

JOURNAL OF CLINICAL RESEARCH IN PEDIATRIC ENDOCRINOLOGY

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JOURNAL OF CLINICAL RESEARCH IN PEDIATRIC ENDOCRINOLOGY

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ISSN / eISSN 1308-5727 / 1308-5735

Publisher GALENOS PUBL HOUSE, Kacamak Sokak 21/1, ISTANBUL, Turkiye, Findikzade, 34093

General Information

| | | | |
|--|--|---------------------------|------------|
| Society or Institution | Pediatric Endocrinology and Diabetes Society | Journal Website | Visit Site |
| Publisher Website | Visit Site | 1st Year Published | 2008 |
| Frequency | Quarterly | Issues Per Year | 4 |
| Country / Region | TURKIYE | Primary Language ⓘ | English |
| Avg. Number of Weeks from Submission to Publication ⓘ | 20 | Article DOIs ⓘ | Yes |

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Psychometric Properties of the Turkish Validity and Reliability of the Parent Diabetes Distress Scale

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What is already known on this topic?

Families of adolescents with type 1 diabetes mellitus (T1DM) experience many difficulties in different areas related to diabetes.

What this study adds?

The adaptation and validation of the Turkish version of the Parent Diabetes Distress Scale (PDDS) is reliable and valid. The Turkish PDDS may be used to assess parental distress when their adolescent children are diagnosed or living with T1DM.

Abstract

Objective: The aim of this study was to evaluate the validity and reliability of the Turkish translation of the Parent Diabetes Distress Scale (PDDS).

Methods: The PDDS is a 5-point Likert-type scale with 20 items. After obtaining permission from the scale developers, the study commenced. First, a systematic adaptation of the scale into the Turkish language was performed including translation, expert panel review, back translation, and pilot study. Test-retest was applied to 35 participants. After these procedures, data collection was undertaken using the adapted PDDS and a demographic data collection form. The collected data were analyzed for reliability, including stability of the scale with test-retest and internal consistency of the scale (Cronbach's α), and validity including construct validity of the scale with confirmatory factor analysis (CFA).

Results: The parents of 210 teenagers, aged > 11 and < 18 years, who had been diagnosed with type 1 diabetes mellitus for at least one year were included. Of these parents, 71.9% ($n = 151$) were mothers and 53.3% ($n = 112$) of the children were girls. The Cronbach's α value was 0.906. The results of the CFA were $\chi^2/df = 4.406$, $p < 0.001$, comparative fit test 0.704, and goodness of fit tests 0.749. The mean total PDDS score was 2.2 ± 0.7 . These results indicate that scores of 1.6 points or less was evaluated as "little or no distress" 1.7-2.4 as "moderate distress," and > 2.4 points as "high distress". This showed that the majority of the parents in the study experienced moderate or severe diabetes-related distress.

Conclusion: The Turkish version of the PDDS fulfilled the validity and reliability tests at an acceptable level.

Keywords: Type 1 diabetes, adolescent, scale, reliability, validity, parent stress

Introduction

Type 1 diabetes mellitus (T1DM) is a common chronic disease caused by pancreatic β -cell damage in children

and adolescents (1,2). The 10th edition of the *International Diabetes Federation Atlas* estimated that 1,211,900 children and adolescents under 20 years of age have T1DM worldwide (3). The incidence of childhood-onset T1DM is



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Conflict of interest: None declared

Received: 19.04.2023

Accepted: 26.07.2023



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reported to be increasing in many countries. Although the rate of increase varies geographically, the overall global annual increase is estimated to be around 3% (4).

T1DM burdens the whole family of affected children in many ways and is thus a cause for clinical concern (5). Although it is generally accepted that childhood diabetes affects all family members, few studies have focused specifically on parents (5,6,7). Furthermore, relatively few studies have examined the relationships between parental stress and family demographic factors. The young age of the sick adolescent, long-term illness, low socioeconomic level, and being a single parent cause higher levels of stress in parents (5,8,9). It has been reported that in adolescents with poor glycemic control and diabetes self-management, family conflict and parental distress tend to be at a higher level (8). Increased parental emotional distress has been associated with more parental depressive symptoms, lower quality of life, and more family stress (9,10,11).

A number of different scales related to the stress caused by type 1 and type 2 diabetes have been published (12,13). However, some of these scales only measure the distress caused by diabetes (14). There are few scales evaluating diabetes-related stress in parents of children with T1DM (12,14,15). The scale developed by Katz et al. (12), on the other hand, measures the familial effect of T1DM in children. Adolescence is a particularly risky period for families in terms of diabetes management because during adolescence family conflicts tend to be increased (16). Adolescents may experience more difficulties in self-management of their chronic diabetes (5). Therefore, in 2016, Hessler et al. (17) developed the Parent Diabetes Distress Scale (PDDS), a 5-point Likert-type scale with 20 items. This scale measures the effect of adolescent T1DM on the family and has been widely used. To the best of our knowledge, however, there is no Turkish version of the PDDS. Therefore, the aim of this study was to test the factor structure, reliability and validity using the PDDS translated into Turkish.

Methods

Design and Setting

This study used a methodological design. The survey was conducted between October and December 2021.

