



Türk Fizyoterapi ve Rehabilitasyon Dergisi

2017 28(2)38-46

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Geliş Tarihi: 06.04.2016 (Received)
Kabul Tarihi: 09.06.2017 (Accepted)

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RELATIONSHIP BETWEEN PHYSICAL ACTIVITY LEVEL AND DEPRESSION, ANXIETY, QUALITY OF LIFE, SELF-ESTEEM, AND HbA1c IN ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to assess the relationship between physical activity (PA) level and depression, anxiety, quality of life, self-esteem and HbA1c in adolescents with type 1 diabetes mellitus (T1DM).

Methods: A cross-sectional study design, including 41 adolescents with T1DM and 38 healthy controls aged 13-17 years, were included in this study. The PA level was assessed using the Physical Activity Questionnaire for Older Children. Anxiety was screened using the Screen for Anxiety Related Emotional Disorders questionnaire. Depressive symptoms were evaluated using the Children's Depression Inventory. The Pediatric Quality of Life Inventory 4.0 was used for evaluating the quality of life. Self-esteem was assessed using the Rosenberg Self-Esteem Scale.

Results: Emotional functioning of parent proxy-report was significantly lower in the T1DM group ($p=0.01$) compared with the control group. The PA level was positively low correlated with the Pediatric Quality of Life Inventory 4.0-child self-report ($r=0.48$, $p=0.03$ for total scale score; $r=0.49$, $p=0.001$ for the physical health summary score). There was a low negative correlation between the PA level and HbA1c ($r=-0.40$, $p=0.01$).

Conclusion: The present study suggested similar PA levels, depression and anxiety scores, self-esteem, and quality of life (except lower emotional score in parents' proxy reports) between adolescents with T1DM and healthy controls. The PA was associated with quality of life-adolescent self-report and HbA1c in patients. Despite similar PA levels, these patients should be encouraged to adherence to PA in the early period to improve the quality of life and metabolic control.

Key Words: Adolescent; Physical Activity; Quality of Life; Type 1 Diabetes Mellitus.

TİP 1 DİYABETİ OLAN ERGENLERDE FİZİKSEL AKTİVİTE SEVİYESİ İLE DEPRESYON, ANKSİYETE, YAŞAM KALİTESİ VE BENLİK SAYGISI ARASINDAKİ İLİŞKİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, Tip 1 diabeti (T1DM) olan ergenlerde fiziksel aktivite (FA) seviyesi ile depresyon, anksiyete, yaşam kalitesi, benlik saygısı ve HbA1c arasındaki ilişkiyi değerlendirmektir.

Yöntem: Yaşları 13-17 yıl olan 41 T1DM ve 38 sağlıklı ergeni kapsayan kesitsel bir çalışma tasarımı kullanıldı. FA seviyesi, Ergenler İçin Fiziksel Aktivite Anketi ile değerlendirildi. Anksiyete, Anksiyete İle İlişkili Duygusal Bozuklukları Tarama Anketi ile tarandı. Depresif belirtiler, Çocuk Depresyon Ölçeği kullanılarak değerlendirildi. Yaşam kalitesini değerlendirmek için, Çocuk Yaşam Kalitesi 4.0 Envanteri kullanıldı. Benlik saygısı, Rosenberg Benlik Saygısı Ölçeği kullanılarak değerlendirildi.

Sonuçlar: Kontrol gruba göre, T1DM grubunda ebeveynin bildirdiği emosyonel işlevsellik daha düşüktü ($p=0,01$). FA ile Çocuk Yaşam Kalitesi 4.0 Envanteri-çocuk öz bildirimi arasında, düşük derecede pozitif korelasyon bulundu (Total envanter skoru için $r=0,48$, $p=0,03$; fiziksel sağlık özet skoru için $r=0,49$, $p=0,001$). FA ile HbA1c arasında düşük derecede negatif korelasyon saptandı ($r=-0,40$, $p=0,01$).

Tartışma: Bu çalışma T1DM olan ergenler ve sağlıklı kontroller arasında benzer FA seviyesi, depresyon ve anksiyete skorları, benlik saygısı ve yaşam kalitesine (ebeveynin çocuk için bildirdiği daha düşük emosyonel skor dışında) işaret etti. FA, hastalarda yaşam kalitesi-ergen öz bildirimi ve HbA1c ile ilişkili idi. Benzer FA seviyelerine rağmen, bu hastalar yaşam kalitesi ve metabolik kontrolü artırmak için erken dönemde FA katılım konusunda cesaretlendirilmelidir.

