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Prevalence of Type 2 Diabetes

in pediatrics and adolescents newly diagnosed with diabetes in Babylon Governorate, Iraq

Prevalencia de diabetes tipo 2 en pediatría y adolescentes con diagnóstico reciente de diabetes en la gobernación de Babilonia, Irak

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Abstract

Type 2 diabetes in children and adolescents is a rising and ongoing problem around the world. It has adverse medical and economic consequences, and it is underestimated in many countries. Highlight characteristics of children presented with type 2 diabetes, and estimate the prevalence of such type of diabetes among newly diagnosed pediatrics. A total of 253 children and adolescents were diagnosed with diabetes. A thorough history and complete physical examination were done on all patients. Patient's samples were sent for assessment of serum C peptide levels and glycated haemoglobin *(*HbA1c*).* 16 out of 253 newly diagnosed patients with diabetes have been found to have type 2 diabetes (proportion was 6.32%) with a mean age of 14.78 ± 2.87. All 16 patients had a positive family history and high body mass index, which significantly differ from type 1 diabetes patients. Also, all showed acanthosis nigricans and higher C-peptide levels than type1 patients (P=0.0001). Most children and adolescents with type 2 diabetes are obese or overweight, and many show features of insulin resistance. Every effort should be done to differentiate type 2 diabetes from the most common type 1 diabetes in young people.

Keywords: Type 2 Diabetes**,** prevalence, pediatric, adolescents.

Resumen

La diabetes tipo 2 en niños y adolescentes es un problema creciente y continuo en todo el mundo. Tiene consecuencias médicas y económicas adversas y se subestima en muchos países. Se resaltan las características de los niños que presentan diabetes tipo 2 y se calcula la prevalencia de este tipo de diabetes entre los niños recién diagnosticados. Un total de 253 niños y adolescentes fueron diagnosticados con diabetes. A todos los pacientes se les realizó una historia clínica minuciosa y un examen físico completo. A los pacientes se les determinaron los niveles séricos de péptido C y de la hemoglobina glicosilada (HbA1c*).*). Se evidenció que 16 de los 253 pacientes con diabetes recién diagnosticados tienen diabetes tipo 2 (la proporción fue del 6,32%) con una edad media de 14,78 ± 2,87. Los 16 pacientes tenían antecedentes familiares positivos y un índice de masa corporal alto, significativamente diferente de los pacientes con diabetes tipo 1. También todos mostraron acantosis nigricans y un nivel de péptido C más alto que los pacientes de tipo 1 (P = 0,0001). La mayoría de los niños y adolescentes con diabetes tipo 2 son obesos o tienen sobrepeso, y muchos muestran características de resistencia a la insulina. Se debe hacer todo lo posible para diferenciar la diabetes tipo 2 de la diabetes tipo 1 más común, en los jóvenes.

Palabras clave: Diabetes Tipo 2, prevalencia, pediátrico, adolescentes.

