ORIGINAL ARTICLE

Diabetes-specific eating disorder and social exclusion in adolescents with type 1 diabetes

Harun Özbey[1,2] · Meral Bayat[2] · İrem Kalkan[3] · Nihal Hatipoğlu[4]

Abstract

Background   Adolescents with type 1 diabetes are at risk of developing eating disorders and social exclusion, and these disorders are associated with serious diabetes-related medical and social complications.

Objective   The present study, which had a descriptive and correlational design, was conducted to determine the relationship between diabetes-specific eating disorders and social exclusion in adolescents with Type 1 Diabetes (T1DM) who were treated at a university hospital in Türkiye between November 2021 and April 2022.

Method   The sampling of the study consisted of 124 adolescents who had T1DM between the ages of 14 and 18 who were followed up in the pediatric endocrinology clinic of a university hospital. The data of the study were collected with the Descriptive Characteristics Form, the Diabetes-Specific Eating Disorder Scale (DEPS-R), and the Adolescent Social Exclusion Scale (OES-A). The study was conducted with the permission of the institution and ethics committee, and written consent was obtained from the adolescents and parents. The descriptive statistics, Mann–Whitney U-Test, Kruskal–Wallis Analysis of Variance, and Simple Linear Regression Analysis were used in the evaluation of the data.

Results   The mean scores of the DEPS-R and OES-A scales of the adolescents who had T1DM were 43.29 ± 17.15 and 34.51 ± 8.41, respectively. A relationship was detected between the OES-A mean scores of the adolescents and the DEPS-R mean scores, and the OES-A mean score explained 74.7% of the DEPS-R mean score ($R^2 = 0.747$) ($p \leq 0.001$).

Conclusion   It was determined in the present study that adolescents with T1DM had high levels of social exclusion and eating disorders. It was also found that as the level of social exclusion of adolescents with T1DM increased, the level of eating disorders increased.

Keywords   Type 1 Diabetes · Social exclusion · Eating disorder · Adolescent

Introduction

Type 1 Diabetes Mellitus (T1DM), which is one of the most common endocrinological and metabolic disorders in childhood, makes up approximately 10% of the diabetes cases in the entire world [1]. It was reported in the 10th Diabetes Atlas (2021) of the International Diabetes Association (IDF) that the population of children aged 19 and under was 2.61 billion in the world, approximately 1.2 million of these children had T1DM, and there were approximately 150 thousand new children diagnosed with T1DM in the world every year. It was also stated in the same report that there were approximately 26 thousand children aged 19 and under with T1DM in Turkey [2].

T1DM causes compulsory medical practices (i.e. blood glucose measurement, insulin injection, etc.), lifestyle changes (diet, exercise, etc.), and social life (family, friend

✉   Harun Özbey
     ozbeyharun@outlook.com

     Meral Bayat
     bayatmeral@gmail.com

     İrem Kalkan
     btsirem7@gmail.com

     Nihal Hatipoğlu
     nhatipoglu@erciyes.edu.tr

1   Department of Pediatric Nursing, Faculty of Health Sciences, Erciyes University, Kayseri, Türkiye

2   Department of Pediatric Nursing, Faculty of Health Science, Erciyes University, Kayseri, Türkiye

3   Faculty of Health Science, Erciyes University, Kayseri, Türkiye

4   Department of Pediatrics, Faculty of Medicine, Erciyes University, Kayseri, Türkiye

relations, etc.) in the daily life of adolescents [3], which cause both adolescents and their parents to face more problems and have adjustment problems. The reasons why the adolescents cannot adapt to these changes in life at the desired level can be listed as being dependent on parents because of T1DM, feeling different from their friends or peer groups, and the chronic illness negatively affecting the adolescents' perception of being normal [4].

Feeling different from friends or peers and the deterioration of the perception of being normal might cause adolescents to feel excluded from peers. Social exclusion, which can be defined as being excluded and ignored by others, is a common issue for many individuals. The exclusion or rejection of the individual from the group/society threatens the sense of belonging and may cause the individual faces painful experiences [5]. These experiences might manifest as anxiety, depression, eating disorders, and behavior problems in adolescents.

