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Psychometric properties of the Italian Food Cravings Questionnaire-Trait-reduced (FCQ-T-r)

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Abstract

Purpose The aim of the present study was to investigate dimensionality and psychometric properties of the Italian Food Cravings Questionnaire-Trait-reduced (FCQ-T-r) in a sample of obese and overweight patients seeking weight loss treatment.

Methods Participants were 504 (416 women and 88 men) overweight and obese patients (BMI $\geq$ 25 kg/m^2), and 289 (215 women and 74 men) Italian adults not currently seeking weight loss treatment. All participants were administered the Food Cravings Questionnaire-Trait (FCQ-T) and the Binge Eating Scale.

Results The fifteen items included in the FCQ-T-r explained 93 % of the variance of the 39-item FCQ-T total score ($R^2 = 0.93$). A principal axis factoring analysis indicated a one-factor solution, explaining 55.6 % of the variance of the data. The FCQ-T-r had high internal consistency and was also able to differentiate between individuals with various severities of binge eating behavior.

Conclusions The FCQ-T-r may be considered a useful instrument for measuring trait food craving, when time constraints impede the use of the 39-item FCQ-T.

Keywords Food Cravings Questionnaire · Obesity · Overweight · Validity · Exploratory factor analysis

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Introduction

Food craving (FC) can be defined as an intense desire to consume a specific food that is difficult to resist [1, 2]. Several studies have reported that FC is an important feature of eating and weight disorders, especially Binge Eating Disorder (BED) and obesity [3–7]. Indeed, FC appears to be a proximal factor in precipitating episodes of binge eating [8–10] and it is predictive of high caloric food intake [11]. More intense or frequent FC is also associated with higher body mass index (BMI) [2, 12–15], lower dieting success and more dropouts from weight loss treatment programs [14, 16, 17], and a higher number of lifetime weight loss attempts [18].

The Food Cravings Questionnaire-Trait (FCQ-T; [9, 19]) is the most extensively validated and internationally used FC measure [15, 20]. The FCQ-T is a multidimensional questionnaire which assesses several aspects of FC such as, anticipation of positive/negative reinforcement from eating, thoughts about and

preoccupation with food, or lack of control over eating, among others.

Although the multidimensionality of the FCQ-T may help clinicians and investigators assess all the major components of FC, it is a relatively long self-report measure (39 items). Thus, Meule et al. [15] developed and validated the Food Cravings Questionnaire-Trait-reduced (FCQ-T-r), a short form of the FCQ-T consisting of 15 items, which showed the highest item-total correlations in a study in which the full version was used [14]. Psychometric properties of the FCQ-T-r were also investigated, with satisfactory results, among Cuban adults [20]. However, to date there are no studies investigating the psychometric properties of an Italian version of the FCQ-T-r. Thus, the aim of the present study was to investigate dimensionality and psychometric properties of the Italian FCQ-T-r in a sample of obese and overweight patients seeking weight loss treatment. Furthermore, to assess whether the FCQ-T-r item and total scores could discriminate obese and overweight patients from the general population, a control group was enrolled. We hypothesized that overweight patients seeking weight loss treatment would report higher food craving severity on the FCQ-T-r.

Methods

Participants

All patients were consecutively admitted to three private medical centers in Rome (Italy) that specialized in the treatment of obesity and shared the same therapeutic approach [21], and who met inclusion criteria were enrolled in the study. Approximately 89.6 % of the patients agreed to participate in the study, and 95.5 % of those who agreed to participate in the study completed the assessment. The final sample was composed of 504 (416 women and 88 men) overweight and obese patients. Inclusion criteria were a minimum age of 18 years and a minimum BMI of 25 kg/m^2. Exclusion criteria were the presence of major disorders of the central nervous system (e.g., epilepsy, dementia, or Parkinson's disease), any psychotic symptoms (hallucinations, delusions, or negative symptoms) or major mood disorders (e.g., bipolar disorder, major depressive disorder), and the presence of any condition affecting the ability to complete the assessment, including the denial of informed consent. Participant characteristics are displayed in Table 1.

Four hundred and ninety-seven patients were part of the sample of a recent study investigating the psychometric properties of the FCQ-T [22], and more detailed information about the sample and the recruitment process can be found in Innamorati et al. [22].