Introduction

Type 2 diabetes mellitus is emerging as a new clinical problem within pediatric practice. Recent reports indicate an increasing prevalence of type 2 diabetes mellitus in children and adolescents around the world in all ethnicities, even if the prevalence of obesity is not increasing any more. Type 2 diabetes in children and adolescents (below the age of 18 years) is a rising and ongoing problem with adverse medical and economic consequences[1]. Giving the early age of occurrence and the long duration of the disease, more serious complications are anticipated. The chronic complications of diabetes mellitus include accelerated development of cardiovascular diseases, end-stage renal disease, loss of visual acuity, and limb amputations. All of these complications contribute to the excess morbidity and mortality in individuals with diabetes mellitus. Despite the wealth of knowledge and experience in diagnosing and treating type 2 diabetes in adults, less is known about type 2 diabetes in the youth[1,2]. Juvenile type 2 diabetes is a challenging problem for endocrinologists and pediatricians because it is underestimated in many countries around the world, besides, not all oral antidiabetic medications are safe in the pediatric age group, and many patients might be reluctant to follow-up and treatment strategies[1,2]. The exact information about the prevalence of type 2 diabetes in children is lacking**,** possibly because it was relatively recently recognized in comparison to the most prevalent type 1 diabetes in young people[1,2]. Juvenile type 2 diabetes has been reported in the United States with an approximate prevalence of 7% of all newly diagnosed cases of diabetes**.** This prevalence shows a steady increment from 2-4% in the early ninety's to the most recent one. Other countries also reported a surge in the diagnosis of pediatric type 2 diabetes as Australia, New Zealand, Canada, and in the Middle East including Saudi Arabia, United Arab Emirates, Libya, Egypt, Kuwait, and Israel[1,4]. Type 2 diabetes in youth is similar to that in adults, it occurs due to insulin resistance and sometimes due to a combination of insulin resistance and a relative insulin deficiency which explains ketosis states that have been encountered in some cases of juvenile type 2 diabetes. Risk factors are obesity and overweight, sedentary life, puberty, certain ethnic groups such as African American and Asians, family history of type 2 diabetes, exposure to maternal diabetes in utero, and features of insulin resistance including acanthosis nigricans, amenorrhea, and infertility (features of the polycystic ovarian syndrome (PCOS)[2-4]. The American Diabetes Association (ADA) has recommended screening for type 2 diabetes in children before puberty since the insulin sensitivity decreases by 25% in the prepubertal stage. The ADA has even recommended an earlier age for screening for juvenile type 2 diabetes (age <10 years) in those presented with one or more of the mentioned risk factors[5,6]. The importance of early diagnosing pediatric type 2 diabetes is to address the important treatment strategies and to prevent the occurrence of diabetic complications including nephropathy, neuropathy, and retinopathy[7,8]. This study aims to highlight the characteristics of type 2 diabetes in children and adolescents and to estimate its prevalence in the pediatric age group, in Babylon Governorate, Iraq.

Methods

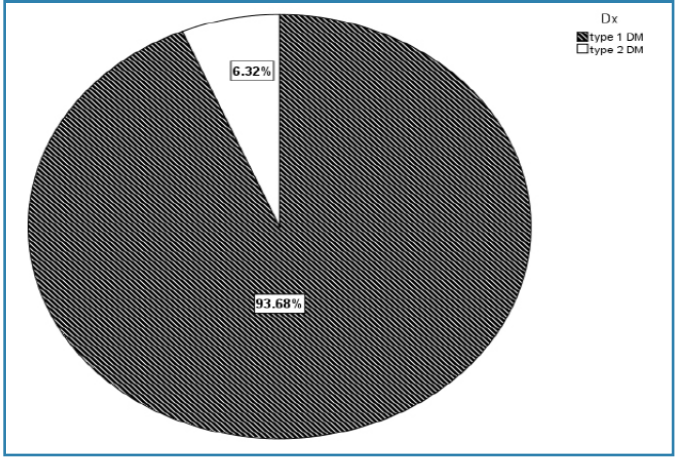
This is a comparative cross-sectional study which was carried at Babylon Diabetes Tertiary Center in Merjan Teaching Hospital, Babylon Governorate, Iraq. The patients were recruited for 18 months, from April 2018 to October 2019. A total of 253 children and adolescents (below the age of 18) were diagnosed with diabetes according to the ADA criteria for diagnosing diabetes: (1) a fasting plasma glucose >7.7 mmol/L, or (2) a random glucose level >11.1 mmol/L plus symptoms, or (3) 2-hour plasma glucose >11.1 mmol/L during an oral glucose tolerance test (OGTT), or (4) a glycated hemoglobin (HbA1c) >6.5% (>48 mmol/L).

A thorough history was obtained from all patients including symptoms of diabetes; polyuria, polydipsia, and weight changes, in addition to a family history of diabetes. A complete physical examination was done on all patients including Body Mass Index (BMI), any signs of dehydration or ketosis, any signs of insulin resistance including high blood pressure, acanthosis nigricans. All patients were assessed for serum C peptide levels using ELISA technique (enzyme-linked immunoassay, with a normal value 0.26-0.62 nmol/L), glycated hemoglobin by fully auto analyzer system with a normal value of 4.5-6.4%. Also, all the patients were evaluated for autoantibodies testing including insulin autoantibodies (IAA) by immunoprecipitation assay (IPA), islet cell cytoplasmic antibodies (ICA) by immunofluorescence test (IFT), and glutamic acid decarboxylase antibodies 65 (GAD65) by ELISA technique. Informed consent was obtained from each patient and the study was issued by the ethics committee at the University of Babylon. The study was approved by the Ethical Committee for Research Work at the College of Medicine, University of Babylon. The statistical analysis was done using SPSS version 23. Data were expressed as mean ± SD. Student T-test was used to study the difference between the two types 1 and 2 groups regarding the continuous variables as age, and HbA1c levels. Chi-square test was used to examine the association of the categorical variables and the development of diabetes and its type. The level of significance was set at 0.05.

