J Nutr Health Aging. 2019;23(9):837-842

THE CHARACTERISTICS, RELIABILITY AND VALIDITY OF THE PERSIAN VERSION OF SIMPLIFIED NUTRITIONAL APPETITE QUESTIONNAIRE (SNAQ)

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Abstract: *Background/Aims:* Using a reliable and valid instrument to measure appetite is highly important in clinical practice and research. We aimed to evaluate characteristics, reliability and validity of the Persian version of simplified nutritional appetite questionnaire (SNAQ). *Material and methods:* After face and content validation of the SNAQ by a panel of experts, the reliability and validity of the Persian form of this questionnaire were assessed among 213 weight-reduction seeking women referring to a nutrition clinic. Furthermore, the factor analysis was performed by varimax rotation method. *Results:* Confirmatory factor analysis shows that all items of the questionnaire are unified and loaded on one factor of "appetite". Internal consistency of the test was approved by Cronbach's alpha coefficient of 0.7. The test–retest reliability of the questionnaire was performed within a two weeks interval. The Pearson correlation showed a consistency of 0.85 between the two administrations ($p<0.0001$). Concurrent Validity of SNAQ with other eating questionnaires and visual analogue rating scale for appetite ($r=0.7$, $p<0.001$)) shows strong correlation. The SNAQ was positively correlated with total dietary calorie intake ($r=0.23$, $p=0.018$) Also convergent validity with body composition measurements shows positive weak correlation with body weight, waist circumference, and total body fat percentage, and negative correlation with muscle mass (divergent validity). *Conclusion:* The current study provides sufficient supports in favor of the reliability and validity of the Persian version of the SNAQ. This questionnaire is a simple and valid instrument to assess the patient's increased appetite in practice and research.

Key words: Appetite, appetite rating scale, simplified nutritional appetite questionnaire (SNAQ).

Introduction

The global epidemic of obesity, especially in the developing countries, has led to extensive research on weight control and appetite regulation (1). Pathologic appetite to food as one of the etiologies of obesity is a complex concept. A better understanding of appetite regulation, and a more accurate measurement tool, improves understanding of the causes of obesity in clinical practice as well as in research (2-4).

In general, theories of controlling the total amount of dietary intake are based on events occurring in the physiological system of the body. For example, theories of, emotional effects of food, brain theory, which emphasizes brain structures, especially hypothalamus, or theory of neurological pathways with a mediator, is a theory based on environmental physiological systems such as the digestive system and stomach structure or the effect of peripheral hormones such as Cholecystokinin. There is a relationship between food intake and appetite, and its neurological mediator is cholecystokinin (5-7). There are other hypotheses about appetite control that relies on controlling physiological parameters, such as the old thermostatic hypothesis, lipo-static, glucostatic and amino-static (6). Some theories have responded to the interactions between environmental and central factors. Others are more complex and are based on the interaction between internal and external factors and physiological variables. The weakness of most of the theories described above is only due to the fact that eating is only considered as a variable factor. Eating behavior is a complex and comparative activity that considers Behvior flux as a behavioral act. Types of personality and mental status especially mood status may play role in this complexity (5).

Appetite means desire of eating food materials that is controlled by the appetite control center in the hypothalamus of the brain (8). In certain conditions, such as a disease or the use of various drugs, especially many of the most commonly used psychiatric drugs, one's appetite may falsely increase or decrease. For example, increased or decreased appetite is widespread in a wide range of patients (especially psychiatric patients) (9, 10). In most cases, changes in appetite are neglected in the early stages until their weight and body mass index are significantly changed, but the timely and correct diagnosis of appetite changes and helping to correct it can have a very important effect on calorie intake of patients and thus help with improvement of the disease and general well being of the patients (9). Therefore, it is absolutely necessary to use a valid and reliable tool that can accurately measure appetite in clinics and research.

The Simplified Nutritional Appetite Appearance Questionnaire (SNAQ) was formed by the Council for Nutritional Strategies for assessment of the appetite loss in adult and elderly patients in Long-Term Care. This instrument first developed by wilson et al. (11) to help assessing loss of appetite and anorexia among older adults. This tool is one of the most applied questionnaires in this regard in the world. We hypothesized that if this is a valid tool for assessing appetite it must be sufficiently good to assess the other end of

Received April 29, 2019
Accepted for publication May 13, 2019

Published online July 3, 2019, http://dx.doi.org/10.1007/s12603-019-1223-9

appetite spectrum. So we decided to extend its applicability among other populations and test its reliability and validity among weight reduction seeking women who may overeating. However, the components of appetite and eating habits vary in different cultures. And many environmental and cultural factors can affect appetite. The purpose of this study is to assess the reliability and validity of Persian version of the simplified nutritional appetite questionnaire (SNAQ) among weight reduction seeking women of Iranian society and culture.

