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Turkish validity and reliability study of the kidney transplant understanding tool (K-TUT) in Kidney transplant recipients

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ABSTRACT

Aim: The study was conducted methodologically to evaluate the validity and reliability of the KTUT scale in kidney transplant recipients.
Material and Method: The population of the study consisted of kidney transplant patients at a private hospital group in Istanbul, while the sample comprised patients who met the inclusion criteria and volunteered for the study. Based on ten times the number of scale items, 220 individuals were included in the sample to prevent data loss and to ensure high representativeness. In the study, data collection tools such as the "Patient Information Form" and the "KTUT" scale were employed. The test-retest study was repeated two weeks later with 50 participants. The participants in the retest were not included in other tests of the scale.
Findings: The overall content validity index of the scale (S-CVI/Ave) was found to be 0.93. According to the experts' opinions, the content validity of the scale is high, and the majority of the items have been deemed appropriate for the measurement purpose. The internal consistency reliability coefficient of the scale (Cronbach's Alpha) was calculated as 0.789. This threshold indicates that the scale possesses an acceptable level of reliability for use at the group level. In addition, the results of the study reveal that the scores of the K-TUT scale show a significant difference in the 27 % lower and 27 % upper groups.
Conclusion: As a result of the study, the K-TUT scale has been shown to reliably distinguish knowledge levels and to be an effective measurement tool in the field of kidney transplant.
It is thought that using the Turkish version of the K-TUT to evaluate the knowledge levels of kidney transplant recipients will contribute to evaluation of developed programs and the improvement of patients' treatment processes.

1. Introduction

As the incidence of end-stage kidney disease increases, it is becoming a significant health issue. According to the Organ Procurement and Transplantation Network data, 40,439 kidney transplants were performed in the United States in 2024. Based on the Turkish Nephrology Association's 2022 data, 3621 kidney transplants were performed in Türkiye in 2022.[1,2] Kidney transplant is recognized as the most effective treatment for patients with end-stage kidney failure. However, complications related to surgery, immunosuppressives and immunologic system can still occur after transplantation.[3] This situation necessitates early and regular follow-up after kidney transplant, management of immunosuppressive therapies, prevention of complications, patient education and psychosocial support, and long-term monitoring.[4]

Maintaining optimal health and well-being in kidney transplant patients continues to pose challenges due to the complex self-management and lifelong follow-up required.[5] The selection of the donor kidney, the transplant operation, post-operative care, the use of immunosuppressive drugs, and lifestyle changes are topics that require patients' knowledge and control.[6,7] Lack of information after transplantation can negatively impact treatment adherence, health outcomes, and quality of life. The primary goal of patient education, which is one of the most important steps in the post-kidney transplant care process, is to help patients acquire the necessary skills for daily life without any issues and to enable them to cope with physiological and psychosocial problems. Therefore, developing effective educational interventions and information assessment tools to increase patients' knowledge levels can enhance the success of treatment processes and improve patient satisfaction.[8,9] It has

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been determined that the education provided after transplantation in ERAS protocols allows the patient to manage their expectations, helps them prepare psychologically, and increases adherence to ensure rapid recovery.[10,11]

Patient education can improve treatment adherence and quality of life by controlling side effects and complications. Many studies have examined the patient's perspective on life or quality of life after kidney transplantation. In the literature, there are no validated tools available to measure knowledge-based outcomes. A valid and reliable assessment tool can play a crucial role in identifying the information needs of kidney transplant recipients, developing educational strategies, and improving patient outcomes. In light of this information, the aim of this study is to identify the educational deficiencies of patients prior to education, address misconceptions, adapt the KTUT scale—originally developed to measure educational outcomes—into Turkish, and conduct validity and reliability studies.

2. Material and method

2.1. Aim and type of the study

The study was conducted methodologically to evaluate the validity and reliability of the KTUT scale in kidney transplant recipients.

2.2. Population and sample of study

The population of the study consisted of kidney transplant patients at a private hospital group in Istanbul, while the sample comprised patients who met the inclusion criteria and volunteered for the study. For the sample size, it is stated that the number of items should be at least five times (Bryman and Cramer, 2001), ten times (Nunnally, 1978), or fifteen times (Gorusch, 1983) the number of items.[12,13,14] In this study, a sample of 220 participants was selected, ensuring a sample size ten times the number of scale items to prevent data loss and enhance the representativeness of the results.