Results

This research aims to find the frequency of T2DM among children and adolescents presented first with diabetes. From 253 children who had been newly diagnosed with diabetes during the study period; the majority of them had type 1 DM while only 16 patients presented type 2 DM. This gives a proportion rate of 6.3% (Figure 1).

Figure 1: Prevalence of type 2 DM among diabetic children



The mean age of patients in group 2 (presented with type 2 diabetes) was 14.78 ± 2.87 years, which was significantly different from the 1st group patients (presented with type1 diabetes) with P=0.0001. All of the patients in group 2 had a positive family history of type 2 diabetes, and a high body mass index, both parameters were significantly different from the type 1DM group (P=0.0001). No statistically significant difference between genders in the two groups as presented in Table 1.

Table 1. Comparison between groups 1 and 2 demographic data.

Characteristic	Group 1 (T1DM) n=237	Group 2 (T2DM) n= 16	P-value
Age (years)	10.29 ± 4.44	14.78 ± 2.87	0.0001
Gender, n(%)			
Male	104 (43.9%)	10 (62.5%)	0.147
Female	133 (56.1%)	6 (37.5%)	
Total	237 (100%)	16 (100%)	
Family history			0.0001
Positive	10 (4.2%)	16 (100%)	
Negative	227 (95.8%)	0 (0%)	
	237 (100%)	16 (100%)	
BMI			0.0001
<18.5	87 (36.7%)	0 (0%)	
18.5-24.9	116 (48.9%)	0 (0%)	
25-29.9	32 (13.5%)	0 (0%)	
30+	18 (0.8%)	16 (100%)	
Total	237 (100%)	16 (100%)	

The level in HbA1c at the time of diagnosis and the presence of autoimmune indicators were significantly higher in group 1 patients, while group 2 patients showed a higher acanthosis nigricans and a higher C-peptide level with (P=0.0001). Hypertension and hyperlipidemia were more obvious in group 2 patients (P=0.0001), as shown in Table 2.

Table 2. Comparison between groups 1 and 2 clinical and bio-chemical parameters

Characteristic	Group 1 (T1DM) n=237	Group 2 (T2DM) n= 16	P value
HbA1c mean±SD	10.61± 2.41	9.01± 2.27)	0.005
C-peptide			0.0001
Normal	29 (12.2%)	3 (18.8%)	
Low	207 (87.3%)	0 (0%)	
High	1 (0.4%)	13 (81.3%)	
Total	237 (100%)	16 (100%)	
Acanthosis nigricans			0.0001
Present	2 (0.8%)	16 (100%)	
Absent	235 (99.2%)	0 (0%)	
Total	237 (100%)	16 (100%)	
Autoimmune indicators			0.0001
Negative	14 (5.9%)	16 (100%)	
Positive	223 (94.1%)	0 (0%)	
Total	237 (100%)	16 (100%)	
Other autoimmune diseases			0.613
Negative	221 (93.2%)	14 (87.5%)	
Positive	16 (6.8%)	2 (12.5%)	
Total	237 (100%)	16 (100%)	
Hyperlipidemia			0.0001
Positive	1 (0.4%)	3 (18.8%)	
Negative	236 (99.6%)	13 (81.3%)	
Total	237 (100%)	16 (100%)	
Hypertension			0.0001
Positive	1 (0.4%)	4 (25%)	
Negative	236 (99.6%)	12 (75%)	
Total	237 (100%)	16 (100%)	

The comparison between causes of referral for the children and adolescents in the two groups is shown in table 3, which shows a statistically significant difference in the symptomatology of people in the two groups (P< 0.0001).