Table 1 Participant characteristics and group differences between patients and controls

Variable	Patients ($n = 504$)	Controls ($n = 289$)	Test statistics
Women, n (%)	416 (82.5)	215 (74.4)	$p = 0.01$*
Age (years), M (SD)	44.00 (12.14)	32.67 (13.49)	$t_{(791)} = 11.80$, $p < 0.001$
Employed, n (%)	390 (77.4)	207 (71.6)	$p = 0.37$*
Education (>13 years), n (%)	445 (88.3)	238 (82.4)	$p = 0.64$*
Married or in a stable relationship, n (%)	314 (62.3)	195 (67.5)	$p = 0.27$*
Body mass index (kg/m^2), M (SD)	30.53 (5.35)	22.83 (3.13)	$t_{(791)} = 25.55$, $p < 0.001$
Binge eating, n (%)			$\chi^2_{(2)} = 48.84$, $p < 0.001$
No binge eating	326 (64.6)	259 (89.5)	
Probable binge eating	127 (25.2)	27 (9.5)	
Clinical-level binge eating	51 (10.3)	3 (0.9)	

* One-way Fisher exact tests

Controls included 289 (215 women and 74 men) adults from the Italian general population (see Table 1 for participant characteristics). The same inclusion/exclusion criteria were used for controls with the exception of BMI limits. The controls were recruited through advertisements posted in established community groups (e.g., universities and community organizations operating in Rome and in Central Italy).

Groups differed in sex distribution, age, and BMI (Table 1). Patients and controls voluntarily participated in the study, did not receive payment, provided written informed consent, and completed the protocol anonymously. The research was approved by the Università Europea's ethics review board.

Measures

All participants completed the 39-item Italian version of the FCQ-T [22] and the Binge Eating Scale (BES) [23]. Clinical and socio-demographic information was obtained from medical records for patients, while controls completed a socio-demographic form during the assessment.

The FCQ-T is a 39-item questionnaire with items rated on a 6-point Likert scale (from 1 = never to 6 = always) for the assessment of the frequency of FC experiences. Several studies [9, 19, 24, 25] indicated a nine-factor structure: (1) anticipation of positive reinforcement from

eating (Ant+); (2) anticipation of relief from negative states and feelings from eating (Ant−); (3) intentions and plans to consume food (Intent); (4) cues that may trigger food cravings (Cues); (5) thoughts or preoccupation with food (Thoughts); (6) craving as hunger (Hunger); (7) lack of control over eating (Control); (8) emotions that may be experienced before or during food cravings or eating (Emotions); and (9) guilt from cravings and/or for giving into them (Guilt). Previous studies conducted both in samples of healthy individuals and patients with eating disorders reported that the scale has high internal consistency (Cronbach's alphas between 0.92 and 0.97); however, alphas for some subscales were not always satisfactory ranging from 0.57 to 0.84, most likely due to the low number of items included on some factors [3, 9, 13, 14, 19, 24, 25]. Test–retest reliability at 3 weeks was high for the English and the Spanish Versions (r = 0.88; [9, 19]), and for the German version (r = 0.84; [14]). Cronbach's alpha in the present sample was 0.96.

The FCQ-T-r is composed of 15 items from the FCQ-T. The items belonged to five dimensions of the original FCQ-T: Control (items 2, 3, 25, 26, 29), Thoughts (items 6, 8, 27, 32, 33), Intent (items 5, 18), Emotions (items 20, 34), and Cues (item 36). Meule et al. [15] reported unidimensionality and high internal consistency (Cronbach's alpha = 0.94). Validity was demonstrated by, for example, positive correlations between scores on the FCQ-T-r, BMI and cue-elicited FC [15].

The BES is a 16-item questionnaire assessing binge eating severity as well as the feelings and thoughts associated with such behavior. Thus, it assesses both behavioral and cognitive/emotional manifestations of binge eating. Each item has three or four weighted statements, and the respondent is directed to choose one. In the validation sample, the BES successfully discriminated among persons judged by trained interviewers to have or not have binge eating problems [26]. The scores range from 0 to 46. Individuals with scores <18 were considered not to be engaging in significant binge eating; individuals with scores in the 18–26 range likely experience binge eating; and individuals with scores of >27 engage in clinically significant binge eating behaviors [26]. Using these categories resulted in a 98 % concordance rate with diagnosis made in a semi-structured interview [27] and, thus, we also used these cut-offs in the present study. Furthermore, the BES has been shown to have good internal consistency (Cronbach's alpha of 0.85) [26]. Cronbach's alpha in the present sample was 0.88.

