Determinants of Type 2 Diabetes Mellitus among Children and Adolescents Attending A Tertiary Specialized Hospital in Bangladesh

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ABSTRACT

Background: Type 2 diabetes in children and adolescents has increased in frequency around the world over the past two decades. The worldwide epidemic of childhood obesity has been accompanied by an increase in the incidence of type 2 diabetes in children and adolescents.

Objective: To observe the determinants of type 2 diabetes mellitus among children and adolescents attending a tertiary specialized hospital in Bangladesh.

Methods: This cross-sectional, descriptive study was done on a total of 151 children and adolescents attending the pediatric diabetic out-patient department (OPD) of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital, Dhaka, Bangladesh. The sampling technique was purposive. All patients who came to the hospital between July to December 2017 were included. Data was collected through a structured questionnaire.

Results: Among 151 respondents, 98 were in age group of 10-14 years (64.9%), female to male ratio of 1.22:1. The majority belonged to a high used to lead socio-economic class. Regarding food habit, 55.6% had history of taking fast food regularly used to lead sedentary lifestyle with lack of exercise. 43.7% children and adolescents were obese 76.8% had high cholesterol and 84.1% had high triglyceride levels. Most of the children had positive family history of type 2 diabetes mellitus (74.8%).

Conclusion: Our study reflects that determinants like obesity, physical inactivity, eating habit, family history are important factors of development of type 2 diabetes mellitus in children and adolescents.

Keywords: Bangladesh, children and adolescents, type 2 diabetes mellitus

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INTRODUCTION

Type 1 diabetes is one of the most common chronic diseases among children and adolescents. Recently, type 2 diabetes has increasingly been reported in children and adolescents[1]. Type 2 diabetes has become increasingly common among children aged 6-11 years and adolescents aged 12-19 years[2-3]. A recent epidemiological review has led to the suggestion that as many as 8–45% of new-onset pediatric diabetes cases in the United States may be type 2[4-6]. Data from the Indian Health Service national outpatient database showed that the prevalence of diabetes in those aged 15-19 years increased by 68% between 1990 and 1998 (3.2 per 1000 to 5.4 per 1000). In all these children type 2 diabetes mellitus was

related to obesity and appeared at the time of puberty[7]. At present it has assumed epidemic proportions in Japan, Canada, and the United States.[8] Data from Libya, Bangladesh and aboriginal children in Australia and Canada indicate that childhood type 2 diabetes is occurring in these populations[9]. The prevalence of IGT in this group is reported to be 17.1% in a study done in Bangladesh;[10] and observed between 10% and 30% in various studies performed in different countries[11]. In a study done in school going children in India, the prevalence of pre-diabetes was 3.7%.[9] The prevalence of IFG (Impaired fasting glucose) was 3.4% & Type 2 diabetes was 1.8% in a study done in different schools in Bangladesh[12]. This study helped us to find out the magnitude of problems of Type 2 diabetes in children & adolescents, among obese adolescent population in our country. Hence, early diagnosis of risk factors, early interventions can be done to reduce mortality and morbidity. Type 2 diabetes happens when the body cannot effectively use the insulin it produces, due to both impairment of insulin secretion& resistance of insulin action. Type 2 diabetes depend on a combination of risk factors such as genes and lifestyle. The modifiable risk factors are eating habits, physical inactivity & weight gain. Although non-modifiable risk factors are family history, age, or ethnicity. The development of type 2 diabetes at an early age is likely to be associated with earlier development of complications[13-14]. Currently, more than 200 children and adolescents develop the disease everyday.[15]

To the best of our knowledge, there is hardly any specific study on clinical characteristics of type 2 diabetes in children and adolescents in our country. Our study aims to determine the baseline characteristics of type 2 diabetes in children and adolescents who were coming for follow-up in pediatric diabetic out-patient department (OPD) of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital, Dhaka, which is a tertiary specialized hospital in Bangladesh.

METHODS

This cross-sectional, descriptive study was conducted among a total of 151 children and adolescents attending the pediatric diabetic out-patient department (OPD) of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital, Dhaka, Bangladesh. A purposive sampling technique was adopted. All patients who came to the hospital between July and December of 2017 were included as study population. Data was collected through a structured questionnaire.

In a resource limited developing country like Bangladesh, C-peptide, antibody, or insulin level are not routinely done to classify the type of diabetes rather classify on clinical basis. Researchers do not fully understand why some children develop type 2 diabetes and others do not, even if they have similar risk factors. Type-2 diabetes occurs when insulin secretion is inadequate to meet the increased demand posed by insulin resistance, leading to relative insulin deficiency[16]and is generally associated with other metabolic abnormalities characteristic of insulin resistance (dyslipidaemia, hypertension, polycystic ovary syndrome, fatty liver etc.).

