

# Newly Diagnosed Type 2 Diabetes in Children and Adolescents in Bangladesh- A Cross Sectional Study

JEBUN NAHAR<sup>1</sup>, BEDOWRA ZABEEN<sup>2</sup>, BULBUL AHMED<sup>3</sup>, TASNIMAAHMED<sup>4</sup>,  
NASREEN ISLAM<sup>4</sup>, KISHWAR AZAD<sup>5</sup>

## Abstract

**Background:** Type 2 diabetes (T2D) has become a serious health problem in children and adolescents as the prevalence of obesity is increasing.

**Objective:** To observe the baseline clinical and laboratory findings and treatment modalities of children and adolescents with newly diagnosed T2D.

**Materials & Methods:** This cross-sectional study was done from Jan- Dec.2017 in Changing Diabetes in Children (CDiC), Paediatric diabetes OPD clinic in BIRDEM among newly diagnosed T2D children and adolescents.

**Results:** Among 68 patients majority were female (64.7%). Mean age was 13.1 ± 2.5 years. Ten patients were below 10 years. Most of the patients were from urban & semi urban area and high to middle socioeconomic status. Family history was present in 91.2% and 22.1 % mother had H/O GDM. Forty two patients (61.8%) had typical and 22 (32.3%) had atypical symptoms. Thirty seven children had acanthosis nigricans (54.4%). Majority were found overweight (53/68), and (12/68) were obese. Mean HbA1c was 10.2 ± 2.8. Life style modification was advised to all. Insulin was started along with metformin in patients with high HbA1c and 33.8% patients were given metformin only. While comparing, BMI was found high in basal and metformin group. Lower fasting blood glucose and HbA1c were observed in patients with metformin only.

**Conclusion:** T2D is emerging in children and adolescents. The screening of children at high risk of T2D is essential for preventive and timely remedial measures.

**Key words:** Type 2 diabetes (T2D)

## Introduction:

Type 2 diabetes (T2D) has become a serious health problem in children and adolescents as the prevalence of obesity has increased in this age group.<sup>1-5</sup> The worldwide epidemic of childhood

obesity has been accompanied by an increase in the incidence of T2D in youth, which now accounts for 8-45% of new pediatric cases in urban diabetes centers.<sup>3-6</sup> The SEARCH for Diabetes in Youth study indicated a significant increase in the incidence of T2D (from 9.0 cases per 100 000 youths per year in 2002-2003 to 12.5 cases per 100 000 youths per year in 2011-2012; annual increase, 7.1%) in the USA.<sup>1</sup> It is of more concern that T2D was seen initially in older children and now prediabetes and diabetes have become encountered in even younger children. Thus, screening for and early detection of T2D are very important. On the other hand, as the number of children with T2D increases, it is necessary to differentiate T2D from other types of diabetes to administer the most appropriate treatment. Risk

1. Associate Professor, Department of Paediatrics, BIRDEM,
2. Consultant and Coordinator, Department of Paediatrics & Changing Diabetes in Children Programme, BIRDEM
3. Senior Medical Officer, Department of Paediatrics, BIRDEM
4. Assistant Professor, Department of Paediatrics, BIRDEM
5. Honorary Senior Consultant, Director, PCP & CDiC, BADAS, BIRDEM

**Corresponding Author:** Dr. Bedowra Zabeen, Consultant Paediatric Endocrinologist & Coordinator, Department of Paediatrics and CDiC Paediatric Diabetes Center, Room 309, 1/A Shegunbagicha, BIRDEM 2, Dhaka - 1000, Bangladesh. email: bzabeen@gmail.com, Cell : +8801819259647

**Received:** 12/04/2121

**Accepted:** 19/11/2121

factors for developing childhood T2D are similar to those for adulthood, and include obesity, family history and ethnicity.<sup>6</sup> In this study, the baseline clinical and laboratory findings and treatment modalities of children and adolescents diagnosed with T2D were evaluated.