Adolescents who have T1DM have to regulate their eating habits and lifestyles to keep blood sugar under control throughout their lives. Because of the nature of the disease, factors such as diet lists to be followed, prohibited foods, and chronic disease cause anxiety in patients, leading to focus on food and weight control. Along with these, the exclusion of the adolescent by friends or peer groups also brings anxiety and causes the adolescent to not manage nutrition therapy appropriately. For all these reasons, adolescents who had T1DM experience deterioration in eating attitudes and behaviors. It was reported in previous studies that eating disorders are associated with diabetic ketoacidosis, acute or chronic complications of diabetes, electrolyte imbalances, cardiac/musculoskeletal complications, and increased mortality in adolescents who have T1DM [6]. The present study was planned to determine the relationship between diabetes-specific eating disorders and social exclusion in adolescents with T1DM.

Materials and methods

This study was planned as a descriptive and relational study to determine the relationship between diabetes-specific eating disorders and social exclusion in adolescents with type 1 diabetes who were treated at a university hospital in Türkiye between November 2021 and April 2022. The sampling of the study consisted of 124 adolescents who had T1DM between the ages of 14 and 18 who were followed up in the pediatric endocrinology clinic of a university hospital. The results of the post-power analysis performed in G-Power were; $\beta = 0.95$. ($n = 124$, $\alpha = 0.05$, $d = 0.33$). Ethics Committee (Decision No: 2021/697) and institutional permission were obtained for the study. Before the study started, the purpose of the study was explained to the adolescents and written and verbal consent was obtained from their parents and themselves.

The data of the study were collected with Adolescent Information Form, Diabetes-Specific Eating Disorder Scale (DEPS-R) and Ostracism Experience Scale for Adolescents (OES-A). Data collection process was carried out in the pediatric endocrinology outpatient clinic of the hospital. A questionnaire form was applied to the adolescents who came to the control via a tablet computer. The application period of the questionnaire took an average of 15 minutes.

Adolescent information form There are 14 questions about the introductory characteristics (age, gender, grade, number of siblings, income status, diagnosis time, type of insulin used, person administering insulin, using insulin regularly, nutrition model, number of blood glucose measurements, compliance with the exercise program, compliance with the nutrition plan, BMI-for-age) and diseases of adolescents with T1DM in this form.

Diabetes-specific eating disorder scale (DEPS-R) The scale was developed by Markowitz et al. [7] to evaluate diabetes-specific eating disorders and was adapted into Turkish by Atik Altınok et al. [8]. It is a 6-point Likert-type scale (0: Never, 5: Always) consisting of 16 items. The highest score that can be obtained from the scale is 80, and the lowest score is 0. High scores indicate a high level of diabetes specific eating disorder. The total Cronbach's Alpha was determined as $= 0.86$ in the scale adaptation study [8]. In the present study, the total Cronbach's alpha was found to be 0.93.

Ostracism experience scale for adolescents (OES-A) The Turkish validity and reliability of the scale, which was developed by Gilman et al. [9], was conducted by Akın et al. [10]. It is a 5-point Likert-type scale (1: Never, 5: Always) consisting of 11 items and two subscales (negligence and exclusion). There is no reverse-coded item on the scale. The highest score that can be obtained from the scale is 55, and the lowest score is 11. High scores indicate a high level of perception of social exclusion. The total Cronbach's Alpha was determined as 0.87 in the scale adaptation study for the Disregarding subscale of the scale [10]. In the present study, the total Cronbach's alpha was found to be $= 0.86$.