Informed consent was obtained from the parents to use the data of the children and adolescents and the family members for scientific purposes. Details of socieo-demographic and clinical history were recorded. Blood pressure was measured by auscultation after 5 minutes of rest and hypertension was diagnosed when blood pressure was e"95th percentile for age and sex[17]. Dietary habits were recorded. Healthy food habit contains all the components of food with exact proportions (carbohydrate, fat, proteins, and fibers), while fast food items are easily prepared and available yet are low on their nutritional values and contain extra fat and protein contents. The body mass index (BMI) was calculated as weight in kilogram divided by square of the height in meter. BMI was calculated and classified using the cutoff points (e"85th percentile overweight and e"95th percentile as obese) using the Center for Disease Control and Prevention growth chart[18]. Waist circumference was measured along with height and weight. A cutoff 0.5 was used to differentiate low waist to height ratio (WHtR) from high WHtR[19,20]. Regarding family history of first- and second-degree relatives of type 2 diabetes, had more chance of development of diabetes 74.8%. Investigations such as fasting blood glucose, glycated hemoglobin (HbA1c) and lipid profile were routinely done in all patients at diagnosis. Estimation of blood glucose and lipid profile was done by enzymatic colorimetric method using multichannel auto analyzer. Total cholesterol>200mg, triglyceride >150mg/dl, low-density lipoprotein cholesterol >130mg/dl and high-density lipoprotein <40mg/dl were designated abnormal.[21,22] HbA1c was assessed by Clover A1c using photoelectric method.

Data were processed using the Statistical Package for the Social Sciences (SPSS) (SPSS Inc, Chicago, IL., USA) version 20.0 for Windows. Continuous variables were

expressed as mean±SD and compared between groups by using unpaired student's t-test. Categorical variables were expressed as frequency and percentage and compared using the Chi-square test. The level of significance was at 95% confidence interval and a p-value <0.05 was considered as significant. The study was approved by the Institutional Review Board of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh.

RESULTS

Among 151 respondents, majority of determinants were in age group of 10-14years (64.9%) female predominance (54.9%) with female to male ratio of 1.22:1. Most of them were from urban areas (78.8%) and had a family history of DM (97.35%) (Table-I). The majority of them belonged to high socio-economic class (Fig. 1), history of eating fast food regularly, used to lead sedentary lifestyle with lack of exercise (Table-II, Fig. 2 & 3). Regarding family history of first and second-degree relatives of type 2 diabetes, had developed diabetes (74.8%). 43.7% of children and adolescents were obese,76.8% had high cholesterol and 84.1% had high Triglyceride. According to BMI, among 151 children and adolescents, 54(35.8%) had normal weight, 66(43.7%) were overweight, 31(21.5%) were obese, 73.5% of girls' hip circumference were >80cm and 14.7% of boys' hip circumference >90cm were considered to be in high-risk group. 7(4.6%) patients had hypertension. They were advised to follow up with weight-reducing dietary advice. 102 patients had their HbA1c >9.0%; hypertriglyceridemia was found in 15.9% and hypercholesterolemia in 23.2% patients (Table-III).

Table-I : *Demographic status among children and adolescents with type 2 diabetes (n=151)*

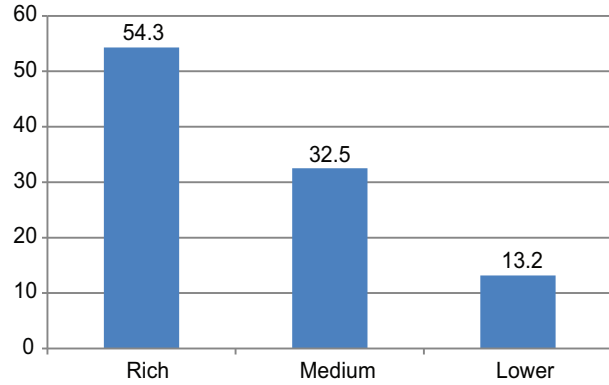| Characteristics	Frequency	Percentage
Age group		
7-9 years	9	5.96
10-14 years	98	64.9
15-19years	44	29.14
Gender		
Male	68	45.1
Female	83	54.9
Living Area		
Urban	119	78.8
Rural	32	21.2
Family history for DM		
Positive	147	97.35
Negative	4	2.65

Figure 1: Socio-economic status of the children's family. (According to social welfare Department of BIRDEM Hospital, Lower income group BD Taka <10000/month, Medium income group BD Taka 20000-40000/month, Rich income group BD Taka >40000taka/month)[23]
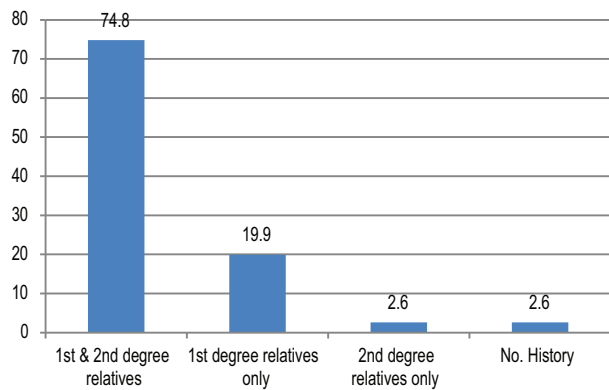