Participants

The sample of the study consisted of the parents of adolescents over the age of 11 and under the age of 18 who attended Sivas Cumhuriyet University Faculty of Medicine, Pediatric Endocrinology outpatient clinic and had been diagnosed with T1DM for at least one year. As the scale

contained 20 items and it is recommended that a sample of 5-10 times the number of items should be reached in cross-cultural scale adaptation (18), the required sample size was calculated as at least 200 participants (20 items x 10). The targeted sample was achieved by administering the research questionnaire to 210 people. It was administered by one of the researchers using the face-to-face interview method. The participants were informed about the study beforehand, and their consent was obtained. Either the mother or father was included in the study. Other relatives were excluded. Parents who were illiterate were also excluded.

Process

The participants answer the items in the PDDS with responses ranging from *Not at all* to *A great deal*, according to how they felt about the scale items in the last month. There are no negatively scored items in the scale. To score the scale, the participants' responses to the items are summed and divided by the number of items in the scale. The scores that can be obtained from the scale range from 0 to 5. High scores are associated with increased stress levels. Hessler et al. (17) defined four sub-dimensions of the scale (personal distress, teen management distress, parent/teen relationship distress, and healthcare team distress). In the original study of Hessler et al. (17), the Cronbach's α value for the whole scale was 0.94.

In this study, the Turkish version of the PDDS and a data form created by the researchers were administered to the participants. The data form gathered information about the sociodemographic characteristics of the parents, the demographic characteristics of the teenagers, and the characteristics of their diabetes. Permission to use the PDDS was obtained by mail (info@behavioraldiabetes.org) from Dr. Polonsky, one of the original authors. The adaptation stages of the scale were conducted in line with World Health Organization intercultural adaptation guidelines, as well as recommendations in the literature review (Figure 1). The scale was translated into Turkish by two translators. Then the authors committee decided on a common translation. The translated scale was sent to experts and assessed and the content validity index (CVI) was calculated. The Turkish scale was back-translated into English, and after translation was completed, a second confirmation was received from Dr. Polonsky by e-mail. The Turkish version of the scale was administered to 10 people as a pilot study. Then 30 people were tested-retested on the final version of the scale. Correlation analysis between the test-retest was examined. Afterwards, the data collection form and PDDS were administered to 210 participants for the main study. Figure 1 shows the intercultural adaptation stages applied.

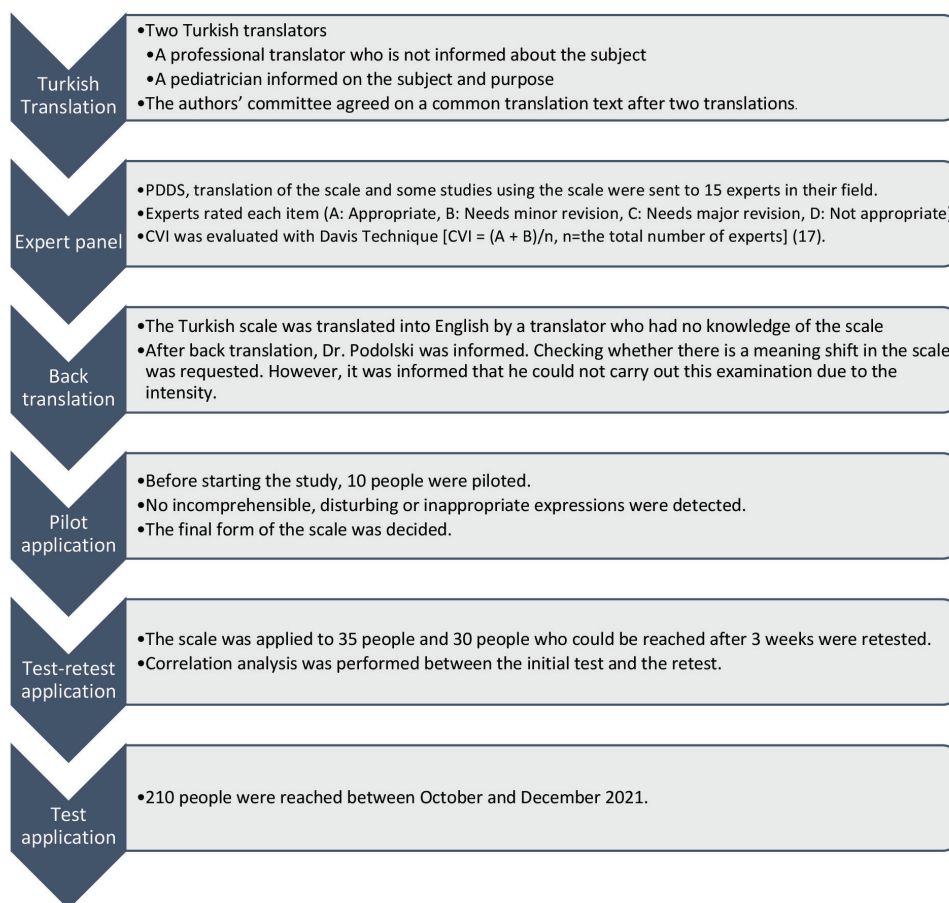


Figure 1. Intercultural adaptation stages applied in the research

CVI: content validity index, PDDS: Parent Diabetes Distress Scale

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) for Windows, version 25 and IBM SPSS Amos 20 were used for statistical analysis (IBM Inc., Armonk, NY, USA). Normality analysis was performed with the Shapiro-Wilk test for numerical values. Descriptive statistical analyses were calculated for sociodemographic data and items of the scale. The Student's t-test was used to compare normally distributed numerical data between two categorical variables. The factors affecting the PDDS score were evaluated with a multiple linear regression model analysis (enter method). The presence of multicollinearity among the independent variables was tested with the variance inflation factor (VIF) value. Within the scope of the reliability analysis of the scale, the stability of the scale was determined by test-retest, and the internal consistency of the scale was evaluated with Cronbach's α . Content validity was evaluated with the Davis technique to test the validity of the scale (19). Construct validity was tested with confirmatory factor analysis (CFA).

