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ORIGINAL ARTICLE

Turkish validity and reliability study of the falsified hand sanitizer identification scale

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ABSTRACT

Background: The objective of this study was to assess the validity and reliability of the Falsified Hand Sanitizer Identification Scale in Turkish culture and language, which was developed to help consumers identify safe and effective hand disinfectants.

Methods: Between February and April 2021, this methodological study used an online questionnaire to survey state university staff members. 355 people were reached. The scale's Turkish validity was assessed using language (translation-back translation), construct (confirmatory factor analysis (CFA)), and known group validity. Cronbach's alpha internal consistency coefficient was used to assess reliability, as well as item-total correlation analysis and the test-retest method (Spearman correlation analysis).

Results: The majority of the participants (62.18%, n = 217) were male. The mean age of all participants was 41.14 ± 9.80 years. In DFA, $x^2/sd = 3.67$, with CFI = 0.98, GFI = 0.92, NFI = 0.97, and RMSEA = 0.08. As the frequency of daily use of sanitizer increased, the score obtained from the scale increased ($p < 0.001$). When all of the items were removed from the scale, its Cronbach's alpha coefficient decreased. The Cronbach's alpha coefficient for the scale was 0.934, with 0.892 for factor 1, 0.891 for factor 2, and 0.818 for factor 3. The corrected item-total correlation coefficients for all items ranged between 0.584 and 0.758. The test-retest correlation coefficient was 0.859 ($p < 0.001$).

Conclusion: The Turkish Falsified Hand Sanitizer Identification Scale is a valid and reliable 5-point Likert scale consisting of 12 items and three sub-dimensions.

Keywords: Disinfectant, COVID-19, Validity, Reliability.

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INTRODUCTION

Hand hygiene is one of the most effective measures that can be taken to reduce the spread of pathogens and prevent infections, including the COVID-19 virus (1). In cases where hand washing is not possible, it is recommended to use alcohol-based hand sanitizer if the hands are not visibly dirty (2). A meta-analysis of 18 randomized controlled studies indicated that alcohol-based hand sanitizers were more effective in reducing the incidence of acute respiratory infections than soap and water (3). The reason for this is that alcohol-based hand sanitizers are easier to use, take less time, and produce less irritation to the skin (4).

Global hand sanitizer sales have risen dramatically in response to COVID-19 prevention (5). Because of the huge demand for alcohol-based hand sanitizers, many manufacturers from various sectors have started to produce hand sanitizers. However, many may not have adequate facilities or a quality management system to ensure that the raw materials used are up to the required standards to manufacture alcohol-based hand sanitizers (6). In this process, an increase was observed in methanol-containing hand sanitizers, although the label listed ethanol as an active ingredient (7). As a result, the number of people suffering from methanol poisoning has increased (8).

There are two basic types of falsified hand sanitizers: sanitizers containing methanol, not typically listed as an ingredient, and sanitizers with an alcohol percentage less than sufficient (9). Methanol has toxic effects when inhaled, swallowed, or absorbed via the skin. Methanol poisoning is characterized by metabolic acidosis, ocular toxicity, and nervous system toxicity, and in severe cases, it can result in blindness and death (10). Given the widespread popularity of hand sanitizers and their importance in preventing the spread of COVID-19, falsified hand sanitizers pose an important public health problem (9).

Hand sanitizer labels must include the product's commercial name, any descriptive descriptions, the name of the active substance, the purpose of use, the instructions for use, the possible side effects, the first aid instructions, the batch number, and the expiration date (11).

The Falsified Hand Sanitizer Identification Scale (12) was developed by Jairoun et al. to help consumers identify safe and effective hand sanitizers. There is no similar scale developed in the Turkish language. As a result, our study aimed to evaluate the validity and reliability of this scale in Turkish culture and language.

