

## **The prevalence of psychological and behavioral changes among children and adolescents with diabetes in Makkah, Saudi Arabia.**

**Eman Alkhairi<sup>1</sup>, Abdulmoein E AlAgha<sup>2</sup>, Arwa Alasmari<sup>1</sup>, Asmaa Khan<sup>1</sup>, Nuha Hijazi<sup>1</sup>, Yara Subahi<sup>1</sup>, Ghofran Sulaimani<sup>1</sup>, Nada Telmesani<sup>1</sup>, Yara Bojan<sup>1</sup>, Israa Alzarmah<sup>3</sup>**

<sup>1</sup>Umm AlQura University, Makkah, Saudi Arabia.

<sup>2</sup>Pediatrics Department, King Abdulaziz University Hospital, Jeddah, Saudi Arabia.

<sup>3</sup>Royal College of Surgeons, Ireland.

### **Abstract**

**Objective:** To assess the prevalence of emotional and behavioral changes, depression symptoms, as well as risk factors that affect the development of depression in children and adolescents with type 1 or 2 diabetes.

**Methods:** A cross-sectional study was conducted with the department of pediatric and endocrinology on children and adolescents with type 1 or 2 diabetes at various ambulatory diabetic centers in Makkah, Saudi Arabia, between July and September 2017. The study had three parts: collection of participant personal data, and completion of two self-report depression inventories, the Center for Epidemiological Studies Depression Scale for Children (CES-DC) and Strengths and Difficulties Questionnaire (SDQ). The personal data questionnaire assessed the socioeconomic status of the family and its effect on the patient's condition. Pearson's regression was also used to test correlation between depression score and other variables.

**Results:** Approximately 67.5% of the 120 patients were at risk of depression based on the CES-DC scale. The SDQ showed that 10% of the patients were borderline and 30% abnormal in the emotional aspect, 14.2% were borderline and 30% abnormal in the conduct aspect, 10% were borderline and 10% abnormal in the hyperactivity aspect, 24.2% were borderline and 10.8% abnormal in the hyperactivity aspect and 8.3% were borderline and 9.2% abnormal in the prosocial aspect.

**Conclusion:** Depressive symptoms have a high prevalence among children and adolescents with diabetes, including other abnormalities in the emotional, conduct, hyperactivity, peer and prosocial aspects. All children and adolescents with diabetes should be screened for depressive symptoms, as well as other social and psychological abnormalities.

**Keywords:** Diabetes, Depression, Psychology, Makkah.

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### **Introduction**

Diabetes mellitus is the most common chronic metabolic disease in children. Over 90% of children and adolescents with diabetes have Type 1 diabetes mellitus (T1DM) and require lifelong treatment with multiple daily insulin injections, frequent glucose monitoring, and nutrition therapy [1,2].

Children and adolescent with T1DM or type 2 diabetes mellitus (T2DM) are at a greater risk for emotional and behavioral problems, including aggression, general anger

and frustration. Anger may result from discontent with lifestyle changes that make the children feel different from their peers [3]. Diabetes has significant emotional implications for children, and several studies have shown an association between diabetes and depressive mood [4,5]. Type 1 diabetes mellitus can cause substantial stress in affected children due to its chronic nature, the required multiple daily injections, blood glucose monitoring, adjusted insulin dosages based on current blood glucose, dietary restrictions and risk of complications [3].

Many studies have examined the psychosocial and

behavioral impact of diabetes on children in various countries, but these studies are somewhat rare in Saudi Arabia. Thus, we aim to assess the prevalence of emotional and behavioral changes, depression symptoms, as well as risk factors that lead to depression in children and adolescents with T1DM or T2DM at various ambulatory diabetic centers in Makkah Region.

## **Methods**

### **Study Design**

This is a cross-sectional study conducted in the Department of Pediatric and Endocrinology on children and adolescents with diabetes at various ambulatory diabetic centers in Makkah Region, Saudi Arabia, between July and September 2017, using the Center for Epidemiological Studies Depression Scale for Children (CES-DC) and Strengths and Difficulties Questionnaire (SDQ).

