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Turkish Validity and Reliability of the Novel Validated Short Questionnaire for Assessing Adherence to the Mediterranean Diet and Nutritional Sustainability (MedQ-Sus): A Methodological Study

Akdeniz Diyetine Uyumun ve Beslenme Sürdürülebilirliğinin Değerlendirilmesine Yönelik Yeni Doğrulanmış Kısa Anketin (MedQ-Sus) Türkçe Geçerliliği ve Güvenilirliği: Metodolojik Bir Çalışma

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ABSTRACT

This study aims to validate the "Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire (MedQ-Sus)" and Filling the gap of a valid and reliable, alcohol-free Mediterranean diet adherence tool for the Turkish population, considering the culture of low alcohol consumption. This study, which involved 290 participants aged 18 to 64, was conducted from October 2023-May 2024. Content validity was assessed by an expert panel of 10 dietitian. The Davis method was applied to calculate the Content Validity Index (CVI). With CVI scores ranging from 0.8 to 1.0, none of the scale items were removed. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) served to assess the construct validity of the scale. The data were deemed appropriate for factor analysis, as indicated by the Kaiser-Meyer-Olkin (KMO) value of 0.905 and the Bartlett test results (χ^2 = 2426.436, $p < 0.001$). The single-factor structure of the scale was supported by the EFA results, with item factor loadings between 0.699 and 0.916. The Cronbach's α coefficient for the scale was found to be 0.954 in the internal consistency analyses. Positive item-total correlations were observed, and removing any item did not result in a significant increase in the Cronbach's α coefficient. As a result, it was concluded that the MedQ-Sus scale in its Turkish version is both valid and reliable. In Türkiye, this scale can be utilized to evaluate the adherence of adults to the Mediterranean diet (MD) as well as their perception of nutritional sustainability. This study contributes to establishing the validity and reliability of a tool for measuring adherence to the MD and nutritional adherence to sustainable diet among Turkish-speaking individuals.

Keywords: Mediterranean Diet, Reliability, Validity, Sustainability, Adherence

ÖZ

Bu çalışmanın amacı "Akdeniz Diyetine Uyum ve Beslenmenin Sürdürülebilirliği Anketini (MedQ-Sus) doğrulamak ve düşük alkol tüketimi kültürüne sahip olan Türk toplumu için geçerli ve güvenilir, alkolsüz bir Akdeniz diyetine uyum ölçeği boşluğunu doldurmaktır. Çalışma, Ekim 2023 ile Mayıs 2024 arasında, 18 ile 64 yaşları arasındaki 290 katılımcı üzerinde gerçekleştirilmiştir. İçerik geçerliliği, 10 diyetisyen akademisyenden oluşan bir uzman paneli tarafından değerlendirilmiştir. Ayrıca, Davis yöntemi kullanılarak içerik geçerlilik indeksi (CVI) hesaplanmıştır. Maddelerin CVI puanları 0,8 ile 1,0 arasında değişmiş; bu doğrultuda, ölçekte herhangi bir madde çıkarılmamıştır. Açıklayıcı faktör analizi (AFA) ve doğrulayıcı faktör analizi (DFA) kullanılarak ölçeğin yapı geçerliliği değerlendirilmiştir. Kaiser-Meyer-Olkin (KMO) değeri 0,905 ve Bartlett testi sonuçları (x^2 = 2426,436, $p < 0,001$), verilerin faktör analizi için uygun olduğunu göstermiştir. AFA sonuçları, ölçeğin tek faktörlü yapısını doğrulamış ve Faktör yükleri maddeler için 0,699 ile 0,916 arasında bulunmuştur. İç tutarlılık analizlerinde, ölçeğin Cronbach α katsayısı 0,954 olarak tespit edilmiştir. Madde-toplam korelasyonları pozitif olup, herhangi bir madde çıkarıldığında Cronbach α katsayısında anlamlı bir artış gözlemlenmemiştir. Sonuç olarak, MedQ-Sus ölçeğinin Türkçe versiyonunun hem geçerli hem de güvenilir olduğu belirlenmiştir. Bu ölçek, Türkiye'de yetişkinlerin Akdeniz diyetine uyumunu ve beslenme sürdürülebilirliğine ilişkin algılarını değerlendirmek için kullanılabilir. Bu çalışma, Türkçe konuşan bireyler arasında Akdeniz diyetine uyumu ve sürdürülebilir diyete beslenme açısından uyumu ölçmek için bir aracın geçerliliğini ve güvenilirliğini sağlamaya katkıda bulunmaktadır.

