



The Reliability and Validity of the Persian Version of Food Craving Questionnaire-Trait-Reduced (FCQ-T-r) in Overweight and Obese Women

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Research Paper</p> <hr/> <p><i>Article History:</i> Received: 30 Sep 2018 Accepted: 27 Dec 2018 Published: 02 Feb 2019</p> <hr/> <p><i>Keywords:</i> Appetite Eating Behavior Food Craving Food Craving Questionnaire (FCQ) Women Obesity Overweight</p>	<p>Introduction: Food craving questionnaire (FCQ) is a common method used to assess food craving, which consists of the two sections of trait (FCQ-T) and state (FCQ-S). The present study aimed to evaluate the reliability and validity of the Persian version of FCQ-trait-reduced (FCQ-T-r) with 15 items in overweight and obese women.</p> <p>Methods: This cross-sectional study was conducted on 168 overweight and obese women who consented to participate. The subjects completed the FCQ-T-r. In addition, anthropometric, body composition, and psychometric assessments were performed to evaluate the inter-correlations and concurrent validity. Confirmatory factor analysis was also carried out to derive the potential factors and internal consistency of the questionnaire. After two weeks, FCQ-T-r was completed again by 126 participants in order to confirm the test-retest reliability.</p> <p>Results: The confirmatory factor analysis based on VARIMAX rotation indicated that three principal components were loaded on the expected factors, and the Cronbach's alpha coefficient was estimated at 0.90. (0.91, 0.78, and 0.71 for the factors, respectively). Moreover, the test-retest analysis showed acceptable reliability ($P=0.001$), and Pearson's correlation-coefficient was calculated to be 0.92 between the two administrations. In the split-half reliability analysis, the Cronbach's alpha coefficient of the first and second section of the questionnaire was estimated at 0.80 and 0.86, respectively, while the correlation-coefficient between the two sections was 0.81.</p> <p>Conclusion: This preliminary study provided evidence confirming the reliability and validity of the Persian version of the FCQ-T-r. The findings indicated high internal consistency for the FCQ-T-r, and none of the items in the questionnaire had to be removed to improve the alpha.</p>

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Introduction

Craving is a psychological state that urges substance seeking behaviors for drugs or food. Food craving has been associated with binge eating (bulimia), restrained eating, and unsuccessful dieting [1, 2]. Although food craving is associated with overeating, it is not necessarily synonymous with increased calorie intake [3]. A hypothesis regarding the etiology

of food craving denotes that these behaviors are an attempt to compensate for certain deficiencies (e.g., lack of energy) and physiological mood alterations. For instance, carbohydrate craving may increase the serotonin level in the brain and decrease depression.

Food craving has been typically associated

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with negative emotions, depression, and stress. Although food craving and hunger often occur simultaneously, lack of food may not inherently trigger food craving [4]. Currently, subjective self-report instruments are applied as the most effective methods to assess food craving. To date, several research tools have been developed to evaluate food craving behaviors, while most of these tools are limited to brief psychometric measurements and specific food cravings (e.g., craving for sweets, chocolate, and fast foods). As a result, these instruments may fail to measure the other dimensions of food craving that have been noted in the current literature, such as the general psychometric characteristics of food craving [5].

Using reliable and valid instruments to measure the psychometric characteristics of food craving is essential for the clinicians and researchers in the field of eating behaviors. The food craving questionnaire (FCQ) is widely used for the assessment of food craving. FCQ measures the general psychometric characteristics of food craving rather than measuring the level of craving for specific foods. Furthermore, this questionnaire covers multiple dimensions of food craving, including the physiological, behavioral, and cognitive aspects. FCQ has been developed by Cepeda-Benito et al. based on the psychometric drug craving questionnaire. FCQ consists of two sections, including trait (FCQ-T) with 39 items, and state (FCQ-S) with 15 items [1]. In the following years, a short version of the questionnaire was proposed, which was known as the FCQ-trait-reduced (FCQ-T-r) with 15 items [5]. FCQ-T is applicable in the case of unsuccessful dieting, eating pathology, and body mass index (BMI).

Reliable and valid diagnosis of subjective measurements (e.g., food craving) is of paramount importance for the clinicians and researchers in the field of eating behaviors [6]. Although FCQ-T is considered to be a valid instrument, food craving depends on the culture of food consumption and dietary habits in various communities. Therefore, further validation is required for the translated versions of these scales, so that they could be applied in a new cultural context.

