Adaptation of the Problem Areas in Diabetes-Teen Scale into Turkish and examination of its psychometric properties: a validity and reliability study

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ABSTRACT

Objective. Management of type 1 diabetes (T1DM) is quite challenging for both adolescents and their families. In this study, we aimed to translate the 14-item Problem Areas in Diabetes-Teen (PAID-T) scale, which measures variables that influence diabetes distress, to Turkish and investigate the Turkish version's reliability and validity.

Methods. One hundred and ninety-four adolescents with T1DM participated in the study. PAID-T and forms for sociodemographic and diabetes characteristics were used for data collection. The scale's content validity was checked using the Davis technique. Cronbach's α was used to analyze the scale's internal reliability and the test-retest for the scale's reliability. Exploratory factor analysis (EFA) was utilized to examine the factor structure. The fit of the scale was assessed using confirmatory factor analysis (CFA).

Results. Of the participants, 54.6% (n=106) were girls. The content validity index values of the scale items ranged between 0.86 and 1.0. The PAID-T scores of girls and boys were similar. No significant difference was found between PAID-T scores with sociodemographic data and diabetes characteristics (p>0.05). The test-retest correlation coefficient of the scale was found to be 0.952. The three-factor (emotional burden, family and friend distress, and regimen-specific distress) model identified in EFA explained 61.8% of the common variance. Fit analysis was performed using CFA for the three-factor model, which did not show adequate fit (x2/df = 2.402, GFI = 0.822, CFI = 0.815, NFI = 0.727, NNFI = 0.772, RMSEA = 0.118). The Cronbach α value of the scale was 0.864.

Conclusion. The Turkish version of the 14-item PAID-T showed moderate validity and strong reliability. Accordingly, it can be used as a reliable measurement tool to assess diabetes stress in adolescents with T1DM.

Key words: Type 1 diabetes, adolescents, problem areas, scale, validity, reliability.

Type 1 diabetes (T1DM) is one of the most common most common endocrinological diseases of childhood and adolescence.[1] In 2021, it was reported that the estimated prevalence of T1DM is approximately 8.4 million people worldwide, and approximately 1.5 million of these are children and young people under the age of 20.[2] T1DM, a chronic disease with mostly adolescence-onset, requires daily activities and tasks such as monitoring blood sugar at regular intervals, administering exogenous insulin, regular physical exercise, and complying with a diet.[3] During adolescence, when physical, emotional, and social changes occur, peer

connections and identity development come to the fore, and independence grows, managing a chronic illness that entails such a tight treatment regimen can be quite challenging.[4] Adolescents with diabetes experience embarrassment, alienation, and a lack of social connections. Also, living with diabetes may have a negative impact on academic performance and family functioning.[5] While parents expect their teens to take responsibility for managing and implementing diabetes-related daily care activities, adolescents try to push the parent's boundaries, which could lead to conflict.[6]

T1DM is associated with significant mental disorders and increased psychological morbidity. Adolescents with T1DM face higher levels of psychosocial stress and adjustment issues than those without the disease, making following a strict diabetes care routine more challenging.[7] This diabetes-related emotional stress refers to the negative emotions arising from the difficulties of living with and managing diabetes.[8] It comprises the negative feelings and fears inherent in living with diabetes, such as worrying about complications, out-of-range blood sugar, not being supported by family or friends, or feeling overwhelmed by the diabetes regimen.[9] Diabetes-related emotional stress has been linked to poor glycemic control, low quality of life, increased psychiatric disorders (such as depression and anxiety disorder), and less adherence to drug regimens.[10] A systematic review conducted by Hagger et al.[11] stated that one-third of adolescents with T1DM experienced severe diabetes-related emotional stress like adults with T1DM. Thus, it is crucial to assess diabetes-related emotional stress in adolescents with T1DM, which has a significant detrimental impact on the long-term health outcomes of diabetes.