### **Participants**

The study population was made of 120 patients aged 4 to 17 years. The mean and standard deviation (SD) of ages were 11.64 and 4.47 years, respectively. Of the study population, 45 were males, 75 were female, while 75 were prepubertal and 45 were pubertal. The inclusion criteria were: patient's aged 4 to 17 years diagnosed with Type 1DM or Type 2 DM. The exclusion criteria were: patients outside the age range <4 and >17, presence of other chronic diseases that could cause participants to have psychological problems and depression and patients on antidepressants or antipsychotic drugs.

### **Data Collection**

This study used a convenience sample; data was collected from patients at various ambulatory diabetic centers in Makkah Region.

### **Anthropometric Data**

Height, weight, and body mass index were taken from the patients' medical records, and the SD of height, weight, and body mass index (BMI) were calculated by using growth calculator software at <http://growthcalc.chip.org/>.

### **Questionnaire**

The study had three sections of data collection: participant's personal data, the CES-DC, and the SDQ. The questionnaire started with patient characteristics, including age, gender, height, weight, BMI, puberty, DM type, antidiabetic agent prescribed, diet, how controlled the child's blood glucose level is, and how regularly the child visits endocrinology clinics. The second part of the questionnaire on personal data clarifies parent status, if the child lives with their parents, parent education levels, family income, number of family members, and where and how they live. This assessed the socioeconomic status of the family and its effect on the patient's condition.

## **Definitions**

**The CES-DC scale:** The full version of the CES-DC is a 20-item self-report depression inventory with possible scores ranging from 0 to 60. Each response to an item is scored as follows: 0="Not at All" 1="A Little" 2="Some" 3="A Lot." However, items 4, 8, 12, and 16 are phrased positively, and thus are scored in the opposite order: 3="Not at All" 2="A Little" 1="Some" 0="A Lot."

The CES-DC is a screening tool that assesses a child's risk for depression. Higher CES-DC scores indicate increasing levels of depression. A score of 15 or higher indicates a risk for depression and children suspected to have symptoms of depression need to be further evaluated to confirm the diagnosis of depression or behavioral disorders [6,7].

**SDQ:** The SDQ is a brief emotional and behavioral screening questionnaire used for children and adolescents. It consists of five subscales: emotional symptoms subscale, conduct problems subscale, hyperactivity/inattention subscale, peer relationships problem subscale and prosocial behavior subscale. Each of these subscales has five items. The questionnaire takes between five and ten minutes to complete. A self-report version is used for children ages 11 to 17 years, while children ages 4 to 10 years have a SDQ parent version completed by their parents.

Total difficulties score is calculated by summing the scores of the emotional symptoms, conduct problems, hyperactivity/inattention and peer problems scale. Scales are scored from 0 to 10 and the total difficulties score ranges from 0 to 40. For all scales, except prosocial behavior, higher scores are associated with worsening symptoms. The results for each child are determined to be either 'normal,' 'borderline' or 'abnormal.' The externalizing score ranges from 0 to 20 and is the sum of the conduct and hyperactivity scales. The internalizing score ranges from 0 to 20 and is the sum of the emotional and peer problems scales [8,9].

**Children and adolescent:** The World Health Organization defines adolescents as people aged 10 to 19 years. But according to the national law in Saudi Arabia and hospitals policies adolescent defined as person aged 14 to 18 years and children are those younger than 14 years.

### **Ethical Considerations**

This study was approved by Institutional Review Board in King Abdulaziz Hospital before implementation. All patient information was confidential.

### **Statistical Analysis**

Descriptive statistics were used to describe the demographic characteristics of the study participants. Mean, SDs, are reported for continuous variables. Frequencies with proportions were reported for categorical variables. The Pearson chi-square test was used to compare the percentage of risk of depression for different factors. Spearman's correlation was used to evaluate the correlation between

depression score and other ordinal factors. Statistical significance was set at  $p < 0.05$ . Analysis was performed using IBM SPSS statistics, version 23 (IBM, Armonk, NY, USA).

## Results

This study included 120 patients with diabetes aged 4 to 17 years. Mean age was 11.6 years ( $SD \pm 4.5$ ), mean height was 140.3 cm ( $SD \pm 21.4$ ) and mean weight was 39.1 kg ( $SD \pm 16.1$ ). This study sample comprised of 62.5% female patients. Almost half of the study cases (47.5%) had a BMI ranging from 18.5 to 24.9  $kg/m^2$ , 30% had a BMI of less than 18.5 and the rest had a BMI of 25 or more. Only 37.5% of the patients had reached puberty. A total of 95.8% of the patients are T1DM, while only 4.2% are T2DM.

