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Validity and Reliability of the Turkish Version of the Diabetes Education Questionnaire in People with Diabetes

ABSTRACT

Objective: Patient education is a key component of diabetes management and chronic disease care, facilitating behavioral changes and supporting effective self-management. Reliable instruments for assessing patients' diabetes knowledge are essential for identifying educational needs and designing evidence-based strategies. The purpose of this study was to examine the reliability and validity of the Turkish adaptation of the Diabetes Education Questionnaire (DATE-Q) in evaluating the diabetes knowledge of individuals with diabetes.

Methods: This methodological study was conducted with 200 people with type 1 (T1DM) or type 2 diabetes mellitus (T2DM). The study involved translation, back-translation, and cross-cultural adaptation of the DATE-Q. The Turkish version of the Revised Diabetes Knowledge Test (DKT2) was used for validation. Criterion validity was assessed using Spearman's correlation between DATE-Q and DKT2. Cronbach's alpha and intraclass correlation coefficient (ICC) values were used to determine the reliability.

Results: Participants had a mean age of 55.9 ± 12.5 years, 63% were female, and 82.5% had T2DM. The Turkish DATE-Q demonstrated moderate criterion validity with the DKT2 ($r = 0.576$, $P < .001$). Internal consistency was excellent (Cronbach's alpha = 0.90), and test–retest reliability was strong (ICC = 0.80-0.96).

Conclusion: The Turkish version of the DATE-Q is a moderately valid and strongly reliable tool for assessing diabetes knowledge. Its use in research and clinical settings can support endocrinologists, physiotherapists, dietitians, and nurses in identifying patients' knowledge gaps, developing tailored education programs, and promoting effective self-management strategies. Incorporating the DATE-Q into multidisciplinary diabetes care may enhance patient outcomes and help prevent diabetes-related complications.

Keywords: Diabetes, patient education, health knowledge, self-management, questionnaires

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Introduction

Diabetes represents one of the most rapidly expanding global health challenges of the twenty-first century. According to reports from the International Diabetes Federation (IDF), an estimated 589 million adults aged between 20 and 79 were living with diabetes in 2024. The total number of people living with diabetes is projected to reach 853 million by 2050.[1] In Türkiye, the prevalence of diabetes among the population aged 20 and above has been reported as 13.7% in the Turkish Diabetes Epidemiology Study (TURDEP).[2] Diabetes is a chronic disease that necessitates continuous and comprehensive medical care, and its management involves lifestyle modifications, medical options, and behavior change through patient education.[1,3] To achieve the therapeutic goals set at each stage of diabetes treatment, both medical and self-care behaviors need to be developed.[4] Therefore, patient education is a crucial part of diabetes care, as it helps patients manage the disease more effectively.

Patient education in diabetes management has been reported to promote positive behavioral changes, thereby improving the success of diabetes care.[3] For this reason, it is necessary to assess patients' knowledge about diabetes to identify gaps in their understanding and design appropriate educational strategies.[5-8] Understanding the level of knowledge that individuals with diabetes have about their condition may affect their behavior change process. Several different questionnaires have been developed to assess knowledge of the disease in people with diabetes, each with different content and methods of administration, depending on the demographic and clinical profile of the target group.[9-12] However, despite these

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available options, there is a lack of short-form self-administered questionnaires that address the core components of diabetes care (i.e., healthy eating, physical activity, psychosocial well-being, disease management/self-care, and long-term complications).

Several diabetes management questionnaires have been tested for validity and reliability.[13-15] However, these questionnaires do not include items that assess knowledge of physical activity and exercise, which are key components of diabetes management.[13,14] Another questionnaire only assesses whether people with diabetes engage in physical activity.[15] The DiAbeTes Education Questionnaire (DATE-Q) was developed to fill this gap.[16] The DATE-Q includes items covering core components of diabetes management and specifically asks patients about the effect of exercise on blood glucose levels and the correct intensity of exercise.[17] Additionally, the DATE-Q was found to be an easily understood self-administered tool, which was adapted to be culturally appropriate for use in Brazil.[16] It is expected that the DATE-Q will be very useful in clinical practice, helping healthcare professionals to tailor their educational and clinical care plans to the needs of people with diabetes. The purpose of this study was to examine the reliability and validity of the Turkish adaptation of the DATE-Q in evaluating the diabetes knowledge of individuals with diabetes.