The number of standardized scales developed to identify problem areas for adolescents with T1DM is low. The novelty of the studies will be further enhanced by using a simple self-report scale for adolescents to comprehend and complete, and evaluating the difficulties and emotional burdens of living with diabetes. The Problem Areas in Diabetes- Teen version (PAID-T) scale, which was first adapted from the adult Problem Areas in Diabetes (PAID) scale by Dr. Weissberg-Benchell and her colleague[12] and shortened by Shapiro et al.[13], appears to be a very convenient measurement tool to specifically assess diabetes-related emotional stress. Furthermore, to perform cross-cultural studies in various groups and better assist their patients, clinicians require trustworthy, validated assessment instruments in their native languages and cultures.[14] In Türkiye, there is no available scale in Turkish for assessing diabetes-related emotional stress among adolescents with T1DM. Therefore, in the present study, we aimed to translate the original version of the 14-item PAID-T scale into Turkish to evaluate its validity and reliability and to examine its psychometric properties to measure diabetes-related problems in adolescents with T1DM.

Materials and Methods

Design

The data was collected between February 2021 - February 2022. Inclusion criteria include adolescents aged between 12-18 years, diagnosed with T1DM for at least one year and receiving inpatient treatment or outpatient follow-up by a pediatric endocrinologist in a tertiary hospital, and fluent in Turkish to complete questionnaires.

Patients under the age of 12 years and over the age of 18 years, having T1DM for less than one year, being illiterate, and having a serious psychiatric or neurological disease that may interfere with reading comprehension were excluded from the study. A child and adolescent psychiatrist evaluated all participants. Participants with severe depression, anxiety disorder, or a psychopathology that would impair their ability to assess reality were not included in the study.

Taking samples 5-10 times the number of items is sufficient for scale validity. The recommended sample size for a psychometric study is between 100-200 individuals, especially if the factors are strong and specific.[15,16]

Measurements

Questionnaire form: The form prepared by the researchers consists of two parts: sociodemographic information about adolescents and their families and information about the teens' diabetes. The socio-demographic information consisted of questions regarding the adolescent's age, gender, place of residence, parents' occupation and educational background, family structure, and monthly income. The duration of diabetes, the type of diabetes treatment currently being used (insulin injection or pump), the frequency of daily glucose measurements, the current HbA1c level, the presence or absence of severe diabetes complications necessitating hospitalization, and the existence of any other medical conditions were all included in the section pertaining to diabetes.

Problem Areas in Diabetes - Teen Scale (PAID-T): The PAID scale was first developed in 1995 to measure the emotional stress areas specific to diabetes in adults.[17] A 26-item PAID-T was first developed by Weissberg-Benchell and Antisdel-Lomaglio[12] to evaluate adolescents with T1DM and their families by considering the developmental characteristics of adolescents. Finally, in 2018, the scale was transformed into the final version (short form) with 14 items.[13] Last year, Lee et al.[18] translated the 26-item form into Chinese and carried out a validity and reliability study. The 14-item PAID-T has been utilized in studies but has not been translated into any foreign language other than the most current German translation by Saßmann et al.[19]

PAID-T is a 6-point Likert scale consisting of 14 questions that measure diabetes-specific distress in adolescents (12 to 18 years of age) with diabetes. Participants are asked to rate on a scale of "1=not a problem'' to "6=serious problem'' how much each scale item bothered them over the past month according to their diabetes-related stress. High scores indicate a greater level of distress. The PAID-T has no subscales. There is no reverse item on the scale. The maximum score obtained from the scale is 84, and the minimum is 14. The Cronbach's α value of PAID-T was 0.93.[13]

Procedure

We received permission to translate the English version of PAID-T from Jill Weissberg-Benchell (one of the authors) by e-mail. The World Health Organization (WHO) recommendations and the literature research on this topic were used as a guide for the intercultural adaptation of the scale.[20,21] In the first step for scale adaptation, two independent bilingual Turkish translators translated the scale from English to Turkish. After completing the translations, our research team evaluated the items of both translations in terms of whether they contained complex sentences or simple translations that would distort the item's content and prepared a joint translation. In the second step, the original text and the translation version were sent to fifteen experts in the field to calculate the content validity of the scale according to the Davis Technique.[22] They were asked to evaluate the scale items one by one as "Appropriate," (b) "Needs minor revision," (c) "Needs major revision," and (d) " Not appropriate." The "content validity index" (CVI) for each item is obtained by dividing the number of experts who marked options (a) and (b) by the total number of experts, and >0.80 is accepted as the suitability criterion for the item.