The data were evaluated by using the SPSS 22.0 (IBM Corp., Armonk, NY, USA) package program. Descriptive statistical methods are given as numbers (n), percent (%), mean ($\bar{x}$), standard deviation (SD), and min–max. The conformity of the data to the normal distribution was evaluated with the Shapiro–Wilk Test and it was determined that the data did not show normal distribution. The Mann–Whitney U Test was used to compare the pairwise independent groups that did not conform to the normal distribution, the

Kruskal–Wallis Analysis of Variance was used to compare three or more independent groups, and the relationship between scale scores was evaluated with Simple Linear Regression Analysis.

Results

It was found that the mean age of the adolescents who participated in the study was 15.60 ± 1.04, the mean BMI for age was -0.59 ± 1.13 in girls and 0.95 ± 1.65 in boys; 50.8% ($n = 63$) of the adolescents were female, 58.9% ($n = 73$) were in the 14–15 age group, 76.6% ($n = 95$) were studying at the 9-10th grades, 46.8% ($n = 58$) had two siblings, 72.6% ($n = 90$) perceived their income level as moderate, 43.5% ($n = 54$) were diagnosed between 1–3 years, 94.4% ($n = 117$) used an insulin pen, 88.7% ($n = 110$) self-administered the insulin, 93.5% ($n = 116$) used insulin regularly, 82.3% ($n = 102$) followed a fixed-meal (morning, noon, and evening) diet, 93.5% ($n = 116$) measured blood sugar three times a day or more, 64.5% ($n = 80$) did not follow an exercise program, 50.0% ($n = 62$) did not follow nutrition program, and 58.9% ($n = 73$) had a normal BMI for age (Table 1).

In the present study, the mean scores of the adolescents on the DEPS-R and OES-A scales were found to be 43.29 ± 17.15 and 34.51 ± 8.41, respectively (Table 2). A statistically significant positive correlation was found between the DEPS-R and OES-A scores of the adolescents with T1DM ($r = 0.865$; $p \leq 0.001$) (Table 3).

The mean DEPS-R scores were found to be higher in those who were male ($p \leq 0.001$), those who were educated in the 9-10th grades ($p = 0.001$), used an insulin pump ($p = 0.011$), administered insulin by their parents ($p = 0.046$), did not use insulin regularly ($p \leq 0.001$), applied carbohydrate counting as a nutrition model ($p \leq 0.001$), who did not measure blood sugar levels at all ($p = 0.037$), and who were obese according to the BMI classification for age ($p \leq 0.001$). It was also determined that the mean DEPS-R scores were not affected by the variables of the number of siblings, perceived income, duration of diagnosis, compliance with the exercise program, and compliance with the nutrition plan ($p > 0.05$) (Table 4).

It was determined that the mean OES-A scores were higher in adolescents who were male ($p \leq 0.001$), students who were educated in the 9-10th grades ($p = 0.001$), used an insulin pump ($p \leq 0.001$), administered insulin by their parents ($p = 0.002$), used carbohydrate counting as a nutrition model ($p \leq 0.001$), did not measure blood sugar levels at all ($p = 0.001$), and obese according to BMI classification for age ($p = 0.003$). It was also found that the mean OES-A scores were not affected by the variables of the number of siblings, perceived income levels, duration of diagnosis,

Table 1 Characteristics of adolescents with Type 1 Diabetes ($n = 124$)

Characteristics	Mean ± SD	
Age	15.60 ± 1.04	
Characteristics	n	%
Gender		
Female	63	50.8
Male	61	49.2
Age		
14–15 years	73	58.9
16–17 years	51	41.1
Grade		
9–10. grade	95	76.6
11–12. grade	29	23.4
Number of siblings		
One	17	13.7
Two	58	46.8
Three or more	49	39.5
Income Status		
Low	17	13.7
Middle	90	72.6
High	17	13.7
Diagnosis Time		
1–3 years	54	43.5
4–6 years	48	38.7
7 years and above	22	17.7
Type of Insulin Used		
Pen	117	94.4
Insulin pump	7	5.6
Person Administering Insulin		
Himself (adolescent)	110	88.7
Mom dad	14	11.3
Using Insulin Regularly		
Yes	116	93.5
No	8	6.5
Nutrition Model		
Carbohydrate count	22	17.7
Fixed meal (morning, noon, evening)	102	82.3
Number of Blood Glucose Measurements		
None	8	6.5
Three times or more	116	93.5
Compliance with the Exercise Program		
Yes	31	25.0
No	80	64.5
Partially	13	10.5
Compliance with the Nutrition Plan		
Yes	19	15.3
No	62	50.0
Partially	43	34.7
BMI-for-age*		
Malnutrition	19	15.3
Normal	73	58.9
Obese	32	25.8