Statistical analyses

To investigate dimensionality of the FCQ-T-r in obese and overweight patients we used principal axis factoring

analysis. The number of factors to retain was determined by means of Kaiser criterion (only factors with eigenvalues >1 were retained), and parallel analysis [28]. To investigate psychometric properties of the FCQ-T-r at the item level, we report corrected item-total correlations and descriptive statistics (means and standard deviations), and analyzed differences between patients and controls by means of independent t tests. At the scale level, we report Cronbach's alpha and mean inter-item correlation as measures of reliability, and descriptive statistics (mean and standard deviation). We also calculated the proportion of variance (R^2) of the full FCQ-T that is explained by the FCQ-T-r by means of a linear regression analysis with the FCQ-T as the criterion and the FCQ-T-r as the independent variable. Scores on the FCQ-T-r were compared between patients and controls, and scores were also compared with those reported in previous studies [15, 20]. Relationships between FCQ-T-r scores and socio-demographic characteristics were tested with independent t test (sex) and Pearson correlation coefficients (age, BMI, and BES). Cohen's d coefficients are reported as measures of effect size. To assess the performance of the FCQ-T-r in categorizing individuals based on the severity of their current binge eating, we performed the Receiver Operating Characteristic (ROC) test procedures. A ROC curve is a two-dimensional depiction of test performance [29, 30]. The main outcome variable is the area under the ROC curve (AUC), which is interpreted as the probability that a randomly sampled respondent will be correctly assigned to the appropriate group. The AUC directly represents the overall accuracy of the instrument in screening for binge eating. ROC curve analyses were performed both on the whole sample, which included patients and controls, and on the sample of patients. In line with the validation study of the Italian version of the FCQ-T [22], we tested the ability of FCQ-T-r to discriminate respondents with clinical-level binge eating (BES scores ≥27) from those with probable binge eating (BES scores between 18 and 26). We analyzed the accuracy of the FCQ-T-r in differentiating only respondents with clinical-level binge eating from those with probable binge eating because this may be the most challenging situation in clinical settings, due to the fact that the use of the BES only may produce too many false positive and negative. All analyses were performed with the Statistical Package for the Social Sciences (SPSS) 19.0 for Windows (IBM Corp., Armonk, NY).

Results

In Table 2, statistics for the FCQ-T-r in obese and overweight patients are reported. Corrected item-total correlations for the FCQ-T-r items ranged between 0.60 and 0.79

Table 2 Psychometric properties of the FCQ-T-r in obese and overweight patients and differences in FCQ-T-r item and total scores compared with controls

Item #	Obese and overweight patients ($n = 504$)			Controls ($n = 289$)	Cohen's d[a]
	Factor loadings	Corrected item-total correlation	Item M (SD)	Item M (SD)	
2	0.63	0.61	3.52 (1.51)	2.64 (1.39)	0.61
3	0.70	0.69	3.63 (1.46)	2.69 (1.24)	0.69
5	0.68	0.66	2.72 (1.47)	2.12 (1.22)	0.44
6	0.77	0.74	2.52 (1.46)	1.79 (1.13)	0.55
8	0.76	0.73	2.25 (1.35)	1.52 (0.90)	0.64
18	0.70	0.67	2.49 (1.44)	2.07 (1.15)	0.32
20	0.60	0.59	3.55 (1.47)	2.79 (1.31)	0.55
25	0.71	0.70	3.18 (1.55)	2.12 (1.20)	0.76
26	0.84	0.82	2.91 (1.55)	1.97 (1.13)	0.69
27	0.83	0.80	2.24 (1.44)	1.51 (0.93)	0.60
29	0.82	0.79	2.38 (1.55)	1.55 (0.89)	0.66
32	0.76	0.73	2.32 (1.36)	1.88 (1.06)	0.35
33	0.72	0.70	1.78 (1.16)	1.37 (0.74)	0.42
34	0.66	0.64	2.66 (1.42)	2.09 (1.63)	0.37
36	0.64	0.62	3.54 (1.45)	3.00 (1.33)	0.39
		FCQ-T-r sum score	41.69 (16.09)	31.00 (11.26)	0.77

[a] All tests on group differences in FCQ-T-r item and total scores were significant at $p < 0.001$