In the third step, two independent translators blindly translated the Turkish text back into English. They forwarded it to the original scale developer (Dr. Weissberg-Benchell) to confirm any meaning shift. After debating the disparities between the back and forward translations with our team, a 14-item Turkish PAID-T was ultimately authorized. As a

pilot study, 15 adolescents with T1DM were administered the Turkish version. Then, forty-three adolescents with T1DM were tested and retested on the final Turkish PAID-T at 3-week intervals. Analysis of test-retest reliability was completed. Afterward, the demographic form and the scale were applied to 194 adolescents with T1DM for the research. This study was approved by the Ethics Committee of Sivas Cumhuriyet University (date 13.01.2021, number 2021-01/23). Adolescents and their legal guardians were informed of the study and gave their written consent before the study.

Statistical analysis

SPSS for Windows Version 25 package program was used for statistical analysis in the research. A normal distribution was accepted if the numerical values were in the range of -1.5 to +1.5 skewness and kurtosis values.[23] Descriptive statistical analyses of sociodemographic data and the score of the scale were calculated. The independent samples t-test was used to compare numerical data between two categorical variables; when comparing numerical data between more than two categorical variables one-way ANOVA was employed. To test the validity of the scale, the content validity study was evaluated with the Davis Technique.[22] CVI above 0.80 indicates good content validity.[24] In the context of the scale's reliability examination, test-retest reliability was used to identify the scale's consistency, and Cronbach's alpha was used to assess the scale's internal consistency. A Cronbach's alpha value above 0.80 is an indicator of strong reliability.[25] Construct validity was tested with confirmatory factor analysis. The suitability of the scale for factor analysis was evaluated with the sphericity method of Kaiser-Meyer-Olkin (KMO) and Bartlett. A KMO value above 0.6 and a significant Barlett's test indicate that the data are suitable for factor analysis.[24] Confirmatory factor analysis was calculated with the IBM SPSS Amos 20 package program. Confirmatory factor analysis results were reported with total variance values and factor loadings, X2/df, comparative fit test (CFI), goodness fit test (GFI), normed fit index (NFI), non-normed fit index-Tucker Lewis index (NNFI-TLI) and root mean square error of approximate (RMSEA) values.[26] An x2/df value of 3 and below is an excellent indicator of model fit. GFI and CFI values between 0.80-0.90 indicate that the model is suitable for a good fit, while 0.90 and above means an adequate good fit. The RMSEA value is a measure of approximate fit in the population. An RMSEA value of 0.06 and below indicates a good fit, while a value greater than 0.1 indicates a poor fit.[23] A p-value of less than 0.05 was considered for statistical significance, with a 95% confidence interval (CI).

Results

One hundred ninety-four adolescents with T1DM participated in the study. The mean age of the adolescents was 13.6±2.4 years. The mean HbA1c was 9.1±1.9% and the mean diabetes duration was 4.0±3.5 years. Table I shows sociodemographic data of adolescents and information about their diabetes.

The mean total score obtained from the scale was 34.8±15.4 (min 14, max 97). The average of the scores given to the scale items varied between minimum 2.0±1.7 (Item 8: ''Feeling like my parents don't trust me to care for my diabetes.'') and maximum 2.9±1.8 (Item 7: ''Feeling like my friends or family act like 'diabetes police' (e.g. repetitively reminding to maintain a healty diet, checking blood sugars, not trying hard enough). The comparison of the participants' PAID-T scores with sociodemographic data and characteristics of diabetes is given in Table II. No significant relation was found between PAID-T scores with diabetes-related parameters and demographic data. As expected, PAID-T scores tended to decrease as the mother's and father's educational level, and socioeconomic status increased, but the difference was insignificant (p=0.168, p=0.353; and p=0.855 respectively).

Table I. Adolescents' diabetes and demographic characteristics (N=194), n (%).