Anahtar Kelimeler: Ergen; Fiziksel Aktivite; Yaşam Kalitesi; Tip 1 Diabetes Mellitus.

INTRODUCTION

One of the most common chronic diseases among children and adolescents is type 1 diabetes mellitus (T1DM). Individuals with T1DM have a higher risk of developing cardiovascular diseases compared with healthy peers (1). Endothelial dysfunction in individuals with diabetes can occur as early as pre adolescence (2), highlighting the importance of physical activity (PA), and appropriate insulin and dietary treatments (3). However, adolescence is a period of rapid physical, psychological and social change along with the development of autonomy and self-identity. These factors increase the risk of ineffective management of diabetes (4). Adolescents may deal with metabolic control with difficulty as the result of hormonal factors at puberty (5).

Mohammed et al. (6) suggested a strong link between PA level and cardiovascular risk factors in adolescents with T1DM. On one hand, PA may improve glycemic control, cardiovascular health, and lipid profiles as well as reduce blood pressure in youth with T1DM (3,4,6,7). The PA level also increases psychological well-being in these young people (3,7-9). On the other hand, the health status of youth with T1DM and severity of disease may affect PA levels (8,10,11). It is stated that levels of PA decrease in healthy adolescents (12).

Children and adolescents with T1DM have low PA levels (13,14). Therefore, they seem to be at high risk for several psychosocial morbidities including depression, anxiety, low health-related quality of life (HRQoL), low self-efficacy, low self-esteem, low adherence to treatment, and low metabolic control (15-18). Although the studies investigating the self-esteem in youth with T1DM have stated mixed results, to our knowledge, associations have been investigated only in few studies (19,20). In addition, several studies have examined PA level and psychological well-being in people with T1DM, few of them have focused on the only adolescent group with T1DM (5,8,17,19). Thus, it is hard to determine whether adolescents with T1DM are at risk for psychosocial problems. Depression and low HRQoL may negatively impact metabolic control or outcomes of T1DM (21,22). It is important to determine the relationship between PA level and psychological factors in Turkish adolescents with T1DM.

We, therefore, hypothesized that PA level was correlated with psychological factors mentioned previously. In this study, we assessed the relationship between PA level and depression, anxiety, HRQoL, self-esteem, and HbA1c in adolescents with T1DM.

METHODS

This study was a cross-sectional study carried out from December 2014 to July 2015. The study jointly conducted by Bezmialem Vakif University, Faculty of Medicine, Department of Paediatrics Endocrinology, and the Istanbul University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Istanbul, Turkey.

The project observed the principles outlined in the Declaration of Helsinki of 2013 and was approved by the Human Research Ethics Committee of Bakirkoy Dr. Sadi Konuk Training and Research Hospital (IRB: 2014/271). All participants and their parents were informed about the study, and parents of each participant gave written informed consent.

Inclusion criteria were age 13-17 years at recruitment for all subjects and diabetes duration >1 year for the T1DM group (13). Exclusion criteria were any other disease affecting the PA level and severe social deprivation for all groups, and diabetes diagnosis is known to be non-type 1 for the T1DM group. Participants had no reading problems that hindered them from completing the self-rating scales. In addition, they had no any known psychiatric treatment and mental deficiency. The control group was selected from healthy adolescent of same gender and age, whose data were collected from primary and secondary school near the hospital, volunteered to take part in the study. The control group was formed from students who met the inclusion criteria and who came to school with their parents on the selection day.

A power analysis was performed to determine sample size at the beginning of the study. Raosoft (Raosoft Inc. 2004, Seattle, WA, USA, www.raosoft.com) was used to calculate the sample size. With a power of 95%, an error of 5%, and 2.52% (23) for the incidence of T1DM youth, the minimal sample size was estimated at 38 participants to detect a statistically significant difference between the

T1DM and control groups.

