Karya J Health Sci. 2025;6(3):94-101
RESEARCH ARTICLE/ARAŞTIRMA MAKALESİ doi: 10.52831/kjhs.1706195 e-ISSN:2717-9540

KARYA JOURNAL OF HEALTH SCIENCE

journal homepage: www.dergipark.org.tr/kjhs

TURKISH VALIDITY AND RELIABILITY OF PEDIATRIC DIABETES ROUTINES QUESTIONNAIRE

PEDİATRİK DİYABET RUTİNLERİ ÖLÇEĞİNİN TÜRKÇE GEÇERLİK VE GÜVENİRLİK ÇALIŞMASI

Gizem Kerimoğlu Yıldız[1], Merve Azak[2*], Sezer Korkmaz[3], Nimet Barna[3], Fatma Özgüç Çömlek[4]

[1]Department of Pediatric Nursing, Faculty of Health Sciences, Hatay Mustafa Kemal University, Hatay, Türkiye

[2]Department of Pediatric Nursing, Florence Nightingale Faculty of Nursing, İstanbul University-Cerrahpaşa, İstanbul, Türkiye

[3]Cengiz Gökçek Gynecology and Pediatrics Hospital, Gaziantep, Türkiye

[4]Department of Pediatric Endocrinology, Faculty of Medicine, Selçuk University, Konya, Türkiye

ABSTRACT

Objective: The aim of this study is to evaluate the validity and reliability of the Turkish version of the Pediatric Diabetes Routines Questionnaire (PDRQ) for parents of children diagnosed with Type 1 Diabetes Mellitus (T1DM), in order to determine its applicability in assessing children's daily diabetes-related routines.

Method: This methodological study was conducted face-to-face with 131 parents of children aged 5-17 who visited the outpatient diabetes clinic of a women's and children's hospital in the southeastern part of Türkiye. The adaptation followed standard procedures including translation, back-translation, expert evaluation, a pilot study, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Reliability was examined using Cronbach's alpha, item-total correlations, and split-half methods.

Results: Based on the exploratory factor analysis, it was determined that the scale was explained by five factors instead of the original two-factor structure. However, the confirmatory factor analysis showed that the two-factor structure of the original version, consisting of "daily regimen routines" and "technical/situational routines," was largely preserved. With three modifications made without removing any items, the model fit indices of the scale were found to be at an acceptable level (χ^2/df=1.60, RMSEA=0.068, SRMR=0.079, CFI=0.99, and NNFI=0.90). The Cronbach's alpha coefficient for the total of 21 items was 0.822, while the values for the subscales were 0.752 and 0.655, respectively. These findings indicate that the Turkish version of the PDRQ is a valid and reliable measurement tool.

Conclusion: The 21-item Turkish version of the Pediatric Diabetes Routines Questionnaire (PDRQ) has been found to be a valid and reliable instrument for assessing the daily diabetes management routines of children diagnosed with Type 1 Diabetes Mellitus. This scale can be confidently used in both clinical practice and scientific research to objectively evaluate the level of parental involvement in their children's diabetes management.

Key Words: Diabetes Mellitus, Type 1, Activities of Daily Living, Parents, Psychometrics

ÖZ

Amaç: Bu çalışmanın amacı, Tip 1 Diyabetes Mellitus (T1DM) tanısı almış çocukların ebeveynleri için geliştirilen Pediatrik Diyabet Rutinleri Ölçeği'nin (PDRQ) Türkçe formunun geçerlilik ve güvenirliğini değerlendirerek, çocukların diyabete ilişkin günlük rutinlerinin ölçülmesinde kullanılabilirliğini belirlemektir.

Yöntem: Bu metodolojik çalışma, Türkiye'nin güneydoğu kesiminde bulunan bir kadın ve çocuk hastanesinin diyabet polikliniğini ziyaret eden 5-17 yaş arası çocukların 131 ebeveyniyle yüz yüze görüşme yapılarak gerçekleştirildi. Kültürel uyarlama sürecinde; çeviri, geri çeviri, uzman görüşü alma, pilot çalışma, açıklayıcı faktör analizi (AFA) ve doğrulayıcı faktör analizi (DFA) adımları gerçekleştirildi. Güvenirlik ise Cronbach alfa katsayısı, madde-toplam korelasyonları ve yarı yarıya güvenilirlik yöntemleriyle değerlendirildi.

Bulgular: Yapılan açıklayıcı faktör analizi doğrultusunda ölçeğin original formunda yer alan iki faktörlü yapı yerine beş faktör ile açıklandığı belirlendi. Doğrulayıcı faktör analizi sonucunda ise ölçeğin özgün versiyonunda yer alan iki faktörlü yapı, "günlük rejim rutinleri" ile "teknik/durumsal rutinler" olmak üzere, büyük oranda korundu. Ölçekten madde çıkarılmadan yapılan üç modifikasyonla ölçeğin model uyum indekslerinin kabul edilebilir düzeyde olduğu belirlendi (χ^2/df=1.60, RMSEA=0.068, SRMR=0.079, CFI=0.99, and NNFI= 0.90). Toplam 21 madde için Cronbach alfa katsayısı 0.822 olarak bulundu. Alt ölçekler için bu değerler sırasıyla 0.752 ve 0.655 idi. Bu bulgular Türkçe PDRQ'nun geçerli ve güvenilir bir ölçüm aracı olduğunu gösterdi.

Sonuç: PDRQ ölçeğinin 21 maddeli Türkçe formunun Tip 1 Diyabetus Mellitus tanısı almış çocukların günlük diyabet yönetim rutinlerinin değerlendirilmesinde geçerli ve güvenilir bir ölçüm aracı olduğu belirlendi. Bu ölçek hem klinik uygulamalarda hem de bilimsel çalışmalarda, ebeveynlerin çocuklarının diyabet yönetimine katılım düzeylerini nesnel olarak değerlendirmek amacıyla güvenle kullanılabilir.

