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Original Article

Comparison of mothers of adolescents diagnosed with type 1 diabetes mellitus and mothers of healthy adolescents in terms of difficulty in emotion regulation, depression and anxiety levels and clinical variables

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ABSTRACT

Background. The aim of our study was to evaluate the difficulty in emotion regulation, depression and anxiety levels of mothers with a child diagnosed with type 1 diabetes mellitus (T1DM) compared to mothers of the non-T1DM control group.

Methods. Our study included 72 adolescents followed up with T1DM and 72 healthy adolescents and their mothers. Psychiatric evaluation of children was performed according to DSM-IV diagnostic criteria. All mothers were administered the "Difficulties in Emotion Regulation Scale-Brief Form (DERS-16)" and the "Hospital Anxiety-Depression Scale (HAD)".

Results. The most common psychiatric diagnoses in the T1DM group were attention deficit and hyperactivity disorder and anxiety disorders. The total and subscale scores of the DERS-16 and HAD scales of the mothers in the T1DM group were significantly higher than the control group. There was a statistically significant positive correlation between the DERS-16 total score and the HAD total and subscale scores of the mothers in the T1DM group. In the multivariate model found to be significant ($p<0.001$), only HbA1c levels an indicator of metabolic control, had significant and negative effects on emotion regulation, anxiety and depression ($p<0.05$), while sociodemographic characteristics did not have a significant effect ($p>0.05$)

Conclusions. Difficulty in emotion regulation and depression-anxiety levels were found to be higher in mothers of adolescents with T1DM compared to the control group. Difficulties in emotion regulation, depression and anxiety symptoms in the parent may reduce the treatment compliance of the adolescent with T1DM, which may result in worse metabolic control. Therefore, both adolescents and their parents should be evaluated in terms of psychiatric symptoms and necessary guidance should be given.

Key words: adolescents, depression, difficulty regulating emotion, mothers, type 1 diabetes mellitus.

Diabetes mellitus (DM) is a common metabolic disease in children. It is characterized by insulin deficiency or the effect of insulin causing hyperglycemia. Type 1 DM (T1DM) is insulin dependent and is usually first diagnosed in childhood or adolescence.[1] T1DM can be potentially life-threatening. As a result, emotional distress and psychiatric disorders may develop in both children and their parents. This is one reason why not only children but parents should also be treated, especially mothers.[2] The scientific literature shows that parents play an important role in developing

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self-care and controlling blood sugar in children with diabetes from early diagnosis.[3] A child with T1DM needs care and support that requires constant effort and sacrifice from the family. Therefore, mothers play an important role in managing the health care and treatment regimen of children with T1DM.[4]

The standard parameter used to evaluate glycemic control in patients with DM is glycated hemoglobin (HbA1c). Good glycemic control in patients with type 1DM can prevent complications. In some studies, it has been shown that individuals with poor glycemic control have high levels of intrafamilial conflicts. Hospitalization, intensive medical treatments and the difficulty of treatment management negatively affect family members physically, emotionally and financially. Parents of children and adolescents with T1DM take responsibility for medical care (such as blood glucose monitoring, nutritional management, and insulin production).[5,6] Adolescence is the period when metabolic controls are at their worst in T1DM. In a study, it was shown that HbA1c levels were above the target (>7.5%) in 86% of adolescents with T1DM.[7] This situation develops as a result of many factors such as social influences, increased independence, irregular eating and exercise habits, decreased adherence to treatment, risky behaviors, weight gain and hormonal changes during adolescence. Adolescence-specific changes, as well as chronic disease diagnosis, treatment regimen, and challenging controls cause psychiatric symptoms in both adolescents and family members.[8] A recent meta-analysis showed a 30% prevalence for depression and 32% for anxiety among adolescents with T1DM, based on self-reported symptom severity.[9] Psychiatric problems are also common among the parents of adolescents with this disease.[10,11] Parents experience high levels of anxiety about their child's diagnosis of T1DM and the burden of daily treatment of T1DM. Anxiety is defined as a mental and emotional tension. Mothers of children with T1DM report more anxiety, lower satisfaction and self-confidence in caring for their children than fathers. Mothers feel more responsibilities than fathers in meeting the care and needs of children with chronic diseases.[12] In our study, this situation was effective in our purpose of evaluating mothers with such characteristics.