Of all the patients, 93.3% used insulin injections, 4.2% used an insulin pump, 0.8% used pills and 1.7% used only diet control. 89.2% of the participants took their treatment regularly; the remaining did not regularly take the treatment. About 13.3% had irregular clinic follow-ups, 28.3% sometimes had regular follow-ups, and 58.3% always went regular follow-up. Parent educational level ranged from non-educated to postgraduate studies: 9.2% of mothers and 2.5% of fathers were not educated, while 32.5% of mothers and 9.2% of fathers have postgraduate studies. The remaining parents ranged between primary school levels to university graduate.

All patients had a live parent, with 2.5% of patients having only one live parent. Children lived with both parents in 91.7% of the cases. In 66.7% of cases, they mentioned that the family income is sufficient for the family. Only 37.5% live in owned houses while the remaining live in rented spaces. Analysis of participant response showed a mean depressive symptoms score of 19.9 ( $SD \pm 10.6$ ) (Table 1). The mean and standard deviation for the total difficulties score was  $13.6 \pm 5.3$ . The mean and standard deviation for the externalizing and internalizing scores were  $6.9 \pm 3$ , and  $6.8 \pm 3.3$ , respectively.

Based on the SDQ, approximately 67.5% of the patients were at risk for depression. In the emotional aspect, 10% were borderline and 30% were abnormal. In the conduct aspect, 14.2% were borderline and 30% were abnormal. In the hyperactivity aspect, 10% were borderline and 10% were abnormal. Regarding peer problems, 24.2% were borderline and 10.8% were abnormal. In the prosocial aspect, 8.3% were borderline and 9.2% were abnormal.

The chi square test was used to compare the risk of depression across different factors, as shown in Table 2. The difference in the proportion of patients at risk of depression was nonsignificant in all the studied variables, including sex, nationality, BMI, patient puberty status, type of diabetes (type 1 or 2), type of treatment used (insulin injection, pills, diet or insulin pump), treatment regularity, regularity of the diet, regularity of clinic follow-

**Table 1.** Results of different psychiatric aspects of the study

Variables	Frequency	Percent
<b>Risk for Depression</b>		
No	39	32.5
Yes	81	67.5
<b>Emotional</b>		
Normal	72	60.0
Borderline	12	10.0
Abnormal	36	30.0
<b>Conduct</b>		
Normal	67	55.8
Borderline	17	14.2
Abnormal	36	30.0
<b>Hyperactivity</b>		
Normal	96	80.0
Borderline	12	10.0
Abnormal	12	10.0
<b>Peer Problems</b>		
Normal	78	65.0
Borderline	29	24.2
Abnormal	13	10.8
<b>Prosocial</b>		
Normal	99	82.5
Borderline	10	8.3
Abnormal	11	9.2

up, sufficiency of family income, and home ownership status. In all cases the  $p$ -value was  $> 0.05$ .

Pearson's regression was also used to test correlation between depression score and other factors, such as age, BMI, parent educational level, and number of family members. There was no significant correlation between depression score and any of these variables, as shown in Table 3.

## Discussion

This research study examines the influence of diabetes on mental health and behavior in children and adolescents with diabetes. In the current study, only 95.8% of patients have T1DM and 4.2% have T2DM. Several studies suggested that diabetes was a risk factor for the development of psychological problems in children and adolescents [10-14].

A study reported that 42% of adolescents with T1DM developed a psychiatric disorder; the most commonly found disorders were depression (26%) and anxiety (20%) while the least common were behavior disorders (16%) [11]. Another study performed on adolescents aged 10 to 21 found that 14% of subjects were mildly depressed and 8.6% were moderately or severely depressed [12]. It has also been implied that depressive symptoms affect level of engagement in healthy behaviors, such as physical activity and healthy diet, which reduce risk and improve quality of life [13]. A study performed by Khan [14] in Pakistan found that, of 86 children with diabetes, clinical