The present study aimed to evaluate the

reliability and validity of the Persian version of FCQ-T-r in overweight or obese women for the first time. Moreover, we provided the factor analysis, construct validity, internal consistency, test-retest reliability, and concurrent validity of the short version of the FCQ-T in Iranian overweight and obese women.

Material and methods

Participants

This cross-sectional study was conducted on 168 women with the BMI of $>25 \text{ kg/m}^2$ in a private nutrition clinic located in Tehran in 2015. Test-retest analysis was performed, and the participants were selected via convenience sampling. The study protocol was approved by the ethics Committee Review Board of Tehran University of Medical Sciences. Before starting the weight loss program, the participants were invited to participate in the research project. In addition, written informed consent was obtained from all the participants before enrolment.

The inclusion criteria were overweight or obese women. Complete anthropometric and body composition measurements were performed using a body composition analysis device (model: Omron HBF-500 BIA, Omron Co., Japan), the application of which has been validated in clinical settings [7].

After body composition analysis, the participants were asked to complete the FCQ-T-r, as well as other relevant validated questionnaires, including the compulsive eating scale (CES), Beck's depression inventory, visual analogue scale (VAS) for appetite, and three-factor eating questionnaire-R18. In addition, the participants were instructed to note their food and beverage intakes at meal times and snack times for three non-consecutive days and deliver the information during their next visit. After two weeks, 126 participants completed the FCQ-T-r again during their second visit for the evaluation of the test-retest reliability.

Sample Size

Adrian Meule et al. [5] have reported the Cronbach's alpha of the English version of FCQ-T-r to be 0.94. Therefore, the sample size of the present study was determined accordingly with an acceptable Cronbach alpha

with 95% confidence level and confidence interval of 0.6 based on the method proposed by Feldt et al. [8]. The final sample size was predicted to be sufficient with 140 subjects.

Research Instruments

In the present study, we applied the FCQ-T-r for factor analysis and evaluating the reliability of this scale in Iranian obese and overweight women. The other instruments are presented in the following sections.

Compulsive Eating Scale (CES)

CES contained eight items to measure the severity of binge eating disorder. The Persian version of CES has been validated for Iranian obese individuals with the estimated Cronbach's alpha of 0.85. In addition, factor analysis has revealed two factors for CES, including eating due to negative emotions and overeating [9].

Beck's Depression Inventory (BDI)

BDI is a valid instrument used worldwide to evaluate the symptoms of depression in adults. The Persian translation of this questionnaire has been validated with the internal consistency of 0.92 [10].

Visual Analogue Scale (VAS) for appetite

The appetite VAS is a tool applied to assess appetite subjectively. Previous findings have denoted a strong association between the appetite VAS and dietary intake [11].

Three-Factor Eating Questionnaire-R18 (TFEQ-R18)

This tool is commonly used for the assessment of eating behaviors. The Persian version of TFEQ-R18 has been validated with the Cronbach's alpha of 0.73. Moreover, the psychoanalysis of this instrument has revealed three factors, including hunger, cognitive restraint, and emotional eating [12].

Weight and Height Gage

The weight and height of the participants were accurately measured by a specialist dietitian in standard conditions.

Body Composition Analyzer

The reliability and validity of this

instrument in clinical settings have been confirmed based on dual-energy X-ray absorptiometry and magnetic resonance imaging (MRI) [13].

Research Procedures

The authors of the current paper (S. A.M. and T.A), who are fluent in English and native Persian speakers, translated the original version of the FCQ-T-r into Persian. Afterwards, another author (M. R.M), who is a psychiatrist and fluent in English and Persian, approved the contents of the translated version (content validity). At the next stage, an independent English language expert back-translated the questionnaire into English to compare both texts and approved the accuracy of the translated version.

All the authors assessed and confirmed the content validity and face validity of the questionnaire [6]. Following that, 200 women with the BMI of more than 25 kg/m² were invited to participate in the research. The study procedures were explained to the participants, and 168 women provided written informed consent for enrollment and participated in the factor analysis. In addition, 126 subjects participated in the retest phase after two weeks, and the test-retest reliability analysis was performed with 126 participants.

Statistical Analysis

Data analysis was performed in SPSS version 19 (SPSS, Inc., 2009, Chicago, IL, www.spss.com) using descriptive and analytical statistics. Additionally, Cronbach's alpha coefficient and Pearson's correlation-coefficient were employed to assess the internal consistency and test-retest reliability of FCQ-T-r, respectively.