Anahtar Kelimeler: Akdeniz Diyeti, Geçerlilik, Güvenilirlik, Sürdürülebilirlik, Uyum

The Ethics Committee at Erzurum Technical University approved the study protocol (19.10.2023-11-15).

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INTRODUCTION

As stated by the World Health Organization building healthy, resilient food systems that can nourish people while also protecting the planet requires a critical component of nutritional sustainability. Promoting sustainable diets has therefore become a global priority for improving public health worldwide.[1]

One dietary pattern that exemplifies this interdisciplinary "One Health" approach is the traditional Mediterranean diet (MD).[2] Known for its sustainability and health benefits, the MD emphasizes plant-based foods, encourages moderate consumption of dairy and fish, and limited processed foods and red meat intake.[3,4] This eating style supports human health, animal welfare, and environmental well-being.[2]

Numerous health benefits have been associated with following the MD, including reduced risks of type 2 diabetes, gestational diabetes mellitus, obesity, cancer, cardiovascular disease, and psychological disorders. It may also improve aging, fertility, and pregnancy outcomes, increasing the chances of live birth, especially in non-obese women under 35.[5]

The environmental benefits of the MD are rooted in its emphasis on sustainable agroecological practices, such as pasture-based animal husbandry. These practices promote biodiversity, conserve water resources, boost sustainable productivity, and reduce greenhouse gas emissions.[2] Thus, the MD exemplifies the principles of nutritional sustainability by nourishing people while also protecting the planet.[1]

As interest in the MD has grown, there has been an increasing need for valid and reliable tools to assess adherence to this dietary pattern. Several studies have developed questionnaires to evaluate adherence to the MD, all of which consider consumption of alcohol.[15-21] However, considering the well-documented risks and potential harms of alcohol, including its link to various diseases and its classification as a Group 1 carcinogen, it is advisable to avoid alcohol consumption, even in light or moderate amounts.[22]

Most scales measuring compliance with the Mediterranean diet take into account alcohol consumption. Interestingly, a study reported an alcohol consumption rate of only 26.6% in Türkiye, which is quite low compared to other countries.[23] The use of existing scales is limited in expressing compliance with the total score of MD in societies where alcohol consumption is low due to belief. Additionally, the latest MD pyramid has removed a specific amount for alcohol consumption.[24] These factors suggest that a MD adherence tool that does not consider alcohol consumption may be more appropriate for use in the Turkish context.

One such tool is the “A new short questionnaire: Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire (MedQ-Sus)” developed by Ruggeri and colleagues in Italy.[25] This instrument is designed to measure both adherence to the MD and perceptions of the sustainability of this dietary pattern, without including questions about alcoholic beverage consumption. The researchers intentionally designed and implemented the study to include all groups within the adult population, starting with young adults between the ages of 18 and 21, as well as women in the preconception period and pregnant women.[4,25]

Considering the potential weaknesses of existing scales used in Türkiye for assessing compliance with the MD, as well as the need for a valid scale that can be applied to all adult groups, including those who are legally unable to consume alcohol, the evaluation of the MedQ-Sus in a sample of Turkish adults is an important research endeavor.

The aim of this study is to determine the validity and reliability of the Turkish version of the MedQ-Sus scale, which is thought to be more useful for Turkish people with low alcohol consumption.

MATERIALS AND METHODS

This methodological study was conducted between November October 2023 and May 2024. With Ethics Committee approval from Erzurum Technical University (19.10.2023-11-15). A self-administered questionnaire designed with Google Forms was used to collect the data. This questionnaire was sent to the individuals who were selected by snowball sampling via email or WhatsApp. Before data collection began, permission was obtained from the developers to use the questionnaire. The study adhered to the Declaration of Helsinki throughout all stages. After explaining to the participants about the voluntary participation and the use of the data obtained for scientific purposes, informed consent forms were obtained from them.

