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# Turkish Adaptation of Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test and Determination of Factors Affecting the Knowledge Level of Diabetic Individuals

## Diyabet Araştırma ve Eğitim Merkezi Revize Diyabet Bilgi Testi'nin Türkçeye Adaptasyonu ve Diyabetli Bireylerin Bilgi Düzeyini Etkileyen Faktörlerin Belirlenmesi

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## Abstract

**Objective:** Education is the cornerstone of diabetes management, and numerous educational studies used Diabetes Knowledge Level Tests to determine the effectiveness of education. Our study was planned to adopt the revised Diabetes Knowledge Test (DKT2) of the Michigan Diabetes Research and Training Center for the Turkish population. **Material and Methods:** A total of 296 diabetic subjects using insulin were included in the study. After the determination of the validity of the language and content of the test, it was applied to the patients. The reliability of the study was assessed using Cronbach's alpha coefficient. The results of the DKT2 demographic values, and laboratory tests of the patients were noted. **Results:** Cronbach's alpha values were 0.60, 0.59, and 0.70 for the first part, second part, and complete test, respectively. The test-retest reliability values were 0.76 and 0.87 ($p<0.001$), respectively. The correct response rate to the first part was 32.68±2.47% in patients with Type 1 diabetes and 32.16±2.66% in patients with Type 2 diabetes using insulin. The correct response rate to the second part was 19.68±2.05% and 19.55±2.96%, respectively. **Discussion:** The Turkish adapted version of DKT2 is a reliable tool to measure patients' level of diabetes knowledge. However, in order to increase the level of knowledge of the patients, education of diabetes should be improved.

**Keywords:** Diabetes; knowledge level; reliability

## Özet

**Amaç:** Eğitim, diyabet yönetiminin köşe taşıdır ve yapılan pek çok eğitim çalışmasında eğitimin etkinliğini saptamak amacıyla Diyabet Bilgi Düzeyi Testleri kullanılmıştır. Çalışmamız, Michigan Diyabet Araştırma ve Eğitim Merkezi Revize Diyabet Bilgi Testi'nin (DKT2) Türkçeye adaptasyonunu yapmak amacıyla planlanmıştır. **Gereç ve Yöntemler:** Çalışmaya, insülin kullanan toplam 296 diyabetli birey dâhil edilmiştir. Test, dil ve kapsam geçerliliğinin belirlenmesini takiben hastalara uygulanmıştır. Cronbach alfa katsayısı kullanılarak güvenirlilik çalışması yapılmıştır. Katılımcıların Diyabet Bilgi Testi sonuçları, demografik özellikleri ve laboratuvar verileri kaydedilmiştir. **Bulgular:** Cronbach alfa değerleri 1. kısım, 2. kısım ve tüm test için sırasıyla 0,60, 0,59 ve 0,70 olarak saptanmıştır. Test-tekrar test güvenirlilik değerleri sırasıyla 0,76 ve 0,87'dir ($p<0.001$). Ölçeğin ilk kısmına verilen doğru yanıt oranı Tip 1 diyabetli bireylerde %32,68±2,47 ve insülin kullanan Tip 2 diyabetli bireylerde ise %32,16±2,66'dır. Ölçeğin 2. kısmına verilen doğru yanıt oranı ise sırasıyla %19,68±2,05 ve %19,55±2,96 olarak saptanmıştır. **Sonuç:** Bu sonuçlar bize, DKT2'nin Türkçe versiyonunun hastaların diyabetle ilgili bilgi düzeyini ölçmek için güvenilir bir araç olduğunu göstermektedir. Ancak, hastaların bilgi düzeyini artırmak amacıyla diyabet eğitimleri geliştirilmelidir.

**Anahtar kelimeler:** Diyabet; bilgi düzeyi; güvenirlilik

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## Introduction

There is a rise in the prevalence of diabetes in Turkey as well as globally. There was a rise in the incidence of diabetes, from 7.2% in the TURDEP-I data in 1998 to 13.7% in the TURDEP-II study in 2010 (1). Diabetes reduces the lifespan by 5-10 years (2). It is the 5th leading cause of death in many countries (3,4). Adult diabetics are at 2-4 times higher risk of cardiovascular events than their non-diabetic peers (5). Its complications present a high economic burden for individuals and society (2). In addition, diabetes expenditure constitutes 3-12% of total healthcare expenditure in various countries (6).