Of the patients examined in the pediatric endocrinology clinic within the study period, the first 45 and their parents were called by phone and expressed willingness to participate in the study. They were invited to an interview held at Istanbul University. The assessment comprised three parts including demographic data, the questionnaires, and clinical features. A physical therapist fulfilled the demographic data form. Each participant's weight and height were measured, and body mass index (BMI) was calculated as $\text{weight}/\text{height}^2$. Then, the adolescent and parents were asked to complete the questionnaires, which assessed PA level, psychological factors, HRQoL, and self-esteem. PA level was evaluated by the Physical Activity Questionnaire for Adolescents (PAQ-A). The psychological factors were assessed according to the Children's Depression Inventory (CDI) and The Screen for Anxiety Related Emotional Disorders (SCARED) questionnaire. HRQoL was evaluated using the Pediatric Quality of Life Inventory 4.0 (PedsQL 4.0), and the self-esteem was assessed with the Rosenberg Self-Esteem Scale (RSES). The assessment of each patient was completed nearly in 30 minutes.

Disease duration and HbA1c were assessed by an endocrinologist at the Bezmialem Vakif University, Faculty of Medicine, Department of Pediatric Endocrinology, Istanbul, Turkey. HbA1c levels which represented the measurements in previous one month were measured by turbidimetric inhibition immunoassays and were presented by NGSP units (%). For nondiabetic adolescents, normal laboratory values of HbA1c is 2.0 and 6.5%.

Physical activity level was measured using the PAQ-A. It is self-administered, 7-day recall validated questionnaires that provide a general moderate to the vigorous measure of PA (24). It was developed to assess general levels of PA for high schools students in grades 9 to 12 and approximately 14 to 19 years of age. It contains nine items, and each scored on a 5 point-scale, which is used to derive a total activity score. Total activity scores range from 9 to 45, in which higher scores indicate more physical activity level. Turkish versions of the PAQ-A has been shown to be reliable and valid in the assessment of PA level (25).

Depressive symptoms were assessed by the CDI. This self-report measure is widely used in children and adolescents aged 7–18 years (26). The CDI was designed to screen depression in the apparently healthy sample and a measure of symptom severity. It is often used in clinical studies because of its high-reliability coefficient (Cronbach's α 0.81–0.89). It contains 27 items, each consisting of three statements. For each item, the participant is asked to select the statement that best describes participant's feelings during the past two weeks. Scores range from 0 to 54, in which higher scores indicate more severe depression. The CDI scores of ≥ 19 are considered as clinically meaningful to identify significant depressive symptomatology (26). Oy adapted this inventory into Turkish (27).

Anxiety of the participants was evaluated by the SCARED questionnaire (28). Karaceylan adapted this inventory into Turkish (29). It consists of 41 items and five subscales. Each item is scored on a scale from 0 to 2, with "0: not true or hardly ever true", "1: sometimes true", and "2: true or often true". The five subscales are panic/somatic (13 items); generalized anxiety (9 items); separation anxiety (8 items); social phobia (7 items), and school phobia (4 items). The total score ranges from 0 to 82, with higher values indicating higher degrees of anxiety. A total score of ≥ 25 may indicate the presence of an anxiety disorder. Scores higher than 30 are more specific (28).

The HRQoL was assessed by the PedsQL 4.0 self-report form for adolescents aged between 13 and 18 years (30). The scale consists of the adolescent self-report and parent proxy report forms. The caregiver who was mother completes the parent proxy report form, and the adolescent completes the adolescent self-report form at the same time but separately. It contains 23 items, each consisting of five statements. In the present study, the total scale score (TSS), physical health summary score (PHSS), and psychosocial health summary score (PsHSS) were calculated. The PsHSS provides three subscale scores in the following domains: emotional functioning, social functioning, and school functioning. Each items are scored on a five-point response Likert scale and transformed into a 0-100 scale: "0: (100) never a problem"; "1: (75) almost never"; "2: (50) sometimes"; "3: (25) al-

most always”; and “4: (0) always”. Higher PedsQL scores indicate better HRQoL (29). In the present study, the Turkish version of the scale was used. The internal consistency of the adolescent self-report and parent proxy report were 0.82 and 0.87, respectively (31).

The participants’ self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES) (32). The scale includes 10 items and measures global self-worth by evaluating both positive and negative feelings about the self. Each item is answered using a 4-point Likert scale format ranging from “strongly agree” to “strongly disagree”. Higher scores indicate higher levels of self-esteem. For this scale, Cronbach’s alpha value was 0.79 (32).