Figure 2: Distribution of family history of DM among participants (parents, siblings-first degree relatives by consanguinity, grandparents-second degree relatives)
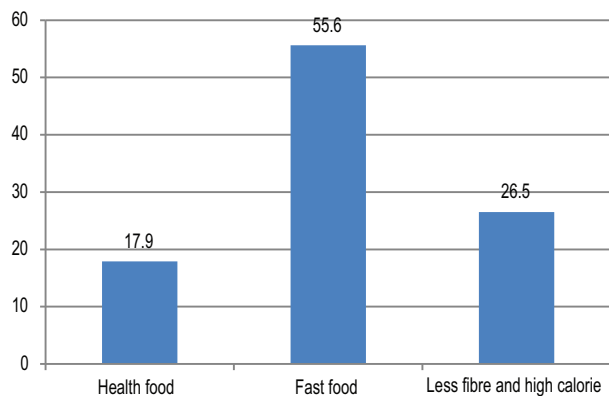

Figure 3: Dietary habits of the participants (n=151)

Table-II : *Association of Food habit and physical exercise and level of HbA1c (n=151)*

Characteristics	HbA1c level						P
	<7.50		7.50 – 9.00		>9.00		value
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Food habit							
Healthy food habit	6	22.2	4	18.2	17	16.7	>0.05[NS]
Unhealthy food habit	21	77.8	18	81.8	85	83.3	
Physical exercise							
Sedentary lifestyle	0	0.0	0	0.0	72	70.6	<0.001[S]
Adequate	27	100.0	22	100.0	30	29.4	

S=significant; NS=not significant.

Table-III : *Clinical characteristics of type 2 diabetes mellitus among participants (n=151)*

Characteristics	Frequency	Percentage
BMI		
Normal weight	54	35.8
Overweight	66	43.7
Obese	31	21.5
Mean hip circumference (cm)	91.75±10.57	
Mean waist circumference (cm)	90.75±8.93	
Blood Pressure		
Mean systolic BP (mm of Hg)	112±11.5	
Mean diastolic BP (mm of Hg)	71.8±7.6	
Glycated hemoglobin (HbA1c)		
>9%	102	67.5
7.5-9%	22	14.6
<7.5%	27	17.9
Lipid profile		
Mean cholesterol (mg/dl)	175.47±49.54	
Mean triglycerides (mg/dl)	107.43±96.11	

DISCUSSION

The present study was undertaken to assess the determinants of type 2 diabetes among 151 children and adolescents attending the pediatric diabetic outpatient department of a tertiary specialized hospital. Most of our participants were from urban areas. Rapid urbanization has become a risk factor for type 2 diabetes. In one study, found that 86% of cases were from urban area, which is similar to some other studies.[23-25]

The American Academy of Diabetes recommends for screening overweight in children aged 10 years or more with a family history of diabetes and or signs of insulin resistance for diabetes[5]. Another study looked at familial history and other factors in weight management strategies to prevent further metabolic diseases.[26] In our study, 6% were diagnosed at 7-9 years of age, which was similar to a recent report[27]. The worldwide epidemic of childhood obesity has been accompanied by an increase in the incidence of type 2 diabetes in youth. Obesity was present in more than half of my patient, which was consistent in a study done in Asian-Indian children.[28] In the present study, the majority of the children and adolescents (54.3%) belonged from higher socio-economic class. This finding was surprising to us; it was previously well accepted that obesity was prevalent among affluent society.[29]

Along with family history, obesity stands out as a prominent risk factor for the development of type 2 diabetes. In our study, 83.3% of the children and adolescents with type2 diabetes had a history of taking fast food or rich food intake. Moreover, 70.6% of children and adolescents with type 2 diabetes had sedentary lifestyle. When compared blood sugar level (HbA1c) with physical inactivity, it was significantly (p<0.001) related to the development of type 2 diabetes. Hyperlipidemia is a well-known co-morbidity in children and adolescents with type 2 diabetes. Isolated hypertriglyceridemia (15.9%) and hypercholesterolemia (23.2%) were found in our patients. Hypercholesterolemia in one third and hypertriglyceridemia in more than half patients were found in a study done in Australian youth with type 2 diabetes.[30]

CONCLUSION

Our data revealed that certain determinants like obesity, physical inactivity, eating habits, family history are important factors of development of type 2 diabetes in children and adolescents. Association of different risk factors with type 2 diabetes were analyzed and physical inactivity was significantly related to development of type 2 diabetes. Family history of first- and second-degree relatives of type 2 diabetes also increases chance to develop diabetes at later age. In this study, triglyceride and cholesterol levels were significantly higher among children and adolescents having type2 diabetes. Fasting blood glucose, 2 hours after breakfast and glycated hemoglobin (HbA1c) need to be routinely done in all children having those factors present in their medical history.

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