*WHO growth reference data for 5–19 years

Table 2 DEPS-R and OES-A Mean Scores of Adolescents with Type 1 Diabetes (n = 124)

Scales	Med (Min–Max)	Mean ± SD
DEPS-R	46.50 (5–67)	43.29 ± 17.15
OES-A	36.00 (15–50)	34.51 ± 8.41

DEPS-R Diabetes-Specific Eating Disorder Scale, *OES-A* Ostracism Experience Scale for Adolescents

regular use of insulin, compliance with the exercise program, and compliance with the nutrition plan ($p > 0.05$) (Table 4).

Discussion

Intense emotional changes in adolescents with T1DM because of the nature of the period, the complex management of the disease, and the sense of being accepted or not different by their peers may predispose adolescents who have T1DM to some risky health behaviors. Negative emotional states such as stress and anxiety may appear in adolescents with T1DM who are socially excluded by their peers, which might then lead to eating disorders in adolescents with T1DM [11]. It was found in the present study that adolescents with T1DM had high levels of social exclusion and eating disorders (Table 2). Similar to the findings of the present studies, social exclusion in adolescents with T1DM [12–15] and eating disorders [16–21] were reported in previous studies.

It was determined that as the level of social exclusion increased in adolescents who had T1DM who participated in the study, eating disorders also increased ($p \leq 0.001$) (Table 3). No study was detected in the literature examining the relationship between social exclusion and eating disorders in adolescents with T1DM. In some studies, it was reported that eating disorders and social exclusion were detected in adolescents with T1DM who had high stress and depressive states [22, 23]. It can be argued that adolescents experience negative emotions such as stress, anxiety, and depression more intensely because of the characteristics of the period, and the addition of a disease with complex management such as Type 1 Diabetes increases the risk of social exclusion and eating disorders in adolescents with T1DM.

It was found that eating disorders and social exclusion were higher in males with T1DM who participated in the study

Table 3 Correlation (pearson correlation) between the mean scores of DEPS-R and OES-A of adolescents with Type 1 Diabetes (n = 124)

	DEPS-R	OES-A
DEPS-R	1.000	
OES-A	0.865*	1.000

*$p \leq 0.001$

Table 4 Distribution of DEPS-R and OES-A scale mean scores according to descriptive characteristics of adolescents with Type 1 Diabetes (n = 124)

Characteristics	DEPS-R Mean Rank	OES-A Mean Rank
Gender		
Female	48.44	48.29
Male	77.02	77.18
	p ≤ 0.001	**p ≤ 0.001**
Age		
14−15 years	66.42	61.62
16−17 years	56.88	63.76
	p = 0.143	p = 0.742
Grade		
9−10. grade	68.24	68.52
11−12. grade	43.69	42.79
	p = 0.001	**p = 0.001**
Income Status		
Low	51.94	78.82
Middle	63.31	58.20
High	68.76	68.94
	p = 0.357	p = 0.067
Diagnosis Time		
1−3 years	59.83	64.13
4−6 years	62.48	55.16
7 years and above	69.09	74.52
	p = 0.591	p = 0.099
Type of Insulin Used		
Pen	60.50	59.30
Insulin pump	96.00	116.0
	p = 0.011	**p ≤ 0.001**
Person Administering Insulin		
Himself (adolescent)	60.32	58.98
Mom dad	79.64	90.18
	p = 0.046	**p = 0.002**
Using Insulin Regularly		
Yes	58.97	61.74
No	113.68	73.50
	p ≤ 0.001	p = 0.368
Nutrition Model		
Carbohydrate count	70.50	92.86
Fixed meal (morning, noon, evening)	53.77	55.95
	p ≤ 0.001	**p ≤ 0.001**
Number of Blood Glucose Measurements		
None	88.00	103.00
Three times or more	60.74	59.71
	p = 0.037	**p = 0.001**
Compliance with the Exercise Program		
Yes	69.32	78.37
No	58.94	53.76
Partially	68.15	78.42
	p = 0.323	p = 0.312