Age (months)*	13.6 ±2.4
Gender	
Female	106 (54.6%)
Male	88 (45.4%)
Place of residence	
Center	117 (60.4%)
Rural	77 (39.6%)
Maternal education level	
Primary and secondary education	138 (71.4%)
High school	33 (17.3%)
University and above	23 (11.3%)
Paternal education level	
Primary and secondary education	95 (49.0%)
High school	53 (27.5%)
University and above	46 (23.5%)
Maternal employment status	
Employed	26 (13.3%)
Unemployed	168 (86.7%)
Paternal employment status	
Employed	188 (96.9%)
Unemployed	6 (3.1%)
Family structure	
Nuclear family	162 (83.7%)
Extended family	22 (11.2%)
Single parent (divorced or dead)	10 (5.1%)
Monthly family income	
Minimum wage and below	73 (37.8%)
Above minimum wage	121 (62.2%)
HbA1c (%)*	9.1 ± 1.9
Duration of diabetes (months)*	4.0 ± 3.5
Presence of severe hypoglycemia in the last month (<50 mg/dl)	
Yes	13 (6.7%)
No	181 (93.3%)
Number of glucose monitoring per day	
0-4	81 (43.5%)
5-8	75 (40.3%)
>8	30 (16.2%)
Insulin administration method	
Pump	8 (4.1%)
Pen	186 (95.9%)
Additional chronic disease in teen	
Yes	36 (18.8%)
No	158 (81.2%)

*Presented as mean ± standard deviation

Table II. The comparison of the participants' PAID-T scores with their demographic data and diabetes characteristics (N=194), mean ± SD.

	PAID-T score	p
Teen gender		
Female	34.8 ± 14.6	0.980
Male	34.7 ± 16.4	
Living in		
Center	32.6 ± 14.1	0.160
Rural	37.3 ± 19.0	
Education level of mothers		
Primary and secondary education	35.9 ± 16.2	0.168
High school	29.9 ± 14.7	
University and above	28.2 ± 14.4	
Education level of fathers		
Primary and secondary education	35.5 ± 17.2	0.353
High school	34.8 ± 13.6	
University and above	29.8 ± 15.4	
Employment status of mothers		
Employed	28.4 ± 10.9	0.179
Unemployed	34.9 ± 16.4	
Employment status of fathers		
Employed	33.9 ± 16.1	0.340
Unemployed	38.3 ± 6.1	
Family structure		
Nuclear family	34.6 ± 16.1	0.520
Extended family	28.9 ± 13.5	
Single ± divorced or dead	36.0 ± 18.8	
Monthly family income		
Minimum wage and below	34.4 ± 13.6	0.855
Above than minimum wage	33.8 ± 17.2	
Presence of severe hypoglycemia in the last month ± <50 mg/dl		
Yes	40.4 ± 15.1	0.173
No	34.3 ± 15.4	
Insulin administration method		
Pump	26.8 ± 11.6	0.088
Pen	35.1 ± 15.5	
Number of glucose monitoring per day		
0-4	35.5 ± 16.0	0.926
5-8	34.6 ± 15.5	
>8	35.4 ± 14.6	
Additional chronic disease in teen		
Yes	35.2 ± 15.5	0.712
No	33.6 ± 16.2	

PAID-T, problem areas in diabetes-teen; SD, standard deviation.

We also did not find any significant correlation between the PAID-T score and the adolescent's age, duration of diabetes diagnosis, or HbA1c level (r=-0.017, p=0.819; r=0.002, p=0.984; r=0.065, p=0.480, respectively).

Psychometric Properties of the Turkish Version of the PAID-T

The evaluation results of fifteen experts who reviewed the PAID-T translation into Turkish were analyzed using the Davis Technique, and the CVI was determined. As per the Davis Technique, the items' CVI scores varied from 0.86 to 1.0 (Table III).

We used test-retest analysis to assess the scale's reliability. After applying the test to 50 adolescents, we reached 43 of them again three weeks later and applied the retest. The scale's item correlation coefficients varied from 0.652 to 0.942 (all p-values <0.001). In the literature, an effect size above 0.5 is interpreted as large.[27] All items and the scale's total score had a significant positive and large effect size between the two measurements. The overall scale's correlation coefficient was calculated as 0.952.

The literature suggests that EFA and CFA analyses should be studied on different data sets.[28] We randomly divided our data set into two in the SPSS program. We calculated EFA and CFA on two different datasets.