The suitability of the scale for factor analysis was evaluated with the sphericity method of Kaiser-Meyer-Olkin (KMO) and Bartlett's test. CFA results were reported with total variance values and factor loads, χ^2/df , comparative fit test (CFI), goodness-of-fit test (GFI), and root mean square error (RMSEA) values of approximate approximation. A p value of less than 0.05 was considered to indicate statistical significance, with a 95 % confidence interval.

Results

Descriptive Characteristics of the Participants

The parents of 210 teenagers were included in the study. The mean age of their children was 14.0 ± 2.1 years and the mean duration of diabetes diagnosis was 56.7 ± 37.8 months. Eighty (38.1%) of the parents had completed primary school. The demographic characteristics of the participants are shown in Table 1. The children of 84 (40.0%) of the participants experienced severe hypoglycemia (< 50 mg/

dL) every month. The median monthly frequency of those who had hypoglycemia was 2 (minimum: 1 - maximum: 6; interquartile range: 2.0).

Diabetes-Related Stress of Parents and Affecting Factors

The PDDS mean score of the parents was 2.2 ± 0.7 . The scores were divided into three categories: ≤ 1.6 points, 1.7-2.4, and > 2.4 . The interpretation of these three categories was: ≤ 1.6 points evaluated as “little or no distress,” 1.7-2.4 points as “moderate distress,” and > 2.4 points as “high distress.” The cut-off value was not calculated in this study. It is recommended that further studies using this scale

determine their own cut-off value. The effect of variables on PDDS scores is shown in Table 2.

Diabetes-related stress levels were found to be higher in mothers compared with fathers and in those living in rural areas compared with those living in the city center ($p < 0.05$). Diabetes-related stress levels were also found to be higher in families whose children used an insulin pen, those who had been hospitalized in the last year, those who had difficulty complying with the diabetes regimen, and those who had experienced severe hypoglycemia in their children ($p < 0.05$). In the multiple linear regression model created, the diabetes-related stress score was confirmed as higher in mothers compared with fathers, those living in rural areas compared with those living in the city center,

Table 1. Parent and teen characteristics and diabetes mellitus-related features

| Demographic characteristics | n = 210 |
|---|-------------|
| Parent (% mother) | 151 (71.9%) |
| Domicile situation n (%) | |
| City | 138 (65.7%) |
| Rural | 72 (34.3%) |
| Education level of parent* | |
| Primary school (5 years) | 81 (38.6%) |
| Secondary school (3 years) | 55 (26.2%) |
| High school (3 years) | 42 (20.0%) |
| University and above | 32 (15.2%) |
| Income level | |
| Minimum wage and below | 86 (41.0%) |
| Above minimum wage | 124 (59.0%) |
| Family structure | |
| Nuclear | 158 (75.2%) |
| Extended | 41 (19.5%) |
| Separated | 11 (5.2%) |
| Number of children | 2.1 (0.9) |
| Teen age | 14.0 (2.1) |
| Teen gender (% female) | 112 (53.3%) |
| Months since diagnosis | 56.7 (37.8) |
| HbA1c (percent) | 8.6 (1.9) |
| Frequency of self-monitoring blood glucose per day | 6.8 (2.0) |
| Insulin delivery method | |
| Pen | 193 (91.9%) |
| Pump | 17 (8.1%) |
| Additional chronic disease n (%) | 62 (29.5%) |
| Hospitalization in the last year n (%) | 114 (54.3%) |
| Intensive care hospitalization in the last year n (%) | 44 (21.0%) |
| Diabetic diet compliance | |
| Difficult | 98 (46.7%) |
| No difficulty | 112 (53.3%) |

*Educational status of the parent who answered the questionnaire was shown and illiterate people were not included in the study.
 HbA1c: glycated hemoglobin

Table 2. Effect of variables on PDDS score

| | Mean score of PDDS | p |
|--|--------------------|---------|
| Gender of teenager | | |
| Female | 2.2 (0.7) | 0.941 |
| Male | 2.2 (0.7) | |
| Parent | | |
| Mother | 2.3 (0.7) | < 0.001 |
| Father | 1.9 (0.7) | |
| Parent education | | |
| Lower than high school education | 2.2 (0.7) | 0.856 |
| High school and above education | 2.2 (0.8) | |
| Domicile situation | | |
| City | 2.0 (0.6) | < 0.001 |
| Rural | 2.5 (0.8) | |
| Method of Insulin delivery | | |
| Pen | 2.2 (0.7) | 0.001 |
| Pump | 1.6 (0.4) | |
| Hospitalization in the last year | | |
| Yes | 2.4 (0.7) | < 0.001 |
| No | 1.9 (0.6) | |
| Intensive care hospitalization in the last year | | |
| Yes | 2.6 (0.6) | 0.046 |
| No | 2.3 (0.7) | |
| Regime compliance | | |
| Easy | 2.0 (0.7) | 0.006 |
| Not easy | 2.3 (0.7) | |
| Presence of additional chronic disease | | |
| Yes | 2.4 (0.8) | 0.011 |
| No | 2.1 (0.7) | |
| Presence of severe hypoglycemia (< 50 mg/dL) every month | | |
| Yes | 2.3 (0.7) | 0.005 |
| No | 2.1 (0.7) | |