Table 4 (continued)

Characteristics	DEPS-R Mean Rank	OES-A Mean Rank
Compliance with the Nutrition Plan		
Yes	49.68	64.45
No	65.24	57.61
Partially	64.21	68.69
	$p = 0.233$	$p = 0.286$
BMI-for-age*		
Malnutrition	31.32[a]	42.24[a]
Normal	57.70[b]	61.32[a,b]
Obese	91.97[c]	77.22[b]
	$p \leq 0.001$	**$p = 0.003$**

x^2: Kruskal-Wallis, Z: Mann-Whitney U

***The superscripts a, b, c show in-group differences in each group, and measurements with the same letters are similar

($p \leq 0.001$) (Table 4). Unlike the findings of the present study, some previous studies reported that the level of eating disorders was higher in girls with T1DM [20–22, 24]. Although female adolescents experience negative emotional states such as anxiety, stress, and depression more intensely, it is considered that this may be related to the fact that they support each other more and are less likely to be excluded than male adolescents [25]. The fact that males who had T1DM had higher exclusion levels in the study supports this situation.

In the present study, it was also found that eating disorders and social exclusion were higher in adolescents with T1DM who used carbohydrate counting as a nutrition model ($p = 0.011$, $p \leq 0.001$, respectively). Carbohydrate counting aims to improve glycemic control by providing flexibility in food choices. However, it can also be difficult for children and parents, and the training given must be adapted to the culture, preferences, capacities, and understandings [26]. Although there is no study conducted on children and adolescents who have T1DM, it was reported in a previous study conducted with adults with T1DM that carbohydrate counting is more difficult to implement in daily life because it fluctuates glucose levels and complicates diabetes management [27]. It was also reported that peer influences, social relationships, stress, and depression are among the factors preventing children and adolescents with T1DM from counting carbohydrates [28].

Eating disorders and social exclusion were found to be higher in those who used insulin pumps ($p = 0.022$, $p \leq 0.001$, respectively) in adolescents with T1DM who participated in the study. No study was detected in the literature examining the relationship between insulin pump use and eating disorders and social exclusion. However, in a previous study conducted with children who had T1DM, it

was found that those using insulin pumps experienced more glycemic control and treatment-related problems and were more anxious [29]. Despite the increased use and defined benefits of the insulin pump, it is considered that it may also increase social exclusion in children because of constantly being reminded of the disease and making them feel different from their peers [30].

It was found that the levels of social exclusion and eating disorders were higher in obese adolescents who had T1DM who participated in the study ($p = 0.003$, $p \leq 0.001$, respectively) (Table 4). Previous studies support these findings [21, 22, 31–33]. Obesity causes negative conditions such as anxiety, stress, depression, inability to move around with peers, and exclusion from peers [34]. Both the negative emotions brought on by obesity and the complex disease management brought about by the disease may cause adolescents with T1DM to be exposed to more exclusion and to experience eating disorders.

Conclusion

It was found that the mean DEPS-R and OES-A scale scores of the adolescents were high. A high and positive significant relation was detected between DEPS-R and OES-A scores. It was also found that the variables of Body Mass Index according to gender, type of insulin used, the person administering the insulin, nutritional model, and age affected DEPS-R and OES-A scores.

Limitations

This study was conducted with 124 adolescents with type 1 diabetes. All data were limited with self-reports.

Declarations

Conflicts of ınterest The authors declare that there are no conflict of interests.