Anahtar Kelimeler: Diyabet Mellitus, Tip 1, Günlük Yaşam Aktiviteleri, Ebeveynler, Psikometri

Article Info/Makale Bilgisi

Submitted/Yükleme tarihi: 29.05.2025, **Revision requested/Revizyon isteği:** 15.10.2025, **Last revision received/Son düzenleme tarihi:** 21.11.2025, **Accepted/Kabul:** 25.11.2025

***Corresponding author/Sorumlu yazar:** İstanbul University-Cerrahpaşa, Florence Nightingale Faculty of Nursing, Department of Pediatric Nursing, İstanbul, Türkiye

[2*]Email: merve.azak@iuc.edu.tr, [1]Email: gizemkerimogluyildiz@mku.edu.tr, [3]Email: sezer2745@gmail.com, [4]Email: barnanimet@gmail.com, [5]Email: fatmaozguc@gmail.com

INTRODUCTION

Diabetes-specific routines emerge when individuals establish certain patterns of behavior in adherence to their diabetes treatment regimen. The management of Type 1 Diabetes Mellitus (T1DM) involves a range of self-care tasks, including regular blood glucose monitoring and regulation, dietary regulation, insulin administration, and exercise management, all of which are essential for preventing both acute and long-term complications [1,2]. Therefore, managing diabetes through consistent daily routines plays a critical role in achieving successful outcomes, such as treatment adherence, glycemic control, and quality of life.

Poor management of pediatric diabetes routines can lead to acute serious complications (e.g., hypoglycemia and diabetic ketoacidosis) and chronic complications (e.g., retinopathy, neuropathy, heart and kidney disease, vision loss, etc.) as well as psychosocial consequences (e.g., stress, reduced quality of life, etc.) [3-6]. International guidelines typically recommend measures that require a strict regimen, emphasizing daily and consistent management of blood glucose, diet, exercise and administration of insulin [7,8]. The practices recommended in these guidelines are typically a part of the child's daily or weekly activities. These may include activities such as eating regular meals, attending school, preparing for bedtime, and engaging in daily tasks. Within this context, diabetes management is integrated into the child's everyday life. However, it is critically important that parents are able to establish such routines and actively involve their children in them. Studies have shown that collaborative parental involvement, where parents and children work together on diabetes management, improves self-care, reduces family conflict, enhances quality of life, and is associated with lower glycolyzed hemoglobin levels, indicating better blood glucose control [9-11]. Insufficient parental involvement in diabetes management has been shown to delay the child's adaptation to the illness and may result in serious outcomes such as severe hyperglycemia. Ongoing parental monitoring, particularly of blood glucose levels and insulin administration, is critically important during the transition from childhood to adolescence. Such parental involvement supports treatment adherence and helps prevent the deterioration in glycemic control that is often observed in older children [12].

Although numerous studies have examined the impact of diabetes management and family involvement in preventing complications of childhood diabetes mellitus, there is currently no scale developed in Türkiye that enables parents to assess their children's diabetes-related routines. Therefore, the aim of this study is to conduct the Turkish adaptation and psychometric evaluation of the Pediatric Diabetes Routines Questionnaire (PDRQ), a 21-item instrument developed by Pierce and Jordan [13]. The PDRQ allows for the evaluation of specific daily diabetes routines, with the purpose of identifying the structured nature of the diabetes regimen, guiding intervention strategies, and informing educational planning. The Turkish adaptation of the PDRQ is expected to serve as an important tool for understanding parental behaviors and routines in pediatric diabetes management. Furthermore, the use of this scale may provide valuable insights for researchers and healthcare professionals in supporting and guiding parents, informing family-based interventions, and ultimately enhancing success in the management of pediatric diabetes.

Research Question

- Is the Turkish version of the PDRQ a valid tool for assessing daily diabetes-related routines among Turkish parents of children with Type 1 Diabetes Mellitus?
- Is the Turkish version of the PDRQ a reliable tool for assessing daily diabetes-related routines among Turkish parents of children with Type 1 Diabetes Mellitus?

METHOD

Study Design and Partipicants

The purpose of this methodological study is to test the validity and reliability of PDRQ for Turkish population, which is intended to be used by parents of children aged 5 to 17 with T1DM to evaluate their children's illness-related routines.

This study was conducted between 20th January and 20th June 2023 in the outpatient diabetes clinic of a women's and children's hospital in the southeastern region of Türkiye. The clinic is staffed by two endocrinologists and two diabetes education nurses. It serves patients aged 0-18 who have been newly diagnosed with T1DM and who apply for treatment and follow-up services after they get the diagnosis.

The study population consisted of children's parents with diabetes aged between 5 and 17 years who applied to the diabetes clinic during the study period. The study sample consisted of parents who volunteered to participate and correspond the inclusion criteria: having a child aged 5-17 diagnosed with T1DM, being able to speak and understand Turkish, having no visual or hearing impairments, and having no cognitive or mental health issues.

Since the scale used in the study consists of 21 items, a minimum of 105 participants was targeted as minimum in line with literature suggesting that the sample size should be minimum five times and ideally ten times the number of items to ensure adequacy for factor analysis in validity and reliability studies [14]. Additionally, the literature also indicates that a sample size between 100 and 200 is considered acceptable for factor analysis [15]. However, data collection coincided with the devastating earthquakes that occurred on February 6, 2023, in Türkiye. During this period, many families were displaced and did not attend their follow-ups, which limited the possibility of recruiting additional participants. Moreover, since the study group consisted of a special group (mothers of children aged 5-17 years diagnosed with Type 1 Diabetes Mellitus), reaching the ideal sample size was practically challenging. Based on these situations, the study sample consisted of 131 randomly selected parents who volunteered to participate. Informed consent was obtained from all parents who volunteered to take part in the study.