Material and Methods

Type of Research

This study is a methodological study that aims to assess the validity of the DATE-Q. The study was conducted at the Diabetes Clinic of the Department of Endocrinology and Metabolism, Division of Internal Medicine, Istanbul University Istanbul Faculty of Medicine. The research was conducted between August and December 2024, following approval by the ethics committee (Approval No. E-46770954-045.99-2599941, dated July 12, 2024). The ethical principles outlined in the Declaration of Helsinki were adhered to in this research, and informed consent was obtained from all participants before their enrollment. The protocol was registered to the "ClinicalTrials.gov" website before the study began (Registration no. NCT06573385).

Population, Sample, and Sample Size of the Study

The sample size for the study was calculated according to the recommendation for sample size in psychometric analysis by Hair et al,[18] which suggests a minimum of 10 individuals per item. Considering the number of questionnaire items, the sample size was determined to be 200 participants.

MAIN POINTS

- The Turkish version of the DATE-Q was shown to be a valid and reliable tool for assessing diabetes knowledge across multiple domains of self-care and management.
- Integrating the DATE-Q into clinical practice may facilitate systematic identification of patients' knowledge gaps and support the development of tailored, patient-centered education programs.
- The observed differences in knowledge levels between individuals with T1DM and T2DM underscore the need for tailored educational approaches to enhance patient outcomes.

Subjects diagnosed with type 1 diabetes mellitus (T1DM) or type 2 diabetes mellitus (T2DM) based on the criteria of the IDF [1] by an endocrinologist and routinely followed up in the Department of Endocrinology and Metabolism, Istanbul University Istanbul Faculty of Medicine were invited to the study.

The inclusion criteria were a diagnosis of T1DM or T2DM, being aged 18-80 years, being able to communicate, write, and read in the native language, and agreeing to participate in the study voluntarily. Participants who were unable to cooperate (standardized mini-Mental Test Score <24) or who had visual or cognitive impairments that would limit completing the questionnaire were not included in the study.

Data Collection

The sociodemographic features of the participants, including age, weight, height, body mass index, education level, type of diabetes, duration of diabetes, medical history, comorbidities, and laboratory reports for lipid profiles, fasting blood glucose, and glycosylated hemoglobin (HbA1c), were noted.

Diabetes Education Questionnaire

Diabetes Education Questionnaire, developed by de Melo Ghisi et al in 2021, is a 20-item questionnaire specifically designed for individuals with diabetes. The psychometrically validated DATE-Q is divided into 5 domains: disease management/self-care, long-term complications, physical activity, healthy eating, and psychosocial well-being. The responses are scored as "True," "False," or "I don't know," with each correct answer receiving one point. The total score ranges from 0 to 20, and a higher score indicates a greater level of knowledge about diabetes.[17] The DATE-Q was originally developed in English, and its validity and reliability were assessed after it was translated into Portuguese (Brazil).[16] Permission was obtained from the founder of the questionnaire to translate the DATE-Q into Turkish and to perform its validity and reliability assessment.

The Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test

Revised Diabetes Knowledge Test form consists of 23 questions. The initial 14 items of the questionnaire assess general diabetes knowledge, whereas the subsequent 9 items focus specifically on insulin use. The first part can be administered to all adults with T1DM or T2DM, while the insulin-related section is applicable only to individuals receiving insulin therapy. Each item is scored, with correct responses receiving a value of 1 and incorrect responses receiving a value of 0. The score for each subscale is obtained by summing the number of correct responses within that domain. As a result, the general knowledge subscale yields scores ranging from 0 to 14, and the insulin use subscale yields scores ranging from 0 to 9. The sum of all correct responses provides the total DKT2 score, which ranges from 0 to 23. Higher scores indicate a greater level of knowledge about diabetes. The questionnaire has been shown to be both reliable and valid, making it useful for researchers, clinicians, and diabetes educators in assessing overall diabetes knowledge at either the patient or population level.[19]

Reliability and Validity Stages of the Diabetes Education Questionnaire

The translation of the DATE-Q was performed in accordance with published guidelines and underwent cultural adaptation.[20] Initially, 2 independent translators translated the questionnaire from English to