Participants

The study was completed with 290 participants aged 18-64 years. During data collection, individuals who agreed to participate, who were not diagnosed with psychiatric disease(s), and who used smartphones were included. In studies of validity and reliability, a sample size of 10 times the number of items has been deemed sufficient.[26] However, this study's sample size is 36.25 times the number of items.

Stages of the research

The research was completed with the following stages: (1) Translating the MedQ-Sus into Turkish and re-translating it into English, (2) Evaluating content validity with a panel of experts, and (3) Performing psychometric analysis, including factor analysis, validity coefficient, and item-total correlation.

Translation process

The scale was re-translated to its original language after four academic dietitians independently translated the MedQ-Sus into Turkish. Two independent academicians, working as lecturers in the Department of English Language and Literature, carried out the translation process into the original language. The native language of the translators is Turkish.

Content validity

The scale was presented to a panel of ten academic dietitians after the translation process was completed. Experts, who provided their opinions via email, evaluated the scale items for cultural suitability and comprehensibility. Content validity was assessed using the Davis method, based on expert opinions. The experts evaluated the items of the scale as non-compliant (1), needs to be appropriately revised (2), appropriate but needs slight change (3), and very appropriate (4) according to the Davis method, where quadruple grading was used.[26] The content validity index (CVI) was calculated by dividing the total of the first two ratings by the number of experts after this evaluation. The CVI of the scale was considered sufficient when it was greater than 0.90.

Pilot application

The scale was applied to 36 individuals as pilots, and they were asked to assess the items for clarity, fluency, and other issues that drew their attention at this stage.

Data collection tools

Two forms, the demographic introduction form, and MedQ-Sus, were used in the study. The demographic form includes 5 questions: age, gender, marital

status, educational status, and alcohol consumption.

A new short questionnaire: Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire (MedQ-Sus). The questionnaire developed by Ruggeri et al. consists of two sections and a total of 19 questions. The first part includes questions about sociodemographic characteristics and anthropometric measurements of individuals. The second part contains 8 questions regarding the consumption of eight different food groups: cereals and cereal products (excluding sweets), fresh vegetables, fresh fruits, legumes, fish and fish products, dairy products, meat and meat products, along with olive oil. A score ranging from 0 to 2 is assigned to assess adherence to the MD, based on the number of servings of each food group. The scale score ranges from 0 (no compliance) to 16 (high compliance). In the evaluation of the scale, 0-9 points indicate low compliance, 9.1-11 points indicate moderate compliance and 11.1-16.0 points indicate high compliance. To assess compliance with the sustainable healthy eating model, a score between 0 and 1 is given based on the number of servings of each food group (1 = compliant with the nutritional level; 0 = not compliant with the nutritional level). The range of the total sustainable nutrition score (SUS) spans from 0 points, indicating no compliance, to 8 points, indicating high compliance. In the evaluation of the scale, 0.0 to 3.0 points indicate low compliance, 3.1 to 4.0 points indicate moderate compliance and 4.1 to 8.0 points indicate high compliance.[25]

Statistical Analysis

SPSS-27 for Windows 22 and AMOS 25 software were used to analyze the data. The analysis involved calculating numbers, percentages, means, and standard deviations, and applying the Davis method, sample adequacy, and assessments of the data set's suitability for factor analysis through Kaiser-Meyer-Olkin (KMO) and Bartlett's tests, as previously mentioned in the content validity. Also performed were exploratory factor analysis (EFA), confirmatory factor analysis (CFA), Cronbach's α coefficient, and item-total correlation. A statistically significant result was indicated by a "p" value below 0.05

RESULTS

The study comprised 290 participants, whose ages ranged from 18 to 64 years, with an average age of 25.02 ± 7.81 years. In this research, a majority of 72,4% of the participants were female, 76.8% were single, 75.9% had completed university education and, 75.2% did not use alcohol (Table 1).