The inclusion criteria for the study were as follows: being willing to participate in the study, speaking Turkish, being literate, having a child who had been receiving treatment for Type 1 Diabetes Mellitus for at least three months (to ensure that the disease and treatment routines had been experienced), and not having any additional chronic disease other than Type 1 Diabetes Mellitus.

Outcome Measures

Parent Information Form: This form consists of 20 questions developed by the researchers based on the relevant literature, designed to collect demographic information about the children and their families [16].

Pediatric Diabetes Routines Questionnaire (PDRQ): The scale was developed by Pierce and Jordan [13] in the United States (Mississippi) to assess the routines that parents of children diagnosed with diabetes implement in their daily lives. The original psychometric evaluation of the PDRQ was conducted with 198 parents of children aged 5-17 years with Type 1 Diabetes [13]. The results demonstrated promising psychometric properties, including high internal consistency (α=.88) and strong test-retest reliability (r=.81). It aims to evaluate various aspects of routines related to the care and management of diabetes in children. The scale provides information about daily activities such as monitoring blood glucose levels, administering insulin, adjusting diet, and planning physical activity for their children. It is used to understand the processes of diabetes management within families, evaluate daily routines, and determine the impact of these routines on children's health. The items are rated using a 5-point Likert scale ranging from 1 (never) to 5 (every day).

The scale has two factors entitled as "daily regimen routines" (Items 3,4,5,7,10,11,12,13,14,17,18 and 19) and technical/situational routines" (Items 1,2,6,8,9,15,16, 20 and 21). Additionally, participants are given the option to mark "N/A" (cannot rate this item/not applicable). An item is considered invalid if more than 50% of the participants select the "N/A" option [6]. However, in the pilot study conducted prior to this research, no item received more than 50% "N/A" responses. Additionally, since this was a scale validation study, the term "N/A" was not explicitly used during the data collection phase. Items 3, 12, and 13 are reverse-coded. The total score that can be obtained from the scale ranges from 21 to 105.

Adaptation Process of the Scale

Language Validity: During the translation of the PDRQ into Turkish, careful attention was paid to both linguistic accuracy and the cultural relevance of diabetes-related routines. The translation procedures were conducted in accordance with the guidelines of the Professional Society for Health Economics and Outcomes Research (ISPOR) [17]. Three native Turkish speakers independently translated the original English version into Turkish. The most appropriate and culturally meaningful expressions were selected from among the three translations to form a preliminary Turkish version. In the back-translation phase, the Turkish version was translated back into English by an expert fluent in both English and Turkish, who had no prior exposure to the original instrument. This back-translated version was compared with the original PDRQ then, and discrepancies were reviewed to ensure semantic and conceptual equivalence. Based on the comparisons, the final version of the Turkish PDRQ was prepared for expert review and cultural adaptation.

Pilot Study: A pilot study was conducted with 10 parents to assess the clarity of the items and the usability of the scale. Items that were unclear or difficult to understand were identified and revised as necessary. No negative feedback was received, and the data collected during the pilot study were not included in the final analysis. In addition, prior to conducting the content validity analyses, experts in the fields of diabetes and nursing were consulted to assess the clarity of the items. The experts were asked to assess the content of the scale, and the final version of the form was created according to their feedback.

Content Validity: The content validity was evaluated using the Davis technique [18,19]. The content validity of the scale was assessed by obtaining expert opinions from 10 professionals who specialize in diabetes and nursing and are fluent in both Turkish and English. These experts were asked to evaluate each item in both languages using a 4-point rating scale. The scale was scored as follows: 1=Not appropriate, 2=Somewhat appropriate, 3=Quite appropriate, and 4=Highly appropriate. The scale Content Validity Index/Average (S-CVI/Ave) was calculated by averaging the proportions of items rated as 3 or 4 ("quite relevant" or "highly relevant") by the experts and then dividing this total by the number of experts. Accordingly, the S-CVI/Ave for the 21-item scale in this study was found to be 0.93 and a value above 0.90 is considered acceptable, indicating that the content validity of the scale is adequate [18,20]. There were no items that was recommended to be removed after expert opinion. Since ratings were obtained from more than two experts, Kendall's W coefficient of concordance was calculated to assess the level of agreement among them. The Kendall's W value was found to be 0.93, indicating a very high level of agreement among the experts [21]. No items were removed during the content validity index evaluation process.

Data Collection

After making necessary corrections, parents who met the inclusion criteria were provided with a consent form explaining the study's purpose. Consent was obtained from all participating parents. The researchers explained the data collection process and how to complete the PDRQ to the parents in person. Subsequently, the researchers administered the Information Form and PDRQ face-to-face to the parents.

Ethical Approval

To ensure the cultural adaptation of the scale, permission to use the original instrument was requested via email from the author of the original scale [13], and the study was initiated after receiving approval from the author. The study also received ethical approval from the Ethics Committee of Hatay Mustafa Kemal University in Türkiye (date: 07.03.2022, decision number: 2022/03/17), and institutional permission was obtained from the hospital. The researchers informed the parents about the study, and written informed consent was obtained from all participants. The study followed the ethical guidelines outlined in the Declaration of Helsinki.

Statistical Analysis

The data were analyzed using IBM SPSS (Version 23.0) and LISREL [22]. Descriptive statistics were presented using frequencies, percentages, and mean values. Normality was assessed via skewness (-0.791) and kurtosis (0.355), which fell within the acceptable range of -1.5 to +1.5 [23]. The validity analysis of the PDRQ included language validity, S-CVI/Ave calculation, and construct validity through EFA and CFA. Items in the EFA were assigned to factors based on the highest factor loadings, with factors having eigenvalues ≥1 and loadings ≥0.30 retained. KMO > 0.50 and a significant Bartlett's test ($p < 0.05$) confirmed data suitability [15]. Among the summary fit indices, the values of chi-square/degrees of freedom ratio (χ^2/df), Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Residual (SRMR) were reported. For reliability, Cronbach's alpha, item-total and item-subscale correlations, split-half reliability, and response bias were evaluated. Mean, standard error, and standard deviation values were calculated for all 21 items.