**Materials & Methods:**

It was a cross-sectional study done from January 2017 to December 2017 in Changing Diabetes in Children (CDiC), Paediatric diabetes outpatient clinic in BIRDEM 2. The newly diagnosed T2D children and adolescents were included. All patients were evaluated at the time of diagnosis. Diagnostic criteria for diabetes included HbA1C  $\geq 48$  mmol/mol ( $\geq 6.5\%$ ), random glucose  $> 11.1$  mmol/l, 2 hour post challenge glucose  $\geq 11.1$  mmol/l or a fasting glucose  $\geq 7.0$  mmol/l. Classification of diabetes was based on ISPAD and local criteria.<sup>7-9</sup> The body mass index (BMI) was calculated as weight in kilogram divided by square of the height in meter. Estimation of blood glucose was done by enzymatic colorimetric method using multichannel auto analyzer. HbA1c was assessed by Clover A1c using photoelectric method. Informed consent was obtained from the parents to use the data of the children and adolescents and the family members for scientific purposes. Demographic and clinical data were recorded including age, gender, weight, Blood pressure, insulin and oral drugs. Investigations such as fasting blood glucose, glycated hemoglobin (HbA1c) done at diagnosis were taken for analysis. Patients were divided into three groups according to treatment modality. Forty patients were started with basal, bolus insulin & Metformin, only five patients received Metformin only. Clinical and biochemical characteristics were compared between three treatment groups. Data were analyzed with the help of SPSS version 25.0. Descriptive statistics are presented as mean (SD) score for normally distributed data. Continuous data were compared using parametric ANOVA test.

**Results:**

A total of 68 patients were included, majority were female (64.7%). Mean age during diagnosis was  $13.1 \pm 2.5$  years. Ten patients were diagnosed below 10 years of age (Table-I).

**Table-I**  
*Demographic characteristics of children and adolescents (n= 68)*

Characteristics	Frequency (%)
<i>Age group</i>	
<10 years	10 (14.7%)
10-14 years	37 (54.4%)
>14 years	21 (30.9%)
<i>Gender</i>	
Male	24 (35.3%)
Female	44 (64.7%)
<i>Residence</i>	
Urban	46 (67.6%)
Semi Urban	12 (17.6%)
Rural	10 (14.7%)
<i>Socioeconomic status</i>	
Low	17 (25%)
Middle to high	51 (75%)
<i>Family history</i>	
Positive	62 (91.2%)
Negative	5 (7.4%)
Unknown	1 (1.4%)
<i>H/O GDM</i>	
Yes	15 (22.1%)
No	53 (77.9%)

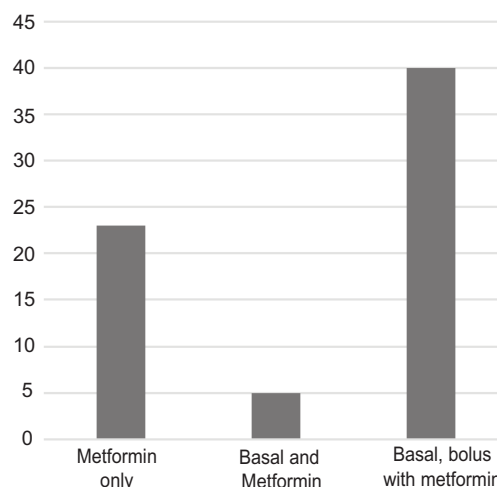
Most of the patients were from urban or semi urban area and were of high to middle socioeconomic status, only 14.7% were from rural area. Family history was present in 91.2% and 22.1% mother had H/O GDM. At diagnosis, 42 patients (61.8%) had typical and 22 (32.3%) had atypical symptoms. Four patients were asymptomatic who were diagnosed incidentally while tested at home because of having obesity and/or strong family history. Thirty-seven of the children had acanthosis nigricans (54.4%). Only three children (4.4%) had normal weight, 53 was overweight, and 12 were obese (Table-II).

**Table-II**  
*Clinical Characteristics of newly diagnosed children and adolescents with Type 2 diabetes ( n=68)*

	Frequency (%)
<b>Symptoms</b>	
Typical symptoms	42 ( 61.8%)
Atypical	22 (32.3%)
Asymptomatic	4 (5.8%)
<b>Acanthosis nigricans</b>	
Present	37(54.4%)
Absent	31(45.6%)
<b>BMI</b>	
Normal weight	3 (4.4%)
Overweight	53 (77.9%)
Obese	12 (17.6%)
<b>Blood Pressure</b>	
Systolic	107.7 ±13,3
Diastolic	70.3 ± 10.5
Mean Fasting blood glucose	13.78 ±5.5
Mean HbA1c	10.2 ± 2.8

Mean HbA1c was 10.2 ± 2.8 at diagnosis. Life style modification was advised to all, providing emphasis on diet and exercise. Insulin was started initially along with metformin in patients with high HbA1c and 33.8% patients were started with metformin only (Fig 1).