Methods

Participants

263 women referring to a private nutrition clinic in Tehran were invited to participate in this validation study before beginning their diet. 213 of them accepted to postpone their dietary plan at least for two weeks. The study procedure was explained to them and informed consent was obtained. Inclusion criteria were weight reduction seeking adult women. Exclusion criteria were pregnancy, lactation, menopause, any disease and pills affecting appetite. The protocol of this study was approved by the Ethics Committee Review Board in Tehran University of Medical Sciences.

Procedure

First, the SNAQ, translated from English to Farsi then the English language expert, approved the accuracy of text with back translation. Also its content was approved by a panel of experts consisting of professors in nutrition and psychiatry. Afterward, 263 weight reduction seeking women were invited to participate. Of them 213 consented and participated in the first session of the study and completed the questionnaires at the first visit and their data was used for factor analysis and internal consistency measurements. An expert in nutritional sciences preformed anthropometric assessments and body composition analysis. We used Omron HBF-500 BIA (Omron Co., Japan) body composition analyzer devise which is validated by Dual-Energy X-Ray Absorptiometry and Magnetic Resonance Imaging (MRI) (12). Then we asked the subjects to complete the simplified nutritional appetite questionnaire (SNAQ) as well as other previously validated questionnaires of eating habits including the three factor eating questionnaire-R18 (TFEQ-R18), compulsive eating scale (CES), food craving questionnaire (FCQ), and also the Visual Analogue Scale (VAS) for appetite. At the end of the first session the expert nutritionist instructed the subjects to document whatever they will eat at home over two randomly selected regular days and a holyday (3-day food record). 171 subjects participated in the second session. They delivered their 3-day food record and participated in the retest of SNAQ. The expert nutritionist analyzed the food records with the software nutritionist-4.

Instruments

- Simplified Nutritional Appetite Questionnaire: which we aim to validate it in this study.
- Appetite visual analogue scale: it is a much applied simple tool in which the subject is asked to rate and mark his/her appetite on a 0 to 10 analogue rating scale. This instrument have been validated and used in previous clinical studied (13).
- Three-Factor Eating Questionnaire-R18 (TFEQ-R18): this instrument evaluates eating behavior under three subscales of emotional eating, hunger, and cognitive restraint. The internal consistency of this test was 0.73 (14).
- Restraint eating visual analogue scale: it is a rating scale at the end of TFEQ-R18 in which the subject is asked to rate and mark his/her ability to inhibit food intake on a 0 to 8 analogue rating scale (14).
- Compulsive Eating Scale (CES): it rates the severity of binge eating disorder under the subscales of overeating and eating due to negative emotions. The internal consistency of this tool is approved by the Cronbach's alpha of 0.85 (15).
- Food Craving Questionnaire (FCQ): this toll evaluates food craving under subscales of "uncontrollable food craving", "intention toward food craving" and "emotional eating". Its internal consistency was: 0.90 (16).
- Weight and height gage: the subject's weight and height were measured to the nearest gram and centimeter respectively with accurate digital weight and height gage.
- Non-stretchable tape: waist and hip circumferences of patients were measured to the nearest centimeter by an expert nutritionist in standard situation.
- Body composition analyzer; Omron HBF-500 BIA (Omron Co., Japan).the validity of this device is approved by Dual-Energy X-Ray Absorptiometry and Magnetic Resonance Imaging (MRI) (12).

Data analysis

In order to measure the internal consistency of the simplified nutritional appetite questionnaire, we used Cronbach's Alpha. To further assess the validity of the questionnaire we used split half and test retest analysis with the Pearson correlation coefficient. Furthermore, we assessed the concurrent validity with correlations between the simplified nutritional appetite questionnaire and appetite VAS, TFEQ-R18, FCQ, CES, anthropometric indices and dietary intake of calorie, and macronutrient intake. Confirmatory factor analysis was used to verify dimensions by varimax rotation. We used the PASW Statistics 18, Release Version 19.0.0 (SPSS, Inc., 2009, Chicago, IL, ww.spss.com) to analyze the data.

Results

The participants were 18-55 year women with mean age of 39±9.1. The characteristics of subjects are shown in table 1.

Table 1
Characteristics of the participants in validation study of SNAQ

	mean±SD
Age (Years)	39±9.1
BMI (Kg/m^2)	28.1±5.6
Waist circumference (cm)	101±12.8
Hip circumference (cm)	114±11.6
Total calorie intake (Kcal)	1880±242
Fat mass (%)	40.2±5.4

Factor Analysis

In order to investigate the construction of the questionnaire we performed Factor analysis with principal component analysis extraction method. Furthermore, with assumption that the factors are not independent of each other we used the varimax rotation method.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.77) and the significant Bartlett's Test of Sphericity (P<0.0001, df = 10) shows that we can perform factor analysis on our data set (table 2). Also, the independency of the variables used in the analysis among studied population is assumed. Therefore we were allowed to perform factor analysis through correlation matrix.