Turkish. Then, a panel of experts, including 2 internal medicine physicians, 3 physiotherapists, a nurse, and a dietitian, compared the 2 versions to create a Turkish version. A bilingual expert (native in both English and Turkish) translated the new Turkish version back into English. The original English version was compared with this back-translated version, and necessary adjustments were made before sending the finalized version to the founder of the questionnaire. In line with expert opinion, we made changes to items 2, 3, and 5 to adapt them to the Turkish population. In the original survey, "10 mmol/L" in item 2 was changed to "180 mg/dL" in the Turkish version, and "A1C" in items 3 and 5 was revised to "HbA1c" in the Turkish version. The final Turkish version of the DATE-Q was reviewed and approved by the expert committee. In the final stage, a pre-test was conducted to assess the comprehensibility of the Turkish version. The pre-test was administered to 30 patients, and the clarity of each item was evaluated through individual interviews. The researchers recorded the responses from participants for each item to identify any ambiguities.

Before conducting the main questionnaire, a pilot study was carried out using the pre-final Turkish version of the instrument. In this stage, the translated form was tested on 5 individuals, and each item was evaluated on a Likert scale ranging from 1 (completely unclear) to 5 (completely clear). After identifying potential ambiguities, necessary adjustments were made to finalize the version for psychometric testing. Patients were asked the following questions: "Is there any question that you do not understand?" The Revised Diabetes Knowledge Test (DKT2) from the Michigan Diabetes Research and Training Center was used to assess the validity of the Turkish version of the DATE-Q questionnaire. The Turkish version of the DATE-Q was retested 1 week later. The reliability of the Turkish version of the DATE-Q was established through the test-retest analysis.

Statistical Analysis

The data were analyzed using the IBM SPSS Statistics software (version 30.0) for Windows. Descriptive statistics (frequency, percentage, mean, standard deviation, and median) were used to evaluate the sociodemographic characteristics of the participants. To determine normality, the data distribution was analyzed using the Kolmogorov–Smirnov test. To determine the validity of the questionnaire, the relationship between test and retest scores was assessed using Spearman correlation analysis. The reliability of the questionnaire was evaluated using Cronbach's alpha coefficient, internal consistency (ICC), and CIs (95% CI). The interpretation of Cronbach's alpha values was based on the following ranges: <0.40, not reliable; 0.40-0.59, low reliability; 0.60-0.79, acceptable reliability; and ≥0.80, high reliability.[21] The relationship between DATE-Q and DKT2 total scores was examined using Spearman correlation analysis for criterion validity. Results were regarded as statistically significant when $P < .05$.

Results

A total of 215 individuals with diabetes were assessed for inclusion criteria in this study. Two hundred participants who met the criteria and completed all questions were included in the study (Figure 1). The mean age of the participants was 55.86 ± 12.50 years. The majority of the study participants were female (n = 126, 63%). In addition, most participants had a diagnosis of T2DM (n = 165, 82.5%). The participants' demographic and clinical characteristics are shown in Table 1.

Table 2 presents the Turkish version of the DATE-Q total and subgroup scores, along with the DKT2 scores, for all participants, as well as separately for those with T1DM and T2DM. When the total mean scores of the first and second DATE-Q assessments were compared,