These psychiatric symptoms that develop in mothers are especially common due to inconsistent eating habits, frequent insulin administration, and the child's inability to recognize hypoglycemia attacks.[13] If adequate psychosocial support is provided to these children, treatment compliance, glycemic control, an increase of quality of life, and a decrease in disease-related complications can be observed.[14]

Difficulty in emotion regulation is defined by not accepting emotional reactions, lack of clarity, difficulty in behaving purposefully, inability to control impulses, lack of awareness, and difficulty in accessing emotion regulation strategies.[15] Difficulty in emotion regulation causes more anxiety and depression symptoms and an increase in internalization problems.[16] In the literature, it is seen that emotion regulation has important relations with anxiety and depression. Difficulty in emotion regulation causes negative emotional states to continue and depressive feelings to continue in individuals. The increase in negative mood and the inability of the person to control their emotions increase the negative affect from the features of major depressive disorder.[17] Living with T1DM can lead to difficulties in the management of emotions as well as psychiatric disorders in both the children who suffer from the disease and their parents. It is assumed that T1DM patients have difficulties in emotion regulation and their emotion regulation skills are weaker than healthy controls.[18] As far as we know, when we examined the literature, no study to date has investigated the difficulty levels of emotion regulation in parents of children with T1DM.

Anxiety and depression in parents of children and adolescents with T1DM often develop

because their child is diagnosed with T1DM. The depression, anxiety and stress experienced by the parents of children and adolescents with T1DM can negatively affect family dynamics and functions. As a result, problems may occur in children's compliance with T1DM treatment. There is no study in the literature investigating the relationship between difficulties in emotion regulation in mothers of adolescents with T1DM and HbA1c in adolescents. The main purpose of our work was therefore to compare the emotion regulation difficulty, depression and anxiety levels between the mothers of adolescents with T1DM and the mothers of healthy controls. Our secondary aim was to determine the relationship between T1DM disease duration and HbA1c levels of adolescents with T1DM and their mothers' emotional regulation difficulties, depression and anxiety symptoms.

Material and Methods

To obtain clinically and statistically significant difference with 5% significance level, 80% power and 0.48 effect size (medium), it was decided to randomly select a total of at least 140 individuals, with equal number of individuals in each group. Thus, our study included 72 adolescents aged 12-17 years who were followed up at the pediatric endocrinology outpatient clinic of Düzce University Hospital with the diagnosis of T1DM for at least one year, and their mothers. Adolescents with clinically normal intelligence and without chronic systemic disease other than T1DM were evaluated. 72 adolescents without T1DM diagnosis and their mothers who applied to the Pediatrics Department for routine check-up were determined as the control group. Siblings of adolescents with T1DM and control group included in the study did not have any chronic systemic disease or psychiatric disorder. All cases in the patient and control groups were evaluated by the child and adolescent psychiatrists who conducted the study. Psychiatric assessment of adolescents was performed using K-SADS-PL (Affective Disorders and Schizophrenia for School-Age Children, Current and Lifetime Version) and according to DSM-IV diagnostic criteria. The depression and anxiety levels of all mothers were evaluated with the "Hospital Anxiety-Depression Scale (HAD)" completed by the mothers, and the difficulty level in emotion regulation was evaluated with the "Difficulties in Emotion Regulation Scale-Brief Form (DERS-16)". T1DM-related variables (duration of disease, type of insulin delivery system [pump or injection]) and the last measured HbA1c level of adolescents with T1DM were recorded. According to the criteria set by the International Society for Pediatric and Adolescent Diabetes (ISPAD), the group with HbA1c values less than 7.5% was evaluated as having good glycemic control, and the group with more than 7.5% was evaluated as having moderate-poor glycemic control. BMI and BMI percentiles for weight and height of all adolescents were within the normal range according to World Health Organization parameters (https://www.who.int/growthref/who2007_bmi_for_age/en/, Accessed September 09, 2018). Adolescents and their mothers were verbally informed about the design of the study. Written informed consent was obtained from both adolescents and their mothers. Ethics committee approval was obtained for the study from the Non-Invasive Health Research Ethics Committee of Düzce University Faculty of Medicine (Decision No: 2022/05, Date: 17.01.2022).