The factor structure of the 14 items was examined using EFA with oblique rotation. Principal component analysis and direct oblimin techniques were utilized for this. Since there were three factors in the original scale, the number of factors was fixed to three. When the number of factors was also calculated based on the Eigenvalue, the results were similar for three factors. KMO = 0.833, and Bartlett's sphericity test results were $\chi2$ = 610.864, p<0.001. EFA analysis indicated three factors accounted for 61.80% of the variance. The contents of these three factors were examined, and the factors were named emotional burden (5 items), family and friend distress (5 items), and regimen-specific distress (4 items), like Shapiro's original scale. Rotation sums of squared loadings of these factors: emotional burden = 4.1, family and friend distress= 2.2, and regimen-specific distress = 2.2. Factor loadings for the emotional burden factor ranged from 0.718 to 0.907, the family and friends distress factor ranged from 0.457 to 0.770, and the regimen-specific distress factor from -0.737 to -0.473. The factor loads in Table IV are expressed by the 3-factor model's

Table III. The results of CVI on PAID-T using the Davis technique, expert N=15.

	Appropriate	Needs minor revision	Needs major revision	Not appropriate	CVI
Item 1	15	0	0	0	1.00
Item 2	13	0	2	0	0.86
Item 3	12	2	1	0	0.93
Item 4	13	1	1	0	0.93
Item 5	11	2	2	0	0.86
Item 6	13	1	1	0	0.93
Item 7	15	0	0	0	1.00
Item 8	15	0	0	0	1.00
Item 9	15	0	0	0	1.00
Item 10	13	1	1	0	0.93
Item 11	12	2	1	0	0.93
Item 12	12	1	2	0	0.86
Item 13	15	0	0	0	1.00
Item 14	11	3	1	0	0.93

CVI, content validity index; PAID-T: problem areas in diabetes-teen.

Table IV. Factor loads based on the PAID-T items' pattern matrix from the exploratory factor analysis (N=194).

	Factor 1: Emotional burden	Factor 2: Family and friends distress	Factor 3: Regimen-specific distress
Item 1	0.907		
Item 4	0.852		
Item 2	0.827		
Item 3	0.819		
Item 6	0.718		
Item 11		0.770	
Item 7		0.596	
Item 8		0.558	
Item 14		0.508	
Item 12		0.458	
Item 9			-0.737
Item 10		0.349	-0.722
Item 5			-0.711
Item 13			-0.473
KMO		0.833	
Bartlett's Test χ2		610.864	
P value		<0.001	

Principal components and direct oblimin methods fixed to 3 factors, compatible with the original scale, are used.
KMO, kaiser-meyer-olkin; PAID-T, problem areas in diabetes-teen.

pattern matrix outcome. The table does not include factor loading less than 0.30. When we look at the results, item 10 "Feeling that I am often failing with my diabetes regimen'' is included in both factor 2 and factor 3. Since the item content was compatible with factor 3 (regimen-specific distress), it was assigned to factor 3.

The fit analysis of the three-factor model we determined in EFA was evaluated with CFA. The results of this three-factor and also one-factor models did not show an adequate fit (three-factor's results: $x2/df = 2.402$, GFI = 0.822, CFI = 0.815, NFI = 0.727, NNFI = 0.772, RMSEA = 0.118). The single-factor model's CFA was computed as follows: $x2/df = 2.799$, GFI = 0.735, CFI = 0.752, NFI = 0.668, RMSEA = 0.139.

The Cronbach α value of the Turkish PAID-T, which tested the scale's internal reliability, was calculated at 0.864. The range of the item-total correlation coefficients was 0.388 to 0.653. All items' α value was greater than 0.80, suggesting that the scale's internal consistency and

Table V. Cronbach reliability analysis of the Turkish version of PAID-T.

	Item total correlation	Cronbach's α if the item deleted
Item 1	0.577	0.852
Item 2	0.636	0.849
Item 3	0.608	0.850
Item 4	0.653	0.849
Item 5	0.388	0.861
Item 6	0.423	0.873
Item 7	0.592	0.851
Item 8	0.423	0.860
Item 9	0.544	0.854
Item 10	0.575	0.853
Item 11	0.538	0.854
Item 12	0.568	0.852
Item 13	0.509	0.855
Item 14	0.482	0.857

PAID-T, problem areas in diabetes-teen.

reliability were appropriate.[25] Table V displays the results of the scale's internal reliability analysis.

