Reliability and Validity of the 14-item Mediterranean Diet Adherence Screener among the Healthy Iranian Population

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ABSTRACT

Background:
Considering the beneficial effect of the Mediterranean diet on health in different populations, we aimed to validate the Persian version of the Mediterranean Diet Adherence Screener (MEDAS) in the healthy population.

Materials and Methods:
This cross-sectional study was performed on healthy Iranian adult s, in December 2020. The scale was translated into Persian language and then confirmed by back-translation. Data were collected by google forms. To evaluate the content validity, the two concepts of content validity index (CVI) and content validity ratio (CVR) were used according to the evaluation of 18 medical experts. Intra-class correlation coefficients (ICC) and Pearson's r correlation coefficient wwere used to evaluate the internal reliability of the items.

Results:
Three hundred and four healthy volunteers (mean±SD age: 36.43±10.14 years; mean±SD body mass index: 25.65±4.18 kg/m^2) were enrolled in our study. According to medical experts' opinions, CVR was ≥0.714 and CVI was 1. Also, a significant correlation was seen regarding Pearson coefficient for test-retest reliability (r=0.74 , $p < 0.001$).

Conclusion:
The cultural modified persian version of MEDAS had an acceptable validity and reliablity for rapid assessment of adherence to the Mediterranean healthy diet and it can be useful in research and clinical practice.

Keyworlds: Mediterranean Diet; Mediterranean Diet Adherence Screener; Reliability; Validity; Healthy adult

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INTRODUCTION

The Mediterranean diet (MD) is known as a beneficial healthy diet in different populations worldwide, especially in Mediterranean countries (1). It is one of the three healthy diets recommended in the US Dietary Guidelines 2015-2020 (2). The diet incorporates adequate amout of fruits and vegetables, legumes, whole grains, nuts, fish, vegetable protein and vegetable fat from olive oil and little amounts of fast food, sweetened beverages, refined grain products, and hydrogenated or trans-fats (3).

Most studies have used the complete 136-item food frequency questionnaires (FFQ) to evaluate the adherence of dietary patterns. However, a brief tool assessing healthy dietary patterns such as the MD facilitates immediate feedback to participants, and quickly evaluates their dietary quality for nutritional advice (4). The 14-item Mediterranean diet adherence screener (MEDAS) was established in the Prevención con Dieta Mediterránea (PREDIMED) study on 7146 participants. It was validated in comparison with the established FFQ (the average MEDAS score estimate was 105% of the 136-item FFQ score) (5,6). Several studies have compared MEDAS with FFQ or food records to show that this questionnaire is a reliable screener for rapid assessment of a healthy diet (6-8). Recently, a study assessed the reliability and validity of MEDAS among the Iranian high risk population (9).

Non-communicable diseases are growing all around the world, including Iran, and it seems that the dietary patterns are one the most modifieable environmental factor in this regard. MEDAS has been evaluated in diferent populations and known as a modest and reasonable dietary questionnaire. We aimed to weigh the reliability and validity of the modified 14-item MEDAS in the healthy Iranian population.

MATERIALS AND METHODS:

Study design and population:

This cross-sectional study was performed on healthy adult people in Iran. Data were collected by the modified online persian version of MEDAS as a convenience sampling method in December 2020. Also, demographic characteristics (sex, anthropometric indexes, marriage status, level of education, employment status, smoking, and alcohol use) were recorded. The inclusion criteria were as follows: i) being an adult (age more than18 years), ii) being healthy without any type of medical disease, iii) willingness to participate in the study, iv) being able to read and write in Persian. Non-cooperative participants and incomplete forms were excluded.

The protocol of the study was approved by the Ethics Committee of Iran Univesity of Medical Sciences (IR. IUMS.FMD.REC.1399.586). All volunteers were fully informed about the aim of the study and online informed consent forms were obtained form all participants.

MEDAS:

MEDAS is a 14-item dietary questionnaire including 12 questions about the habitual frequency of food consumption and two questions on food intake habits (10,11). Each question is scored zero or 1. If the condition of each item was not met, a score of zero is assigned. The total score of MEDAS ranges from zero to 14. The Iranian portion and serving sizes were used, as appropriate, to facilitate completion of the MEDAS. Based on the religious belief in Iran, item 8 (*"How much wine do you drink per week?" and ham, shellfish, and pork in meat question in the question 5, 10, and 13 (???)*) were deleted in the final Persian version. However, alcohol consumption was recorded in this study. Finally, a few Iranian flavour modifications were made in food species such as custard for better understanding .