RESULTS

Results of Participants' Demographic Characteristics

When examining the mean ages of the participants, the average age of the mothers was 39.80±6.01, the average age of the fathers was 43.65±6.59, and the children's mean age was 12.20±2.76. The average number of children per family was reported as 3.50±1.27. Of the participants, 74% were mothers (n=97) and 26% were fathers (n=34). Among the children, 55% were girls (n=72) and 45% were boys (n=59). Regarding mothers' educational level, 8.4% were literate and majority of them (51.9%) had completed primary school; for fathers, 1.5% were literate, and 45% had completed primary school. The majority of mothers (91.6%) were not employed, while 76.3% of fathers were employed in the private sector. Of parents, 15.3% had another child with a chronic illness, and 13% had another child diagnosed with Type 1 Diabetes Mellitus (Table 1).

Validity Analyses

Exploratory factor analysis was applied to evaluate the factor structure. To assess the suitability of the dataset for factor analysis, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were used to determine whether the variables were correlated with each other. For the PDRQ, the sample adequacy calculated as the KMO value was 0.735, and Bartlett's test result was x^2:781.142, $p<0.000$. When examining the factor structure of the PDRQ, in the principal component analysis performed by allowing the scale items to be free, seven factors with eigenvalues greater than 1 were obtained. Since the number of items in the 6th and 7th subfactors was less than three, the importance of the contribution of these three factors to the total variance was evaluated by examining the scree plot graph (Figure 1). As a result of the scree plot graph, it was determined that the contribution of the two factors to the variance was small, and it was decided that the number of factors should be five. The total variance explained by the five factors consisting of 21 items was found to be 53.35% (Table 2).

Table 1. Descriptive characteristics of the parents (n=131)

Demographic characteristics		Mean± SD	(min-max)
Age (year)	Mother	39.80±6.01	(24-55)
	Father	43.65±6.59	(29-58)
	Child	12.20±2.76	(5-17)
Number of children		3.50±1.27	(1-7)
		n	**%**
Parent	Mother	97	74
	Father	34	26
Children	Female	72	55
	Male	59	45
Mothers' educational level	Literate	11	8.4
	Primary School	68	51.9
	Secondary School	26	19.8
	High School	14	10.7
	University	12	9.2
Fathers' educational level	Literate	2	1.5
	Primary School	59	45
	Secondary School	25	19.1
	High School	31	23.7
	University	14	10.7
Mother's profession	Not working	120	91.6
	Public sector	7	5.3
	Private sector	4	3.1
Father's profession	Not working	23	17.6
	Public sector	8	6.1
	Private sector	100	76.3
Chronic disease with other children	Yes	20	15.3
	No	110	84
DM with other children	Yes	17	13
	No	114	73
Mother with Type 1 DM	Yes	7	5.3
	No	124	94.7
Mother with Type 2 DM	Yes	7	5.3
	No	124	94.7
Father with Type 1 DM	Yes	1	0.8
	No	130	99.2
Father with Type 2 DM	Yes	10	7.6
	No	121	92.4

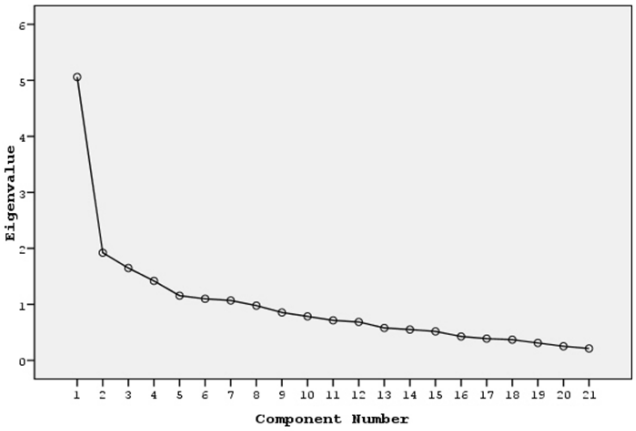

Figure 1. Scree Plot

Table 2. Exploratory factor analysis (for 21 Items)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Item 7	0.838				
Item 8	0.805				
Item 9	0.541				
Item 11	0.474				
Item 16	0.410				
Item 4		0.785			
Item 20		0.693			
Item 19		0.638			
Item 5		0.507			
Item 3			0.767		
Item 14			0.629		
Item 10			0.423		
Item 18			0.420		
Item 21				0.815	
Item 15				0.627	
Item 17				0.533	
Item 13					0.776
Item 12					0.588
Item 1					-0.381
Item 2					0.377
Item 6					0.366
Eigenvalue	5.06	1.92	1.64	1.41	1.15
Explained variance	24.09	9.15	7.85	6.75	5.50
Total explained variance			53.35		

When the contents of the items distributed across the factors were examined, and based on the subdimension names of the original scale, the following factor labels were determined: items 7, 8, 9, 11, and 16 as "Self-Management" (Factor 1); items 4, 5, 19, and 20 as "Management in School and Out-of-Home Settings" (Factor 2); items 3, 10, 14, and 18 as "Adherence to Routines" (Factor 3); items 15, 17, and 21 as "Maintenance/Contiunity" (Factor 4); and items 1, 2, 6, 12, and 13 as "Treatment Adherence" (Factor 5).

To evaluate the theoretical structure of the PDRQ developed by Pierce and Jordan, a Confirmatory Factor Analysis (CFA) was conducted. In this study, the covariance matrix was used to examine the interactions among the items, and the Maximum Likelihood estimation method was employed to analyze the constructed matrix. To assess the model fit, the following goodness-of-fit indices were evaluated: χ^2/df, RMSEA, SRMR, GFI, AGFI, CFI, NFI, and NNFI. The summary fit indices of the two-factor model are presented in Table 3.