MATERIALS AND METHODS

Study design, Setting, and Participants

This research is methodological type. The research was carried out between February and April 2021 by applying a 2-stage online survey to the staff of Fırat University (academic, administrative, contracted personnel, and permanent workers). Inclusion criteria for the study: Being a staff member of Fırat University and consenting to participate in the study. Exclusion criteria: Never used or purchased a hand sanitizer in their life. In the first stage, an official letter containing the necessary explanations, the permission of the ethics committee, and the questionnaire link was sent to all personnel via the Electronic Information System at Fırat University. Individuals who consented to participate in the study filled out an online questionnaire. The second-stage questionnaire was sent to the people who filled out the questionnaire in the first phase for a test-retest two weeks after they filled out the questionnaire. The first stage reached 355 people, while the second stage reached 66 people. A sample size of 300 people, or ten times the number of items, is considered sufficient for the validity and reliability analysis to develop and/or adapt the measurement tool (13). Therefore, the present study provided an adequate sample size (355 people).

Data Collection Tools

In the first stage of the research, the questionnaire consisted of two parts. The sociodemographic information form was used in the first part, and the Falsified Hand Sanitizer Identification Scale was used in the second part. In the second stage, the questionnaire consisted of a single part and included only scale questions. Additionally, the first and second-stage questionnaires also included a question asking for people's e-mail addresses. Participants in the first and second stages of the questionnaire were matched based on their e-mail addresses.

Falsified Hand Sanitizer Identification Scale: It is an English-language self-rating scale created by Jairoun (2020) et al. (12). The 12-item scale is of the 5-point Likert type (never, rarely, sometimes, often, always). The lowest score that can be obtained from the scale is 12, and the highest score is 60. The scale consists of three sub-dimensions: Safety Measures (5 questions), Identity Measures (4 questions), and Efficacy Measures (3 questions).

Evaluation of Data

Translation

The scale was translated from English to Turkish by two unrelated language translators who know both cultures and languages. The Turkish scale questions were compared by the responsible researcher and a third-language translator and turned into a single form. The expressions were then checked for compliance with Turkish by two Turkish language experts. Corrections were made based on their suggestions. The scale, which was translated from English to Turkish, was translated back from Turkish to English by separate fourth- and fifth-language translators. The researchers compared the original and translated English scales, evaluated the contradictory points, and completed the translation. Because hand sanitizers in Turkey contain 70% alcohol, the alcohol percentage of at least 60% specified in item 11 on the original scale has been revised to 70%.

Validity

Construct validity

Confirmatory Factor Analysis (CFA) was used to determine construct validity. The CFA examined the x^2/sd (standard deviation) coefficient, the Comparative Fit Index (CFI), the Goodness of Fit Index (GFI), the Normed Fit Index (NFI), and the Root Mean Square Error of Approximation (RMSEA). "Acceptable fit" criteria included $x^2/sd < 5$, CFI ≥ 0.95, GFI ≥ 0.85, NFI ≥ 0.90, and RMSEA ≤ 0.08. "Good fit" was defined as having $x^2/sd < 3$, CFI ≥ 0.97, GFI ≥ 0.90, NFI ≥ 0.95, and RMSEA ≤ 0.05 (14).

Known group validity

The hypothesis that those who use hand sanitizer more frequently daily would score higher on the scale for identifying falsified hand sanitizer was tested.

Reliability

Reliability was evaluated with Cronbach's alpha internal consistency coefficient, item analysis based on item-total correlation, and the test-retest method. The Cronbach's alpha internal consistency coefficient indicated "sufficient" between 0.60-0.70, "high" between 0.70-0.90, and a "very high" reliability level above 0.90 (15). A corrected item-total correlation coefficient below 0.20 indicated that the relevant item should be removed from the scale (14). As a result of the Pearson correlation analysis applied for the test-retest analysis, it was expected to be $0.80 \leq r \leq 0.90$ (15).

Statistical Analysis

SPSS 21.0 (IBM Corp., Armonk, NY, USA) and LISREL (SSI Inc., Michigan, USA) programs were used for statistical analysis. Descriptive statistics were frequency (n) and percentage (%) for categorical variables and mean ± standard deviation (mean ± sd) and/or median (1st quarter–3rd quarter) for continuous variables. The Shapiro-Wilk test was used to test compliance with the normal distribution. Since the data did not comply with a normal distribution, the Kruskal-Wallis H test was used to test known group validity, and Spearman correlation analysis was used for test-retest analysis. Statistical significance was evaluated at the $p < 0.05$ level.