Table 3. Comparison between the causes of referral of patients with diabetes

		type 1 DM	type 2 DM	Total	P-value
Causes of referral	High BGL	128 (54.0%)	14(73.7%)	142(55.5%)	0.0001
	Polyuria	71(30.0%)	1(5.3%)	72(28.1%)	
	DKA	22(9.3%)	0(0%)	22(8.6%)	
	Weight loss	11(4.6%)	0(0%)	11(4.3%)	
	Weight gain	0 (0%)	4(21.1%)	4(1.6%)	
	Fungal infection	3(1.3%)	0(0%)	3(1.2%)	
	Short stature	1(0.4%)	0(0%)	1(0.4%)	
	UTI	1(0.4%)	0(0%)	1(0.4%)	
Total		237(100.0%)	19(100.0%)	256(100.0%)	

Discussion

Type 2 diabetes in pediatric and adolescent is a growing issue all over the world with an estimated prevalence of 7% of all newly diagnosed cases of diabetes in the USA[1-3]. It carries a higher risk of complications than type 2 DM in adults due to the longer duration of the disease, reluctance of many families to treat their children, and the fact that not all modalities of treating juvenile type 2 DM are feasible[9-11]. This study is a comparative cross-sectional study that was carried out at Babylon Diabetic Tertiary Center in Babylon Governorate, Iraq. It showed that for 18 months, out of a total of 253 children and adolescents diagnosed with diabetes, 16 patients had type 2 DM, (the prevalence of type 2 DM in young people is 6.3% as shown in figure 1). This prevalence was similar to that documented in the USA (7% of all new cases)[1,2], less than that documented in Egypt (13.3%)[12], in Kuwait (11.5)[13], and much less than that documented in Taiwan (54.2%)[14]. The mean age of patients with type 2 DM was 14.78 ± 2.87 years, and this age is around puberty when there are much insulin resistance and more weight gain. This finding agrees with the findings of most literatures[1-5], and with what was found in Egypt and Kuwait[12,13]. These patients were 6 females and 10 males, and this disagrees with what was mentioned in most literature were is reported that female gender is a risk factor for type 2 diabetes[1-10]. This disagreement might be explained by the small number of our sample. Is was shown that all patients with type 2 DM have a positive family history of diabetes, and they have a higher BMI. These findings go with most of the literature that agrees that > 90% of children with type 2 diabetes have a family history of diabetes, and that >85% of youth with type 2 DM are overweight or obese respectively[15-17]. Most of the patients with type 2 DM had normal to high serum C peptide levels, all of them had acanthosis nigricans, some of them had high blood pressure and hyperlipidemia, and none of them had positive autoimmune antibodies. These findings indicate that insulin resistance is the main cause of juvenile type 2 DM and this is similar to other studies[1-16]. Most young people with type 2 diabetes were referred due to high blood glucose levels (73.7%), and some of them were referred due to other symptoms like weight gain (21.1%). This was significantly different from the causes of referral of patients with type one diabetes who were referred due to high blood glucose (45%), polyuria (30%), ketoacidosis (9.3%), weight loss (4.6%), or due to other causes like genital tract fungal infection, urinary tract infections and short stature (1.3%, 0.4%, and 0.4%, respectively) with a P=0.001. These findings agree with the reported by others who indicate that type 2 diabetes in youth are somewhat different from that in type 1 diabetes as many patients with type 2 diabetes are discovered accidentally during the workup due to other complains, such as weight gain, amenorrhea, or other symptoms, while some of them can present with the classical symptoms of hyperglycemia such as polyuria, polydipsia[10-18].

Conclusion

Juvenile type 2 diabetes is an important rising problem in Babylon Governorate, Iraq, even though its prevalence is less than that documented in the surrounding countries such as Egypt and Kuwait. Every effort should be done to differentiate juvenile type 2 diabetes from the most common type 1 diabetes to prevent any delay in the management. Many characteristics help to discriminate type 2 diabetes in youth from type 1diabetes such as obesity, positive family history, and features of insulin resistance such as acanthosis nigricans.

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