2.3. Inclusion criteria

- Being over 18 years old
- Being literate
-Being volunteer to participate in the study
- Having had a kidney transplant

2.4. Exclusion criteria

- Having communication problems or psychiatric problems
- Having had more than one kidney transplant

2.5. Data collection tools

In the study, data collection tools such as the "Patient Information Form" and the "KTUT" scale were employed.

2.6. Patient information form

The Patient Information Form was developed by the researchers in line with the literature. The form consists of 9 questions (age, gender, marital status, education level, employment status, duration of chronic kidney failure, dialysis status, donor type, donor characteristics).

2.7. KTUT scale

The KTUT scale was developed by Rosaasen N et al. (2017) to assess the knowledge of kidney transplant patients regarding transplantation and its management.[15] The K-TUT consists of 9 true/false and 13 multiple-choice questions, and scores are based on the number correct answers [YES/NO format] of 69 items (each with >1 potential answer). Each statement was dichotomized ("correct" or "incorrect"). A point was given for each correct answer chosen, and the scores were summed and converted to percentages. A perfect score (100 %) equated to a total of 69 points. Cronbach α ranged from 0.794 to 0.875 in all cohorts indicating favorable internal consistency.

Data Collection: After obtaining permission from the authors via email and approval from the ethics committee for the use of the scale, the study was initiated. In the creation of the Turkish version of the K-TUT, the first step was to evaluate language validity and cultural differences. The scale was translated into Turkish by expert translators in the field, and then its linguistic validity was evaluated by back-translation into the original language. One of the most preferred methods for ensuring linguistic validity is the back-translation method. In this study, the translation of the K-TUT scale in terms of linguistic equivalence was carried out by two linguists proficient in both English and Turkish. In line with the positive expert opinions, it was decided that the K-TUT was linguistically compatible. The readability level of the education booklet was calculated by the researcher using Ateşman and SMOG readability formulas. The readability level of the scale was calculated according to Ateşman (consisting of 55 sentences and 1100 words, with 202 words having 3 or more syllables). According to the SMOG formula, words with three or more syllables were counted from the beginning, the middle, and the end of the scale. According to the SMOG conversion table, the readability level of the scale was determined to be 11.22, indicating a higher education level. After the final version of the scale was developed, it was administered to kidney transplant patients in a private hospital group through face-to-face and phone interviews. The average response time was 20 min. The test-retest study was repeated two weeks later with 50 participants. The participants in the retest were not included in other tests of the scale.

Ethical aspects of the study: Informed consent was obtained from the patients who agreed to participate in the study. Permission of the institution where the study was conducted was obtained. Approval was obtained from the ethics committee of University (Date: 19.04.2024 and Approval Number: 2024–05). Considering the principles of justice and equality, the patients in the control group were also given education and the education booklet at the end of the study.

Limitations and generalizability of the study: Since the data was obtained from a specific group of hospitals, it may have limited generalizability. The psychological state of the patients, social support systems, individual differences, and the varying duration since the transplant may have affected the outcomes.

3. Findings

3.1. Data analysis

The data obtained in the research were evaluated using the SPSS 22.0 statistical program in computer environment. Kurtosis and Skewness values were analyzed to determine whether the scale items were normally distributed. In the related literature, the results of the kurtosis skewness values of the variables between +1.5 and −1.5[16], +2.0 and −2.0[17] are accepted as normal distribution. The scale items showed a normal distribution. The reliability of the scale was performed by Cronbach's alpha and test-retest analysis. The scale's discriminability was analyzed using an independent groups *t*-test between the 27 % lower and 27 % upper groups. In examining the differences in scale scores based on the descriptive characteristics in the field report, independent samples *t*-tests, one-way analysis of variance (ANOVA), and post hoc analyses (Tukey, LSD) were employed.

3.2. Descriptive characteristics

The data presented in the table show the distribution of the patients who participated in the study according to their descriptive

characteristics. In the distribution by age groups, the average age of the patients is 44.63±13.835, with the youngest participant being 18 years old and the oldest participant being 76 years old. 20.5 % of the participants are 30 years old or younger, while 24.5 % are in the 51–60 age range. According to the gender distribution, 62.7 % of the participants are male, and 37.3 % are female. In terms of educational status, 40.0 % are primary school graduates, 44.1 % are high school graduates, and 15.9 % are university graduates. According to their marital status, 70.5 % of the participants are married, while 29.5 % are single.