Translation:

The scale was translated into Persian by two translators (one nutritionist and a professional translator), whom were fluent in oral and written English. Then, a group of seven experts in the field of clinical nutrition, gastroenterology and epidemiology contributed their ideas to improve the clarity of the items in the Persian translated version for the general population. The questionnaire was filled by 10 people as a pilot study to check the understandability and redundancy of each item. A back-translation was done by a blind experienced English translator. Finally, the translated version was compared to the original English version.

Content validity:

To determine the content validity, first, the initial

questionnaire was given to 7 nutritionist, 8 gastroenterologist and 3 epidemiologist for checking logical (this is a presentation for face validity or logical validity) and content validity. Then, we asked them to evaluate the questionnaire in terms of necessity (0-2 points), relevance or specificity (1-4 points), simplicity, and fluency (1-4 point), as well as clarity (1-4 points), and score each question separately. The total score for each question ranged from 3 to 14. Then, the content validity index (CVI) and the content validity ratio (CVR) was calculated. The numerical average of all judgments (impact factor) included the number of expert opinions that agreed on the necessity of a question (12). Each question was approved or rejected in the following cases:

- If the CVR of the question was ≥0.56, the question would be accepted.
- If the CVR of the question was zero to 0.56 and its impact factor was more than 1.5, the question would be accepted.
- If the CVR of the question was less than zero and its impact factor is less than 1.5, the question will be rejected.

Test-Retest Reliability:

Reliability was evaluated by two methods: internal consistency and reliability. Internal consistency examines the complementary nature of items by searching for contradictions and measurement errors. Test-retest data were obtained from 25 participants with 14 days interval. Intra-class correlation coefficients (ICC) and Pearson's r correlation coefficient method were used to evaluate the internal stability of the questionnaire items.

Sample Size and Statistical Analyses:

The sample size for the validation of the questionnaire was calculated to be at least 15 participants for each question. The data were analysed using SPSS software, version 25. Descriptive statistics were reported for qualitative variables using frequencies and percentages and for quantitative variables using mean and standard deviation (SD). Pearson correlation coefficients (r) was calculated for the test-retest reliability.

CVR was obtained through the following formula. In this formula, N represents the total number of participating

experts and Ne represents the number of people who thought the question was necessary.

$$CVR = (Ne- N/2)/(N/2)$$

CVI was obtained from the following equation. In this formula, N represents the total number of professionals participating in the study, and $n3$ and $n4$ are the number of those who gave a score of 3 and 4 to the ite, of relevance, clarity, and simplicity. A value of more than 0.79 was acceptable.

$$CVI=(n3+n4)/(N)$$

RESULTS:

Participant Characteristics

Three hundred and four healthy volunteers (50% women; mean±Sd age: 36.43±10.14 years; mean±SD body mass index [BMI]: 25.65 ± 4.18 kg/m²) were enrolled in our study. Table 1 shows the demographic characteristics of the participants.

Table 1: Demographic characteristics of the participants (n=304)

Age (year)*	36.43	±10.14
Sex**		
Male	152	50%
Female	152	50%
Height* (Cm)	169	±10
Weight* (Kg)	74.06	±15.35
Body mass index* (Kg/cm²)	25.65	±4.18
Marital status**		
Single	115	37.8%
Married	189	62.2%
Education**		
Middle school degree	18	5.9%
School graduate	55	18.1%
Bachelor degree	107	35.2%
Master and higher degree	124	40.8%
Occupation**		
Employed	204	67.1%
Unemployed	45	14.8%
Housewife	55	18.1%
Smoking**		
Smoker	32	10.5%
Non-smoker	272	89.5%
Alcohol using**		
Alcohol user	13	4.3%
No alcohol user	291	95.7%

*data were reported as Mean±SD
**data were reported as number and percentage

Content Validity:

In terms of necessity, relevance, fluency, and clarity, each item of the questionnaire received aa high score from experts (12.58±1.51). CVI, CVR, and numerical average of all judgments and finally acceptance or rejection of the question were determined separately for each question. All questions were accepted with a CVR score higher than 0.714 and a CVI equal to 1 in terms of validity (Table 2).

Test-Retest Reliability:

Among the 304 individuals, 50 were randomly selected and completed the questionnaire twice for reliability testing. The two administrations of the MEDAS produced a similar mean total score (6.48±1.36 vs 6.28±1.46; $P = 0.327$). Test-retest reliability coefficient was calculate using Pearson correlation coefficient (r=0.74, $p < 0.001$, Figure 1). Intraclass correlation coefficient is shown in Table 3.