Materials

Schedule for affective disorders and schizophrenia for school aged children, present and lifetime version (K-SADS-PL): K-SADS-PL is a semi-structured diagnostic interview developed to identify psychopathology in children and adolescents aged 6-18 years in accordance with DSM-IV.[19] As a result of the evaluation of the child's or adolescent's and parent's responses, the presence and severity of the symptoms are decided. Turkish validity and reliability were established by Gökler et al.[20]

Difficulties in Emotion Regulation Scale-Brief Form (DERS-16): The DERS-36 scale, developed

by Gratz and Roemer in 2004, consists of questions and 5 sub-dimensions (clarity, nonacceptance, impulse, strategies, and goals). A 16-item short form of the scale was created by Bjureberg et al. in 2016.[21] High scores on this scale indicate greater difficulty in emotion regulation. Turkish validity and reliability studies were performed by Yiğit et al.[22]

Hospital Anxiety Depression Scale (HAD): The scale, developed by Snaith and Zigmond in 1983, consists of 14 items. It was developed to evaluate the level and severity of depression and anxiety in patients.[23] Even number of items in the scale measure depression, odd items measure anxiety symptoms. The scale is a four-likert-type evaluation tool. Items are scored between 0-3. The patients can receive the lowest score of 0 and the highest score of 21 from the depression and anxiety subscales in the scale. The Turkish validity and reliability study of the scale was performed by Aydemir et al. in 1997.[24]

Statistical analysis

Appropriate descriptive statistics were calculated according to the type of variables examined in the study and the type of analysis applied. While quantitative variables were presented as median [Q1: 1st quartile, Q3: 3rd quartile], categorical variables were presented as numbers and percentages. Normality assumption control of quantitative variables was examined using the Shapiro Wilk test. Mann-Whitney U test was used for comparisons between groups. Spearman correlation coefficient was calculated to examine the relationships between the scales. Relationships between categorical variables were examined using the Pearson chi-square test. Although general regression assumptions such as independent observations and linearity of the relationship between dependent and independent variables were provided, the multivariate normality assumption which is one of the important assumptions of multivariate parametric regression analysis could not be provided. Hence, multivariate non-parametric regression (L1 spatial sign) analysis was applied to examine the factors affecting emotional regulation difficulties, depression and anxiety levels of mothers in T1DM group simultaneously. While Mardia's test and pairwise scatter plots were used to control the multivariate normality assumption, scatter plots were generated to check linearity assumption. SPSS 22 and R version 4.1.1 (MNM package) programs were used for statistical evaluations.[25] $p<0.05$ was considered statistically significant.

Results

50% of the 144 adolescents included in the study were T1DM and the other half were the control group. Of the adolescents with a median age of 14 [12-15], 61.1% (n=88) were female and 38.9% (n=56) were male. The groups were homogeneous in terms of gender and age ($p>0.05$). The characteristics of the adolescents according to the groups are given in Table I. In terms of height percentile and BMI percentile value, a significant difference was found between the groups ($p<0.001$ and $p=0.016$, respectively). While the BMI percentile value in the T1DM group was significantly higher than the control group, the opposite finding was obtained for the height percentile value ($p<0.05$ Table I).

54.2% of the adolescents in the T1DM group were treated with injection and 45.8% with a pump. It was determined that 30 (41.7%) of the adolescents with T1DM had a diagnosis of psychiatric disorder. The most common psychiatric disorders were anxiety disorder (15.3%), ADHD (15.3%), adjustment disorder (8.3%) and major depressive disorder (MDD, 5.6%), respectively. No psychiatric disorders were observed in children in the control group. The clinical characteristics of the participants are given in Table II in detail.

DERS-16 and HAD scale scores were obtained from the mothers of the adolescents in each group. In Table III, the descriptive statistics and

Table I. Sociodemographic characteristics of participants according to groups.