Permissions

Ammar Abdulrahman Jairoun, the responsible author of the scale's article, was contacted via email, and permission to adapt the scale to Turkish was granted on November 27, 2020. The Fırat University Non-Interventional Research Ethics Committee approved the research (letter dated January 7, 2021, numbered 1899). The institutional approval was granted by the Rectorate of Fırat University via a letter numbered 8160 dated January 26, 2021.

RESULTS

Characteristics of study participants

The majority of the participants (62.18%, n = 217) were male, and the mean age of all participants was 41.14 ± 9.80 years. The characteristics of the study participants are presented in Table 1. 72.60% (n = 257) stated their socioeconomic level as middle, and 65.35% (n = 232) stated their education level as university. 47.61% (n = 169) of the participants are healthcare workers. The most common answer to the question questioning the frequency of daily use of hand sanitizer was "often" (40.56%, n = 144).

Table 1. Characteristics of participants

	First stage, n (%)	Second stage, n (%)
Gender (n = 349)*		
Male	217 (62.18)	32 (48.5)
Female	132 (37.82)	34 (51.5)
Socioeconomic level (n = 354)*		
Low	42 (11.86)	2 (3.0)
Middle	257 (72.60)	46 (69.7)
High	55 (15.54)	18 (27.3)
Education (n = 355)		
Elementary school, middle school, and high school	80 (22.54)	1 (1.5)
University	232 (65.35)	52 (78.8)
Postgraduate	43 (12.11)	13 (19.7)
Health employees (n = 355)		
Yes	169 (47.61)	38 (57.6)
No	186 (52.39)	28 (42.4)
Frequency of daily use of hand sanitizer (n = 355)		
Never	4 (1.13)	1 (1.5)
Rarely	78 (21.97)	16 (24.2)
Sometimes	97 (27.32)	25 (37.9)
Often	144 (40.56)	19 (28.8)
Always	32 (9.02)	5 (7.6)

** There was missing data.*

Validity

Construct validity

The CFA results were as follows: $x^2/sd = 3.67$ ($p < 0.001$), CFI = 0.98, GFI = 0.92, NFI = 0.97, and RMSEA = 0.08 (Table 2).

Table 2. Confirmatory factor analysis

	Turkish Falsified Hand Sanitizer Identification Scale	Acceptable fit	Good fit
x^2/sd	3.67 ($p < 0.001$)	≤ 5	≤ 3
CFI	0.98	≥ 0.95	≥ 0.97
GFI	0.92	≥ 0.85	≥ 0.90
NFI	0.97	≥ 0.90	≥ 0.95
RMSEA	0.08	≤ 0.08	≤ 0.05

CFI: Comparative Fit Index; GFI: Goodness of Fit Index; NFI: Normed Fit Index; RMSEA: Root Mean Square Error of Approximation

Known group validity

The results of the analysis performed to test the known group validity are given in Table 3. Those who "always" or "frequently" use hand sanitizer daily scored significantly higher on the scale than those who "sometimes" use it ($p < 0.001$).

Table 3. Known group validity analysis

	Turkish Falsified Hand Sanitizer Identification Scale Median (1st Quarter–3rd Quarter)	p
Frequency of daily use of hand sanitizer		< 0.001*
Never	26.50 (22.50–31.00)	
Rarely	30.50 (24.00–41.00)	
Sometimes	38.00 (26.00–46.00) [a, b]	
Often	39.50 (33.00–48.00) [b]	
Always	41.00 (34.00–54.00) [a]	

Note: a, b A statistically significant difference was found between the values with the same letters. * Kruskal-Wallis H test

Reliability

Reliability analysis results are shown in Table 4. When each item was removed from the scale, the Cronbach's alpha coefficient of the scale decreased. The Cronbach's alpha coefficient of the full scale was found to be 0.934; the Cronbach's alpha coefficient of factor 1 was 0.892; factor

2 was 0.891; and factor 3 was 0.818. The corrected item-total correlation coefficients of all items ranged between 0.584 and 0.758. The test-retest correlation coefficient was 0.853 ($p < 0.001$).