PDDS: Parent Diabetes Distress Scale

those who were hospitalized in the last year compared with those who were not hospitalized, and the presence of severe hypoglycemia (<50 mg/dL) compared to those not have ($p < 0.05$) (Table 3). Adjusted R^2 was calculated as 0.327. It shows that this established model explains 32.7% of the diabetes-related stress on parents. The VIF values of the independent variables of the model ranged from 1.088 to 1.318. Since the VIF value is below ≤ 4 , there is no multi collinearity problem (20).

Validity and Reliability Analyses of the PDDS

Content validity analysis was evaluated with the Davis technique to test the validity of the scale. With this technique a CVI > 0.80 will indicate content validity (18). The CVI for all items of the Turkish version of the PDDS was above 0.80 (Table 4).

The Cronbach's α value calculated within the scope of the internal consistency analysis of the scale was 0.906. The item-total correlation coefficients ranged from 0.208 to

Table 3. Examination of the effects of variables on parent diabetes distress using multiple regression analysis model

| | β | %95 CI | p |
|--|---------|-----------------|-------------------|
| Female teen gender (compared to male) | 0.087 | -0.270 – 0.095 | 0.345 |
| Female parent gender (compared to fathers) | 0.213 | 0.011 – 0.415 | 0.039 |
| Parent's lower than high school education level (compared to above) | -0.070 | -0.012 – 0.153 | 0.094 |
| Number of children | 0.194 | 0.097 – 0.291 | < 0.001 |
| Living in the city center (compared to rural) | -0.440 | -0.628 – -0.251 | < 0.001 |
| Using insulin pen (compared to pump) | 0.335 | -0.675 – 0.005 | 0.053 |
| Months since diagnosis | 0.002 | 0.000 – 0.004 | 0.074 |
| Hospitalization in the last year (compared to not) | 0.294 | 0.097 – 0.492 | 0.004 |
| Easy regime compliance (compared to harder) | 0.145 | -0.323 – 0.034 | 0.111 |
| Presence of additional chronic disease (compared to not) | 0.309 | 0.107 – 0.512 | 0.003 |
| HbA1c | -0.014 | -0.061 – 0.032 | 0.543 |
| Presence of severe hypoglycemia (< 50 mg/dL) every month (compared to not) | 0.209 | 0.012 – 0.407 | 0.038 |

n = 210, adjusted $R^2 = 0.327$.

CI: confidence interval, HbA1c: glycated hemoglobin

Table 4. The results of CVI on PDDS using the Davis technique

| | Appropriate | Needs minor revision | Needs major revision | Not appropriate | CVI |
|---------|-------------|----------------------|----------------------|-----------------|------|
| Item 1 | 11 | 2 | 2 | 0 | 0.86 |
| Item 2 | 14 | 0 | 1 | 0 | 0.93 |
| Item 3 | 13 | 1 | 1 | 0 | 0.93 |
| Item 4 | 15 | 0 | 0 | 0 | 1.00 |
| Item 5 | 9 | 4 | 2 | 0 | 0.86 |
| Item 6 | 10 | 3 | 2 | 0 | 0.86 |
| Item 7 | 8 | 5 | 2 | 0 | 0.86 |
| Item 8 | 15 | 0 | 0 | 0 | 1.00 |
| Item 9 | 14 | 1 | 0 | 0 | 1.00 |
| Item 10 | 15 | 0 | 0 | 0 | 1.00 |
| Item 11 | 12 | 1 | 2 | 0 | 0.86 |
| Item 12 | 15 | 0 | 0 | 0 | 1.00 |
| Item 13 | 11 | 2 | 2 | 0 | 0.86 |
| Item 14 | 7 | 6 | 2 | 0 | 0.86 |
| Item 15 | 14 | 1 | 0 | 0 | 1.00 |
| Item 16 | 13 | 1 | 1 | 0 | 0.93 |
| Item 17 | 15 | 0 | 0 | 0 | 1.00 |
| Item 18 | 12 | 1 | 2 | 0 | 0.86 |
| Item 19 | 7 | 6 | 1 | 1 | 0.86 |
| Item 20 | 15 | 0 | 0 | 0 | 1.00 |