		Group									p-value
		T1DM (n=72)			Control (n=72)			Total (n=144)			
		Median	Q1	Q3	Median	Q1	Q3	Median	Q1	Q3	
Age (year)		13	12	15	15	12.5	15.5	14	12	15	0.051
Height persentil		40	15	60	65	50	80	55	30	75	<0.001
Weight persentil		55	30	80	60	35	80	55	32.5	80	0.725
BMI persentil		65	37.5	85	50	25	65	55	34	80	0.016
Gender*	Female	44 (61.1%)			44 (61.1%)			88 (61.1%)			0.999
	Male	28 (38.9%)			28 (38.9%)			56 (38.9%)			

Q1: 1st quartile, Q3: 3rd quartile, *: n (%). T1DM: Type 1 Diabetes Mellitus.

Table II. Distribution of adolescents in the T1DM group according to clinical characteristics.

	n	%
Injection	39	54.2
Insulin infusion pump	33	45.8
Psychiatric Disorders		
Absent	42	58.3
Present	30	41.7
Adjustment disorder	5	6.9
MDD	2	2.8
ADHD	5	6.9
ADHD+Adjustment disorder	1	1.4
ADHD+MDD	1	1.4
ADHD+Anxiety disorders	2	2.8
ADHD+Eating disorders	1	1.4
ADHD+Conduct disorder	1	1.4
Anxiety disorders	9	12.5
OCD	1	1.4
Encopresis	1	1.4
MDD+ Eating disorders	1	1.4
HbA1c level*	8.4 [7-9.4]	
DM Disease Duration (Year)*	3 [2-7]	

*Median [Q1: 1st quartile, Q3: 3rd quartile]. ADHD: attention deficit and hyperactivity disorder, MDD: major depressive disorder, OCD: obsessive compulsive disorder, T1DM: Type 1 Diabetes Mellitus.

comparison results of the total and subscale scores of the scales examined in the study according to the groups are given. There was a significant difference between the groups in terms of total and subscale scores of all the examined scales. Total and subscale scores of DERS-16 and HAD scales were significantly higher than those of the T1DM group compared to the control group ($p<0.05$, Table III).

In Table IV, the relationships between the scores of the mothers of the adolescents in the T1DM group are given from the scales. In the T1DM group, there was a significant positive correlation between the DERS-16 total scale score and HAD total (moderate), anxiety (moderate) and depression (poor) subscale scores. Similarly, a significant positive correlation was found between HAD total scale

Table III. Descriptive statistics and comparison results of the total and subscale scores of the scales according to groups.

	Group						p-value
	T1DM (n=72)			Control (n=72)			
	Median	Q1	Q3	Median	Q1	Q3	
DERS-16 Total	28	23	37	22	20	25	<0.001
Clarity	4	3	4	3	2	4	<0.001
Goals	6	5	8	5	4	6	0.005
Impulse	4.1	3	6	4	3	5	0.011
Strategies	8.5	6	10	6	5	8	<0.001
Nonacceptance	5	4	6	4	3	5	<0.001
HAD Total	14.5	10.5	18	6	3	8	<0.001
HAD Anxiety	8	6	10	4	2	5.5	<0.001
HAD Depression	6	4	9	2	1	4	<0.001

DERS: Difficulties in Emotion Regulation Scale-Brief Form, HAD: Hospital Anxiety Depression Scale, Q1: 1st quartile, Q3: 3rd quartile. T1DM: Type 1 Diabetes Mellitus.

Table IV. Relationships between the scales and subscales examined in the T1DM group.