According to their professional status, 55.0 % of the participants are employed, while 45.0 % are unemployed. In terms of the duration of chronic kidney failure, 26.8 % of the participants have had kidney failure for <1 year, 47.3 % have had it for 1–5 years, and 25.9 % have had it for 6 years or more. When looking at the dialysis status, 90.0 % of the participants are receiving dialysis treatment, while 10.0 % are not receiving dialysis treatment. In terms of donor type, 93.2 % of the participants received a kidney transplant from a living donor, while 6.8 % received one from a cadaveric donor.

3.3. Evaluation of expert opinions: Davis method

In this study, the content validity of the measurement tool was evaluated by obtaining opinions from 11 local experts (2 nephrologists, 2 kidney transplant surgeons, 2 transplant nurses, 2 nursing academicians, 2 linguists, and 1 pharmacist). Using the Davis method, the scores given by the experts to each item were analyzed. Experts were asked to rate each item on a scale from "not appropriate" (1) to "very appropriate" (4), and the Content Validity Index (CVI) was calculated for each item. The CVI values of the items ranged from 0.82 to 1.00, indicating that the majority of the items have high content validity. The overall content validity index of the scale (S-CVI/Ave) was calculated as 0.93. Additionally, to evaluate the reliability of the S-CVI/Ave, a 95 % one-sided lower confidence limit was calculated and found to be 0.84. This lower limit excludes the possibility that the validity occurred by chance. In conclusion, according to expert opinions, the content validity of the scale is high, and the majority of the items were considered appropriate for the intended measurement purpose.

3.4. Reliability

The internal consistency reliability coefficient of the scale (Cronbach's Alpha) was calculated as 0.789. Moreover, the 95 % lower confidence bound shifts to 0.720. This threshold indicates that the scale possesses an acceptable level of reliability for use at the group level.

Table 1, Table 2.

3.5. Distinctiveness

The distinctiveness of the scale was evaluated by comparing the scores of the lower and upper 27 % groups.[18] In this analysis, the average score of participants in the lower 27 % group was 34.780, while it was 47.034 in the upper 27 % group. The results of the Independent Samples T-Test showed that there was a statistically significant difference between the groups ($t = -29.070$; $p < 0.001$). Additionally, to more robustly assess the discriminatory power of the measurement tool, the quartile deviation coefficient ([Q3−Q1]/[Q3+Q1]) was calculated and reported with the 95 % lower confidence limit. The calculated coefficient was 0.29, and the 95 % lower confidence limit was 0.26. These values indicate that the scale can distinguish significantly and adequately between groups with low and high levels of knowledge.

3.6. The test-retest

The test-retest results presented in Table 3 demonstrate the temporal reliability of the K-TUT scale. No significant difference was found between the scores obtained in the first test (Mean = 40.800, SD = 4.585) and the retest (Mean = 40.820, SD = 4.443) ($t = -0.127$, $p = 0.900$). Test-retest reliability was evaluated using the Intraclass Correlation Coefficient (ICC), and the ICC value was calculated as 0.984. This calculation was conducted using a two-way mixed effects model, absolute agreement, and single measures approach.

Although the ICC value is high, the 95 % confidence interval was also considered to provide a more reliable interpretation of the results. The lower bound of this interval was found to be 0.972, which supports the conclusion that the measurement tool is highly consistent and reliable over time. These findings indicate that the K-TUT scale yields stable results in repeated administrations and can be confidently used over time to measure individuals' knowledge levels.

The findings in Table 4 show the differentiation of CSCT scores according to demographic characteristics. Although no significant difference was observed between the age groups, the scores of the 41–50 age group were found to be higher than those of the other groups ($p = 0.059$). There was no statistically significant difference in scores in terms of gender, marital status, education level, occupational status, and duration of chronic kidney failure ($p > 0.05$). However, in the evaluation based on donor type, the scores of those who had received transplants from cadaveric donors were found to be significantly lower compared to

Table 1
Distribution of patients according to descriptive characteristics.