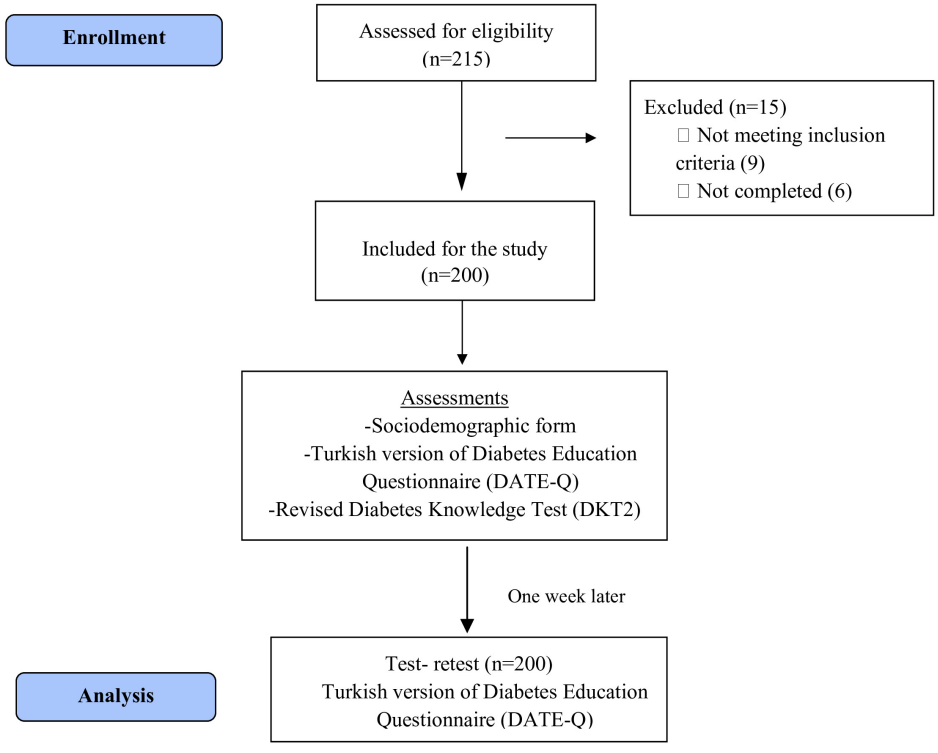

Figure 1. Flow diagram of the study.

Table 1. Demographic and Clinical Characteristics of the Study Participants

	Total (n = 200)	T1DM (n = 35)	T2DM (n = 165)
Age (years)	55.86 ± 12.50	42.02 ± 13.75	58.80 ± 10.05
Gender			
Female	126 (63)	23 (65.7)	103 (62.4)
Male	74 (37)	12 (34.3)	62 (37.6)
Weight (kg)	79.01 ± 15.08	67.64 ± 12.31	81.43 ± 14.53
Body mass index (kg/m^2)	29.74 ± 5.65	25.23 ± 4.68	30.73 ± 5.40
Glycated hemoglobin (%)	8.18 ± 1.03	8.01 ± 1.15	8.22 ± 1.00
Fasting blood glucose (mg/dL)	143.87 ± 31.08	135.49 ± 21.89	145.65 ± 32.48
Lipid profile			
HDL (mg/dL)	47.58 ± 9.07	50.43 ± 13.32	46.98 ± 7.81
LDL (mg/dL)	126.13 ± 32.52	104.57 ± 15.76	130.70 ± 33.34
TG (mg/dL)	156.28 ± 41.50	129.65 ± 30.82	161.92 ± 41.34
Education level			
Primary school	57 (28.5)	—	57 (34.5)
Middle school	28 (14)	3 (8.6)	25 (15.2)
High school	71 (35.5)	23 (65.7)	48 (29.1)
University degree (bachelor)	40 (20)	8 (22.9)	32 (19.4)
Master's degree	4 (2)	1 (2.9)	3 (1.8)
Duration of diabetes (years)	14.02 ± 9.43	16.37 ± 10.83	13.52 ± 9.06
Medical history			
OHA	73 (36.5)	—	73 (44.2)
OHA + insulin	99 (49.5)	7 (20)	92 (55.8)
Insulin	127 (63.5)	35 (100)	92 (55.8)
Comorbidity			
Hypertension	101 (50.5)	9 (4.5)	92 (55.7)
Obesity	90 (45)	5 (14.2)	85 (51.5)
Dyslipidemia	41 (20.5)	2 (5.7)	39 (23.6)
Cardiac diseases	36 (18)	1 (2.8)	35 (21.2)
Kidney disease	13 (6.5)	1 (2.8)	12 (7.2)
Thyroid disease	20 (10)	1 (2.8)	19 (11.5)
Respiratory disease	11 (5.5)	1 (2.8)	10 (6.0)
Musculoskeletal disorders	5 (2.5)	1 (2.8)	4 (2.4)
Neurologic diseases	3 (1.5)	—	3 (1.8)
Cancer	6 (3)	—	6 (3.6)
Sleep apnea	4 (2)	1 (2.8)	3 (1.8)

Data are presented as mean ± standard deviation or n (%).
DM, diabetes mellitus; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol, OHA, oral hypoglycemic agent; TC, total cholesterol, TG, triglycerides.

the first (15.76 ± 3.09) and second DATE-Q scores (15.50 ± 3.42) were found to have no statistically significant difference (P = .054, 95% CI = −0.01 to 0.54). Across all participants, some items demonstrated the lowest correct response score within their respective domains in both the first and second assessments: In the self-management domain, the lowest correct response was observed for item 16 ("If your blood sugar is too low, you should eat chocolate as a fast-acting carbohydrate") with a mean score of 0.68 ± 0.46. In the long-term complications domain, item 3 ("The results of your HbA1c blood test show the average level of your blood sugar over the past year") had the lowest mean score (0.60 ± 0.49). Within the physical activity domain, item 17 ("If your heart rate is within the target limits and you feel short of breath, you are exercising at the right level") showed the lowest correct response rate (0.49 ± 0.50). In the healthy eating domain, item 14 ("Consumption of fibrous foods helps manage diabetes by lowering your blood sugar, LDL cholesterol, and blood pressure") had the lowest mean score (0.78 ± 0.41). Finally, in the psychosocial well-being domain, item 15 ("Depression does not affect how you manage your diabetes") had the lowest correct response rate (0.63 ± 0.48).