Education is the cornerstone of diabetes management (7). Diabetes knowledge can improve parameters such as blood glucose, HbA1c, blood pressure, and body weight (8). In many studies, the Diabetes Knowledge Level Test was used to determine the effectiveness of education (9,10). The revised Diabetes Knowledge Level Test (DKT2) is a quick and low-cost method of assessing general diabetes knowledge and associated self-care (11). In our country, tests measuring the level of diabetes knowledge are needed. In this study, we aimed to adapt DKT2 for the Turkish population.

## Material and Methods

### Setting and Samples

The study was carried out in the Diabetes outpatient clinic between June to October 2016.

In the present study, a test, which consisted of 23 questions, was applied to 296 diabetic individuals using insulin in order to adapt DKT2 for the Turkish population. The scale was applied to 42 cases twice at 15 days interval for the examination of invariance over time. All participants filled the patient identification form, which questioned their demographic characteristics and the medical treatment they had undergone.

The inclusion criteria for the volunteers were as follows; patients aged 18 years or older, with type 1 and 2 diabetes receiving insulin therapy, having an established diagnosis of diabetes since at least a year, under insulin therapy for at least six months, literate and without hearing, speaking or understanding disorders.

### Instruments

Two instruments including the basic information form and Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test, were used.

### Basic Information Form

The basic information form was developed by the authors and consisted of two parts. In the first part, the questions about sociodemographic data such as age, gender, and educational status were inquired. In the second part, type, duration and complications of diabetes, and levels of HbA1c were questioned. These values were used to determine the variables affecting the diabetes knowledge of the patients.

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

This test form consists of 23 questions. The English version of the test is given in Table 1. The first 14 questions measure the general level of diabetes knowledge. In the last 9 questions, the level of knowledge about the use of insulin is evaluated. While the first 14 questions can be applied to all adults with type 1 and 2 diabetes, the last 9 questions are relevant only to those using insulin. DKT2 is a reliable and valid tool for researchers, clinicians, and diabetes educators to evaluate the overall diabetes knowledge of a patient or population (11). There is no threshold value or passing level for the test. This test usually compares different patient groups or pre- and post-intervention.

### Procedures and Data Collection

Instruments were administered in the hospital education room, which is located in the diabetes outpatient clinic. It is a quiet, well-lit room providing an atmosphere in which patients could concentrate on completing the questionnaires without being disturbed. The test was applied to 296 diabetic individuals and the subjects were invited to visit the outpatient clinic within two weeks of the first evaluation for test-retest stability. A total of 50 patients agreed to make a second visit to the outpatient clinic. Two days prior to the scheduled visit, a researcher called up the patients to remind them of their appointment. Of the 50 patients who

Table 1. The Original English version of the Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test.

1. The diabetes diet is:
   a. The way most American people eat
   b. A healthy diet for most people
   c. Too high in carbohydrate for most people
   d. Too high in protein for most people
2. Which of the following is highest in carbohydrate?
   a. Baked chicken
   b. Swiss cheese
   c. Baked potato
   d. Peanut butter
3. Which of the following is highest in fat?
   a. Low fat (2%) milk
   b. Orange juice
   c. Corn
   d. Honey
4. Which of the following is a "free food"?
   a. Any unsweetened food
   b. Any food that has "fat free" on the label
   c. Any food that has "sugar free" on the label
   d. Any food that has less than 20 calories per serving
5. A1C is a measure of your average blood glucose level for the past:
   a. Day
   b. Week
   c. 6-12 weeks
   d. 6 months
6. Which is the best method for home glucose testing?
   a. Urine testing
   b. Blood testing
   c. Both are equally good
7. What effect does unsweetened fruit juice have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect
8. Which should not be used to treat a low blood glucose?
   a. 3 hard candies
   b. 1/2 cup orange juice
   c. 1 cup diet soft drink
   d. 1 cup skim milk
9. For a person in good control, what effect does exercise have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect
10. What effect will an infection most likely have on blood glucose?
    a. Lowers it
    b. Raises it
    c. Has no effect
11. The best way to take care of your feet is to:
    a. Look at and wash them each day
    b. Massage them with alcohol each day
    c. Soak them for 1 hour each day
    d. Buy shoes a size larger than usual
12. Eating foods lower in fat decreases your risk for:
    a. Nerve disease
    b. Kidney disease
    c. Heart disease
    d. Eye disease

*continued* →

Table 1. The Original English version of the Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test *(continued)*.