Table 3. Fit indices for the Turkish version of the PDRQ (for 21 Items)

Fit indices	PDRQ Values (Original scale is two-dimensional)	Post-modification (Original scale is two-dimensional)	Acceptable values
x^2/df	364.90/188=1.94	297.28/185=1.60	<5
RMSEA	0.085	0.068	<0.08
SRMR	0.086	0.079	<0.08
GFI	0.79	0.82	≥90
AGFI	0.74	0.78	≥90
CFI	0.86	0.99	≥90
NFI	0.77	0.81	≥90
NNFI	0.85	0.90	≥90

RMSEA:Root Mean Square Error of Approximation, SRMR:Standardized Root Mean Square Residual, GFI:Goodness-of-Fit Index, AGFI:Adjusted-goodness-of-fit index, CFI:Comparative fit index, NFI:Normed fit index, NNFI:Non-normed fit index.

Among the CFA fit indices, it was observed that the χ^2/df index had acceptable values, while the RMSEA, SRMR, CFI, NFI, NNFI, GFI, and AGFI indices were below the acceptable thresholds. After performing three modifications (between items 7 and 8, items 14 and 15, items 19 and 20) (Figure 2) to improve the model fit, the χ^2/df, RMSEA, SRMR, CFI, and NNFI indices reached acceptable levels, whereas the GFI, AGFI, and NFI indices remained below the acceptable cutoff values (Table 3). As a result of the CFA, the two-factor structure of the PDRQ was confirmed. The factor loadings of the PDRQ model ranged from 0.17 to 0.75, and in the modified model, they ranged from 0.20 to 0.76.

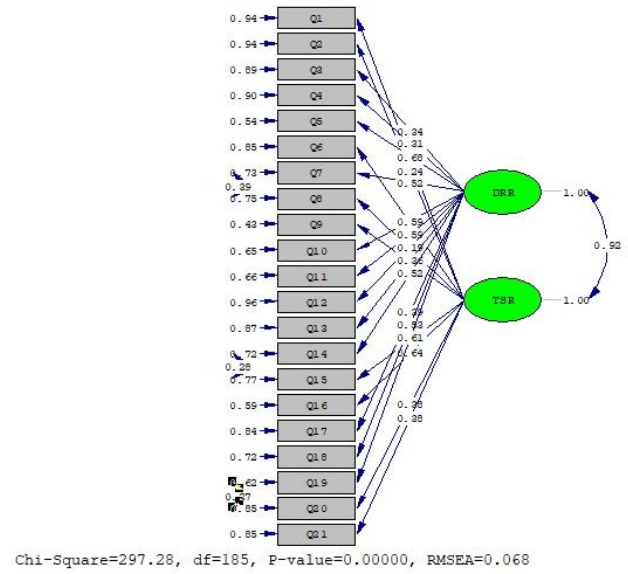

Figure 2. Path diagram for 21 Items

Descriptive Statistics and Reliability Analyses of the Scale

The mean total score of the PDRQ was 81.22±12.80 (Min-Max: 21.00-105.00; Median: 82.00), while the mean item score was 3.86±0.60 (Min-Max: 2.14-4.90; Median: 3.90). The mean total score of Factor 1 was 45.76±8.28 (Min-Max: 20.00-60.00; Median: 46.00), and the mean item score was 3.81±0.69 (Min-Max: 1.67-5.00; Median: 3.83). The mean total score of Factor 2 was 35.46±5.86 (Min-Max: 15.00-45.00; Median: 36.00), and the mean item score was 3.94±0.65 (Min-Max: 1.67-5.00; Median: 4.00). The mean item scores of the PDRQ were found to range between 2.20 and 4.66.

In the reliability analysis conducted to evaluate the internal consistency of the scale used in the study, the total Cronbach's alpha coefficient was calculated as 0.822. In the internal consistency analysis conducted after item removal, a minimal increase in the Cronbach's alpha value (from 0.822 to 0.823-0.824, respectively) was observed when items 4 and 12 were removed. The Cronbach's alpha coefficient for two factors was calculated as 0.752 for factor 1. In the internal consistency analysis conducted after item removal, a minimal increase in the Cronbach's alpha value (from 0.752 to 0.762-0.755, respectively) was observed when items 4 and 12 were removed. The Cronbach's alpha coefficient for Factor 2 was calculated as 0.655. In the internal consistency analysis conducted after item removal, a minimal increase in the Cronbach's alpha value (from 0.655 to 0.661) was observed when item 2 was removed. The item-total score correlations of the PDRQ items ranged from 0.245 to 0.686, and the item-subscale score correlations ranged from 0.266 to 0.659 ($p < 0.01$). All items of the scale were retained without altering the original structure, and the corresponding data are presented in Table 4.

As part of the reliability analyses, split-half reliability was also examined. The scale items were divided into two halves by odd and even item numbers. The Cronbach's alpha coefficient was 0.723 for the first half and 0.614 for the second half. Considering that the number of items was unequal in both halves, the Spearman-Brown coefficient was calculated as 0.881, and the Guttman split-half coefficient was also 0.873; indicates a good reliability. The correlation between forms was found to be 0.787. Tukey's test of additivity was conducted to assess the scalability (additivity) of the scale. The result (p=.637) indicated that the scale scores could be summed. Additionally, in the study, Hotelling's T^2 test was conducted to examine whether the participants' responses to the scale items were equal, and the result was found as Hotelling's T^2=586.208, p=0.000.