The Turkish version of the DATE-Q demonstrated strong reliability. Test–retest analysis and internal consistency yielded high Cronbach's alpha values (α = 0.903). Across all items, the alpha coefficients ranged from 0.891 to 0.979. The internal consistency coefficient was 0.823, with a 95% CI. Detailed results for Cronbach's alpha, internal consistency, and CIs of each item are presented in Table 3.

The validity of DATE-Q was demonstrated using criterion validity. The first assessment of DATE-Q showed a moderate correlation with DKT2 (r = 0.576, P < .001). The Turkish version of the DATE-Q questionnaire was found to have moderate validity. The coefficient correlations of the DATE-Q and DKT2 questionnaires are shown in Table 4.

Discussion

The study results indicated that the DATE-Q has high reliability (Cronbach's alpha = 0.90) and strong internal consistency, with 20 items showing high interclass correlations (ICC = 0.80-0.96). The Turkish version of the DATE-Q questionnaire demonstrated acceptable validity, with a moderate correlation to the validated DKT2 questionnaire and high internal consistency over time.

Table 2. Diabetes Education Questionnaire Item, Domain, and Total Scores and Revised Diabetes Knowledge Test Domain and Total Scores of the Study Participants

		Total (n = 200) DATE-Q Score Item, Mean ± SD		T1DM (n = 35) DATE-Q Score Item, Mean ± SD		T2DM (n = 165) DATE-Q Score Item, Mean ± SD	
Domain	Item	First Assessment	Second Assessment	First Assessment	Second Assessment	First Assessment	Second Assessment
Self management	2. Two hours after eating, your blood sugar should be higher than 180 mg/dL.	0.69 ± 0.46	0.75 ± 0.43	0.74 ± 0.44	0.80 ± 0.40	0.67 ± 0.46	0.73 ± 0.44
	12. When you have a cold or the flu, your blood sugar may be higher or lower than normal.	0.74 ± 0.43	0.75 ± 0.43	0.65 ± 0.48	0.68 ± 0.47	0.76 ± 0.42	0.76 ± 0.42
	16. If your blood sugar is too low, you should eat chocolate as a fast-acting carbohydrate.	0.68 ± 0.46	0.69 ± 0.46	0.62 ± 0.49	0.62 ± 0.49	0.69 ± 0.46	0.70 ± 0.45
	18. If you're taking insulin or certain oral diabetes medications (for example, pills like glibenclamide), your blood sugar is more likely to drop.	0.87 ± 0.33	0.87 ± 0.33	0.91 ± 0.28	0.91 ± 0.28	0.86 ± 0.34	0.86 ± 0.34
	DATE-Q Score per "Self Management Domain"	3.01 ± 0.95	3.07 ± 1.05	2.99 ± 0.78	3.02 ± 1.12	2.97 ± 0.82	3.07 ± 1.04
Long-term complications	1. When living with diabetes, it is important to manage your blood pressure and cholesterol to prevent complications.	0.94 ± 0.23	0.95 ± 0.21	0.97 ± 0.16	0.97 ± 0.16	0.93 ± 0.25	0.94 ± 0.22
	3. The results of your HbA1c blood test show the average level of your blood sugar over the past year.	0.60 ± 0.49	0.64 ± 0.47	0.71 ± 0.45	0.71 ± 0.45	0.58 ± 0.49	0.63 ± 0.48
	6. Keeping your HbA1c low (less than 7%) will help to prevent complications of diabetes.	0.78 ± 0.41	0.80 ± 0.40	0.77 ± 0.42	0.82 ± 0.38	0.78 ± 0.41	0.79 ± 0.40
	11. If your diabetes is not well managed, your blood vessels and nerves can be damaged.	0.95 ± 0.20	0.96 ± 0.19	0.94 ± 0.23	0.94 ± 0.23	0.95 ± 0.20	0.96 ± 0.18
	DATE-Q Score per "Long term complications" Domain	3.27 ± 0.72	3.35 ± 0.82	3.39 ± 0.75	3.45 ± 0.70	3.24 ± 0.68	3.33 ± 0.85