We have shown the range of factor loadings for the items and their variance as well as the Eigen values in Table 3; Eigen values of greater than 1.00 explained variance of 54.02%. Moreover, factor analysis via scree plot is plotted in figure 1. As the table 4 shows only one component extracted via correlation matrix which shows the uniform structure of the questionnaire. Four items were loaded on a single component. The single factor which explaining 54.02 percentage of the variance (table 3) was named "appetite".

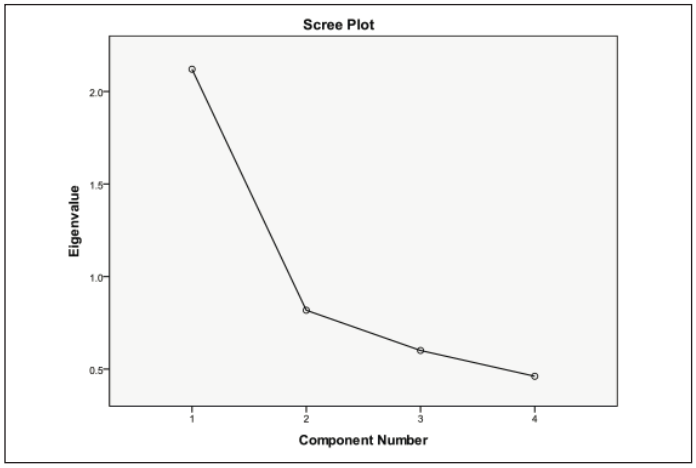
Table 2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.770
Bartlett's Test of Sphericity	Chi-Square	249.776
	df	10
	Sig.	<0.001

Analysis of Internal Consistency

The preliminary reliability of Simplified appetite questionnaire as measured using Cronbach's alpha coefficient was 0.7 which was well acceptable. Overall, the results revealed an acceptable level of internal consistency for all items of the questionnaire, and they were homogenous. Furthermore no items should be removed to increase the internal consistency.

Figure 1
Factors extracted via scree plot



Test-Retest Reliability

The test–retest reliability of the questionnaire was administered to 171 participants with a two weeks interval. The Pearson correlation showed a consistency of 0.85 between the two administrations (p<0.0001).

Concurrent Validity

The concurrent validity and inter-correlations between simplified nutritional appetite questionnaire score and body composition and anthropometric indices are shown in table-5. The convergent validity of SNAQ is assessed with diverse relationship with muscle mass.

The concurrent validity and inter-correlations between simplified nutritional appetite questionnaire score and other eating scales are shown in table-6. The convergent validity of SNAQ is assessed with significant negative association with Restraint eating visual analogue scale.

Table3
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.701	54.021	54.021	2.701	54.021	54.021

Extraction Method: Principal Component Analysis.

Table 4
Component Matrix[a]

	Component 1
1- My appetite is	0.801
a very poor	
b poor	
c average	
d good	
e very good	
2- When I eat	0.688
a I feel full after eating only a few mouthfuls	
b I feel full after eating about a third of a meal	
c I feel full after eating over half a meal	
d I feel full after eating most of the meal e I hardly ever feel full	
3- Food tastes	0.694
a very bad	
b bad	
c average	
d good	
e very good	
4- Normally I eat	0.724
a less than one meal a day	
b one meal a day	
c two meals a day	
d three meals a day	
e more than three meals a day	

Extraction Method: Principal Component Analysis, a. 1 components extracted.

Table 5
Inter-correlations among simplified nutritional appetite questionnaire score and body weight, waist circumference, BMI, fat%, muscle %

	Simplified Nutritional appetite questionnaire	
	Pearson correlation	**Sig (2-tailed)**
weight	0.17	0.05
waist circumference	0.17	0.05
BMI	0.16	0.05
fat%	0.16	0.05
muscle %	-0.12	0.17

Table 6
Inter-correlations between simplified nutritional appetite questionnaire score and, appetite visual analogue scale, Food Craving questionnaire, Compulsive Eating Scale, Restraint eating visual analogue scale, and TFEQ-R18

	Simplified nutritional appetite questionnaire	
	Pearson correlation	**Sig (2-tailed)**
Food Craving questionnaire	0.66	<0.001
Compulsive eating scale	0.59	<0.001
TFEQ-R18	0.49	<0.001
Appetite visual analogue scale	0.70	<0.001
Restraint eating visual analogue scale	-0.38	<0.001

The concurrent validity and Inter-correlations between simplified nutritional appetite questionnaire score dietary intake of carbohydrate, fat, protein, sugar, fiber and calorie are shown in table-7.