Discussion

In this study, we performed a Turkish validity and reliability study of the 14-item PAID-T scale to assess diabetes-related emotional stress areas (such as diabetes management and emotional burdens of living with diabetes) experienced by Turkish adolescents with T1DM. We aimed to introduce the scale to the Turkish medical literature and make sure that the scale is easily accessible and used by healthcare professionals who work in this field to assess patients during routine clinical practice.

In our study, the mean age was lower than the studies by Shapiro et al.[13] and Saßmann et al.[19]; the proportion of girls to boys was higher, similar that by Shapiro et al. Unlike the other two validity studies, the total PAID-T scores of boys and girls were very close to each other with no significant difference. The lack of a significant correlation between the gender variable and PAID-T score could be attributed to several factors, including a smaller sample size than in the other two studies, the inclusion of adolescents from a single ethnic origin and similar sociocultural level, a younger average age of adolescents (since disease awareness rises with age, female adolescents may be more aware of it than male adolescents), and the absence of psychopathology in the sample. Several studies investigating diabetes-related emotional stress in adolescents have demonstrated that female adolescents scored significantly higher on the scales and reported higher levels of stress than males.[3,7,11,29,30] Similar to our results, in the review of Hagger et al.[11], a significant difference was found in only 3 of 14 studies examining the relationship between the gender variable and diabetes-related emotional stress, while no significant difference was found in 11 studies. Girls with T1DM reported more severe depressive symptoms and anxiety than boys. Several studies reported that adolescents with depressive symptoms and anxiety were found to have higher diabetes-related emotional stress and girls were more likely to be psychosocially vulnerable than boys.[3,11,13,19,29]

When comparing PAID-T scores with sociodemographic information and diabetes features, we could not find any significant differences. Although the PAID-T scores of adolescents living in rural areas, parents with lower educational status, unemployed parents, low family income, living in divorced families, using insulin injections, and having additional chronic diseases were higher than those without, but statistically insignificant. This could potentially be attributed to the limited size of our sample. To date, most of the studies measuring diabetes stress in adolescents have mostly evaluated race/ethnicity, age and gender as demographic variables, and parameters such as parental education, employment status, and family structure have not been examined.[3,7,31] Vesco et al.[31] examined the relationship between the use of technological methods for treatment and follow-up with diabetes stress and HbA1c level in adolescents with T1DM and evaluated diabetes stress with the 14-item PAID-T. They discovered that diabetic stress had a negative correlation with poor family income and low socioeconomic status and a positive correlation with age. They also showed that those who used continuous subcutaneous insulin infusion (pump) had a significantly lower PAID-T score than those who did not (insulin injection group).

We also found no significant relationship between PAID-T scores, duration of diabetes, number of daily glucose checks, and HbA1c levels. While Shapiro et al.[13] did not find a significant difference between the age and duration of diabetes and PAID-T scores of adolescents in the STePS study, they found a significant difference in the camp study. Accordingly, older adolescents with long-term diabetes reported significantly higher distress than younger adolescents with shorter durations of diabetes. In contrast to our findings, Saßmann et al.[19] found a positive correlation between PAID-T score and HbA1c level and a negative correlation with the number of daily glucose measurements. Although they did not find a significant correlation between the insulin administration method and PAID-T

score as we did, they found a small positive correlation between serious complications and PAID-T scores. Polish authors translated the English 14-item PAID-T into Polish and applied it to adolescents (without conducting a validity and reliability study), and similar to our research, they did not find a significant correlation between PAID scores with HbA1c levels and duration of diabetes.[30] In a recent study using the 14-item PAID-T, PAID-T scores were significantly associated with HbA1c levels, whereas no significant association was found with age and duration of diabetes.[7]