Being active	4. Resistance training (using bands or weights) helps strengthen your muscles and lower your blood sugar.	0.76 ± 0.42	0.77 ± 0.41	0.71 ± 0.45	0.74 ± 0.44	0.77 ± 0.41	0.78 ± 0.41
	8. Exercise is a good way to help manage your blood sugar.	0.85 ± 0.35	0.82 ± 0.38	0.80 ± 0.40	0.80 ± 0.40	0.86 ± 0.34	0.83 ± 0.37
	13. You should check your feet for blisters, sores or ulcers only before exercise.	0.65 ± 0.47	0.64 ± 0.47	0.57 ± 0.50	0.57 ± 0.50	0.66 ± 0.47	0.66 ± 0.47
	17. If your heart rate is within the target limits and you feel short of breath, you are exercising at the right level.	0.49 ± 0.50	0.50 ± .0.50	0.45 ± 0.50	0.45 ± 0.50	0.49 ± 0.50	0.51 ± 0.50
	DATE-Q Score per "Being active" Domain	2.70 ± 0.90	2.75 ± 0.94	2.73 ± 0.66	2.57 ± 0.77	2.76 ± 0.89	2.78 ± 0.98
Healthy eating	5. Skipping breakfast and overeating dinner helps prevent high and low blood sugars.	0.90 ± 0.30	0.86 ± 0.34	0.91 ± 0.28	0.91 ± 0.28	0.89 ± 0.30	0.85 ± 0.35
	9. Prepared or processed foods (such as canned soup and frozen meals) are healthy food choices every day.	0.97 ± 0.15	0.98 ± 0.14	1.00 ± 0.00	1.00 ± 0.00	0.96 ± 0.17	0.97 ± 0.15
	14. Consumption of fibrous foods helps you manage diabetes by lowering your blood sugar, LDL (bad) cholesterol, and blood pressure.	0.78 ± 0.41	0.77 ± 0.41	0.88 ± 0.32	0.85 ± 0.35	0.76 ± 0.42	0.75 ± 0.42
	20. A healthy diet in diabetes includes a more plant-based diet. For example: fruits, vegetables, whole grains and legumes.	0.88 ± 0.32	0.88 ± 0.31	0.88 ± 0.32	0.91 ± 0.28	0.87 ± 0.32	0.87 ± 0.32
	DATE-Q Score per "Healthy eating" Domain	3.50 ± 0.72	3.53 ± 0.78	3.66 ± 0.50	3.68 ± 0.58	3.45 ± 0.71	3.46 ± 0.74

(*Continued*)

Table 2. Diabetes Education Questionnaire Item, Domain, and Total Scores and Revised Diabetes Knowledge Test Domain and Total Scores of the Study Participants (Continued)

Domain	Item	Total (n = 200) DATE-Q Score Item, Mean ± SD		T1DM (n = 35) DATE-Q Score Item, Mean ± SD		T2DM (n = 165) DATE-Q Score Item, Mean ± SD	
		First Assessment	Second Assessment	First Assessment	Second Assessment	First Assessment	Second Assessment
Psychosocial wellbeing	7. Being aware of your feelings and asking for help and support can prevent diabetes from overwhelming you.	0.78 ± 0.41	0.82 ± 0.38	0.77 ± 0.42	0.80 ± 0.40	0.78 ± 0.41	0.83 ± 0.37
	10. Having support from family and friends is a good way to help you cope with stress.	0.81 ± 0.39	0.81 ± 0.39	0.80 ± 0.40	0.80 ± 0.40	0.81 ± 0.39	0.81 ± 0.38
	15. Depression does not affect how you manage your diabetes.	0.63 ± 0.48	0.63 ± 0.48	0.62 ± 0.49	0.62 ± 0.49	0.64 ± 0.48	0.63 ± 0.48
	19. Poor quality of sleep, or sleep apnea, is common in type 2 diabetes and can make your health worse.	0.78 ± 0.41	0.78 ± 0.41	0.85 ± 0.35	0.85 ± 0.35	0.76 ± 0.042	0.77 ± 0.42
	DATE-Q Score per "Psychosocial Well-being" Domain	3.00 ± 0.98	3.05 ± 1.14	3.06 ± 1.11	3.08 ± 1.17	3.04 ± 1.14	3.04 ± 1.14
Total DATE-Q scores		15.76 ± 3.08	15.49 ± 3.42	17.25 ± 2.01	17.45 ± 1.96	15.44 ± 3.18	15.07 ± 3.52
	DKT2 Score "General knowlegde" domain (14 items)	10.26 ± 2.39		11.31 ± 2.59		9.44 ± 2.59	
	DKT2 "Insulin use" domain (9 items)	3.46 ± 2.93		6.46 ± 2.67		3.42 ± 2.99	
Total DKT2 scores		13.72 ± 4.06		17.77 ± 2.60		12.86 ± 3.79	