13. Numbness and tingling may be symptoms of:
  a. Kidney disease
  b. Nerve disease
  c. Eye disease
  d. Liver disease
14. Which of the following is usually not associated with diabetes:
  a. Vision problems
  b. Kidney problems
  c. Nerve problems
  d. Lung problems
15. Signs of ketoacidosis (DKA) include:
  a. Shakiness
  b. Sweating
  c. Vomiting
  d. Low blood glucose
16. If you are sick with the flu, you should:
  a. Take less insülin
  b. Drink less liquids
  c. Eat more proteins
  d. Test blood glucose more often
17. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:
  a. Less than 2 hours
  b. 3-5 hours
  c. 6-12 hours
  d. More than 13 hours
18. You realize just before lunch that you forgot to take your insulin at breakfast. What should you do now?
  a. Skip lunch to lower your blood glucose
  b. Take the insulin that you usually take at breakfast
  c. Take twice as much insulin as you usually take at breakfast
  d. Check your blood glucose level to decide how much insulin to take
19. If you are beginning to have a low blood glucose reaction, you should:
  a. Exercise
  b. Lie down and rest
  c. Drink some juice
  d. Take rapid-acting insülin
20. A low blood glucose reaction may be caused by:
  a. Too much insulin
  b. Too little insulin
  c. Too much food
  d. Too little exercise
21. If you take your morning insulin but skip breakfast, your blood glucose level will usually:
  a. Increase
  b. Decrease
  c. Remain the same
22. High blood glucose may be caused by:
  a. Not enough insulin
  b. Skipping meals
  c. Delaying your snack
  d. Skipping your exercise
23. A low blood glucose reaction may be caused by:
  a. Heavy exercise
  b. Infection
  c. Overeating
  d. Not taking your insulin

agreed, 42 patients made the second visit to the clinic and again completed the DKT2. The patients completed the DKT2 in 8-20 min, with 95% completing the questionnaire in 15 min or less.

### Statistical Analysis

The data were analyzed using SPSS 21.0 package software (SPSS Inc., Chicago, Illinois USA). The sociodemographic characteristics of the participants were evaluated by number, percentage, mean, standard deviation, and median values. The effect of socio-demographic variables on the subscale scores of DKT2 was analyzed by variance analysis and t-test. In the reliability analysis of the scale, Pearson's Correlation coefficient was calculated by using the test-retest method to evaluate the invariance with respect to time, and the Cronbach alpha reliability coefficient was calculated for the internal consistency. Lawshe technique was used to evaluate the opinions of experts for the content validity of the scale. The statistical significance level was accepted as $p<0.05$.

### Ethical Issues

The study was conducted in accordance with the Helsinki Declaration and approval was obtained from the local ethics committee Istanbul University Istanbul Medical Faculty Clinical Research Ethics Committee 31.05.2016, No: 690). Written consent was obtained from the individuals who met the inclusion criteria for the study and the purpose of the research and possible benefits were explained. They were ensured of not using the data outside the purpose of the research and non-disclosure of individual data. In the present study, written permission was obtained from James T. Fitzgerald by e-mail on behalf of the working group who owned the questionnaire in order to adapt the DKT2 for the Turkish population.

## Results

### General Characteristics of Participants

The general characteristics of the participants are shown in Table 2 and Table 3. The mean age of the participants was 52.98±3.90 years, with the majority of them having type-2 diabetes (70.6%). More than half of the participants were women (65.5%) and married (72.6%). Almost half of them (47.6%) were primary school graduates and having a job (48.6%), and a very large proportion was not using cigarettes (70.3%) and alcohol (90.5%). The complications observed were hypertension (60.8%), neuropathy (25.7%), retinopathy (25%), nephropathy (16.2%), diabetic foot (4.7%), and cardiovascular events (CVE) (1.4%), and 77% of the participants were educated for diabetes.