Table 4. Reliability analysis

	Cronbach's alpha if the item deleted	Corrected item-total correlation	Cronbach's alfa
Factor 1			0.892
Item 1	0.929	0.685	
Item 2	0.927	0.739	
Item 3	0.928	0.705	
Item 4	0.926	0.758	
Item 5	0.930	0.653	
Factor 2			0.891
Item 6	0.926	0.752	
Item 7	0.927	0.727	
Item 8	0.927	0.750	
Item 9	0.927	0.737	
Factor 3			0.818
Item 10	0.928	0.710	
Item 11	0.933	0.584	
Item 12	0.929	0.695	
Scale			0.934

The final version of the Turkish Falsified Hand Sanitizer Identification Scale is presented in Table 5.

Table 5. Turkish Falsified Hand Sanitizer Identification Scale

El dezenfektanın etiketinde bulunan aşağıdaki bilgileri ne sıklıkla kontrol edersiniz?	Hiç	Nadiren	Bazen	Sıklıkla	Her zaman
Faktör 1: Güvenlik Önlemleri					
Madde 1: Kullanım talimatının etikette açıkça belirtilmiş olduğunu kontrol ederim. Örnek: Avucunuzun içine gerekli miktarda el dezenfektanı dağıtın ve kuruyana kadar ellerinizi hızlıca ovalayın.					
Madde 2: Uyarı/ikazların ürün etiketinde açıkça belirtilmiş olduğunu kontrol ederim. Örnek: Yalnızca harici kullanım içindir. Çocukların erişemeyeceği yerlerde saklayın; gözlerle ve mukoz membranlarla doğrudan temastan kaçının, yanıcıdır.					
Madde 3: İlk yardım önleminin etikette açıkça belirtilmiş olduğunu kontrol ederim. Örnek: Göz teması veya cilt tahrişi durumunda lütfen bir doktora danışın. Yutulursa Zehir Danışma Merkeziyle iletişime geçin.					
Madde 4: Saklama koşullarının etiket üzerinde açıkça belirtilmiş olduğunu kontrol ederim. Örnek: Oda sıcaklığında saklayın, ateş veya alevden uzak tutun.					
Madde 5: Son kullanma tarihi/üretim tarihinin etiket üzerinde açıkça belirtilmiş olduğunu kontrol ederim.					
Faktör 2: Kimlik Ölçütleri					
Madde 6: Barkodun silinmez bir şekilde ürün etiketine basılmış veya yazdırılmış olduğunu kontrol ederim.					
Madde 7: Parti numarasının silinmez bir şekilde ürün etiketi üzerine basılmış veya yazdırılmış olduğunu kontrol ederim.					
Madde 8: Üreticinin adı ve logosunun okunaklı ve doğru olduğunu kontrol ederim.					
Madde 9: Menşei ülkenin, ürün etiketinde açıkça belirtilmiş olduğunu kontrol ederim.					
Faktör 3: Etkililik Ölçütleri					
Madde 10: Biyosidal etki (zararlı organizma üzerinde kontrol edici etki) ile etiketlenmiş olduğunu kontrol ederim. Örnek: Antiseptik/dezenfektan					
Madde 11: En az %70 alkol içeriği ile etiketlenmiş ürün olduğunu kontrol ederim.					
Madde 12: Aktif madde adının (bilimsel ad) doğru yazılmış olduğunu kontrol ederim.					

DISCUSSION

This study assessed the validity and reliability of Jairoun et al.'s (12) Falsified Hand Sanitizer Identification Scale in Turkish culture and language. The current study concluded that the Turkish Falsified Hand Sanitizer Identification Scale is a valid and reliable measurement tool.