DISCUSSION

This study aimed to culturally adapt the PDRQ, a scale designed to assess the daily diabetes-related routines in children and adolescents with T1DM. The study was conducted with the 131 parents of children diagnosed with T1DM, and the findings were evaluated in terms of the scale's reliability and validity. The findings of the validity and reliability study of the Turkish version of the PDRQ, were compared only with the original scale, as it had not been adapted into other languages. In the assessment of the construct validity of the scale, EFA and CFA were conducted to evaluate the consistency of the model with the original theoretical structure defined by Pierce and Jordan [13]. To support the factor structure of the scale more robustly and to verify the suitability of the obtained structure to the data through a different analysis, an EFA was performed. To evaluate the suitability of the dataset for factor analysis, the KMO and Bartlett's tests were used. The fact that the KMO value of the PDRQ was above 0.50 and the significance level of the Bartlett's test results was $p<0.05$ indicates that the dataset is suitable for factor analysis. As a result of the Exploratory Factor Analysis, five factors were obtained, explaining 53.35% of the variance. In the original study of the scale, the total variance explained for 21 item and two factors was found to be 40.97% [13]. Considering that a total explained variance between 40% and 60% is accepted as adequate [15], it can be stated that the variance ratio obtained in this study is above the acceptable limits.

Table 4. Item-level descriptive statistics, cronbach's alpha values, and item-total score correlations of the scale

Factors	Items	Mean± SD	Item-Correlations**		Corrected Item-Total Score Correlation*		Cronbach's alpha reliability coefficient
			Total	Factors	Total	Factors	
Factor 1	Item 3*	3.64±1.47	0.368	0.518	0.821	0.738	
	Item 4	3.97±1.46	0.332	0.344	0.823	0.762	
	Item 5	4.13±1.12	0.686	0.659	0.804	0.717	
	Item 7	3.64±1.35	0.555	0.534	0.810	0.734	
	Item 10	4.17±1.17	0.588	0.608	0.808	0.723	
	Item 11	3.72±1.37	0.589	0.634	0.808	0.719	
	Item 12*	3.26±1.19	0.245	0.333	0.824	0.755	
	Item 13*	3.61±1.29	0.365	0.465	0.820	0.742	
	Item 14	3.98±1.40	0.547	0.563	0.810	0.730	
	Item 17	4.12±1.13	0.415	0.429	0.817	0.744	
	Item 18	3.42±1.61	0.555	0.580	0.810	0.733	
	Item 19	4.04±1.27	0.613	0.585	0.807	0.726	
Factor 2	Item 1	2.20±1.41	0.363	0.467	0.821	0.650	
	Item 2	4.66±0.79	0.254	0.266	0.821	0.661	
	Item 6	4.03±1.25	0.386	0.497	0.818	0.633	
	Item 8	3.87±1.35	0.507	0.515	0.812	0.633	
	Item 9	4.29±1.04	0.663	0.641	0.806	0.594	
	Item 15	3.87±1.52	0.495	0.578	0.814	0.622	
	Item 16	3.98±1.33	0.556	0.627	0.810	0.598	
	Item 20	4.22±1.29	0.402	0.495	0.818	0.635	
	Item 21	4.29±1.18	0.392	0.536	0.818	0.621	
Factor 1	Total score	45.76±8.28 (Min- Max: 20.00-60.00)					0.752
	Item	3.81±0.69 (Min- Max: 1.67-5.00)					
Factor 2	Total score	35.46±5.86 (Min- Max: 15.00-45.00)					0.655
	Item	3.94±0.65 (Min- Max: 1.67-5.00)					
PDRQ	Total score	81.22±12.80 (Min- Max: 21.00-105.00)					0.822
	Item	3.86±0.60 (Min- Max: 2.14-4.90)					

**PDRQ: Pediatric Diabetes Routines Questionnaire, Reverse-coded items, **p<0.01.*

However, given that the original scale consists of a two-factor structure [13], CFA was performed to analyze this original model, and the item factor loadings were assessed accordingly. The χ^2/df index was found to meet the acceptable value. After three modifications were made to assess changes in model fit indices, it was observed that all fit indices, except for GFI, AGFI, and NFI, met the acceptable thresholds. These findings indicate that the two-factor theoretical structure of the PDRQ proposed by Pierce and Jordan [13] was confirmed, and that the scale items adequately represented the two factors.

The modification indices were examined, and a high error covariance was identified between Items 7 and 8, between items 14 and 15, and between items 19 and 20. The error covariance between these items was allowed to vary (Figure 2). In our study, it was considered appropriate to allow error covariances between items 7-8, 14-15, and 19-20, as these items have similar content. The three modifications made were limited only to correlating the error covariances of items with similar content and did not alter the theoretical structure of the model. As emphasized in the literature [15,24,25], modifications should be made based on theoretical justification rather than the number of changes. Accordingly, these adjustments aimed to control the shared variance among semantically similar items and to improve the model fit indices while preserving the theoretical integrity of the model. Therefore, the three modifications performed represent reasonable adjustments that do not change the meaning of the measurement model and strengthen the model's validity. When examining the model fit indices after three modifications, it was found that χ^2/df, RMSEA, SRMR, CFI, and NNFI indices reached acceptable levels (χ^2/df value below 3; RMSEA and SRMR values below 0.08; Comparative Fit Index (CFI) and Non-Normed Fit Index (NFI) values above 0.90) [26], based on the two-factor structure (χ^2/df=1.60; RMSEA=0.06; CFI=0.99; SRMR=0.079, Table 3). Moreover, these findings are consistent with those reported in the original validation study by Pierce and Jordan [13], in which the model fit indices were χ^2/df=1.93, RMSEA=0.08, and CFI=0.97. The similarity between the fit indices obtained in the current study and those reported in the original study supports the cross-cultural validity of the scale and indicates that the cultural adaptation process was successfully carried out. As this study was a cultural adaptation, CFA was conducted to test whether the original two-factor structure of the scale developed by Pierce and Jordan [13] was valid in the target sample. The literature states that in cultural adaptation processes, CFA is generally sufficient for assessing construct validity and that exploratory factor analysis is not required to explore the structure [27].