Groups	Frequency (n)	Percentage (%)
Age (Meant=44.630±13.835; Min=18; Max=76)		
30 and below	45	20.5
31–40	44	20.0
41–50	47	21.4
51–60	54	24.5
61 and above	30	13.6
Gender		
Male	138	62.7
Female	82	37.3
Educational Status		
Primary education	88	40.0
High school	97	44.1
University	35	15.9
Marital Status		
Married	155	70.5
Single	65	29.5
Professional Status		
Unemployed	99	45.0
Employed	121	55.0
Duration of Chronic Kidney Failure		
<1 year	59	26.8
1–5 years	104	47.3
6 years and above	57	25.9
Dialysis Status		
No	22	10.0
Yes	198	90.0
Donor Type		
Cadaveric	15	6.8
Living	205	93.2
Relationship between donor type and recipient		
1st degree relatives	65	31.8
2nd degree relatives	47	22.9
3rd and 4th degree relatives	37	18.0
Donation between spouses	56	27.3

Table 2
Differentiation of scale scores according to 27 % lower and 27 % upper groups.

Groups	Lower 27 % (n = 59)		Upper 27 % (n = 59)		t	sd	p
	Mean	Sd	Mean	Sd			
KTUT Total	34.780	2.364	47.034	2.213	−29.070	116	**0.000**
Independent Groups T-Test							

Table 3
Test-retest.

Measurements	Test		Retest		N	t	p[a]	ICC[b]	p
	Mean	Sd	Mean	Sd					
KTUT Total	40.800	4.585	40.820	4.443	50	−0.127	0.900	0.984	0.000

[a] Dependent Group T-Test.
[b] Intraclass Correlation Coefficient.

Table 4
Differentiation status of CTTC scores according to descriptive characteristics.

Demographic Characteristics	n	KTUT Total
Age		Mean ± SD
30 and below	45	41.244±4.739
31–40	44	40.659±5.048
41–50	47	42.596±4.830
51–60	54	41.185±4.439
61 and above	30	39.233±5.600
F=		2.307
p=		0.059
Gender		Mean ± SD
Male	138	41.268±4.919
Female	82	40.890±4.979
t=		0.548
p=		0.584
Educational Status		Mean ± SD
Primary education	88	41.318±4.827
High school	97	41.454±5.074
University	35	39.743±4.699
F=		1.666
p=		0.191
Marital Status		Mean ± SD
Married	155	41.207±5.041
Single	65	40.939±4.700
t=		0.367
p=		0.714
Professional Status		Mean ± SD
Unemployed	99	40.556±4.937
Employed	121	41.595±4.902
t=		−1.560
p=		0.120
Duration of Chronic Kidney Failure		Mean ± SD
<1 year	59	41.034±3.828
1–5 years	104	40.760±5.331
6 years and above	57	41.895±5.185
F=		0.989
p=		0.374
Dialysis Status		Mean ± SD
No	22	40.409±4.963
Yes	198	41.207±4.936
t=		−0.719
p=		0.473
Donor Type		Mean ± SD
Cadaveric	15	37.733±4.301
Living	205	41.376±4.894
t=		−2.803
p=		**0.006**

F: Anova Test; t: Independent Groups T-Test; PostHoc: Tukey, LSD.

those who had received transplants from living donors ($p = 0.006$). This suggests that the type of donor may affect the CTUT scores.

4. Discussion

End-stage chronic kidney failure is increasing worldwide and in our country. Due to its longer lifespan compared to other treatment methods, kidney transplant is preferred as the most common treatment method.[19] The success of a kidney transplant depends not only on the success of the surgical procedure but also on the patient's education and active participation.[20] In patients who have undergone kidney transplantation, adapting to post-transplant lifestyle changes such as preventing graft rejection, managing chronic diseases, protecting against infections, proper use of immunosuppressive drugs, and adhering to dietary restrictions is of critical importance.[21] Patients need to be well-versed in scientific knowledge after a kidney transplant. Therefore, improving patients' understanding of transplantation is an important factor for the success of transplantation.[22,23] In clinical settings, measurement tools are needed to identify the deficiencies in patient education after such an important transplant. Nevertheless, prior to this study, there was no valid and reliable Turkish scale available to identify patients' knowledge gaps, evaluate educational outcomes, and detect misconceptions. Therefore, the aim of the current study was to translate the K-TUT Scale into Turkish and analyze its adapted validity and reliability.