### Language Adaptation

In order to evaluate the content and validity of the scale, the original English version was translated into Turkish by a faculty member of the Department of Foreign Languages and an English instructor. After the final Turkish version was examined by the literature teacher, the scale was translated into English by an Internal medicine specialist who had not seen the original scale and understood and spoke both languages (Turkish and English). The scale was then translated back to Turkish by two faculty members of the Department of Foreign Languages. The original version of the scale was compared with the English translation, and the necessary arrangements were made and presented to James T. Fitzgerald by e-mail on behalf of the working group. The final translation of the scale was presented to ten different Internal medicine specialists, and it was decided that there was no significant

Table 2. The age, height, weight, BMI, and A1c values of the patients.

| Features | Mean | ±Std | Median | Min. | Max. |
|---|---|---|---|---|---|
| Age (year) | 52.98 | ±3.90 | 52 | 18 | 83 |
| Height (cm) | 163.29 | ±9.12 | 163 | 144 | 191 |
| Weight (kg) | 79.48 | ±17.10 | 78 | 40.70 | 158.30 |
| BMI (kg/m$^2$) | 29.89 | ±6.42 | 29 | 17.40 | 53.50 |
| A1c% | 8.91 | ±1.83 | 8.60 | 5 | 15.30 |

BMI: Body mass index.

Table 3. Distribution of participants according to sociodemographic and disease characteristics (n=296).

| | Number (n) | Percent (%) |
|---|---|---|
| Gender | | |
| Female | 194 | 65.5 |
| Male | 102 | 34.5 |
| Diabetes type | | |
| Type 1 DM | 87 | 29.4 |
| Type 2 DM (using insulin) | 209 | 70.6 |
| Education level | | |
| Primary education | 141 | 47.6 |
| High school | 87 | 29.4 |
| University-doctorate | 68 | 23.0 |
| Marital status | | |
| The married | 215 | 72.6 |
| Single | 51 | 17.2 |
| Widow | 30 | 10.2 |
| Working status | | |
| Working | 144 | 48.6 |
| Not working | 60 | 20.3 |
| Retired | 92 | 31.1 |
| Cigarette | | |
| Uses | 42 | 14.2 |
| Left | 46 | 15.5 |
| Not use | 208 | 70.3 |
| Alcohol | | |
| Uses | 20 | 6.8 |
| Left | 8 | 2.7 |
| Not use | 268 | 90.5 |
| Regular exercise | | |
| Yes | 145 | 49.0 |
| No | 151 | 51.0 |
| Complications * | | |
| Retinopathy | 74 | 25.0 |
| Neuropathy | 76 | 25.7 |
| Nephropathy | 48 | 16.2 |
| CVE | 4 | 1.4 |
| Diabetic foot | 14 | 4.7 |
| HT | 180 | 60.8 |
| Have you ever had DM training (Yes%) | 228 | 77.0 |

* Multiple options are marked.
DM: Diabetes mellitus; CVE: Cerebrovascular disease; HT: Hypertension.

difference between the original and the semantic scale.

### Content Validity

After the validity of the scale, the Turkish version of the scale was given to ten experts to determine the scope of the scale. They were asked to score 1 to 4 items to assess the degree of measurement of each of them. The differences of opinion among the experts were examined by the Lawshe technique, and the data obtained from the experts were evaluated with the content validity index (CVI). The CVI of the items was calculated as 0.87.
As a result of the evaluations made by the experts, the final scale was evaluated by pilot application to a group of 30 people not included in the research, and necessary corrections were made.

### Reliability Study

Internal consistency reliability coefficient: In the reliability analysis of DKT2, Cronbach's alpha reliability coefficient ($\propto$) was found to be $\propto$=0.60 for general test size; $\propto$=0.59 for insulin use size and $\propto$=0.70 for the complete scale (Table 4).

### Test and Retest

In order to evaluate the invariance against time, 42 diabetic patients performed test-retest at 2 weeks interval and test-retest measurements evaluated Pearson's product-moment correlation and t-test. The relationship between the scores obtained from the first and second applications of DKT2 and its sub-dimensions was examined by Pearson's correlation analysis. The reliability coefficient was between 0.76 and 0.87 with positive and strong statistical significance ($p<0.001$) (Table 5). When the mean scores obtained from test and retest were compared with t-test independent groups, no statistically significant difference was found between them ($p>0.05$, Table 5).
There was no statistically significant difference between the groups in terms of type and duration of diabetes, HbA1c level, and education level of diabetes according to subscales of the level of knowledge DKT2 general test and insulin use of the participants ($p>0.05$, Table 6).