When the EFA and CFA results were evaluated together, differences were identified regarding the factor structure of the scale. Although the EFA results showed that the items were distributed across five factors, the CFA findings demonstrated that the two-factor structure proposed in the original form of the scale provided an acceptable level of fit to the data. Since the theoretical basis and original structure of the scale were defined by Pierce and Jordan [13] as consisting of two factors, in this study, the two-factor model confirmed by the CFA was adopted in order to preserve the theoretical integrity of the scale. In other studies,

using variations of the scale, it has also been observed that a single-factor structure was obtained and that a multifactorial structure was not present [28,29]. Pierce et al. developed in 2019 [28] a version of the scale that could be completed by adolescents with Type 1 Diabetes Mellitus. This form was also found to consist of 24 items and a single factor. The items of the scale were similar to those used in our study, with the only difference being the replacement of the phrase "my child" with "I." In addition, in a study conducted in 2023, 21 items of the PDRQ scale were adapted for parents of children under six years of age with Type 1 Diabetes Mellitus, and the 21-item, single-factor scale was found to be valid and reliable [29]. Accordingly, although the EFA results in Turkish parents showed that the scale was distributed across five factors, it was considered appropriate to adopt the model with the two-factor structure used in the original scale, as the CFA results and reliability analyses in this study produced satisfactory outcomes, and to ensure international consistency. Furthermore, this situation was also clarified in the approval obtained from the original author regarding the final structure of the scale. Therefore, the five-factor solution obtained in the EFA was interpreted as a statistical variation specific to the dataset, and the two-factor model was preferred in terms of theoretical and structural validity.

In the reliability analysis of the scale, the Cronbach's alpha reliability coefficient for the original 21-item version was found to be 0.88 (with factor "daily regimen routines" was 0.86 and factor "technical/situational routines" was 0.76) [13]. In the present study Cronbach alpha coefficient was found as 0.82 for the total scale and 0.752 for the first factor and 0.655 for the second factor, which also reflects a good level of internal reliability. Although slightly lower than the original value [13], this difference is not substantial and may be attributed to variations in sample characteristics, cultural context, or differences in data collection settings. According to the literature, a Cronbach's alpha value of 0.70 or above is considered acceptable for a scale to be deemed reliable [30]. A value of 0.80 or higher indicates good reliability [31]. Therefore, the internal consistency of the scale in this sample can still be considered strong. In addition, in this study, a minimal increase was observed in the internal consistency analysis after the removal of items 4 and 12. Except for these two items that caused a minimal increase, the Cronbach's alpha values did not exceed 0.822 when any other item was removed. Since item removal is generally not recommended in scale adaptation studies, and the validity and reliability of a scale are not considered to be specific to a single sample [27], the original structure of the scale was preserved with the approval of the authors of the original version.

In this study, item-total score correlations were examined to assess how well each item aligned with the overall structure of the scale. The item-total score correlation evaluates the consistency of each item with the overall scale [14]. The correlations ranged from 0.245 to 0.686 (Table 4). DeVellis [32] emphasizes that in order to ensure item-level reliability, item-total correlations should not be low, and values below .30 should be carefully considered. However, it is also noted in the literature that item-total correlations should be at least .20 to be considered acceptable. Since these correlation coefficients were above 0.20, it can be concluded that each item had a correlation coefficient value that serves the purpose of the scale. This value serves as a key indicator of an item's alignment with the construct being measured and its contribution to the scale as a whole [33,34].

The result of the Tukey's Nonadditivity test conducted in this study yielded a p-value greater than .05, indicating that the items can be aggregated under a total score [35]. In contrast, Hotelling's T^2 test was found to be statistically significant (p=.000), suggesting that the items of the scale are not homogeneous but elicit different responses in line with the purpose of the scale, thus demonstrating that the scale is functional in terms of measurement [27]. When these findings are considered together, the overall validity and reliability properties of the scale appear satisfactory; however, this result should be considered when interpreting the data. In the Turkish version, the reliability of the PDRQ was at an acceptable level, and all items measured similar characteristics.

Limitations

Although the cultural adaptation of the scale yielded favorable results, this study has some limitations. The first one is that the majority of participating parents were mothers. Given that mothers are typically more involved in the primary care of children, their responses may differ from those of fathers. Another limitation is that the study did not assess changes over time. Due to the timing of data collection, which coincided with the February 6th earthquakes in Türkiye, contact with many patients was lost, and it was not possible to conduct a test-retest procedure. Additionally, as the scale is based on self-report, all items were completed by parents themselves, which may have introduced social desirability bias. The statistically significant result of Hotelling's T^2 test suggests the presence of variation in participants' response patterns, potentially indicating response style bias. This finding represents a limitation of the study, as such bias may affect the internal structure and interpretation of the results. Future studies are recommended to incorporate methods to control for response bias, such as advanced statistical techniques to detect systematic response patterns. Taking these limitations into account, future studies are recommended to use larger and more balanced samples and adopt longitudinal designs incorporating multiple forms of validity assessment.

CONCLUSION

The findings indicate that the Turkish version of the Pediatric Diabetes Routines Questionnaire (PDRQ) exhibits a valid and reliable two-factor structure for assessing diabetes-related daily routines in children. The confirmatory factor analysis confirmed an acceptable model fit, with fit indices comparable to those reported in the original study. The internal consistency of the scale was strong, with a Cronbach's alpha of 0.822, and all items were retained. This study supports the applicability of the PDRQ in the Turkish cultural context for use by parents. Future studies are recommended for longitudinal assessments of routine stability and evaluations of its predictive validity in relation to treatment adherence and metabolic outcomes.