The translation of the K-TUT scale in terms of linguistic equivalence was carried out by two linguists proficient in both English and Turkish. In line with the positive expert opinions, it was decided that the K-TUT was linguistically compatible. After the K-TUT scale was translated into Turkish, the adapted form was analyzed in terms of content validity. Content validity is applied to evaluate whether the entire scale and each item in the scale measure the intended concept. The number of experts required for content validity should be a minimum of 3 and a maximum of 20.[24] In this study, a scale was sent to eleven experts in the field for content validity. Experts examined the scale to determine whether it was appropriate for Turkish culture. In line with the recommendations of the experts, the Turkish version was deemed appropriate. CVI was used to determine whether the experts agreed. In this study, S-CVI was found to be 0.93. In the Chinese version, the S-CVI was 0.96.[24] In the Korean version, the S-CVI was found to be 0.98.[25] This value showed that there was a consensus among the experts about the items of the K-TUT. The scale was found to be highly effective in terms of content validity.

The reliability of measurements signifies the degree to which a score shows accuracy, consistency, and replicability.[26] Internal consistency is an important criterion for assessing the reliability of a scale and its sub-dimensions. The parameters used to assess internal consistency include the item-total score correlation coefficient, split-half reliability, Kuder-Richardson coefficient, and Cronbach's α value. Among these, Cronbach's α is the most widely used.[27,28] If the Cronbach's alpha coefficient is <0.40, the scale is not reliable, if it is between 0.40 and 0.59, its reliability is low, if it is between 0.60 and 0.79, it is regarded quite reliable, and if it is between 0.80 and 1.00, it is considered very reliable.[27] In the original study of this scale, it was reported that the Cronbach's α values for the total scale ranged between 0.794 and 0.875.[15] In the Chinese version, Cronbach's α value was 0.769.[24] In this study, Cronbach's alpha value for the total scale was 0.789.

Another method evaluated in reliability studies is the test-retest method, which reveals the time consistency of a measurement. When conducting reliability analysis using the test-retest method, the measurement should generally be repeated on a sample of at least 30 people within a 2–4 week interval.[29] The consistency is evaluated by calculating the correlation coefficient between the scores of measurements taken at different times, and this coefficient is expected to be above 0.70.[30] In this study, the test was administered again after 2 weeks to a sample group of 220 people. Test reliability score was found to be 0.984. In the original version of the scale, the test reliability score was 0.937. In the Chinese version, it was 0.902 .[24] The results were similar to the original version and the Chinese version. It was observed that the K-TUT scale showed a high level of consistency over time and could be

considered a reliable measurement tool.

When examining the differentiation of KTUT scores according to demographic characteristics, no significant difference was observed among the age groups in the study, although the scores of the 41–50 age group were found to be higher than those of the other groups ($p = 0.059$). This finding suggests that the life experiences, coping mechanisms, or health perceptions of the 41–50 age group may differ from those of other age groups. Moreover, in the evaluation based on donor type, the scores of those who had received transplants from cadaveric donors were found to be significantly lower compared to those who had received transplants from living donors ($p = 0.006$). While there is no data in the literature to support or disprove this result, the study findings suggest that the donor type may affect KTUT scores. This situation suggests the possibility that the type of donor may play a decisive role in individuals' information-seeking processes and their awareness levels regarding transplantation.

5. Conclusion

As a result of the study, the K-TUT scale has been shown to reliably distinguish knowledge levels and to be an effective measurement tool in the field of kidney transplant. The tool can be effectively used to measure patients' knowledge levels about the kidney transplant process. Validity analyses have shown that the K-TUT accurately measures the targeted concepts, while reliability analyses have revealed that the tool provides consistent results. These results support the usability of the K-TUT in both clinical practices and research. In conclusion, it is thought that using the Turkish version of the K-TUT to evaluate the knowledge levels of kidney transplant recipients will contribute to evaluation of developed programs and the improvement of patients' treatment processes. Future studies are important for evaluating the effects of this tool on different populations and its long-term impacts.

Ethical aspect of the study

Institutional permission was obtained from the private hospital where the study was conducted and ethics committee permission (2024) was obtained from Gelişim University Clinical Research Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki. Written and verbal consent was obtained from the participants that they volunteered for the study.

Availability of data and materials

All data generated or analysed during this study are included in this published article. For other data, these may be requested through the corresponding author.

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CRediT authorship contribution statement

Naile Akıncı: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kadriye Nilay Genç:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Çağla Toprak:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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