**Table 2.** Comparison of risk factors for depression

Variables	Risk for Depression		Total	p-value
	No	Yes		
<b>Gender</b>				
Male	14 (31.0%)	31 (68.9%)	45 (100.0%)	0.80
Female	25 (33.3%)	50 (66.7%)	75 (100.0%)	
<b>BMI (kg/m<sup>2</sup>)</b>				
<18.5	11 (30.6%)	25 (69.4%)	36 (100.0%)	0.95
18.5-24.9	19 (33.3%)	38 (66.7%)	57 (100.0%)	
25–29.9	5 (29.4%)	12 (70.6%)	17 (100.0%)	
30-39.9	0 (0.0%)	1 (100.0%)	1 (100.0%)	
>40	2 (50.0%)	2 (50.0%)	4 (100.0%)	
<b>Type of Diabetes</b>				
Type 1	39 (33.9%)	76 (66.1%)	115 (100.0%)	0.34
Type 2	0 (0.0%)	5 (100.0%)	5 (100.0%)	
<b>Treatment Administered</b>				
Insulin injection	36 (32.1%)	76 (67.9%)	112 (100.0%)	0.83
Pills	0 (0.0%)	1 (100.0%)	1 (100.0%)	
Diet	1 (50.0%)	1 (50.0%)	2 (100.0%)	
Insulin pump	2 (40.0%)	3 (60.0%)	5 (100.0%)	
<b>Treatment Frequency</b>				
Not regular	4 (30.8%)	2 (50.0%)	9 (69.2%)	0.89
Regular	35 (32.7%)	72 (67.3%)	107 (100.0%)	
<b>Diet Frequency</b>				
Not regular	29 (35.4%)	53 (64.6%)	82 (100.0%)	0.32
Regular	10 (26.3%)	28 (73.7%)	38 (100.0%)	
<b>Follow-up Frequency</b>				
Not regular at all	3 (18.8%)	13 (81.3%)	16 (100.0%)	0.21
Sometimes	9 (26.5%)	25 (73.5%)	34 (100%)	
Always regular	27 (38.6%)	43 (61.4%)	70 (100.0%)	
<b>Sufficient Income</b>				
No	9 (22.5%)	31 (77.5%)	40 (100.0%)	0.10
Yes	30 (37.5%)	50 (62.5%)	80 (100.0%)	
<b>Type of Housing</b>				
Rented	22 (29.3%)	53 (70.7%)	75 (100.0%)	0.34
Owned	17 (37.8%)	28 (62.2%)	45 (100.0%)	

BMI: Body Mass Index

**Table 3.** Spearman correlation coefficients between depression score and other factors

Spearman's correlation		Age	BMI	Mother's Education	Father's Education	Number of Family Members
Depression Score	Correlation Coefficient	-0.02	0.02	0.06	-0.07	0.07
	p-value	0.79	0.85	0.55	0.43	0.45
	Frequency	120	118	120	120	117

BMI: Body Mass Index

depression was observed in 29 (33.7%) and concluded that depression is a commonly associated psychological disorder in children and adolescent with diabetes, and should be addressed along with medical and dietary management. Another study performed by Sendela et al. [15] investigated the prevalence of depressive symptoms in school aged children and observed depressive symptoms

in 1 out of 12 children with T1DM in primary school and in 1 out of 5 teenagers with T1DM. In this study, based on the CES-D Scale, 67.5% of the patients are at risk of depression. In a systematic review and meta-analysis by Buchberger et al. [16] on symptoms of depression and anxiety in adolescents with T1DM, 14 studies investigated symptoms of depression and anxiety in children and

adolescents with T1DM. The pooled prevalence of depressive symptoms was 30.04% (95% confidence interval, 16.33-43.74).

In a study performed in Kuwait on emotional and behavioral problems among children with diabetes, using the SDQ, Al-Khurinej [17] found that most of children with diabetes (71.7%) were in the abnormal group for the emotional problems subscale and 62.2% were in the abnormal group for the conduct problems subscale. Most of the children (91.7%) had strong pro-social behaviors and were in the normal group. Zenlea et al. [18] also used the strengths and difficulties questionnaire and found that, compared with normative data for US children, a greater proportion of children with T1DM ages 4 to 7 and 8 to 10 years had borderline/abnormal scores on the emotional symptoms scale, suggesting risk for psychological disorders, such as anxiety and depression. Based on the results of the SDQ in this study, in the emotional aspect 10% of patients are borderline and 30% are abnormal. In the conduct aspect, 14.2% are borderline and 30% are abnormal. In the hyperactivity aspect, 10% were borderline and 10% were abnormal. Regarding the peer problems, 24.2% were borderline while 10.8% were abnormal. In the prosocial aspect, 8.3% were borderline and 9.2% were abnormal.