References

1. Draznin B, Aroda VR, American Diabetes Association Professional Practice Committee, et al. 14. Children and Adolescents: Standards of Medical Care in Diabetes-2022. Diabetes Care. 2022;45(Suppl 1):208–31.
2. International Diabetes Federation. International Diabetes Federation-IDF Diabetes Atlas. 10th edition. Karakas Print; 2021. https://diabetesatlas.org/idfawp/resource-files/2021/07/IDF_Atlas_10th_Edition_2021.pdf. Accessed 15 July 2022
3. Foster C, Bellando J, Wang YC. Diabetes Control and Adherence in Adolescence. Pediatr Ann. 2016;45(9):327–31.
4. King KM, King PJ, Nayar R, Wilkes S. Perceptions of Adolescent Patients of the "Lived Experience" of Type 1 Diabetes. Diabetes Spectr. 2017;30(1):23–35.
5. Arslan G, Yıldırım M. Psychological Maltreatment and Loneliness in Adolescents: Social Ostracism and Affective Experiences. Psychological Reports. 2022;125(6):3028–48.
6. Oldham-Cooper R, Semple C. Prevention and early help for eating disorders in young people with type 1 diabetes. Clin Child Psychol Psychiatry. 2021;26(3):656–68.
7. Markowitz JT, Butler DA, Volkening LK, Antisdel JE, Anderson BJ, Laffel LM. Brief screening tool for disordered eating in diabetes: internal consistency and external validity in a contemporary sample of pediatric patients with type 1 diabetes. Diabetes Care. 2010;33(3):495–500.
8. AtikAltınok Y, Özgür S, Meseri R, Özen S, Darcan Ş, Gökşen D. Reliability and Validity of the Diabetes Eating Problem Survey in Turkish Children and Adolescents with Type 1 Diabetes Mellitus. J Clin Res Pediatr Endocrinol. 2017;9(4):323–8.
9. Gilman R, Carter-Sowell A, Dewall CN, Adams RE, Carboni I. Validation of the ostracism experience scale for adolescents. Psychol Assess. 2013;25(2):319–30.
10. Akın A, Uysal R, Akın Ü. The validity and reliability of Turkish version of the ostracism experience scale for adolescents. Kastamonu Educ J. 2016;24(2):895–904 (**Turkish article**).
11. Rose M, Streisand R, Tully C, Clary L, Monaghan M, Wang J, Mackey E. Risk of disordered eating behaviors in adolescents with type 1 diabetes. J Pediatr Psychol. 2020;45(5):583–91.
12. Mahdilouy P, Ziaeirad M. Relationship between perceived social stigma and diabetes self-care activities in Iranian participants with type 1 diabetes. J Diabetes Metab Disord. 2021;20(2):1505–11.
13. Holmes-Truscott E, Ventura AD, Thuraisingam S, Pouwer F, Speight J. Psychosocial Moderators of the Impact of Diabetes Stigma: Results From the Second Diabetes MILES - Australia (MILES-2) Study. Diabetes Care. 2020;43(11):2651–9.
14. Liu NF, Brown AS, Folias AE, et al. Stigma in People With Type 1 or Type 2 Diabetes. Clin Diabetes. 2017;35(1):27–34.
15. Gredig D, Bartelsen-Raemy A. Diabetes-related stigma affects the quality of life of people living with diabetes mellitus in Switzerland: implications for healthcare providers. Health Soc Care Community. 2017;25(5):1620–33.
16. Rancourt D, Foster N, Bollepalli S, et al. Test of the modified dual pathway model of eating disorders in individuals with type 1 diabetes. Int J Eat Disord. 2019;52(6):630–42.
17. Troncone A, Cascella C, Chianese A, et al. Changes in body image and onset of disordered eating behaviors in youth with type 1 diabetes over a five-year longitudinal follow-up. J Psychosom Res. 2018;109:44–50.