## Discussion

The Diabetes Knowledge Level Test was validated and published in 1998, and later revised and published in 2016 by Fitzgerald et al. (11). In 2010, the Malaysian version of the first part of the Michigan Diabetes Knowledge Test (Questions 1 to 14) was made and $\propto$ was found to be 0.702 (12). In 2016, Qah-

Table 4. Reliability test of the 23-item Revised Diabetes Knowledge Test 2.

| DKT2 questions number | Mean±SD | Corrected item: total correlation | Cronbach's alfa if item deleted | Cronbach's alfa General test (1-14) |
|---|---|---|---|---|
| Question 1 | 1.24±0.42 | 0.162 | 0.703 | 0.601 |
| Question 2 | 1.21±0.41 | 0.212 | 0.699 | |
| Question 3 | 1,26±0.44 | 0.125 | 0.707 | |
| Question 4 | 1.78±0.41 | 0.364 | 0.686 | |
| Question 5 | 1.31±0.46 | 0.338 | 0.687 | |
| Question 6 | 1.06±0.25 | 0.164 | 0.701 | |
| Question 7 | 1.18±0.39 | 0.207 | 0.699 | |
| Question 8 | 1.65±0.47 | 0.318 | 0.689 | |
| Question 9 | 1.11±0.31 | 0.232 | 0.697 | |
| Question 10 | 1.23±0.42 | 0.232 | 0.697 | |
| Question 11 | 1.12±0.33 | 0.216 | 0.698 | |
| Question 12 | 1.15±0.36 | 0.238 | 0.637 | |
| Question 13 | 1.22±0.41 | 0.294 | 0.692 | |
| Question 14 | 1.19±0.39 | 0.286 | 0.693 | |
| **DKT2 questions number** | **Mean±SD** | **Corrected item: total correlation** | **Cronbach's alfa if item deleted** | **Cronbach's alfa Insulin use (15-23)** |
| Question 15 | 1.80±0.40 | 0.309 | 0.691 | 0.587 |
| Question 16 | 1.43±0.49 | 0.319 | 0.689 | |
| Question 17 | 1.16±0.36 | 0.132 | 0.704 | |
| Question 18 | 1.51±0.50 | 0.349 | 0.686 | |
| Question 19 | 1.18±0.38 | 0.216 | 0.698 | |
| Question 20 | 1.19±0.40 | 0.310 | 0.691 | |
| Question 21 | 1.15±0.35 | 0.255 | 0.695 | |
| Question 22 | 1.50±0.50 | 0.263 | 0.695 | |
| Question 23 | 1.33±0.47 | 0.311 | 0.690 | |

Cronbach's alpha was 0.701 for the total scale with significant intra-class correlation coefficient (p<0.001).

Table 5. Comparison and Correlation of Test and Retest Score Means of Revised Diabetes Knowledge Test Scale 2 and Sub-Dimensions (n=42).

| Scale and Sub-Dimensions | First Application Mean±SD | Second Application Mean±SD | t | p | r | p |
|---|---|---|---|---|---|---|
| 1. General Test | 32.92±2.16 | 32.64±1.84 | 1.284 | 0.205 | 0.76 | 0.000 |
| 2. Insulin usage | 19.61±2.57 | 19.19±2.12 | 1.783 | 0.085 | 0.87 | 0.000 |

t: Paired Samples t-test, r: Pearson's correlation test.

tani et al. translated the first part of the test (Questions 1 to 14) into the Arabic language and ∝ was 0.60 (13). In this study, the reliability coefficient calculated by ∝ was 0.60 for the first part of DKT2 in accordance with the literature; ∝=0.59 for the second part and ∝=0.70 for the complete scale. Considering ∝ in a range of 0.50-0.70, which corresponds to moderate reliability, the Turkish version of DKT2 is a valid and reliable tool to measure patients' knowledge of diabetes.