As determined by the Davis Technique, the Turkish PAID-T scale items' CVI varied from 0.86 to 1.00, which means the scale has sufficient content validity.[24] The Turkish PAID-T's reliability was assessed by test-retest correlation, item-total correlation, and Cronbach α analyses. The scale items' correlation coefficients ranged from 0.652 to 0.942 based on test-retest results. The overall scale's test-retest reliability was determined to be 0.952. We found that the item-total correlation coefficients ranged from 0.388 to 0.653. Saßmann et al.[19] found that each item to total score correlation ranged from 0.69 to 0.53. A value of 0.30 and above in the item-total correlation analysis indicates high item discrimination rates, which our results confirm.[24] Cronbach's alpha value for Turkish PAID-T was calculated at 0.864, which was 0.93 in the stuy by Shapiro et al.[13] and 0.91 in that by Saßmann et al.[19] Accordingly, all of the items of the Turkish PAID-T were above 0.80, indicating strong reliability.[25]

In the study by Shapiro et al.[13], a three-factor structure was identified in EFA, and these factors were named emotional burden, family and friends' distress, and regimen-specific distress. These three factors explained 64.3% of the total variance and provided an acceptable fit. In the German adaptation of the scale, Saßmann et al.[19] tried the three-factor model like Shapiro et al. and also found that it provided an adequate fit. We tested the adequacy of the sample size to perform factor analysis with KMO and Bartlett's sphericity test. Accordingly,

we had a large enough sample size to do the factor analysis. Of the total variation, 61.80% was explained by the 3-factor model, according to the EFA results. We named the 3-factor structure an emotional burden, family and friends' distress, and regimen-specific distress, similar to Shapiro et al.'s[13] and Saßmann et al.'s[19] study. In our EFA results, the factors to which the items were assigned were similar to Saßmann's study. We applied CFA to test the model fit of this 3-factor structure. Our x2/df value is an excellent indicator of model fit. Our GFI and CFI values indicate that the model is suitable for a good fit. The RMSEA value is a measure of approximate fit in the population. In our results, the RMSEA value was above 0.1. Since the GFI and CFI values were also on the borderline, we interpreted that the three-factor model did not fit well. Therefore, as Shapiro et al.[13] suggested, we recommend disregarding sub-factors to measure diabetes stress but taking the total scale score as the basis.

Strengths and Limitations

The important limitation of our study is its cross-sectional, single-center design, and the relatively small number of participants. Therefore, our findings do not reflect all adolescents with T1DM in Turkey. There is a need for further multicenter studies with large samples on this subject. Another important limitation is that in both the original scale study and the translation study, the authors had adolescents fill out additional scales (quality of life, depression, and anxiety scales, etc.) in addition to the PAID-T, whereas we did not provide other scales in our study. Instead, we only conducted face-to-face psychiatric interviews and excluded children with a psychopathology.

On the other hand, the strengths of our study are that we included adolescents with T1DM from all socioeconomic levels as much as possible. We questioned sociodemographic data and information about diabetes with face-to-face interviews and had the adolescents fill out the PAID-T in a face-to-face setting. Simultaneously with the questionnaires, we analyzed HbA1c

levels. Our study's strongest aspect is that, aside from a very recent German adaptation, it is, as far as we know, the second validity and reliability analysis of the original 14-item PAID-T in a foreign language. In this regard, we believe our research will significantly contribute to the field of pediatric diabetes, especially in the Turkish medical literature.

Conclusion

Approximately one-third of adolescents with T1DM experience significant levels of diabetes distress. Diabetes distress in adolescents with T1DM is associated with increased psychiatric disorders, poor glycemic control, decreased quality of life, and suboptimal diabetes outcomes. Due to the possible detrimental impacts on the prognosis of the disease, specialists working in pediatric endocrinology should regularly monitor distress in adolescents with T1DM. The 14-item Turkish PAID-T showed significant reliability and moderate validity. The Turkish PAID-T can be utilized by physicians and nurses who specialize in pediatric endocrinology in Türkiye to assess teenagers with T1DM, spot potential issues, and implement the required treatments.

Ethical approval

This study was approved by the Ethics Committee of Sivas Cumhuriyet University (date 13.01.2021, number 2021-01/23).

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: SAS, EA, NÇ; Data collection: SAS, NÇ, AK; Analysis and interpretation of results: SAS, EA, SK, ED; Draft manuscript preparation: SAS, EA. All authors reviewed the results and approved the final version of the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

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