Table 1. Descriptive characteristics of the participants (n:290)

Variable		Frequency	Percentage (%)
Gender	Female	210	72,4
	Male	80	27,6
Marital Status	Single	235	81
	Married	55	19
Education Level	Primary school	5	1,7
	High school	14	4,8
	Associate Degree	17	5,9
	Bachelor's Degree	220	75,9
	Post-graduate Degree	34	11,7
Alcohol Consumption	Yes	72	24,8
	No	218	75,2

To determine the validity and reliability of the MedQ-Sus in Turkish, the scale was evaluated for content validity, construct validity, and internal consistency.

Results on Content Validity: Following the completion of the translation process for the MedQ-Sus, which had its validity and reliability assessed, the scale was first reviewed by 10 experts to evaluate content validity, including cultural equivalence. The CVI scores for the MedQ-Sus items, evaluated for content validity using the Davis method, ranged from 0.8-1.0 based on expert opinions. Consequently, all items remained on the scale regarding scope/content validity, and the pilot testing began.

Pilot Application: The scale, piloted on 36 individuals, was evaluated for any difficulties or incomprehensible items. However, there was no need for corrections by the participants or the researchers at that stage.

Construct Validity Results: To establish the construct validity of the MedQ-Sus, EFA and CFA were conducted. This followed the assessment of content validity and the completion of pilot applications to achieve clearer results in the study. Before performing the EFA, KMO and Bartlett's tests were employed to assess the sample adequacy and the data's suitability for factor analysis. A KMO value of 0.905 was calculated, indicating that the data were suitable for component analysis at this stage. The results of Bartlett's test (χ^2 = 2426.436, $p < 0.001$) similarly indicated that the data were sufficiently correlated and suitable for factor analysis (Table 2).

Table 2. MedQ-Sus Explanatory Factor Analysis

Factor	Item	Factor Loading	Explained Variance	Cronbach's α
MedQ-Sus	MedQ-Sus 1	0,867	50,033	0,954
	MedQ-Sus 2	0,869		
	MedQ-Sus 3	0,896		
	MedQ-Sus 4	0,897		
	MedQ-Sus 5	0,902		
	MedQ-Sus 6	0,851		
	MedQ-Sus 7	0,916		
	MedQ-Sus 8	0,699		
KMO=0,905				
Bartlett X^2=2426,436 P<0,001				

MedQ-Sus: Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire

The findings related to CFA of the MedQ-Sus scale are presented in Table 3. To evaluate the validity of the MedQ-Sus scale, CFA was performed with 1 latent and 8 observed variables. The fact that the standard error values found as a result of CFA are greater than 0.45 indicates that statistically significant findings are obtained for the variables within the measurement model. In order to ensure the fit index values within the acceptable range, the necessary alternative modelling was performed, covariances were created between the relevant error terms and the analyses were repeated.

When the fit index measures for the final model were evaluated, the χ2/sd (chi-square/degree of freedom) value of the model was 4.42 (χ2= 66.22 sd=15) and the

p value was 0 (p = 0.000). According to these values, it was determined that the model was within the range of good fit, and the factor structure of the scales used was appropriate.

Table 3. Confirmatory factor analyses of the MedQ-Sus scale

Latent Variable	Observed Variable	Standardised Parameter Value	Standard Deviation Value	t-Value
MedQ-Sus	MedQ-Sus 1	0,55	0,81	16,73
	MedQ-Sus 2	0,56	0,83	17,09
	MedQ-Sus 3	0,59	0,88	18,92
	MedQ-Sus 4	0,60	0,88	19,01
	MedQ-Sus 5	0,60	0,88	19,03
	MedQ-Sus 6	0,59	0,84	17,53
	MedQ-Sus 7	0,60	0,91	20,08
	MedQ-Sus 8	0,51	0,70	13,32

MedQ-Sus: Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire

Table 4 shows the item averages for the MedQ-Sus, along with the item-total correlations and the Cronbach's α coefficients that would result if each item were removed. The Cronbach's α coefficient of the total MedQ-Sus Scale is 0.954. Every item on the scale have positive item-total correlations, and removing any item does not notably improve the Cronbach's α coefficient. Therefore, at this stage, no items were removed from the scale (Table 4).