Factor analysis was performed to identify the factors associated with the FCQ-T-r, and the concurrent validity was assessed through determining the correlations between FCQ-T-r, BDI, appetite VAS, TFEQ-R18, CES, body weight, body fat, and muscle percentages, waist circumference, and dietary intake of calories, fats, protein, and sugar.

Results

Demographic data of the participants are presented in Table 1.

Table 1. Demographic Characteristics of Subjects

	N*	%
Age at Obesity Outset		
Before Puberty	25	14.9
After Puberty	143	85.1
Education Level		
High School Diploma (or lower)	81	48.2
Associate Degree (or BA)	75	44.6
Postgraduate	12	7.1
Socioeconomic Status		
Low	19	11.3
Medium	141	83.9
High	8	4.8
Marital Status		
Single	26	15.5
Married	139	82.7
Widowed/Divorced	3	1.8
Number of Child Deliveries		
0	35	20.8
1	39	23.2
2	53	31.5
3	35	20.8
4	5	3.0
5	1	0.6

*Total: 168

Factor Analysis

Factor analysis was performed in order to analyze the construction of the FCQ-T-rand identify the correlated factors. It was assumed that potential factors were correlated since the principal-components analysis was used to extract the factors through VARIMAX rotation. The factors were considered significant if they explained a minimum of 5% of the total variance (19).

According to the information in Table 2, the

Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was determined to be 0.90. Moreover, Bartlett’s test of sphericity was considered significant ($P < 0.0001$; $df = 105$). Therefore, the null hypothesis of the research, which denoted that the variables used in the analysis were not correlated in the sample population, was ruled out. Based on the KMO index, performing factor analysis was allowed via the correlation matrix (Table 2).

Table 2. KMO and Bartlett’s Test

Kaiser-Meyer-Olkin Test of Sampling Adequacy		
		0.859
Bartlett’s Test of Sphericity		
Approx. Chi-square		524.672
df		28
Sig.		<0.0001

The range of the factor loadings for the items and their variances and Eigen values are shown in Table 3.

Table 3. Eigen values and Percentage of Variances Associated with Each Component

Component	Eigen values	Explained Variance (%)	Cumulative Explained Variance (%)
1	6.939	46.261	46.261
2	1.443	9.617	55.879
3	1.089	7.262	63.141

Extraction method: principal component analysis

Accordingly, the Eigen values of higher than 1.00 could explain the variance of 63.1%. The Scree plot for factor analysis is depicted in Figure 1.

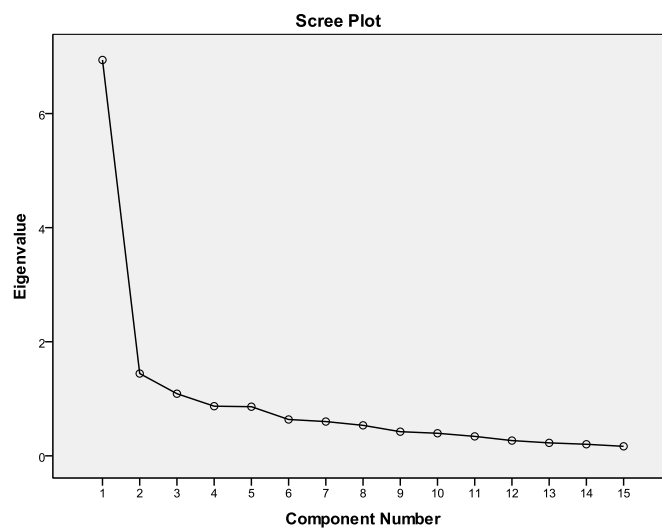


Figure 1. Factors extracted via scree plot

As can be seen, the expected factors included three components; the first factor could explain a higher percentage of the variance (46.2%) and contained six items (Table 4). This factor was referred to as ‘uncontrollable food craving’, and the second derived factor was referred to as the

‘intention toward food craving’, which explained 9.6% of the variance. The third derived factor was ‘emotional eating’, which explained 7.2% of the variance. The results of factor analysis with VARIMAX rotation for the items in the FCQ-T-r are shown in Table 4.