Statistical Analysis

Data were evaluated by using the Statistical Package for Social Science 21.0 program for Windows (IBM-SPSS Inc., Chicago, IL, USA) and by analyzing descriptive statistics (frequency, mean, and standard deviation). Before the statistical analysis, Kolmogorov-Smirnov test was used to test for normal distribution of data. All continuous variables were normally distributed. Independent sample t-tests were used to compare age, BMI, PA levels, depression scores, anxiety levels, levels of HRQoL and self-esteem scores between the T1DM and control groups. Chi-square test was used to compare sex ratio between two groups. Intercorrelations between parameters were analyzed using the Pearson’s correlation analysis. A correlation coefficient between 0.26 and 0.49 reflects poor agreement, those between 0.50 and 0.69 reflect moderate agreement, and those ≥ 0.70 indicates high agreement (33). A $p < 0.05$ was considered statistically significant.

RESULTS

One participant was excluded from the study as they met the exclusion criteria. Three diaries were incomplete and were omitted. Therefore, 41 adolescents (18 boys, and two girls) and their parents were included. Forty healthy subjects and their parents served as the control group. Two diaries were not completed and were omitted; hence, a total of 38 healthy controls (95%) and their parents participated in the study.

There were no significant differences for demographic background between the two groups. Group characteristics are presented in Table 1. The mean \pm SD (range) disease duration at the time of participation was 2.83 ± 0.83 (2-5) years. The mean \pm SD (range) HbA1c was 7.98 ± 1.46 (4.7-11.5)%.

The comparison results of PA level, depression, anxiety, HRQoL, and self-esteem are shown in Table 2. Emotional functioning of parent proxy report was significantly lower in the T1DM group ($p=0.016$) compared with the control group. There was no statistically significant difference in other outcome measures.

The relationship between PA level and depression, anxiety, HRQoL, self-esteem, and HbA1c in adolescents with T1DM are presented in Table 3. The PA level was positively but weakly correlated with HRQoL-child self-report ($r=0.480$, $p=0.003$ for total scale score; $r=0.494$, $p=0.001$ for the physical health summary score). There was a low negative correlation between the PA level and HbA1c ($r=-0.401$, $p=0.015$) in adolescents with T1DM. Significant negative weak correlations existed between the depression and HRQoL-adolescent self-report ($r=-0.392$, $p=0.016$ for TSS; $r=-0.330$, $p=0.040$ for emotional score), and negative moderate cor-

Table 1: Demographics and Clinical Features of T1DM and Healthy Groups.

Demographics	T1DM (n=41)	Healthy (n=38)	p value
Age (years)	15.29 \pm 1.55	14.74 \pm 1.62	0.124
BMI (kg/m ²)	21.10 \pm 4.03	20.52 \pm 3.11	0.961
Gender (Males/Females) ^a	18/23	20/18	0.438

Data are mean \pm SD unless stated otherwise. ^an. T1DM: Type 1 diabetes mellitus, BMI: body mass index.

Table 2: Comparison of Physical Activity, Depression, Quality of Life and Self-Esteem between T1DM and Healthy Groups.

Parameters	T1DM (n=41)	Healthy (n=38)	p value
Physical Activity	20.92±6.44	22.17±6.50	0.399
Depression	14.78±5.58	13.27±5.14	0.240
Anxiety	23.74±10.78	21.12±12.15	0.335
HRQoL-Adolescent Self-Report			
Total Scale Score	75.15±11.00	76.14±14.94	0.781
Physical Health Summary Score	76.12±14.71	76.89±17.74	0.839
Psychosocial Health Summary Score			
Emotional Functioning	67.75±19.99	73.18±19.79	0.250
Social Functioning	92.50±11.43	86.36±18.04	0.096
School Functioning	63.42±20.54	66.67±20.18	0.505
HRQoL-Parent Proxy Report			
Total Scale Score	76.95±15.19	80.15±14.98	0.359
Physical Health Summary Score	75.87±21.44	86.16±20.20	0.269
Psychosocial Health Summary Score			
Emotional Functioning	69.38±17.47	78.65±15.44	0.016*
Social Functioning	90.88±14.40	84.05±23.14	0.122
School Functioning	73.88±20.39	74.73±21.17	0.857
Self-Esteem	1.11±0.78	1.14±0.85	0.864

*p<0.05. Data are mean±SD unless stated otherwise, T1DM: Type 1 Diabetes Mellitus, HRQoL: Health-Related Quality of Life, TSS: Total Scale Score, PHSS: Physical Health Summary Score, PsHSS: Psychosocial Health Summary Score.

relation between depression and self-esteem ($r=-0.574$, $p=0.001$). Furthermore, a significant moderate negative correlation was also found between the anxiety and HRQoL-adolescent self-report

($r=-0.652$, $p=0.001$ for TSS; $r=-0.697$, $p=0.001$ for PHSS): the higher the anxiety score, the lower the quality of life score in adolescents with T1DM.