DATE-Q, The DiAbeTes Education Questionnaire; DM, diabetes mellitus; DKT2, Revised Diabetes Knowledge Test.
*DATE-Q scores ranging from 1 = correct; 0 = incorrect or I don't know.

The Cronbach's alpha value of the DATE-Q in this study was found to be higher (α = 0.90) than that of the original questionnaire (α=0.77)[17] and the Brazilian Portuguese version (α = 0.60).[16] In addition, the DATE-Q showed better reliability compared to other validated diabetes knowledge questionnaires in Türkiye. For example, the DKT2 had a Cronbach's alpha of 0.70,[14] while the Revised Diabetes Self-Care Inventory (SCI-R) and the Perceived Diabetes Self-Management Scale (PDSMS) had alpha values of α = 0.83 and α = 0.78, respectively, in the T1DM group. In the T2DM group, these values were α = 0.78 for the SCI-R and α = 0.82 for the PDSMS.[14] The Multidimensional Diabetes Questionnaire (MDQ) in T2DM showed alpha values between α = 0.58 and α = 0.91 for its 6 subscales.[15] This reliability supports the usefulness of the DATE-Q in clinical and educational settings and may be useful in the comprehensive assessment of key aspects of diabetes management, including self-care, long-term complications, healthy diet, physical activity, and psychosocial well-being.

The high internal consistency between the first and second assessments of the DATE-Q itself ($r = 0.834$, $P < .001$) demonstrated the consistency and reliability of the questionnaire over time. Additionally, the moderate correlations between the DATE-Q and the DKT2 at the first ($r = 0.576$) and second assessments ($r = 0.677$) demonstrated that the DATE-Q is culturally consistent and comparable with the DKT2, which has been validated for assessing diabetes knowledge. We think that the moderate level of validity observed in this study is likely attributable to differences in the domains assessed by the 2 instruments. The DATE-Q was developed as a comprehensive diabetes education instrument that encompasses 5 essential domains of diabetes care: long-term complications, physical activity, healthy eating, self-management, and psychosocial well-being. In contrast, the DKT2 focuses primarily on general diabetes knowledge and insulin-related information, thereby representing a more narrowly constructed assessment tool. Although more limited in scope, the DKT2 is widely used in the literature and has been previously tested, validated, and found to be reliable by the authors' research team; we compared the results. Therefore, the validity of the Turkish version of the DATE-Q questionnaire was considered acceptable. This study demonstrated that the DATE-Q is a valid questionnaire for assessing diabetes knowledge and can yield reliable results for individuals with diabetes in Türkiye.

Physical activity, as a healthy lifestyle behavior, is a crucial component of diabetes care and plays a vital role in regulating blood glucose levels, enhancing insulin sensitivity, and preventing diabetes-related complications.[1,22,23] While the DKT2 primarily evaluates the impact of exercise on blood glucose levels, the DATE-Q encompasses a broader domain of "being active," addressing its various benefits for diabetes management through 4 specific items. This domain examines the beneficial effects of physical activity on blood sugar regulation, the role of resistance exercises in improving muscle strength and overall health, the importance of pre-exercise foot health management in individuals with diabetes, and guidelines for the recommended intensity and duration of exercise for optimal glycemic control. Remarkably, the item on the DATE-Q, "If your heart rate is within the target limits and you feel short of breath, you are exercising at the right level," exhibited the lowest mean scores (T1DM: 0.45 ± 0.50, T2DM: 0.49 ± 0.50) in this study. This result indicates a gap in participants' understanding of exercise intensity, highlighting the need for more focused education on exercise in diabetes management. We suggest that the DATE-Q, with its detailed focus on exercise-related