While comparing between three groups, BMI was high in basal and metformin group. The patients who were on metformin only were having lower fasting blood glucose and HbA1c compared to other groups (Table III).



**Fig.-1:** *Different treatment regimens in children and adolescents ( n=68)*

**Table III**  
*Clinical characteristics compared between three treatment groups with T2DM (n=68)*

Variables	Metformin only	Basal and metformin	Basal, bolus with metformin	p-value
Age at diagnosis	13.3± 2.9	13.6 ± 2.3	12.7 ± 2.3	0.863
<b>Gender</b>				
Male	9 (37.5%)	2(8.3%)	13(54.2%)	0.846
Female	14(31.8%)	3(6.8%)	27(61.4%)	
BMI	26.1 ± 3.4	29.2 ± 3.1	25.0 ±5.2	0.044
Systolic BP	110.7±10.3	106.6 ±15.2	104 ±12.4	0.05
Diastolic BP	75.0 ± 10.4	78.0 ± 13.2	67.3 ± 9.4	0.21
FBS	11.5 ± 5.6	13.4 ± 5.6	14.7 ± 5.5	0.48
HbA1c	8.8 ± 2.7	12.2 ± 3.0	10.9 ± 2.5	0.03

**Discussion:**

This cross sectional study showed the clinical and biochemical features of children who were newly diagnosed with T2D in BIRDEM hospital. In our previous study, 77 (8%) had a diagnosis of T2D over 4-year period among 939 patients who were newly registered at our center<sup>7</sup> whereas in this one year study we found increased prevalence 68 of T2D. The American Diabetes Association recommends screening overweight and obese children with at least two additional risk factors, starting at age 10 or at the onset of puberty if it begins earlier.<sup>10</sup> In our study population majority were diagnosed at adolescent age. However, in recent years, young children aged < 10 years have been reported as having T2D.<sup>11</sup> In our study population there were 10 (14.7%) patients who were diagnosed before 10 years which was consistent with our previous study done in 2015.<sup>7</sup> Despite the rarity of Type 2 diabetes among prepubertal children, however, in recent years, young children aged < 10 years have been reported as having T2D.<sup>11,12</sup> The findings of this Rapid urbanization have become a risk factor for T2D. In our study, we found that 86% of cases were from urban and semi urban area only 14.7% were from rural area, which is similar to other studies.<sup>9,13</sup> Female preponderance was present in our population as like our previous population. This female preponderance has been described previously.<sup>13,14</sup> A major driver of the development of Type 2 diabetes is overweight or obesity. Family history of T2D clearly plays a role in developing the condition in childhood. In our study population, 22.1% had GDM in the Treatment Options for T2D in Adolescents and Youth (TODAY) cohort, one-third were born after a pregnancy complicated by preexisting diabetes or GDM.<sup>14</sup>

ISPAD guidelines recommend metformin monotherapy if the individual is metabolically stable and without symptoms. Insulin treatment is recommended if the individual is not metabolically stable.<sup>8</sup> In our study, majority of the children were started on insulin treatment at the time of diagnosis and 33% were started on metformin alone. The high rate of medical therapy was similar to the other studies.<sup>13,15,16</sup> Fasting blood glucose and HbA<sub>1C</sub> levels of children who were treated with insulin or a combination of insulin and metformin were significantly higher than those who were not treated with insulin, suggesting that physicians mostly follow International Society for

Pediatric and Adolescent Diabetes (ISPAD) guidelines for the treatment of T2D. There were limitations in our study. The sample size was small and diagnosis was based on clinical criteria as the autoantibody or other investigations were not done.

**Conclusion:**

Type 2 diabetes (T2D) is emerging in children and adolescents in Bangladesh. The screening of children who are at high risk of T2D is essential as our data showed a substantial number of children diagnosed even before 10 years of age. One third of our patients could be managed with oral drugs only which implicates careful management based on metabolic characteristics is essential.

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