		DERS-16 Total	HAD Anxiety	HAD Depressio n	HAD Total
HbA1c level	r	-0.19	-0.18	-0.04	-0.12
	p-value	0.117	0.124	0.730	0.330
DM Disease Duration	r	-0.07	-0.10	-0.24	-0.17
	p-value	0.558	0.429	0.046	0.158
HAD Total	r	0.53	0.88	0.79	1
	p-value	<0.001	<0.001	<0.001	-
DERS-16 Total	r	1	0.54	0.35	0.53
	p-value	-	<0.001	0.002	<0.001

DERS: Difficulties in Emotion Regulation Scale-Brief Form, DM: Diabetes Mellitus, HAD: Hospital Anxiety Depression Scale, r: Spearman correlation coefficient.

score and clarity (poor), goals (poor), impulse (poor), strategies (moderate), nonacceptance (moderate) subscale scores of DERS-16, anxiety (very strong), depression (strong). Moreover, there was a significant weak negative correlation between HbA1c level and impulse subscale scores while there was a significant weak negative correlation between DM disease duration and HAD depression scores ($p<0.05$ Table IV). There was no significant correlation between any of the other scales and subscales ($p>0.05$ Table IV).

Table V presents descriptive statistics and comparison results of the total and subscale scores of the scales according to treatment type. There was no significant difference between the treatment type in terms of total and subscale scores of all the examined scales ($p>0.05$ Table V).

The children in the T1DM group were divided into two groups according to their HbA1c levels ≤7.5 (n=23) and >7.5 (n=49). In Table VI, descriptive statistics and comparison results of the total and subscale scores of the scales according to HbA1c group are given. Except for the impulsive subscale score of DERS-16, there was no significant difference between the groups in terms of other scale scores ($p>0.05$). In the group with HbA1c level ≤7.5, the impulse subscale score was significantly higher than those with >7.5 ($p<0.05$ Table VI).

Table V. Descriptive statistics and comparison results of the total and subscale scores of the scales according to treatment type.

	Treatment Type						p-value
	Injection (n=39)			Insulin infusion pump (n=33)			
	Median	Q1	Q3	Median	Q1	Q3	
DERS-16 Total	26	23	39	30	24	36	0.830
Clarity	4	3	4	4	3	4	0.360
Goals	6	4	9	6	5	8	0.681
Impulse	4	3	7	6	4	6	0.093
Strategies	8	6	10	9	6	10	0.860
Nonacceptance	5	4	6	5	4	6	0.679
HAD Total	13	10	20	15	11	17	0.865
HAD Anxiety	8	5	10	8	7	10	0.461
HAD Depression	7	4	10	6	5	8	0.654

Q1: 1st quartile, Q3: 3rd quartile, DERS: Difficulties in Emotion Regulation Scale-Brief Form, HAD: Hospital Anxiety Depression Scale.

Table VI. Descriptive statistics and comparison results of the total and subscale scores of the scales examined in the T1DM group according to HbA1c level.

	HbA1c						p-value
	≤7.5 (n=23)			>7.5 (n=49)			
	Median	Q1	Q3	Median	Q1	Q3	
DERS-16 Total	34	24	39	26	22	34	0.061
Clarity	4	4	5	4	3	4	0.432
Goals	7	6	9	6	5	8	0.145
Impulse	6	4	8	4	3	6	0.008
Strategies	9	6	11	8	6	10	0.414
Nonacceptance	5	4	7	4	3	6	0.053
HAD Total	16	12	20	13	10	17	0.187
HAD Anxiety	9	7	12	7	5	9	0.081
HAD Depression	7	5	9	6	4	8	0.372

Q1: 1st quartile, Q3: 3rd quartile DERS: Difficulties in Emotion Regulation Scale-Brief Form, HAD: Hospital Anxiety Depression Scale.

Table VII. Results of multivariate non-parametric regression analysis showing the effects of sociodemographic and clinical characteristic of children with T1DM on mothers' emotional regulation difficulties, depression and anxiety levels (n=72).

Parameter	DERS-16		*HAD Anxiety*		*HAD Depression*		Parameter
	B	SE	B	SE	B	SE	
(Intercept)	30.242	8.425	10.072	3.501	4.408	3.220	0.001
Age	0.759	0.493	0.135	0.205	0.009	0.188	0.422
HbA1c	-1.238	0.548	-0.476	0.228	-0.013	0.209	0.043
BMI	0.051	0.034	0.028	0.014	0.004	0.013	0.134
Gender*	-2.401	2.013	-1.061	0.836	1.039	0.769	0.112

The model is statistically significant with $\chi 2$= 74.001, df=15, p-value <0.001. *reference: female, B: regression coefficient, BMI: Body Mass Index, DERS: Difficulties in Emotion Regulation Scale-Brief Form, df: degree of freedom, HAD: Hospital Anxiety Depression Scale, SE: standard of error.