CVI: content validity index, PDDS: Parent Diabetes Distress Scale

Table 5. Test-retest and Cronbach's α analyzes of the PDDS

| | Test retest reliability (Pearson's r) | Total correlation | Cronbach's α if item deleted |
|---------|---------------------------------------|---|-------------------------------------|
| Item 1 | 0.743** | 0.355 | 0.906 |
| Item 2 | 0.854** | 0.503 | 0.902 |
| Item 3 | 0.797** | 0.595 | 0.900 |
| Item 4 | 0.809** | 0.599 | 0.900 |
| Item 5 | 0.912** | 0.677 | 0.898 |
| Item 6 | 0.912** | 0.599 | 0.900 |
| Item 7 | 0.953** | 0.700 | 0.897 |
| Item 8 | 0.832** | 0.464 | 0.903 |
| Item 9 | 0.874** | 0.649 | 0.898 |
| Item 10 | 0.660** | 0.542 | 0.902 |
| Item 11 | 0.535* | 0.208 | 0.909 |
| Item 12 | 0.815** | 0.495 | 0.903 |
| Item 13 | 0.820** | 0.646 | 0.898 |
| Item 14 | 0.798** | 0.643 | 0.899 |
| Item 15 | 0.729** | 0.477 | 0.903 |
| Item 16 | 0.836** | 0.410 | 0.905 |
| Item 17 | 0.861** | 0.609 | 0.900 |
| Item 18 | 0.830** | 0.588 | 0.900 |
| Item 19 | 0.909** | 0.469 | 0.903 |
| Item 20 | 0.892** | 0.552 | 0.901 |
| Total | 0.942** | Cronbach's α of total scale: 0.906 | |

* < 0.05, ** < 0.001.

PDDS: Parent Diabetes Distress Scale

0.700. There was a single value below 0.30, but since there was no change in the Cronbach α value when this item was removed, it was decided to retain the item in the scale. The reliability of the scale was also measured using the test-retest method. The test-retest correlation coefficients of the items of the scale ranged from 0.535 to 0.953. The test-retest correlation coefficient of the total score was calculated as 0.942 (Table 5). The KMO coefficient, which was calculated within the scope of the construct validity of the scale, was 0.842. Bartlett's sphericity test results were $\chi^2 = 2003.303$, $p < 0.001$. In the CFA performed on the sub-dimensions defined in the scale, the χ^2/df value was calculated as 4.406 ($p < 0.001$), GFI 0.749, CFI 0.704 and RMSEA 0.128. Figure 2 shows the CFA model of the PDDS.

Discussion

Families who have teenagers with T1DM experience many difficulties, which may include their own personal distress, difficult relationships with their teenagers, and teenagers' problems with managing their diabetes. Identifying and supporting families' diabetes-related distress plays a key role in disease management. Adolescence is already a challenging period for young people, in which many changes occur physically and psychologically. It is more difficult for teenagers to struggle with a chronic illness, such as T1DM, during this period. A happy and psychologically

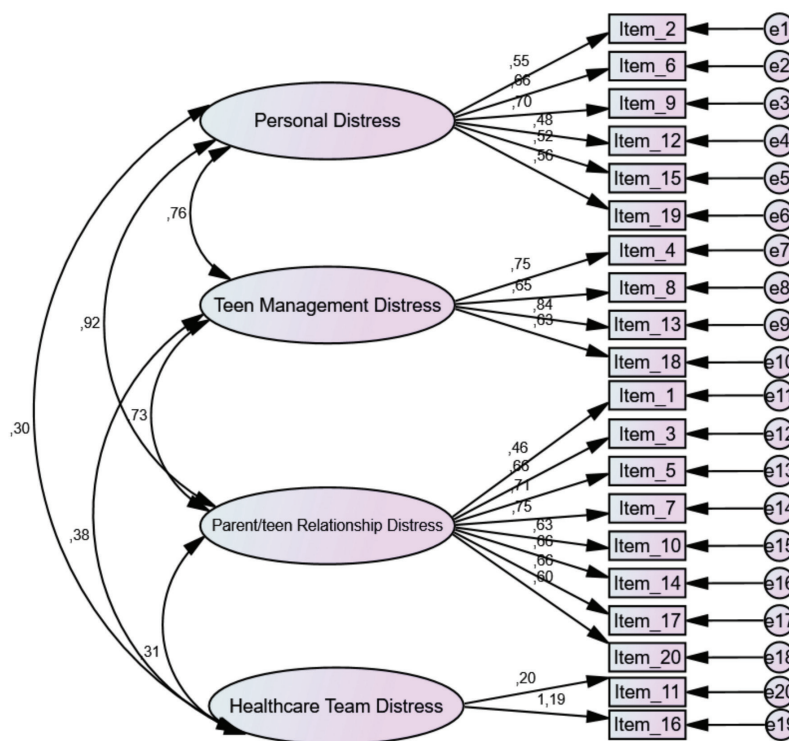


Figure 2. Confirmatory factor analysis model of the PDDS

PDDS: Parent Diabetes Distress Scale

strong parent can better support their child in this process. The current study describes the adaptation of the PDDS for use in Turkey and the subsequent validity testing in order to provide a tool to assess the stress experienced by parents of adolescents with T1DM.

Content validity analysis of the scale was conducted. The CVI value of all items of the PDDS scale were higher than 0.80, which was interpreted as the Turkish version of the PDDS having content validity (20). The Cronbach's α , item-total correlation, and test-retest correlation analyses were performed within the scope of reliability analyses of the scale. The Cronbach's α value calculated for the Turkish version of the PDDS was 0.906 which was comparable with 0.940 reported by Hessler et al. (17) following the original development of the scale. In the literature, a value of 0.60 and above is acceptable for the Cronbach's α value (21) although some researchers suggest that values above 0.70 are reliable (22). Item-total correlation analysis, one of the reliability analyses, explains the relationship between the scores obtained from the test items and the total score of the test. If this value is 0.30 and above, it may be interpreted as the discrimination rate of the items is high (18). Only one of the 20 items of the Turkish version of the PDDS scale had a value below 0.30, but when this item was removed it did not change the Cronbach's α value so it was decided to retain the item in the scale. The test-retest method is the reliability calculation applied to determine the stability of a scale. In this assessment, the time between testing and retesting is important. Deciding the delay should be done according to the feature measured. Generally, it is stated that a period of 2-3 or 4-6 weeks is sufficient (23). In the present study, the test was administered again to 30 of the original 35 participants three weeks after first completion. The test-retest reliability for the present study was 0.942 and there was a strong and significant positive correlation between the two sessions.