Table 2: Content validity index (CVI) and content validity ratio (CVR) and acceptance or rejection of each question

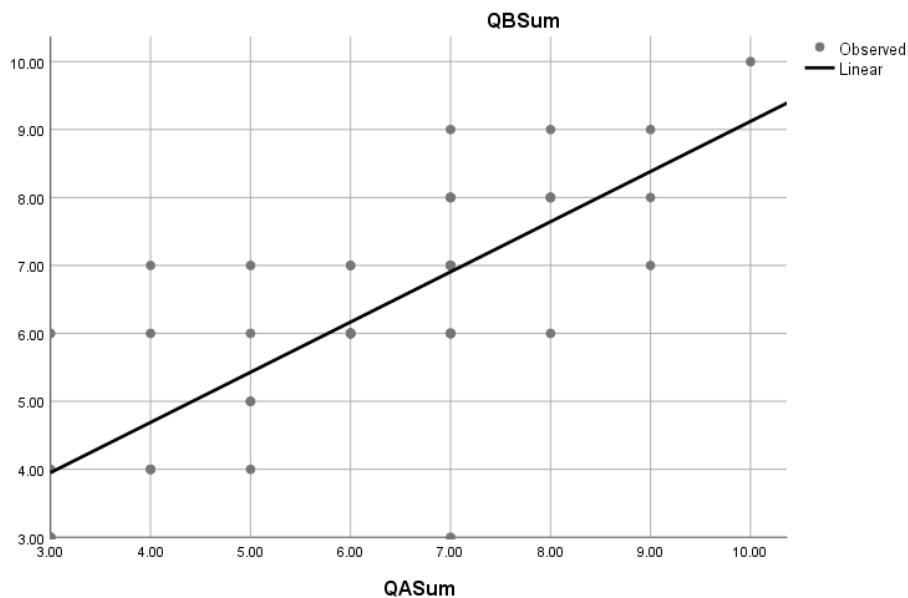| Item	CVR	Average of numerical judgments	CVI	Acceptance or rejection
Q1	0.714	1.8	1	acceptance
Q2	1	2	1	acceptance
Q3	1	2	1	acceptance
Q4	0.714	1.8	1	acceptance
Q5	1	2	1	acceptance
Q6	1	2	1	acceptance
Q7	1	2	1	acceptance
Q8	0.714	1.8	1	acceptance
Q9	1	2	1	acceptance
Q10	1	2	1	acceptance
Q11	1	2	1	acceptance
Q12	0.714	1.8	1	acceptance
Q13	1	2	1	acceptance

Fig. 1: The correlation between the first and second responses

Table 3: Intra-class correlation coefficient

	Intra-class Correlation [b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	**Upper Bound**	**Value**	**df1**	**df2**	**Sig**
Single Measures	.020[a]	-.011	.070	1.261	49	588	.116
Average Measures	.207[c]	-.159	.496	1.261	49	588	.116

Two-way mixed effects model where people effects are random and measures effects are fixed.
a. The estimator is the same, whether the interaction effect is present or not.
b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.
c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

DISSCUSION:

We aimed to examine the validity and reliability of the Persian version of the MEDAS in the Iranian healthy population. Validity and reliability tests showed that the Persian version of the MEDAS questionnaire is a reliable instrument with a good stability to assess a healthy diet in the adult population.

A 14-item Mediterranean Diet Assessment Tool (11) was developed to find a rapid way for assessing the adherence rate with the dietary preventive intervention of the PREDIMED study on cardiovascular disease (4,6,10). Trained dietitians used the validated FFQ and the MEDAS to assess dietary habits of 7146 participants (55–80 years, 57% women) free of cardiovascular disease. The results showed that the total score derived from MEDAS correlated significantly with the corresponding FFQ PREDIMED score (r=0.52; ICC=0.51). Also, the average score of MEDAS was equal to 105% of the average score of FFQ PREDIMED. They recommended that MEDAS is a rapid valid instrument to estimate the MD adherence and may be suitable in clinical practice.

In this regard, Mahdavi and colleagues (9) assessed the reliability and validity of MEDAS among 100 high-risk Iranians. They calculated coefficients of Kuder-Richardson-20 equal 0.559 and finally conculed that MEDAS could be a useful tool for dieticians to understand how the high-risk Iranian population adhere to the MD quantitatively and qualitatively. Our analysis showed a high Pearson correlation (r = 0.74) between the responses derived from test and retest of each item in the 14-day interval. We showed that MEDAS was a resonable, valid, and reliable tool for measuring a healthy diet in the Iranian healthy population.