18. Nip ASY, Reboussin BA, Dabelea D, et al. Disordered Eating Behaviors in Youth and Young Adults With Type 1 or Type 2 Diabetes Receiving Insulin Therapy: The SEARCH for Diabetes in Youth Study. Diabetes Care. 2019;42(5):859–66.
19. Peducci E, Mastrorilli C, Falcone S, et al. Disturbed eating behavior in pre-teen and teenage girls and boys with type 1 diabetes. Acta Biomed. 2019;89(4):490–7.
20. Araia E, Hendrieckx C, Skinner T, Pouwer F, Speight J, King RM. Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth-Australia. Int J Eat Disord. 2017;50(10):1183–93.
21. Cecilia-Costa R, Volkening LK, Laffel LM. Factors associated with disordered eating behaviours in adolescents with Type 1 diabetes. Diabet Med. 2019;36(8):1020–7.
22. Park HR, Ju HO, Yoo JH. Predictors of Eating Disorders in Adolescents with Type 1 Diabetes. Child Health Nurs Res. 2019;25(4):449–57.
23. Almeida ILL, Rego JF, Teixeira ACG, Moreira MR. Social isolation and its impact on child and adolescent development: a systematic review. Rev Paul Pediatr. 2021;40: e2020385.
24. Colton PA, Olmsted MP, Daneman D, et al. Eating Disorders in Girls and Women With Type 1 Diabetes: A Longitudinal Study of Prevalence, Onset, Remission, and Recurrence. Diabetes Care. 2015;38(7):1212–7.
25. Akça SÖ, Selen F, Demir E, Demir T. Cinsiyet ve yaş farklılıklarının ergenlerin depresyon, anksiyete bozukluğu, kendine zarar verme, psikoz, travma sonrası stres bozukluğu, alkol-uyuşturucu bağımlılığı ve dikkat eksikliği hiperaktivite bozukluğu ile ilişkili sorunlara etkisi. Dicle Tıp Dergisi. 2018;45(3):255–64.
26. Tascini G, Berioli MG, Cerquiglini L, et al. Carbohydrate Counting in Children and Adolescents with Type 1 Diabetes. Nutrients. 2018;10(1):109.
27. Fortin A, Rabasa-Lhoret R, Roy-Fleming A, et al. Practices, perceptions and expectations for carbohydrate counting in patients with type 1 diabetes- Results from an online survey. Diabetes Res Clin Pract. 2017;126:214–21.
28. Borus JS, Laffel L. Adherence challenges in the management of type 1 diabetes in adolescents: prevention and intervention. Curr Opin Pediatr. 2010;22(4):405–11.
29. Al Shaikh A, Al Zahrani AM, Qari YH, et al. Quality of Life in Children With Diabetes Treated With Insulin Pump Compared With Multiple Daily Injections in Tertiary Care Center. Clin Med Insights Endocrinol Diabetes. 2020;13:1179551420959077.
30. Monaghan M, Bryant BL, Inverso H, Moore HR, Streisand R. Young Children with Type 1 Diabetes: Recent Advances in Behavioral Research. Curr Diab Rep. 2022;22(6):247–56.
31. Doyle EA, Quinn SM, Ambrosino JM, Weyman K, Tamborlane WV, Jastreboff AM. Disordered Eating Behaviors in Emerging Adults With Type 1 Diabetes: A Common Problem for Both Men and Women. J Pediatr Health Care. 2017;31(3):327–33.
32. Verbist IL, Condon L. Disordered eating behaviours, body image and social networking in a type 1 diabetes population. J Health Psychol. 2021;26(11):1791–802.
33. Wisting L, Reas DL, Bang L, Skrivarhaug T, Dahl-Jørgensen K, Rø Ø. Eating patterns in adolescents with type 1 diabetes: Associations with metabolic control, insulin omission, and eating disorder pathology. Appetite. 2017;114:226–31.
34. Lindberg L, Danielsson P, Persson M, Marcus C, Hagman E. Association of childhood obesity with risk of early all-cause and cause-specific mortality: A Swedish prospective cohort study. PLoS Med. 2020;17(3): e1003078.