According to a study, it was found that the frequency of hand sanitizer use in adults increased during the pandemic compared to before the pandemic. Additionally, adults participating in this study stated that their frequency of hand sanitizer use would remain the same after the pandemic as during the pandemic period. Therefore, it is important to research the use of hand sanitizer in the post-pandemic period (16).

A CFA is used to validate a predetermined model or structure. The researcher, who makes the adaptation study of a measurement tool developed in a different language, should evaluate the adaptation of this structure to her or his own culture and language instead of re-determining the structure of the scale. Therefore, instead of doing exploratory factor analysis (EFA) during the measurement tool adaptation process, the model fit should be examined by performing CFA after language validity (13). In the current study, 12 items and three sub-dimensions were examined with CFA. In the model of the current study, $x^2/sd \leq 5$ and RMSEA ≤ 0.08 indicated acceptable fit, while CFI ≥ 0.95, GFI ≥ 0.85, and NFI ≥ 0.90 indicated good fit (Table 2).

For known group validity, it was evaluated whether the scale could distinguish between groups. As the frequency of daily use of hand sanitizer increased, the score obtained from the scale increased (Table 3, $p < 0.001$). The hypothesis of known group validity was provided. The relationship between the level of knowledge about hand hygiene and hand hygiene practices among university students in India was examined, and it was determined that students with good knowledge about hand hygiene washed their hands more frequently (17).

Cronbach's alpha coefficient evaluates the overall reliability of the scale. In addition, it evaluates whether the items on the scale form a whole to question or explain a homogeneous structure (15). Cronbach's alpha coefficient of the full scale, which was found to be 0.934 in the current study, was 0.90 and above, indicating "very high" reliability (Table 4). Cronbach's alpha coefficients of 0.892 for factor 1, 0.891 for factor 2, and 0.818 for factor 3 indicated a "high" level of reliability, as they range from 0.70 to 0.90 (Table 4). In the study of the original scale, Cronbach's alpha coefficient was 0.867 for the full scale, 0.848 for Factor 1, 0.821 for Factor 2, and 0.736 for Factor 3 (12), and it is seen that the original scale also has a high level of reliability.

The relationship between each item and the overall scale is determined using item-total correlation analysis. If these associations are high, the scale is thought to have a high degree of internal consistency (14). The current study has determined that the scale has internal consistency because the corrected item-total correlation coefficient for all items was more than 0.20 (Table 4).

In the test-retest method, the scale is applied to the same group a second time after a certain time, and the correlation coefficient between the results of the two applications is calculated. The high value of this coefficient indicates that the scale's measurement results do not change over time, are stable, and therefore have high reliability (14). In the current study, this coefficient was found to be 0.859, indicating that the scale has high stability and reliability ($p < 0.001$). In the article on the original scale, the test-retest correlation coefficient was stated as 0.770 ($p < 0.01$) (12).

This study has some limitations. First, the results of the study cannot be generalized to the population, as the present study was conducted among staff of a university. Secondly, the results of this study were only compared with the original scale, as the scale did not have a validity and reliability study in different languages. Finally, the limitation of the study is that no comparison was made using another scale with proven validity and reliability in the known group validity analysis.

It has been found that the Turkish Falsified Hand Sanitizer Identification Scale is a valid and reliable measurement tool with a 5-point Likert scale consisting of 12 items and three sub-dimensions. The scale measures consumers' awareness of hand sanitizers. Training can be provided to increase consumers' awareness about hand sanitizers. Thus, the appropriate use of hand sanitizers can be encouraged, and possible dangers can be prevented (18). This finally helps prevent the transmission of pathogenic microorganisms. In future studies, it is recommended to use the Turkish Falsified Hand Sanitizer Identification Scale and to adapt the Falsified Hand Sanitizer Identification Scale to different languages and cultures.

Declarations

The authors received no financial support for the research and/or authorship of this article. There are no conflicts of interest.

This study was approved by The Fırat University Non-Interventional Research Ethics Committee (Date: 07.01.2021, Number: 1899) and Rectorate of Fırat University (Date: 26.01.2021, Number:8160)

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