Validation of the English version of MEDAS was done by Papadaki and colleagues (7) in 96 high-risk adults for cardiovascular diseases in the UK. They concluded that the English version of the MEDAS was an accurate and reliable tool for determining MD adherence amongst high-risk people in the UK, and can be used in clinical trials and practice.

Another study was doneto assess the validation of the German version of the MEDAS on 66 participants who were given a the and MEDAS at baseline and after 3 months. They showed that the MEDAS could be a suitable tool in clinical studies and in practice to assess compliance to the MD (8).

The strengths of the study were the assessment of MD adherence in the healthy population and our large sample size. The limitations of our study were the self reporting questionnaire which can cause bias in the work, the omition of the question about wine and pork in meat component, no comparison between MEDAS and a standard dietary questionnaire such as FFQ.

CONCLUSIONS:

The cultural and relegious-adapted Persian version of MEDAS as a short screener tool had an acceptable validity and reliablity for rapid assessment of adherence of healthy general Iranian population to the MD. It could be considered in research and clinical practice. Future studies are recommended to compare the MEDAS in the healthy population and individuals with chronic non-communicable diseases.

REFERENCES:
1. Dinu M, Pagliai G, Casini A, Sofi F. Mediterranean diet and multiple health outcomes: an umbrella review of meta-analyses of observational studies and randomised trials. Eur J Clin Nutr. 2018;72(1):30–43.
2. Barbara M, Alice H. L, Steven A,et al. Dietary Guidelines for Americans online Book, 8 th Edition. Available from: https://www.dietaryguidelines.gov/current. 2015-2020.
3. Willett WC, Sacks F, Trichopoulou A, Drescher G, Ferro-Luzzi A, Helsing E, et al. Mediterranean diet pyramid: a cultural model for healthy eating. Am J Clin Nutr. 1995;61(6 Suppl):1402S-1406S.
4. Zazpe I, Sanchez-Tainta A, Estruch R, Lamuela-Raventos RM, Schröder H, Salas-Salvado J, et al. A large randomized individual and group intervention conducted by registered dietitians increased adherence to Mediterranean-type diets: the PREDIMED study. J Am Diet Assoc. 2008;108(7):1134-44; discussion 1145.
5. Fernández-Ballart JD, Piñol JL, Zazpe I, Corella D, Carrasco P, Toledo E, et al. Relative validity of a semi-quantitative food-frequency questionnaire in an elderly Mediterranean population of Spain. Br J Nutr. 2010;103(12):1808–16.
6. Martínez-González MA, García-Arellano A, Toledo E, Salas-Salvadó J, Buil-Cosiales P, Corella D, et al. A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. PloS One. 2012;7(8):e43134.
7. Papadaki A, Johnson L, Toumpakari Z, England C, Rai M, Toms S, et al. Validation of the English Version of the 14-Item Mediterranean Diet Adherence Screener of the PREDIMED Study, in People at High Cardiovascular Risk in the UK. Nutrients [Internet]. 2018 Jan 28 [cited 2020 Aug 11];10(2). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5852714/
8. Hebestreit K, Yahiaoui-Doktor M, Engel C, Vetter W, Siniatchkin M, Erickson N, et al. Validation of the German version of the Mediterranean Diet Adherence Screener (MEDAS) questionnaire. BMC Cancer. 2017 18;17(1):341.
9. Mahdavi-Roshan M, Salari A, Soltanipour S. Reliability and Validity of the 14-point mediterranean diet adherence screener among the Iranian high risk population. Mediterr J Nutr Metab. 2018;11(3):323–9.
10. Martínez-González MÁ, Corella D, Salas-Salvadó J, Ros E, Covas MI, Fiol M, et al. Cohort profile: design and methods of the PREDIMED study. Int J Epidemiol. 2012;41(2):377-85.
11. Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas-Salvadó J, et al. A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. J Nutr. 2011;141(6):1140-5.
12. Zamanzadeh V, Ghahramanian A, Rassouli M, Abbaszadeh A, Alavi-Majd H, Nikanfar A-R. Design and Implementation Content Validity Study: Development of an instrument for measuring Patient-Centered Communication. J Caring Sci. 2015;4(2):165-78.