Other studies have identified several risk factors for depression in children and adolescents with T1DM and T2DM, including sex and age [19,20]. Depression is more common in girls and adolescents in comparison to other patients with diabetes [11]. In addition, the type of diabetes is significantly related to psychological problems. A study reported that children and adolescents with T2DM had worse quality of life than those with T1DM, and that those with obesity appeared to be at higher risk for depression [21]. Another study that examined the association between psychiatric problems and obesity in 13,688 children with T2DM reported that 36% of children and adolescents with obesity have at least one psychiatric issue [22]. Khan [14] found that depression was common in children with T1DM and was associated with adolescent age, longstanding disease, poor socioeconomic status and glycemic control.

Parent awareness about the impact of diabetes on children is also important. A study conducted in the United States by Pendley et al. [23] revealed that increasing awareness of family support overall may not result in improvement of diabetic control, therefore family support was not associated with metabolic control. A review of the literature on family support for adolescents with diabetes indicated that increased family cohesion and family organization was related to better psychosocial outcomes in adolescents [24].

The difference in the percentage of patients at risk of depression was nonsignificant in all the studied variables, which included sex, nationality, BMI, type of diabetes (T1DM or T2DM), type of treatment used (insulin injection, pills, diet or insulin pump), frequency of

treatment, frequency of diet, frequency of follow-up in the clinic, sufficiency of family income and if the patient's family home was owned or rented. In all cases the p-value was  $>0.05$ . Pearson's regression was also used to test correlation between depression score and other factors, such as age, BMI, parent educational level, and number of family members. There was no significant correlation between depression score and any of these factors. However, another investigator found that depression was common in children with T1DM and was associated with adolescent age, longstanding disease, poor socioeconomic status and glycemic control [14].

Moderate associations between depression and poor treatment adherence have been reported in a systematic review and meta-analysis conducted by Kongkaew et al. [25]. Nineteen studies were included in this meta-analysis on depression and adherence to treatment in children and adolescents with diabetes. Similarly, Buchberger et al. [16] found correlations between symptom levels and glycemic control after a systematic review and meta-analysis of fourteen studies. Sendela et al. [15] also found that depressive symptoms are associated with worse quality of life and metabolic control. Depression was also found to affect not only children with poor metabolic control but also those with good HbA1c levels. So, they concluded that screening all children with diabetes, regardless of age and metabolic control, for depression is highly recommended. Another study conducted in 2014 by Streisand et al. [2] stated a limitation in behavioral research among children with access to few existing behavioral or educational programs. The association between glycemic variability, particularly hyperglycemia, and cognitive function was more pronounced in children with earlier onset and longer duration of diabetes, highlighting the vulnerability of the developing brain in this age group [26]. A study conducted at the Children's National Medical Center in Washington revealed that parents also suffer from children's misbehavior associated with diabetes control such as meal and bed times. Parents who have children with T1DM at young age seem to suffer more from typical eating and sleeping misbehaviors like dawdling and refusal in comparison to those without [27].

## **Conclusion**

Depressive symptoms have a high prevalence among children and adolescents with diabetes, along with other abnormalities in the emotional, conduct, hyperactivity, peer and prosocial aspects. Although the analysis of different factors was performed, none of the factors had a significant relationship to the prevalence of depressive symptoms. The relationship between glycemic control and depression is still unclear, although many studies have reported a relationship. All children and adolescents with diabetes should be screened for depressive symptoms as well as other social and psychological abnormalities. More in-depth research is recommended to analyze factors associated with the prevalence of depression in children

and adolescents with diabetes. In addition, more studies should analyze whether emotional symptoms in children continue into adolescence or adulthood. Treating such emotional problems in early childhood could improve the quality of life and reduce morbidity in the future. Therefore, healthcare practitioner involved in diabetes management should include behavioral and mental health screenings as part of children's management plan.

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**Correspondence to:**

Abdulmoein Eid Al-Agha,  
Professor, Pediatric Endocrinology,  
Department of Pediatric Endocrinology & Diabetes  
Section,  
King Abdulaziz University Hospital,  
P.O Box 80215,  
Saudi Arabia.  
Tel: + 966 2 6408353  
Fax: + 966 2 640 3841  
E-mail: aagha@kau.edu.sa