Table 4. Rotated Component Matrix^a

	Component		
	1	2	3
1. When I crave something, I know I will not be able to stop eating once I start.	0.771		
2. If I eat what I am craving, I often lose control and eat excessively.	0.799		
3. Food cravings invariably make me think of ways to get what I want to eat.		0.613	
4. I feel like I have food on my mind all the time.		0.585	
5. I find myself preoccupied with food.			0.558
6. Whenever I have cravings, I find myself making plans to eat.		0.581	
7. I crave foods when I feel bored, angry or sad.			0.828
8. I have no will power to resist my food cravings.	0.836		
9. Once I start eating, I have trouble stopping.	0.831		
10. I cannot stop thinking about eating, no matter how hard I try.	0.671	0.549	
11. If I give in to a food craving, all control is lost.			
12. Whenever I have a food craving, I keep thinking about eating until I actually eat.		0.624	
13. If I am craving something, I am consumed by the thoughts of eating it.		0.598	
14. My emotions often make me want to eat.			0.739
15. It is hard for me to resist the temptation to eat appetizing foods that are available.	0.754		

Extraction method: principal component analysis

Rotation method: VARIMAX with Kaiser Normalization

a. Rotation converged in six iterations

Internal Consistency of the Persian Version of FCQ

According to the findings, the Persian version of the FCQ had acceptable internal consistency, with the Cronbach’s alpha coefficient determined to be 0.90. In addition, the Cronbach’s alpha of the factors was estimated at 0.91, 0.78, and 0.71, respectively. In general, the obtained results indicated that the questionnaire was homogenous and had high internal consistency in all the items. Moreover, none of the items had to be removed to improve the alpha.

Test-retest and Split-half Reliability

Data obtained from 126 respondents were used for the test-retest analysis, demonstrating significant reliability (P=0.001). Furthermore, the Pearson’s correlation-coefficient between the two administrations was calculated to be 0.92. Split-half reliability analysis was also carried out for the FCQ, with the Cronbach’s alpha of the first and second section estimated at 0.80 and 0.86, respectively. The correlation-coefficient between the two sections was calculated to be 0.81.

Validity of the FCQ-T-r Concurrent Validity

The concurrent validity of FCQ-T-r was assessed and compared with the relevant indices (Table5), questionnaires (Table6), and dietary intake components (Table7).

Table 5. Inter-correlations between FCQ-T-r Scores and Body Weight, Waist Circumference, Body Mass Index (BMI), and Fat and Muscle Percentage

	FCQ-T-r	
	Pearson’s Correlation-Coefficient	Sig. (two-tailed)
Body Weight	0.15	0.18
Waist Circumference	0.10	0.38
BMI	0.08	0.48
Fat (%)	0.01	0.88
Muscle (%)	-0.06	0.59

Table 6. Inter-correlations between FCQ-T-r Scores in BDI, Appetite VAS, CES, Three-factor Eating Questionnaire-R18, and Restraint Eating VAS (TFEQ-R18 subscales)

	FCQ-T-r	
	Pearson's Correlation-Coefficient	Sig. (two-tailed)
Beck Depression Inventory (BDI)	0.22	0.04
Appetite Visual Analogue Scale (VAS)	0.61	<0.0001
Compulsive Eating Scale (CES)	0.65	<0.0001
Three-factor Eating Questionnaire-R18 (TFEQ-R18)	0.47	<0.0001
Restraint eating VAS(TFEQ-R18 subscales)	-0.59	<0.0001

Table 7. Inter-correlations between FCQ-T-r Scores and Dietary Intake of Carbohydrates, Fat, Protein, and Calorie

	FCQ-T-r	
	Pearson's Correlation-Coefficient	Sig. (two-tailed)
Calorie	0.06	0.56
Carbohydrates	0.04	0.67
Fat	0.01	0.91
Protein	0.09	0.42
Sugar	0.17	0.14

Discussion

This was the first study to report the reliability and validity of the Persian version of FCQ-T-r, which is an instrument used to measure the psychometric characteristics of food craving behaviors. The original version of FCQ-T-r was developed by Antonio Cepeda-Benito et al. [1], who reported the KMO to be 0.93. On the other hand, Meule et al. [5] assessed the reliability and validity of the short version of this questionnaire in German students, reporting the KMO of 0.93, while the KMO was estimated at 0.85 in the present study.

