.338-30.26)
	Controlled diabetes (HbA1C<7.5)	1	0.461	0.427(0.042-4.354)
Two to three years	Uncontrolled diabetes (HbA1C >7.5%)	26	0.415	0.468(0.073-3.004)
	Controlled diabetes (HbA1C<7.5)	2	0.704	1.478(0.194-11.257)
Three to five years of disease	Uncontrolled diabetes (>7.5%)	9	0.728	0.667(0.067-6.664)
	Controlled diabetes (HbA1C<7.5)	1	0.631	1.778(0.166-19.065)

Males had higher mean HbA1c levels ($10.8 \pm 2.3\%$) than females ($9.87 \pm 1.2\%$). No children were obese in present study. In the early years of the disease (one to three years) there was a high frequency of uncontrolled diabetes as shown in table 2. Treatment duration of cases with mean HbA1C levels is shown in table 3.

The Stratification of cases by BMI and HbA1c levels shown in fig no 1. There is no association of high BMI with type 1 diabetes or IDDM with correlation coefficient ($r=0.32$) as shown in figure no 2. The Cohen kappa also showed poor agreement between high BMI and type 1 diabetes with kappa value of 0.25.

Table No.3: Treatment duration of cases with HbA1C

Treatment duration	Mean HbA1C levels
1 - 2 years	$10.5 \pm 2.4\%$
2 - 3 years	$9.6 \pm 1.5\%$
3 - 4 years	$8.75 \pm 1.3\%$

DISCUSSION

Absolute insulin insufficiency is a hallmark of type 1 diabetes mellitus (T1DM), an autoimmune condition and is one of the most common chronic diseases of childhood, affecting approximately one in every 400 children under the age of 15 years⁷. The pathophysiology of T1DM involves the destruction of insulin-producing beta cells in the pancreas, resulting in the inability to produce insulin and to metabolize glucose. Although the exact etiology of T1DM remains unknown, it is generally accepted that the disease is caused by a combination of genetic and environmental factors⁸. It is well established that obesity is significant risk factors for type 2 diabetic mellitus (T2DM). However, the evidence for an association between body mass index (BMI) and T1DM is less clear⁹. This is due, in part, to the fact that many of the studies on the subject have been limited in their sample size and/or have focused primarily on adults. As a result, there is a need for further research on the potential association between BMI and T1DM in children and adolescents. Our study was to investigate the association of T1DM with BMI in children and teenagers in the developing countries particularly Southeast Asian countries like India and Pakistan¹⁰. The study was conducted in a tertiary care hospital in Karachi, Pakistan. This case-control study was conducted between January and December 2016. Cases were children and adolescents diagnosed with T1DM and on treatment for at least six months while the controls were age and sex matched non-diabetic children¹¹. The BMI was calculated using the World Health Organization (WHO) growth reference. The results of the study showed that most of the cases were underweight and had poor glycemic control despite of taking regular insulin regimen. Furthermore, there was no association of BMI with type 1 diabetes mellitus as the correlation coefficient was

$r=0.32$ and Cohen kappa showed poor agreement between high BMI and type 1 diabetes with $k=0.25$ ¹². This study found that most of the children and adolescents diagnosed with T1DM were underweight and had poor glycemic control despite of taking regular insulin regimen. Furthermore, there was no association of BMI with type 1 diabetes mellitus¹³. According to our research, dietary status may not have a significant role in the onset of type 1 diabetes in children and adolescents. This is in contrast to the findings of previous studies that have examined the association between BMI and T1DM in adults, which have suggested that BMI is a potential risk factor for the development of T1DM (1,2)¹⁴. It is important to note, however, that the BMI of an individual is only one indicator of nutritional status and other factors, such as diet quality, may play a role in the development of T1DM. Additionally, the results of this study are limited by the small sample size and the fact that the study was conducted in a single center^{15,16}. This study found that most of the children and adolescents diagnosed with T1DM were underweight and had poor glycemic control despite of taking regular insulin regimen. Furthermore, there was no association of BMI with type 1 diabetes mellitus. Our study suggests that nutritional status may not be an important factor in the development of T1DM in children and adolescents. Further research is needed to explore the relationship between nutritional status and T1DM in this population¹⁷.

CONCLUSION

Most of the children (cases) were underweight and had poor glycemic control despite of taking regular insulin regimen; there was no association of BMI with type 1 diabetes mellitus.

Author's Contribution:

Concept & Design of Study: Zainab Ghias
 Drafting: Zainab Ghias, Shabnam Dildar, Samar Abbas Jaffri
 Data Analysis: Samar Abbas Jaffri, Nayab Afzal
 Revisiting Critically: Zainab Ghias, Shabnam Dildar
 Final Approval of version: Zainab Ghias

Conflict of Interest: The study has no conflict of interest to declare by any author.

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