In the present study, KMO and Bartlett tests were applied to determine the adequacy of the sample and whether the data were suitable for factor analysis. The present study found a KMO value of 0.842 while Bartlett's sphericity test results were significant at $\chi^2 = 2003.303$ and $p < 0.001$. A KMO value greater than 0.60 and a significant Bartlett test indicate that the data are suitable for factor analysis (18). In the CFA performed on the sub-dimensions defined in the scale, χ^2/df , GFI, CFI, and RMSEA values were used to evaluate the fit index. A χ^2/df value of ≤ 3 is a very good indicator of model fit. GFI and CFI values of 0.90 and above indicate adequate good fit, while values between 0.80 and 0.90 indicate that the structure is suitable for a good fit. Regarding the RMSEA value, while some researchers accept

< 0.06 as being good, others accept 0.07 as the threshold value (24,25,26). In our study, the CFA, performed in accordance with the study of Hessler et al. (17), showed that the fit indexes of the sub-dimensions were low. For this reason, it was concluded that the scale did not show any sub-dimensions in the analyses conducted in our sample and it should therefore be evaluated using the total score.

The results of the present study in more than 200 parents of Turkish adolescents with T1DM found that diabetes-related parental stress was common, which is similar to previous studies (8,11) and the findings of the original scale. The PDDS scale mean score of the parents was 2.2 ± 0.7 which falls towards the upper end of the moderate distress category. This suggests that most of the study participants experienced moderate or severe DDS. Furthermore, earlier studies reported that mothers experience more stress than fathers when caring for a child with diabetes (27,28,29). This finding was replicated with the Turkish version of the PDDS. Common stressors include food management, family conflict related to diabetes, injecting insulin, and monitoring blood sugar (30).

There may be differences between the sexes in terms of adaptation to chronic disease due to hormonal and metabolic changes during adolescence. While it is more difficult for boys to adapt to diabetes during childhood, it is more difficult for girls to adapt during adolescence. This situation also makes a difference in the impact of the disease on their families. Different results have been found in the literature on this issue (31,32). In the study of Hessler et al. (17), it was reported that parents of sons experienced more diabetes-related stress. In another study, it was found that families of adolescent girls experienced more stress (33). The present study found no significant patient gender effect and the scale score.

In the study of Hessler et al. (17), it was reported that parents of sons experienced more diabetes-related stress. Hessler et al. (17) reported no correlation between the duration of diabetes diagnosis and stress and this was also found in the present study. Many studies have reported a relationship between degree of glycemic control and diabetes-related stress (34,35,36). In the present study, there was no relationship between stress level and glycated hemoglobin (HbA1c) level, but a positive correlation was found with increasing frequency of severe hypoglycemia. Hessler et al. (17) found a positive correlation between both frequency of hypoglycemia and HbA1c level and stress. In a study among Lithuanian youth, parents of young people with good diabetes control had lower stress levels (33).

Parents of children with T1DM experience fear and stress during insulin injection and glucose-testing procedures.

Previous studies reported that 13.6% of mothers experienced needle phobia and related stress following the diagnosis of diabetes (37,38). In the present study, higher levels of stress were reported by parents of adolescents who used an insulin pen for injections compared with those who used pumps. This was similar to the original report of Hessler et al. (17) but in a later study by Polonsky et al. (38) research, the opposite was the case.

Studies have shown that the most frequent conflicts between families and young people were around adolescents' blood sugar control and adherence to their diets (39,40). In the present study, parents of adolescents who had difficulties in adapting to their diabetes regimen had increased stress. Frey et al. (41) found that low income level was associated with difficulties in coping with the disease and also with more stress in mothers. Mothers had higher levels of diabetes-related stress than fathers in the present study, in line with earlier reports.

Approximately 20-30% of parents of children with T1DM experience clinically significant depressive symptoms and anxiety (42). These symptoms are mostly related to parents' involvement in their child's diabetes management tasks (43). In addition, parents' fear of hypoglycemia and adolescents' poor glycemic control also increased parents' stress (5,44). In the present study, stress increased in the families of adolescents who had severe hypoglycemia in the month preceding completion of the Turkish version of the PDDS, or if their children had been hospitalized in the previous year, or had an additional chronic disease. These findings are again in line with previously published reports.

Study Limitations

The study data were collected from a single center in the central part of the country. Statistical power was limited. Therefore, the generalization of results by country are likely to be affected. However, the present study also has several strengths. First of all, to the best of our knowledge, this is the first study conducted in Turkey in which this scale was adapted and used. Therefore, this study indicates that the Turkish version of the PDDS may be used in both clinical and research settings, and the validity and reliability of the Turkish version are at a sufficient level. In addition, cross-cultural comparative studies can be carried out using this scale.

Conclusion

Diabetes-related stress is a common and important problem for parents of adolescents with T1DM. This stress is associated with sociodemographic characteristics of families and adolescents' diabetes management. This

study examined the psychometric properties of the Turkish version of the PDDS and the results showed that the Turkish version of the scale was a valid and reliable measurement tool.