Table 3: Association between Physical Activity, Depression, Anxiety, Health-Related Quality of Life and HbA1c in adolescents with T1DM.

Variables	Physical Activity [®]	Depression	Anxiety
Depression	-0.137	-	0.500**
Anxiety	-0.251	0.500**	-
HRQoL- Adolescent Self-Report			
Total Scale Score	0.480**	-0.392*	-0.652**
Physical Health Summary Score	0.494**	-0.271	-0.697**
Psychosocial Health Summary Score			
Emotional Functioning	0.144	-0.330*	-0.579**
Social Functioning	0.240	-0.290	-0.274
School Functioning	0.061	-0.221	-0.075
HRQoL- Parent Proxy Report			
Total Scale Score	-0.061	-0.105	-0.226
Physical Health Summary Score	-0.049	-0.048	-0.164
Psychosocial Health Summary Score			
Emotional Functioning	0.045	-0.313	-0.302
Social Functioning	0.034	0.057	-0.059
School Functioning	-0.183	-0.088	-0.284
Self-Esteem	-0.024	-0.574**	-0.049
HbA1c	-0.401*	0.032	0.240
Disease Duration	-0.172	-0.041	0.300

*p<0.05, **p<0.01. [®]Pearson r. HbA1c: hemoglobin A1c, T1DM: Type 1 Diabetes Mellitus, HRQoL: Health-Related Quality of Life, TSS: Total Scale Score, PHSS: Physical Health Summary Score, PsHSS: Psychosocial Health Summary Score.

DISCUSSION

The present study investigated the relationship between PA level and depression, anxiety, HRQoL, self-esteem, HbA1c and disease duration in adolescents with T1DM. This study showed similar PA levels, depression, and anxiety score, self-esteem, HRQoL (except lower emotional score in parents' proxy reports) in adolescents with T1DM compared with healthy controls. There was a significant correlation of HRQoL-adolescent self-report and HbA1c with PA level in adolescents with T1DM.

PA is a primary determinant of health in youths, and this is of particular importance in young patients with chronic diseases, as such knowledge can help prevent the development of comorbidities like cardiovascular diseases (34). Lukacs et al. found that there were no differences either in body composition or physical activity level, compared to healthy controls (13). However, similar to the present study, adolescents with T1DM have low physical activity level. In addition, previous studies reported that children younger than seven years old (35), older children and adolescents (3,8,10,13) with T1DM were less physically active than their healthy peers. The others reported no difference for children aged 8-12 years (13,36) and for adolescents (6,11,19), which was concurrent with our finding. However, lower PA level was reported more by older children and adolescents (8,37). Our finding may be associated with the subjective assessment of PA level and the fact that PA levels in the patients with T1DM are determined by various factors, including heredity, motor skill, psychological and health status (38). In addition, several factors like poor knowledge of diseases or the benefits of exercise, parental control, poor self-efficacy, and prior negative experiences, hypoglycemic episodes may influence PA levels in patients with T1DM (37,38).

Adolescents with T1DM are at increased risk for psychiatric morbidity, particularly depression and anxiety (39,40). The adolescents with T1DM, up to 20% of them have elevated levels of depression (40), and anxiety disorders are common (41). Bernstein et al. (40) found the rates of 11.3% for depression, 21.3% for anxiety in patients aged 11-25 years. In adolescents with T1DM, compared to healthy controls, previous studies reported higher

depressive symptoms (41), while another study found no differences in depressive and anxiety symptoms (42). Moreover, previous studies found that adolescents with T1DM reported higher physical abilities score and similar scores for self-esteem, physical appearance, and general self-concept, compared to healthy controls (18-20). In line with precedent mentioned findings, the present study revealed no difference in depression and anxiety levels, and self-esteem between adolescents with T1DM and healthy controls, indicating that these patients might adapt well to the disease.