Table 3. Reliability of the Turkish Version of the Diabetes Education Questionnaire

Item	α	ICC	95% IC
Total	0.903	0.823	0.85-0.90
1	0.968	0.939	0.95-0.97
2	0.899	0.816	0.86-0.92
3	0.891	0.804	0.85-0.91
4	0.941	0.899	0.92-0.95
5	0.929	0.867	0.90-0.94
6	0.942	0.891	0.92-0.95
7	0.967	0.936	0.95-0.97
8	0.967	0.936	0.95-0.97
9	0.979	0.960	0.97-0.98
10	0.967	0.936	0.95-0.97
11	0.926	0.862	0.90-0.94
12	0.967	0.936	0.95-0.97
13	0.975	0.951	0.96-0.98
14	0.923	0.857	0.89-0.94
15	0.959	0.922	0.94-0.96
16	0.916	0.844	0.88-0.93
17	0.966	0.935	0.95-0.97
18	0.939	0.885	0.91-0.95
19	0.923	0.857	0.89-0.94
20	0.955	0.913	0.94-0.96

α, Cronbach alpha; CI, confidence interval; ICC, intraclass correlation.

knowledge, could be instrumental in identifying misperceptions and informing the development of targeted educational programs in clinical practice.

In this study, participants with T1DM demonstrated higher overall diabetes knowledge, as indicated by mean DATE-Q scores (17.25 ± 2.01 vs 15.49 ± 3.42) and DKT2 scores (17.77 ± 2.60 vs 12.86 ± 3.79) compared to those with T2DM. In addition, individuals with T1DM had a higher proportion of participants with a university or master's degree compared with those with T2DM (bachelor's: 22.9%, 19.4%, respectively; master's: 5.7%, 1.8%, respectively), while participants with T2DM more frequently had higher primary or middle school education (primary: 34.5%; middle: 15.2%) in Table 1. This difference may be attributed to factors such as the onset of diabetes, educational level, and reliance on insulin therapy. In conclusion, these findings highlight the critical need for comprehensive education programs in diabetes management, particularly for people with T2DM, to improve self-management and promote secondary prevention.

Table 4. Criterion Validity of the Turkish Version of the Diabetes Education Questionnaire

		DATE-Q (First Assessment)	DATE-Q (Second Assessment)	DKT2
DATE-Q (First assessment)	r		834**	576**
	P		<.001	<.001
DATE-Q (Second assessment)	r	834**		677**
	p	<.001		<.001
DTK2	r	576**	677**	
	p	<.001	<.001	

DATE-Q, The DiAbeTes Education Questionnaire; DKT2, Revised Diabetes Knowledge Test. ** Correlation is significant at P < 0.001.

This study has certain limitations. Primarily, because the study was conducted in a single tertiary care center, the generalizability of the results to broader populations may be limited. Second, although the sample size is adequate for psychometric analysis, it may not fully capture the diversity of people with diabetes across different regions of Türkiye. Another limitation of this study is that subgroup analyses could not be performed due to insufficient sample sizes of the 2 groups. Finally, the DATE-Q and the DKT2 encompass different domains of diabetes knowledge. Nevertheless, these findings provide important evidence supporting the reliability and validity of the Turkish DATE-Q. Future studies involving more diverse and larger populations are recommended to strengthen these findings and expand the utility of the DATE-Q in various healthcare settings.

In this study, the Turkish version of the DATE-Q has been demonstrated to be a moderately valid and reliable tool for assessing diabetes knowledge. Its use in clinical settings can assist healthcare professionals in systematically identifying patients' knowledge gaps in key areas of diabetes management, including self-care practices, nutrition, long-term complications, psychosocial aspects, physical activity and exercise, and key components of effective diabetes management. Integrating the DATE-Q into routine care may support the development of tailored educational programs, promote self-management behaviors, and ultimately contribute to the prevention of diabetes-related complications. Moreover, the questionnaire can serve as an effective tool for evaluating the impact of educational interventions and informing future strategies in diabetes care. Given the observed differences in knowledge levels between people with T1DM and T2DM, targeted interventions may further enhance patient outcomes.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Artificial Intelligence Usage Statement: The authors declared that no Artificial Intelligence Tool was used in the preparation of the manuscript.

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Informed Consent: Informed consent was obtained from the patients who agreed to take part in the study.

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