The results of the multivariate non-parametric regression model, in which the effects of some sociodemographic (age, gender, BMI) and clinical characteristic (HbA1c) of children with T1DM on the mothers' emotional regulation difficulties, depression and anxiety levels were examined simultaneously, are given in Table VII. In the multivariate model found to be significant ($p<0.001$), only HbA1c level had significant and negative effects on DERS-16, HAD Anxiety, HAD Depression ($p<0.05$), while sociodemographic characteristics did not have a significant effect. Moreover, HbA1c level had the greatest effect on DERS-16 ($p>0.05$ Table VII).

Discussion

In our study, difficulties in emotion regulation and depression-anxiety symptoms in mothers of adolescents with T1DM were evaluated. Secondly, we investigated the relationship between these parameters in children's mothers with HbA1c level, which affects metabolic control in T1DM, and T1DM disease duration. As a result of our study, the rate of psychiatric disorders was found to be high in adolescents with T1DM. These adolescents were found to be most frequently diagnosed with ADHD and anxiety disorders. It was determined that difficulties in emotion regulation, depression and anxiety levels were higher in mothers of adolescents with T1DM compared to the control group. There was a positive correlation between difficulty in emotion regulation and depression and anxiety levels in the T1DM group. There was no statistically significant relationship between the HbA1c level and DM disease duration of adolescents in the T1DM group and the difficulties in emotion regulation, depression-anxiety level of their mothers. No significant correlation was found between depression, anxiety and emotional dysregulation symptoms of mothers and good-moderate-poor glycemic control of T1DM children and adolescents. There was no significant relationship between the depression, anxiety and emotional dysregulation symptoms of mothers and the injection and pump methods used in the treatment of T1DM children and adolescents with T1DM. In the literature, there are studies evaluating depression and anxiety symptoms in mothers of children with T1DM, but no study evaluating difficulties in emotion regulation has been found. Our study evaluated the difficulties in emotion regulation, depression and anxiety symptoms in mothers of adolescents with T1DM. In the results of the multivariate non-parametric regression model, only HbA1c level was found to have significant negative effects on DERS-16, HAD Anxiety, HAD Depression, also HbA1c level had the greatest effect on DERS-16.

Compared to the general population, the incidence of psychiatric disorders is 2-3 times higher in children and adolescents with T1DM.[26] Fear, anxiety, anger, panic attacks and unhappiness are common in many adolescents after T1DM diagnosis.[27] Studies have reported that the most common psychiatric disorders in adolescents with DM are anxiety disorders, depression, ADHD, and eating disorders.[9,26,28] In a study, it was shown that the current and lifetime prevalence of psychiatric disorders in children with T1DM was 27% and 32%, respectively. In this study, it was shown that anxiety disorders, mood disorders and behavioral disorders are more common.[29] It has been reported that the most common psychiatric isorders in adolescent diabetics are anxiety, depression and eating disorders.[27] Similarly, in our study, the rate of psychiatric disorders in adolescents with T1DM was found to be higher than in the control group. Adolescents in the T1DM group were most frequently diagnosed with anxiety disorders, ADHD, adjustment disorder, depression and eating disorder. Additionally, it was determined that adjustment disorder and MDD, respectively were also prevalent.

Studies evaluating depression and anxiety symptoms in mothers of children with T1DM have reported different results. Many studies have shown that parents of children with T1DM

have higher depression and anxiety symptoms than parents of healthy children.[30-32] Another study investigating the anxiety levels of parents of children with T1DM showed that parents are vulnerable to high anxiety symptoms.[33] These studies included both parents of all participants. Another study reported that mothers of children with T1DM had high levels of anxiety symptoms.[34] In another study, no difference was found in terms of anxiety level in others of children with T1DM compared to the control group.[35] As a result of our study, we found that mothers of adolescents with T1DM had higher levels of depression and anxiety symptoms compared to the control group. We showed that there is a significant positive correlation between anxiety level and depression level. Our results support the literature in this respect. The presence of depression and anxiety symptoms in parents have a positive and significant effect on the depression and anxiety symptoms of their children with T1DM.