Acknowledgements

We thank all the families for participating in the study. Also the authors would like to express their gratitude to Dr. Jill Weissberg-Benchell for supportive approach.

Ethics

Ethics Committee Approval: Ethics approval was granted by the Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee (approval number: 2021-01/52, date: 13.01.2021).

Informed Consent: The participants were informed about the study beforehand, and their consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Seher Karahan, Ezgi Ağadayı, Concept: Seher Karahan, Seda Aybüke Sarı, Nurullah Çelik, Ayça Kömürlüoğlu Tan, Esra Döğër, Design: Seher Karahan, Ezgi Ağadayı, Seda Aybüke Sarı, Nurullah Çelik, Ayça Kömürlüoğlu Tan, Esra Döğër, Data Collection or Processing: Seher Karahan, Ezgi Ağadayı, Seda Aybüke Sarı, Nurullah Çelik, Ayça Kömürlüoğlu Tan, Esra Döğër, Analysis or Interpretation: Ezgi Ağadayı, Literature Search: Seher Karahan, Ezgi Ağadayı, Writing: Seher Karahan, Seda Aybüke Sarı.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Kalyva E, Malakonaki E, Eiser C, Mamoulakis D. Health-related quality of life (HRQoL) of children with type 1 diabetes mellitus (T1DM): self and parental perceptions. *Pediatr Diabetes* 2011;12:34-40.
2. Shulman RM, Daneman D. Type 1 diabetes mellitus in childhood. *Medicine* 2010;38:679-685.
3. Ogle GD, James S, Dabelea D, Pihoker C, Svensson J, Maniam J, Klatman EL, Patterson CC. Global estimates of incidence of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Atlas, 10th edition. *Diabetes Res Clin Pract* 2022;183:109085. Epub 2021 Dec 6
4. Patterson CC, Karuranga S, Salpea P, Saeedi P, Dahlquist G, Soltesz G, Ogle GD. Worldwide estimates of incidence, prevalence and mortality of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract* 2019;157:107842. Epub 2019 Sep 10
5. Streisand R, Swift E, Wickmark T, Chen R, Holmes CS. Pediatric parenting stress among parents of children with type 1 diabetes: the role of self-efficacy, responsibility, and fear. *J Pediatr Psychol* 2005;30:513-521. Epub 2005 Mar 3

6. Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus: Diabetes Control and Complications Trial. Diabetes Control and Complications Trial Research Group. *Journal of Pediatrics* 1994;125:177-188.
7. Wysocki T, Greco P, Buckloh LM. Childhood diabetes in psychological context. In: Roberts MC (ed). *Handbook of pediatric psychology*. The Guilford Press, 2003;304-320.
8. Whittemore R, Jaser S, Chao A, Jang M, Grey M. Psychological experience of parents of children with type 1 diabetes: a systematic mixed-studies review. *Diabetes Educ* 2012;38:562-579. Epub 2012 May 11
9. Jaser SS, Whittemore R, Ambrosino JM, Lindemann E, Grey M. Coping and psychosocial adjustment in mothers of young children with type 1 diabetes. *Children's Health Care* 2009;38:91-106.
10. Moore SM, Hackworth NJ, Hamilton VE, Northam EP, Cameron FJ. Adolescents with type 1 diabetes: parental perceptions of child health and family functioning and their relationship to adolescent metabolic control. *Health Qual Life Outcomes* 2013;11:50.
11. Helgeson VS, Becker D, Escobar O, Siminerio L. Families with children with diabetes: implications of parent stress for parent and child health. *J Pediatr Psychol* 2012;37:467-478. Epub 2012 Jan 19
12. Katz ML, Volkening LK, Dougher CE, Laffel LM. Validation of the Diabetes Family Impact Scale: a new measure of diabetes-specific family impact. *Diabet Med* 2015;32:1227-1231. Epub 2015 Feb 5
13. Telci Çakılı Ö, Feyizoğlu G, Tülü Çolak S, Dizman N, Bozkurt Çakır SI, Oğuz A. Reliability and validity of the Turkish version of the Diabetes Distress Scale for type 2 diabetes and distress levels of the participants. *Turk J Med Sci* 2020;50:464-470.
14. Geffken GR, Lehmkuh H, Walker KN, Storch EA, Heidgerken AD, Lewin AB, Smith LB, Silverstein J. Family functioning processes and diabetic ketoacidosis in youths with type I diabetes. *Rehabil Psychol* 2008;53:231-237.
15. Wennick A, Lundqvist A, Hallström I. Everyday experience of families three years after diagnosis of type 1 diabetes in children: a research paper. *J Pediatr Nurs* 2009;24:222-230. Epub 2008 Jul 21
16. Miller KM, Foster NC, Beck RW, Bergenstal RM, DuBose SN, DiMeglio LA, Maahs DM, Tamborlane WV; T1D Exchange Clinic Network. Current state of type 1 diabetes treatment in the U.S.: updated data from the T1D Exchange clinic registry. *Diabetes Care* 2015;38:971-978.
17. Hessler D, Fisher L, Polonsky W, Johnson N. Understanding the Areas and Correlates of Diabetes-Related Distress in Parents of Teens With Type 1 Diabetes. *J Pediatr Psychol* 2016;41:750-758. Epub 2016 Feb 10
18. Akgül A, Çevik O. İstatistiksel Analiz Teknikleri. Ankara, Emek Ofset, 2003.
19. Davis LL. Instrument review: Getting the most from a panel of experts. *Appl Nurs Res* 1992;5:194-197.
20. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate Data Analysis*. 2010. 7th Edition, Pearson, New York. Open Access Library Journal 2016;3.
21. Karagöz Y, Kösterelioğlu İ. Developing Evaluation Scale of Communication Skills with Factor Analysis. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi* 2008;21:81-98.
22. Büyüköztürk Ş. *Sosyal bilimler için veri analizi el kitabı (7. Baskı)*. Ankara, Pegem Akademi Yayınları, 2007.
23. Liu Thompkins Y. Developing a Scale to measure the interactivity of websites. *J Advert Res* 2003;43:207-216.
24. Taşancıl E. *Tutumların Ölçülmesi ve SPSS ile Veri Analizi*. (6.Baskı). Nobel Tıp, 2018.
25. Hoe SL. Issues and Procedures in Adopting Structural Equation Modeling Technique. *Journal of Applied Quantitative Methods* 2008;3:76-83.
26. Yaşlıoğlu MM. Factor Analysis and Validity in Social Sciences: Application of Exploratory and Confirmatory Factor Analyses IUJBS 2017;46(Suppl):74-85.
27. İlhan M, Çetin B. Comparing the Analysis Results of the Structural Equation Models (SEM) Conducted Using LISREL and AMOS. *Journal of Measurement and Evaluation in Education and Psychology* 2014;5:26-42.
28. Streisand R, Mackey ER, Elliot BM, Mednick L, Slaughter IM, Turek J, Austin A. Parental anxiety and depression associated with caring for a child newly diagnosed with type 1 diabetes: opportunities for education and counseling. *Patient Educ Couns* 2008;73:333-338.
29. Sullivan-Bolyai S, Deatrick J, Gruppuso P, Tamborlane W, Grey M. Constant vigilance: mothers' work parenting young children with type 1 diabetes. *J Pediatr Nurs* 2003;18:21-29.
30. Hansen JA, Weissbrod C, Schwartz DD, Taylor WP. Paternal involvement in pediatric Type 1 diabetes: fathers' and mothers' psychological functioning and disease management. *Fam Syst Health* 2012;30:47-59.
31. Wolpert HA, Anderson BJ. Young adults with diabetes: need for a new treatment paradigm. *Diabetes Care* 2001;24:1513-1514.
32. Luyckx K, Seiffge-Krenke I. Continuity and change in glycemic control trajectories from adolescence to emerging adulthood. *Diabetes Care* 2009;32:797-801.
33. Kassem S. Factors Related to the Glycemic Control in Lithuanian Adolescents with Type 1 Diabetes Mellitus; 2017: pg 37.
34. Beveridge RM, A Berg C, J Wiebe D, L Palmer D. Mother and adolescent representations of illness ownership and stressful events surrounding diabetes. *J Pediatr Psychol* 2006;31:818-827. Epub 2005 Dec 21
35. World Health Organization (WHO). Process of translation and adaptation of instruments. https://www.who.int/substance_abuse/research_tools/translation/en/ Ulaşılma Tarihi: 11.09.2022
36. Markowitz JT, Volkening LK, Butler DA, Antisdel-Lomaglio J, Anderson BJ, Laffel LM. Re-examining a measure of diabetes-related burden in parents of young people with Type 1 diabetes: the Problem Areas in Diabetes Survey - Parent Revised version (PAID-PR). *Diabet Med* 2012;29:526-530.
37. Mitchell SJ, Hilliard ME, Mednick L, Henderson C, Cogen FR, Streisand R. Stress among fathers of young children with type 1 diabetes. *Fam Syst Health* 2009;27:314-324.
38. Polonsky WH, Fisher L, Earles J, Dudl RJ, Lees J, Mullan J, Jackson RA. Assessing psychosocial distress in diabetes: development of the diabetes distress scale. *Diabetes Care* 2005;28:626-631.
39. Howe CJ, Ratcliffe SJ, Tuttle A, Dougherty S, Lipman TH. Needle anxiety in children with type 1 diabetes and their mothers. *MCN Am J Matern Child Nurs* 2011;36:25-31.
40. Savin KL, Hamburger ER, Monzon AD, Patel NJ, Perez KM, Lord JH, Jaser SS. Diabetes-specific family conflict: Informant discrepancies and the impact of parental factors. *J Fam Psychol* 2018;32:157-163.
41. Frey MA, Ellis D, Templin T, Naar-King S, Gutai JP. Diabetes management and metabolic control in school-age children with type 1 diabetes. *Child Health Care* 2006;35:349-363.
42. Campbell MS, Wang J, Cheng Y, Cogen FR, Streisand R, Monaghan M. Diabetes-specific family conflict and responsibility among emerging adults with type 1 diabetes. *J Fam Psychol* 2019;33:788-796. Epub 2019 Apr 25
43. Hilliard ME, Powell PW, Anderson BJ. Evidence-based behavioral interventions to promote diabetes management in children, adolescents, and families. *The American psychologist*; 2016;71:590-601.
44. Jaser SS, Linsky R, Grey M. Coping and psychological distress in mothers of adolescents with type 1 diabetes. *Matern Child Health J* 2014;18:101-108.