Table 7
Inter-correlations between simplified nutritional appetite questionnaire score and dietary intake of carbohydrate, fat, protein, sugar, fiber and calorie

	Simplified nutritional appetite questionnaire	
	Pearson correlation	**Sig (2-tailed)**
Calorie	0.23	0.018
Carbohydrate	0.31	0.001
Fat	-0.08	0.383
Protein	0.13	0.179
Sugar	0.29	0.003
Dietary fiber	0.30	0.002

Discussion

This is the first study that evaluates the reliability, validity and psychometric characteristics of the Persian version of Simplified Nutritional Appetite Questionnaire (SNAQ) in the case of increased appetite among weight reduction seeking women. Rolland Y and colleagues (18) compared the SNAQ scores with Mini-Nutritional Assessment (MNA) among 175 older persons at risk of malnutrition and they were correlated ($r = 0.48$, $P < 0.001$). Pilgrim, A. L. (19) and colleagues also used this instrument among 179 hospitalized old women and lower scores of this instrument was associated with increased risk of infection and death in hospitals. Wang, T. (20) and colleagues also have reported the usefulness of SNAQ in appetite evaluations among older Patients with Liver Cirrhosis. In contrast we studied the characteristics of SNAQ in a new

population with increased appetite. This can be the new application of this instrument among people with excessive appetite and with different culture.

In our study we approved the internal consistency of the test by Cronbach's alpha coefficient of 0.7. The test–retest reliability of the questionnaire was performed within a two weeks interval. The Pearson correlation showed a consistency of 0.85 between the two administrations ($p<0.0001$). Wilson and colleagues how have developed the questionnaire have reported the internal consistency of 0.51 (11) for the questionnaire. Nakatsu, N. et al (21) have assessed the Reliability and validity of the Japanese version of the SNAQ among 84 community-dwelling older adults. They get to the Cronbach's alpha coefficient of 0.5 and intraclass correlation coefficient of 0.7. Also in their study the SNAQ scores was associated with the relevant questionnaires such as Mini-Nutritional Assessment (21). Ilhan, B. et al. (22) have assessed the reliability and validity of Turkish version of SNAQ among the old outpatients. They have reported a good test-retest stability ($r= 0.654$, $p< 0.05$) and Cronbach's alpha coefficient of 0.522. Sabrina Weiss et al. (23) have assessed the reliability and validity of the SNAQ among the participants of the Cardiopulmonary and Metabolic Rehabilitation Program in Brazil and reached the internal consistency of 0.61. The results of these studies as well as our study are in favor of the ability of SNAQ in valid assessment of increased and decreased appetite.

We used the confirmatory factor analyses with maximum likelihood because there was preliminary information about the number of factors before the analysis. One component extracted using Principal Component Analysis. All the items of questionnaire were unified and loaded on one factor named "appetite". Also, all items of questionnaire had the factorial load higher than 0.68. Factor analysis performed by Nakatsu, N. et al. (21) also get in to a single factor with 50.0% explained variance. Sabrina Weiss et al. have reported factor loadings of the questionnaire above 0.40 for all items (23) which is lower than the consistency obtained in our study and of the original version of the questionnaire (0.51) (11). In all, the current and previous studies explain one factor which uniformly measure appetite in relation to SNAQ.

For concurrent validity of SNAQ, we presupposed that it may associate with parallel similar validated eating habits questionnaires, as well as, dietary intake and body composition of the subjects. Concurrent Validity of SNAQ with other eating questionnaires and visual rating scale for appetite ($r=0.7$, $p<0.001$))shows strong correlation. The SNAQ was positively shows fair to moderate correlation with total dietary calorie intake ($r=0.23$, $p=0.018$) Also concurrent validity with body composition measurements shows positive weak correlation with body weight, waist circumference, and total body fat percentage (convergent validity), and negative correlation with muscle mass (divergent validity). The innovation of assessing convergent and divergent validity with using body composition components and dietary calorie and macronutrient intake was not seen in previous studies. The effect size of the correlations between simplified nutritional appetite questionnaire score and anthropometric indices, psychometric questionnaires and dietary intake provided evidence for the validity of simplified nutritional appetite questionnaire.

Conclusion

This can be the new application of Simplified Nutritional Appetite Questionnaire (SNAQ) among people with increased appetite and with different culture. Expanding the use of this questionnaire to the weight loss clinics may help clinicians to judge about the extent of excessive or pathologic appetite and also can be used by researchers how need to rate and monitor the appetite during their clinical studies.

Conflicts of interest: nothing to declare.

Ethical standards: The informed consent form was obtained from all participants before enrolment in the study. Furthermore, the confidentiality of the personal information gathered is guaranteed. The ethics Committee Review Board in Tehran University of Medical Sciences has approved the study protocol.

Acknowledgement: This research has been supported by the Psychiatry & Psychology Research Center, Roozbeh Hospital, Tehran University of Medical Sciences, Tehran, Iran

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