Table 4. Total item correlations of the MedQ-Sus scale and Cronbach's α coefficients

Items	Mean	SD	Item–total correlation	When the item is deleted Cronbach's α
MedQ-Sus 1	0,90	0,68	0,827	0,948
MedQ-Sus 2	0,81	0,67	0,839	0,947
MedQ-Sus 3	0,94	0,67	0,871	0,945
MedQ-Sus 4	0,92	0,68	0,865	0,945
MedQ-Sus 5	0,87	0,68	0,875	0,945
MedQ-Sus 6	0,74	0,70	0,812	0,949
MedQ-Sus 7	0,92	0,65	0,901	0,943
MedQ-Sus 8	1,21	0,73	0,648	0,960
Cronbach's α				0,954

SD: Standart Deviation, MedQ-Sus: Adherence of Mediterranean Diet and Nutritional Sustainability Questionnaire

Results on Confirmatory Factor Analysis: To assess the fit of the MedQ-Sus model, various indices were used. Of these, the χ^2/SD value was determined to be within the acceptable range of 4.42. Additionally, the fit indices for the MedQ-

Sus were as follows: Goodness of Fit Index (GFI) = 0.95, Adjustment Goodness of Fit Index (AGFI) = 0.87, CFI = 0.99, Root Mean Square Error of Approximation (RMSEA) = 0.10, and Standardized Root Mean Square Residual (SRMR) = 0.023. It was decided that the model as such was acceptable based on the related fit index values. Figure 1 shows the sub-scales for the MedQ-Sus and the factor loads of the items as a path diagram. The model was accepted as it was in its original structure without any modification, as shown in Figure 1.

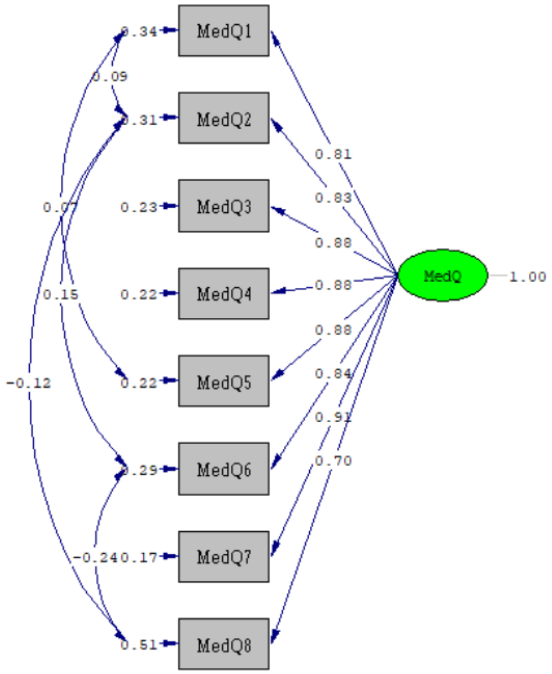

Figure 1. Path diagram of standardized values

DISCUSSION

Evaluating the validity and reliability of the MedQ-Sus was the objective of this study. Translating scales designed for specific target populations into different languages and adapting them to new cultures is a common practice in research. The literature suggests including two or more independent experts fluent in the source language and familiar with the cultural and linguistic nuances of the target language. Following this, an expert with no prior familiarity with the original version of the scale performs the translation. The finalization of the translation is then based on expert opinions and feedback.[26,27] The content validity of the scales, as evaluated by the expert panel, is assessed using the Davis method. The CVI score is derived from the ratings provided by experts using this method. A CVI score above 0.80 is expected in a panel consisting of 10 experts.[26,28] In this study, the MedQ-Sus was sent via email to 10 experts experienced in scale development or adaptation studies within the field of dietetics. It was found that one item scored 0.8, another item scored 0.9, and the remaining 6 items scored a full score of 1.0 in the evaluation. No items were excluded from the scale since all items met the criterion of >0.80 as specified in the literature. Factor analysis is widely utilized as a method to demonstrate construct validity.[28,29] Factor analysis is conducted using two distinct methods: EFA and CFA.[28,30] The greater the variance explained in factor analysis, the more effectively it is considered to measure the relevant behavior or dimension.[31] Factor loads are recommended to be 0.30 and above.[32,33] This study's factor analysis revealed that the scale exhibits a single-factor structure. It was determined that the factor loadings of the items ranged from 0.699 to 0.916, with an explained variance of 50.033 (Table 2). These results were interpreted as the scale showing desirable characteristics in EFA. CFA is another