Several studies reported lower HRQoL in youths (43,44) and adolescents (45), while others not in youths (46) and adolescents (47), compared to healthy controls. Overall, a recent review showed no difference in HRQoL between youth with T1DM and healthy controls (46), generally similar to our findings. No difference in HRQoL scores in the present study seemed to represent possible well-adaptation to the disease in a group of adolescents with T1DM. Interestingly, the present study found that adolescents reported non-significant but slightly poorer HRQoL scores except social functioning than healthy controls. This finding may be due to sufficient social support by patients' parents in our study. In addition, according to parents' proxy reports, only scores for the emotional functioning of HRQoL was lower than controls. This finding may reflect that mothers of adolescents with T1DM seem to have a greater tendency to see their adolescents' emotion as pathological.

The present study found that PA level was associated with total and physical functioning scores of HRQoL-adolescent self-report and HbA1c, but was not associated with other scores of HRQoL-adolescent self-report, depression, anxiety, HRQoL-parent proxy report, and self-esteem in adolescents with T1DM. Similarly, positive correlation between PA level and HRQoL were reported in adolescents with T1DM (5,8) and in those aged 8-12 years (36), easing management of the disease. Kummer et al. (48) reported higher frequency and longer weekly duration of PA were associated with a higher self-rated health status. According to our results, this correlation seems to be particularly in physical functioning of HRQoL in adolescents with T1DM.

No relationship between PA level and depression, anxiety, and self-esteem in the present study suggested that PA level might not improve the scores of depression, anxiety, and self-esteem in a group of adolescents with T1DM. This may be due to chronic stress factors and short duration of the disease, which may not allow depression and anxiety to decrease with PA. Consistent with previous studies (18-20), there was no relationship between PA level and self-esteem in adolescents with T1DM, reflecting the possibly limited contribution of PA level to them regarding a balance among social acceptance, social devaluation, and rejection.

Previous studies have also reported conflicting results related to the impact of PA on HbA1c in adolescents with T1DM, with lowering effect (3,6,49) and no effect (8,9). A meta-analysis identified significant effects of PA on reduction in HbA1c in youth with T1DM (3), consistent with our finding. Beraki et al. (37) suggested that PA had more HbA1c-lowering effect in this age group compared with younger groups. Moreover, the characteristics of PA (duration, type, and intensity) play a major role in this effect (3,6), indicating a possible mechanism of difference in PA effect on metabolic control.

Total score of HRQoL in adolescents with T1DM seems to be also negatively associated with depression and anxiety levels in the present study. Similar results regarding the relationship between HRQoL and depression were found in several studies conducted on youth (50) and adolescents (4). Sinnamon et al. (16) found that negative correlation between anxiety and HRQoL. Our findings suggested that increased anxiety and depression level in adolescents with T1DM might lead to poorer HRQoL.

Despite our findings, the results of the present study should be interpreted carefully in light of several limitations. First, PA level was assessed using a questionnaire; therefore, we obtained limited knowledge about their PA levels. Given that PA is a complex behavior, it is difficult to assess objectively with clinically based measurements. The use of questionnaires has some advantages, such as being inexpensive and needing no complicated technology. Second, depression and anxiety were

measured by self-reported questionnaires. Third, the participants in the study had shorter disease duration when compared the other study. Fourth, all adolescents were Caucasians and recruited from one center, which impeded the generalization of the results.

In conclusion, the data from this cross-sectional study suggested similar PA levels, depression and anxiety scores, self-esteem, and HRQoL (except lower emotional score in parents' proxy reports) in adolescents with T1DM compared with healthy controls. We also found that PA was associated with HRQoL-adolescent self-report and HbA1c, while not with other variables. Even though PA levels seemed to be similar between adolescents with T1DM and healthy controls, these patients should be encouraged to adherence to PA in the early period to improve the quality of life and metabolic control. Physicians, particularly pediatric endocrinologists, should also screen them routinely for psychological problems in their practice to manage diabetes better.

Conflict of interest: None declared.

Sources of support: None declared.

Acknowledgements: We thank all the participants involved in the survey. The help of Arta Fejzullahu from Istanbul Aydin University for English review of the manuscript is very much acknowledged.

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