Ethical Approval: *2022/03/17 Hatay Mustafa Kemal University Social and Human Sciences Scientific Research and Publication Ethics Committee*

Conflict of Interest: *The authors have no conflicts of interest to declare.*

Funding: *None.*

Acknowledgements: *None.*

Author Contribution: Concept: *GKY,MA;* ***Design:*** *GKY,MA,SK,NB,FÖÇ;* ***Data collecting:*** *SK,NB,FÖÇ;* ***Statistical analysis:*** *GKY;* ***Literature review:*** *GKY,MA;* ***Writing:*** *GKY,MA;* ***Critical review:*** *GKY,MA,SK,NB,FÖÇ.*

REFERENCES

1. Papadakis JL, Shapiro JB, Evans M, et al. Psychometric properties of the diabetes skills checklist for adolescents with type 1 diabetes and their parents. Pediatr Diabetes. 2021;22(6):924-932.
2. American Diabetes Association; Standards of Medical Care in Diabetes-2022 Abridged for Primary Care Providers. Clin Diabetes. 2022; 40:10-38.
3. Cosmescu A, Pharmacy I, Oltean C, et al. Major variations in blood glucose levels in pediatric patients with type 1 diabetes. Rom J Med Pract. 2020;15:441-445.
4. Meena J, Yadav J, Kumar J, et al. Incidence, predictors, and short-term outcomes of acute kidney injury in children with diabetic ketoacidosis: a systematic review. Pediatr Nephrol. 2023;1-9.
5. Brar P, Tell S, Mehta S, Franklin B. Hyperosmolar diabetic ketoacidosis--review of literature and the shifting paradigm in evaluation and management. Diabetes Metab Syndr. 2021;15(6):102313.
6. Pierce JS. Examination of the pediatric diabetes routines questionnaire in adolescents: Development of an adolescent self-report version and confirmatory factor analysis [dissertation]. University of Southern Mississippi; 2013.
7. Hur KY. 2021 clinical practice guidelines for diabetes: Pharmacotherapy and the Korean Diabetes Association Support System. J Korean Diabetes. 2021;22(4):250-258.

8. American Diabetes Association (ADA) Statement. Introduction: standards of medical care in diabetes-2022. Diabetes Care. 2021;45(S 1):S1-S2.
9. Anifowoshe K, Jaser S; 722-p. The value of collaborative parental ınvolvement in diabetes management for youth with type 1 diabetes. Diabetes. 2023;72 (S 1):722-p.
10. Yamaguchi M, Honda J, Fukui M. Effects of parental ınvolvement on glycemic control in adolescents with type 1 diabetes mellitus: a scoping review. J Fam Nurs. 2023;29:382-394.
11. Öztornaci B, Akgül E, Yanar N, et al. The Effect of Parental Collaboration on Diabetes Self-efficacy, Quality of Life and HbA1c Level in Adolescents Diagnosed with Type 1 Diabetes. J Clin Res Pediatr Endocrinol. 2024;17:176-184.
12. Smudja M, Milenkovic T, Minaković I, Zdravković V, Javorac J, Milutinović D. Self-care activities in pediatric patients with type 1 diabetes mellitus. PLoS One. 2024;19:e0300055.
13. Pierce JS, Jordan SS. Development and evaluation of the pediatric diabetes routines questionnaire. Child Health Care. 2012;41(1):56-77.
14. Gökdemir F, Yılmaz T. Processes of using, modifying, adapting and developing likert type scales. J Nursology. 2023;26(2):148-160.
15. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 7th ed. Pearson Education Limited; 2014.
16. Elbalshy M, Boucher S, Crocket H, et al. Exploring parental experiences of using a do-it-yourself solution for continuous glucose monitoring among children and adolescents with type 1 diabetes: a qualitative study. J Diabetes Sci. 2020;14(5):844-853.
17. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, Erikson P. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) Measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health. 2005;8(2):94-104.
18. Polit DF, Beck CT. The content validity index: Are you sure you know what's being reported? Critique and recommendations. Res Nurs Health. 2006;29(5):489-497.
19. Davis LL. Instrument review: getting the most from a panel of experts. Appl Nurs Res. 1992;5:194-197.
20. Almanasreh E, Moles R, Chen TF. Evaluation of methods used for estimating content validity. Res Social Adm Pharm. 2019;15(2):214-221.
21. Emerson, R. Kendall's W and Inter-rater Reliability. J Vis Impair Blind. 2023;117:336-336.
22. Jöreskog K, Sörbom D. LISREL [Computer Software]. Lincolnwood, IL: Scientific Software, Inc. 2000.
23. Tabachnick BG, Fidell LS. Using multivariate statistics. 6th ed. Pearson Education; 2013.
24. Brown TA. Confirmatory factor analysis for applied research 2nd ed. The Guilford Press; 2015.
25. Byrne BM. Structural equation modeling with AMOS: Basic concepts, applications, and programming. 3rd ed. Routledge; 2016.
26. Lomax RG. A Beginner's Guide to Structural Equation Modeling. 4th ed. Routledge; 2015.
27. Çokluk Ö, Şekercioğlu G, Büyüköztürk Ş. Multivariate statistics for social sciences: SPSS and LISREL applications. 8th ed. Ankara: Pegem Academy; 2025.
28. Pierce JS, Jordan SS, Arnau RC. Development and validation of the pediatric diabetes routines questionnaire for adolescents. J Clin Psychol Med Settings. 2019;26(1):47-58.
29. Wilcocks CP, Enlow P, Wasserman R, et al. Development and evaluation of the pediatric diabetes routine questionnaire for parents of young children with type 1 diabetes. J Clin Psychol Med Settings. 2023;30(1):216-226.
30. Taber KS. The use of Cronbach's alpha when developing and reporting research instruments in science education. Res Sci Educ. 2018;48(6):1273-1296.
31. George D, Mallery P. SPSS for Windows step by step: A simple guide and reference. 14th ed. Allyn & Bacon; 2024.
32. DeVellis RF. Scale development: Theory and applications. 5th ed. Sage Publications; 2021.
33. Büyüköztürk Ş. Handbook of data analysis for social sciences: Statistics, research design, SPSS applications, and interpretation.31st ed. Ankara: Pegem Academy; 2024.
34. Tavşancıl E. Measurement of attitudes and data analysis with SPSS. 5th ed. Nobel Publications; 2014.
35. Kalaycı Ş. Multivariate statistical techniques with SPSS applications. 11th ed. Seçkin Publications; 2021.