In the validity studies of this test, individuals with diabetes have been evaluated in different countries. In the study by Al-Qazaz et al., the number of correct answers given to the 14 questions of the first part of the scale was 7.88±3.01 (12). In the study by Qahtani et al., the correct re-

Table 6. Comparison of Some Diabetes Characteristics According to Sub-dimensions of Revised Diabetes Knowledge Test 2 Scale.

| | | General Test % Correct Items 1-14 | | General Test % Correct Items 15-23 | |
|---|---|---|---|---|---|
| | | Mean±SD | n | Mean±SD | n |
| Diabetes Type | Type 1 | 32.68±2.47 | 87 | 19.68±2.05 | 87 |
| | Type 2 using insulin | 32.16±2.66 | 209 | 19.55±2.96 | 209 |
| | Difference (t,p) | t=1.566 | p=0.118 | t=0.461 | p=0.645 |
| Educational Level | Primary education | 32.16±2.84 | 141 | 19.62±2.08 | 141 |
| | High school | 32.41±2.56 | 87 | 19.44±2.74 | 87 |
| | University-doctorate | 32.52±2.18 | 68 | 19.69±1.89 | 68 |
| | Difference (F,p) | F=0.524 | p=0.592 | F=0.177 | p=0.838 |
| Diabetes duration | ≤10 years | 32.45±2.75 | 92 | 19.91±2.65 | 92 |
| | >10 years | 32.25±2.56 | 204 | 19.14±2.77 | 204 |
| | Difference (t,p) | t=0.597 | p=0.551 | t=1.357 | p=0.176 |
| A1c level | HbA1c ≤7% | 32.17±2.96 | 40 | 19.35±2.76 | 40 |
| | HbA1c >7% | 32.34±2.56 | 256 | 19.62±2.74 | 256 |
| | Difference (t,p) | t=-0.378 | p=0.705 | t=-0.593 | p=0.556 |
| Diabetes Education | Yes | 32.36±2.52 | 228 | 19.70±2.67 | 228 |
| | No | 32.16±2.93 | 68 | 19.22±2.95 | 68 |
| | Difference (t,p) | t=0.570 | p=0.569 | t=1.270 | p=0.205 |

t: Student's t- test, F:One-Way Anova.

sponse rate to all questions was approximately 54% (16-81%) (13). In the study by Fitzgerald et al., the correct response rate to the first part of the scale was found to be 84.7±20.0% in individuals with type 1 diabetes and 71.7±24.7% in patients with type 2 diabetes using insulin (11). In this study, rates were well below these values (32.68±2.47% and 32.16±2.66%, respectively). Similarly, in the same study by Fitzgerald et al., the correct response rate for the second part was 84.9±24.1% in patients with type 1 diabetes and 64.3 ±28.4% in patients with type 2 diabetes using insulin (11). In our study, their rates were 19.68±2.05% and 19.55±2.96%, respectively. This may be due to the differences in the level of education of the patients in the two study groups and the number of diabetic training.

When the factors affecting the knowledge level score obtained with this scale were examined, Al-Qazaz et al. found a significant difference between the patients with good diabetes control (mean±SD 9.01±3.03) and those with poor diabetes control (mean±SD 7.2±2.79, p<0.001) (12). Fitzgerald et al. found that the scores of individuals with type 1 diabetes were significantly higher than those of type 2 diabetics with and without insulin and that individuals who were high school graduates or less scored significantly lower than others (11). In this study, no statistically significant difference was found between the groups in terms of type and duration of diabetes, type of education, HbA1c level, and the status of receiving education about diabetes (p>0.05). However, in accordance with the literature, it was found that individuals with type 1 diabetes had higher scores for both parts of the DKT2 scale than those with type 2 diabetes. Moreover, individuals with higher education level and diabetes education had higher scores than those without it, but these differences were not statistically significant.

In conclusion, DKT2 is a quick and low-cost method of assessing general knowledge of diabetes and self-care. However, the Turkish version is not yet available. Thus, we assessed the reliability of DKT2, and the Turkish version of DKT2 was observed to be a reliable tool to measure patients' knowledge

of diabetes. However, the knowledge level of the patients can be increased by improving diabetes education.

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## Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

## Authorship Contributions

Idea/Concept: Cemile İdiz; Design: Cemile İdiz, İlhan Satman; Control/Supervision: Cemile İdiz, İlhan Satman; Data Collection and/or Processing: Cemile İdiz, Selda Çelik, Elif Bağdemir, Melike Dişsiz; Analysis and/or Interpretation: Cemile İdiz, Selda Çelik, Elif Bağdemir, Melike Dişsiz; Literature Review: Cemile İdiz, Selda Çelik, Elif Bağdemir, Melike Dişsiz, İlhan Satman; Writing the Article: Cemile İdiz, Selda Çelik, Elif Bağdemir, Melike Dişsiz, İlhan Satman; Critical Review: İlhan Satman.

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