method used for construct validity, assessing whether the collected data align with the theoretical structure. The fit index results obtained from the analysis indicate the model's alignment with the theory. When examining fit index results, the ratio of the chi-square value to the degrees of freedom is expected to be two or less. GFI, AGFI, and CFI values are between 0 and 1. These index results are considered normal if they have a value above 0.95. AGFI value is interpreted as an acceptable fit between 0.80 and 0.89.[26,34] If RMSEA has a value less than 0.05, it corresponds to normal, and if it has a value less than 0.08, it corresponds to an acceptable fit.[28,34] the χ^2/SD value was determined to be within the acceptable range of 4.42. Additionally, the fit indices for the MedQ-Sus were as follows: GFI = 0.95, AGFI = 0.87, CFI = 0.99, RMSEA = 0.10, and SRMR = 0.023 (Figure 1). The path diagram and associated t-values resulting from the CFA were also analyzed. If the t-values obtained are above 1.96, it is thought to be significant at the 0.05 level.[34] Upon examining the path diagrams and t-values of the scale, it was found that all values were greater than 1.96. This led to the conclusion that the relationship between the items and factors of the MedQ-Sus is statistically significant at the 0.05 level. Upon examination of the analyses, it was concluded that the MedQ-Sus demonstrated sufficient construct validity. Reliability is an essential characteristic for the standardization of measurement tools. A scale is considered useless and its scientific value is low if it does not provide reliability.[28] The reliability of the MedQ-Sus was ensured through an analysis of internal validity. Cronbach's α reliability coefficient is the most frequently used method for evaluating the internal consistency of Likert-type scales. It is used to check the homogeneity of each item and subscale within the scale. Greater consistency among the items of the scale and higher homogeneity in the measured characteristics are indicated by a higher Cronbach's α value. The reliability coefficient is interpreted as follows: between 0 and 0.40 indicates no reliability, between 0.40 and 0.60 indicates low reliability, between 0.60 and 0.80 indicates medium reliability, and between 0.80 and 1.00 indicates high reliability.[26,28,34] The original study of the scale did not examine the Cronbach's α value. However, in the original study, the scale was considered valid based on the ROC curve. A value of 0.954 was obtained in our study, indicating high reliability of the scale (Table 2, 4). Another method for assessing internal consistency is to examine the correlation between each item and the total score. With this method, it is decided whether to make a change when assessing the suitability of each item on the scale. While the original scale did not include an analysis of item-total score correlations, this study found that the item-total score correlation values ranged from 0.648 to 0.901 (Table 4). Since these values exceed the 0.30 threshold specified in the literature, it was decided to retain the items in the scale as they are.[28,34]

The limitation of this study is that it includes only the individuals who participated. However, the results of construct validity and internal validity show that the MedQ-Sus is a valid and applicable scale for the Turkish-speaking population. It is recommended that its internal validity be reanalyzed and its suitability for different samples be evaluated each time the scale is applied.

CONCLUSIONS

As a result of the validity and reliability analyses conducted for the MedQ-Sus questionnaire in this study, it was demonstrated that this scale is a practical tool for assessing adherence to the Mediterranean diet and nutritional sustainability in the Turkish-speaking population. Additionally, it was deemed appropriate for the scale to have a single sub-dimension as in the original scale. It was determined that higher scale scores were associated with greater adherence to the Mediterranean diet.

Conflicts of Interest

The authors declare no conflicts of interest.

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