In the study by Antonio Cepeda-Benito et al. [1], the Cronbach's alpha of FCQ-T-r was reported to be 0.97 (range in the subscales: 0.81-0.94), and the test-retest reliability of $r = 0.88$ was obtained. In the research by Meule et al., the Cronbach's alpha for this questionnaire was estimated at 0.94 [5], while the internal consistency of the FCQ was observed to be high in the present study ($\alpha = 0.90$). Furthermore, the Pearson's correlation-coefficient showed the high test-retest reliability of this instrument in our research. In general, the results of the present study indicated that the questionnaire was homogenous and had high internal consistency in all the items ($n = 15$). Also, none of

the items had to be removed to improve the alpha. Therefore, the internal consistency of the FCQ was considered acceptable.

In a study performed on German students, Meule et al. [5] derived one factor from the FCQ-T-r, while we derived three factors in Persian overweight and obese women, including uncontrollable food craving, intention toward to food craving, and emotional eating. These factors could explain 46.2%, 9.6%, and 7.2% of the variance, respectively. The names of the factors were selected based on the rotated component matrix and concept of the items with higher variance (items seven, eight, and 12, respectively). The difference between the mentioned study and current research could be due to the dissimilar language concepts of the items of the questionnaire and different cultural differences and eating/food craving habits. As a result, most researchers prefer reporting the total score of the questionnaire rather than the scores of the subscales.

At the outset of the present study, we hypothesized that food craving may be positively correlated with depression, appetite VAS, compulsive eating, TFEQ, BMI, body weight, and body fat percentage, while negatively correlated with body muscle percentage and TFEQ-R18 subscales. The convergent and divergent validity of the FCQ-T-r was confirmed based on the positive significant correlations between the FCQ-T-r scores in the BDI ($r = 0.22$), appetite VAS($r = 0.61$), CES ($r = 0.65$), and TFEQ-R18($r = 0.47$), as well as the negative associations between FCQ-T-r and restraint eating VAS (TFEQ-R18 subscales) ($r = -0.59$) as was rationally anticipated.

According to the findings of the current research, depressive symptoms in the overweight women increased the risk of food craving, which is consistent with the results of the previous studies in this regard. For instance, Abilés et al. (2010) [14] and Van den Eynde et al. (2012) [15] reported that the FCQ-T score was higher in the subjects with compulsive eating disorder, the subsequent adverse effects (e.g., depression), and obesity. On the other hand, some researchers have reported positive correlations between specific food cravings (e.g., chocolate and sweets) and depression or eating disorders, especially in women [16, 17].

In this regard, Meule et al. reported a weak,

positive correlation between BMI and FCQ-T-r [5], which was not considered significant when adjusted for gender and dieting status ($r=0.08$). Similarly, the Pearson's correlation-coefficient (r) in the current research was determined to be 0.08 ($P=0.4$) between BMI and FCQ-T-r. Our sample size only included overweight and obese women seeking weight loss diets. In another research, Franken and Muris [18] reported $r=0.1$ for the correlation between BMI and FCQ. Other findings have also confirmed the association of anthropometric indices with mood and eating behaviors [19, 20]. In the present study, FCQ-T-r had been observed to have a weak, positive correlation with body weight ($r=0.15$), BMI ($r=0.08$), waist circumference ($r=0.10$), and total body fat percentage ($r=0.01$) (convergent validity), while a weak, negative correlation was observed with muscle percentage ($r=-0.06$) (divergent validity). However, these correlations were considered insignificant. These findings are in congruence with the results of the present study.

Surprisingly, no strong correlations were denoted between the FCQ and dietary components (e.g., calorie, carbohydrate, fat, protein, and sugar intake). This could be due to the fact that FCQ-T-r has been developed to assess the general psychometric characteristics associated with food craving rather than identifying specific food cravings (e.g., sweets or chocolate).

One of the limitations of the present study was that we only investigated women. Therefore, it is recommended that further research in this regard be conducted on men, as well as different age groups, including children and adolescents.

Conclusion

According to the results, the construct validity and reliability of the Persian version of FCQ-T-r was adequate in the overweight and obese women. Therefore, this instrument could be used effectively to assess food craving as a general concept in this population. Furthermore, the results of the present study indicated that the Persian version of FCQ-T-r is a psychometrically efficient instrument to evaluate food craving as a component of eating behaviors in Iranian overweight and obese women. However, the obtained results should be interpreted with caution since the sample

population (i.e., only clinical samples of overweight and obese women) may restrict the generalization of the findings to the general population and men. Overall, the results indicated the high internal consistency in all the items of the questionnaire, as well as their homogeneity. Moreover, none of the items had to be eliminated to improve the alpha.

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Conflicts of interest

None declared.

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