Parents of children with T1DM have many responsibilities, such as regular monitoring of blood sugar levels, administration of insulin therapy, physical activity, and appropriate diet regulation to prevent episodes of hypoglycemia and hyperglycemia. However, psychiatric problems that develop in parents can prevent parents from completing such responsibilities.[12] It has been shown that maternal anxiety and depression symptoms are associated with many negative outcomes in adolescents, including worsening glycemic control, lower quality of life, and depressive symptoms.[31,36] Therefore, mothers of adolescents with T1DM need coping strategies for diabetes-related depression and anxiety symptoms.

Difficulties in emotion regulation have been shown to be associated with psychiatric disorders. In particular, they increase the symptoms of depression and anxiety in individuals.[37,38] In our study, it was found that mothers in the T1DM group had more difficulties in emotion regulation. At the same time, it was determined that mothers who had difficulty in emotion regulation had higher depression and anxiety levels. Our results support the literature in this respect. However, no study has so far investigated the symptoms of difficulties in emotion regulation in parents of children with T1DM. Therefore, our study is valuable in terms of literature.

In a study, it was reported that mothers of children with T1DM had high levels of anxiety symptoms, but no relationship was found between the level of anxiety and the child's metabolic control.[34] In our study, no significant relationship was found between the HbA1c value, which is an indicator of metabolic control in adolescents with T1DM, and their mothers' depression-anxiety level and symptoms of difficulty in emotion regulation. There is a need for more comprehensive studies evaluating this situation.

The level of psychosocial support offered to parents of children and adolescents with T1DM is critical for their long-term coping skills. With adequate psychosocial support available, knowledge and trust can be built. This results in greater adherence to treatment, better glycemic control, better perception of overall quality of life, and reduced complications.

Evaluation of psychosocial support is important in the treatment of T1DM. Comprehensive treatment should include psychiatric problems in both the child and their parents to ensure well-being and prevent the development of complications. To create comprehensive programs that have an impact on individuals, the treatment team must include both child and adult mental health professionals. Today, diabetic patients lack supportive mental health services. Psychosocial support is necessary to create a normal life and a healthy environment at home, to have ideal physical development as well as emotional and cognitive maturity.

The limitations of our study are that the sample size is small, hyperglycemia, hypoglycemia and ketoacidosis attacks in adolescents with T1DM were not questioned, the sociodemographic

characteristics of the mothers were not evaluated, and the psychiatric histories of the mothers and adolescents before the diagnosis of T1DM were not known.

In conclusion, we showed that children and adolescents with T1DM have more psychiatric disorders than the healthy control group. In addition, we found that the mothers of children with T1DM had higher symptoms of depression, anxiety, and difficulty in emotion regulation. Depression and anxiety symptoms in the parent may decrease the treatment compliance of the adolescent with T1DM, which may result in worse metabolic control. Even if adolescents do not show signs of depression, parents should be evaluated for signs of depression and necessary guidance should be given. Large-scale longitudinal studies are needed to investigate difficulties in emotion regulation, depression and anxiety symptoms in parents of T1DM patients, and to clarify this causal relationship with the characteristics of the disease in their children. Considering the cross-sectional characteristics of our study, it is not possible to evaluate causality, so data analysis should be considered with care. Further large-scale studies are needed to establish causality.

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Ethical approval

Ethics committee approval was obtained for the study from the Non-Invasive Health Research Ethics Committee of Düzce University Faculty of Medicine (Decision No: 2022/05, Date: 17.01.2022).

Author contribution

The authors confirm contribution to the paper as follows: study conception and design: BÖ, DYM; data collection: ŞÖK, FY, BÖ, DYM; analysis and interpretation of results: ŞC, BÖ, ŞÖK; draft manuscript preparation: BÖ, ŞC. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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