(mean = 0.70). The FCQ-T-r score explained 93 % of the variance of the 39-item FCQ-T total score ($R^2 = 0.93$), and was correlated strongly with the sum score of the 24 items excluded from the FCQ-T-r ($r = 0.89$; $p < 0.01$). In the principal axis factoring, two factors had eigenvalues >1 (Factor 1 = 8.35, 55.6 % of the variance explained; factor 2 = 1.13, 7.5 % of the variance explained), but a parallel analysis (eigenvalues of 1.30 and 1.23 for simulated data at the parallel analysis) suggested to retain only 1 factor (factor loadings for the FCQ-T-r are reported in Table 2). Internal consistency for the 15-item FCQ-T-r was $\alpha = 0.94$ with a mean inter-item correlation of 0.52. All items scores differed between patients and controls with weak to moderate effects (Table 2). Also, the FCQ-T-r sum score differed between obese patients and controls (Table 2). Mean scores for our sample of obese patients were higher than those reported by Meule et al. [15] in German students (38.47 ± 13.11; $t_{825} = 3.01$; $p < 0.01$; Cohen's $d = 0.22$), and lower than those reported for Cuban adults (45.02 ± 19.74; $t_{1,743} = 3.36$; $p < 0.001$; Cohen's $d = -0.18$) [20]. Mean scores for controls were lower than those reported by German students ($t_{610} = 7.52$; $p < 0.001$; Cohen's $d = -0.61$) and Cuban adults ($t_{1,528} = 11.64$; $p < 0.001$; Cohen's $d = -0.87$). FCQ-T-r scores were weakly but significantly associated with BMI ($r = 0.15$; $p < 0.01$) and strongly correlated with BES scores ($r = 0.77$; $p < 0.01$). They were not correlated with age ($r = -0.04$; $p = 0.34$), and were significantly associated with sex ($t_{141.90} = 4.65$; $p < 0.001$; Cohen's $d = 0.52$), with female patients reporting higher scores than males (43.06 ± 16.21 vs. 35.24 ± 13.89).

Approximately 25 % of obese patients reported probable binge eating as indicated by BES scores (vs. 9.5 % of the controls), and 10.3 % reported clinical-level binge eating (vs. 0.9 % of the controls) (Table 1). A ROC curve procedure indicated that FCQ-T-r scores (area under the ROC curve = 0.78,[1] 95 % CI = 0.71/0.85; SE = 0.03; $p < 0.001$) may categorize individuals with different severity of binge eating well (Fig. 1). A score of 57.5 or higher on the FCQ-T-r categorized individuals with a sensitivity of 0.69 (69 % of all the patients with clinical-level binge eating were correctly identified) and a specificity of 0.69 (31 % of all individuals with only probable binge eating were incorrectly identified to have clinical-level binge eating).

Discussion

The aim of the present study was to investigate dimensionality and psychometric properties of the Italian FCQ-T-r in a sample of obese and overweight patients seeking weight loss treatment. Results showed that FCQ-T-r scores explained more than 90 % of the variance of the original 39-item version of the FCQ-T, that the FCQ-T-r is unidimensional and has high internal consistency, comparable to that of the longer version. Thus, results suggest that the

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[1] Results were similar when only overweight and obese patients were considered in the analysis (area under the ROC curve = 0.75, 95 % CI = 0.69/0.83; SE = 0.04; $p < 0.001$).
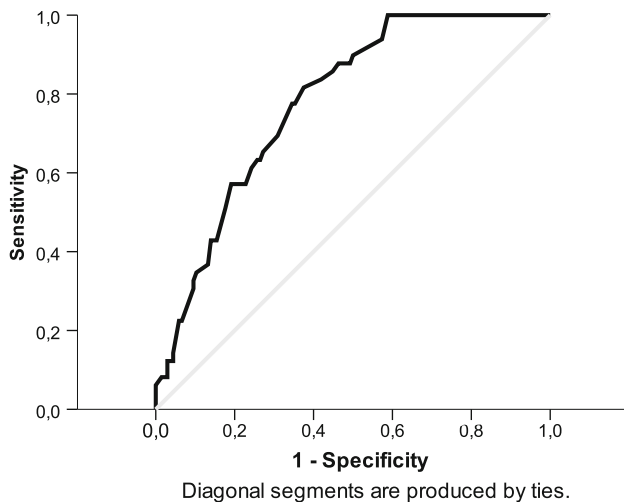
Fig. 1 ROC curve graph for the ability of the FCQ-T-r to discriminate patients with clinical-level binge eating (BES scores ≥27) from those with probable binge eating (BES scores between 18 and 26)

short form may be used as a substitute of the long version without sacrificing much information.

Obese participants had higher FCQ-T-r scores than controls. Obese patients also reported higher mean FCQ-T-r scores than German students [15]. Unexpectedly, they had lower scores compared with those reported by Cuban adults [20]. This difference could reflect some social and cultural factors. After a period of 5 years in which difficulties caused a decrease of food availability for the majority of the Cuban population [20, 31], obesity rates began to rise [32], indicating changes in food-consuming habits among the Cuban population. Likewise, previous studies have reported cultural differences in FC [33, 34]. However, some characteristics among our sample of obese patients may explain the results. In a previous study [22] in which we compared scores on the FCQ-T in obese/overweight patients who made up the majority of the current sample, their mean scores were intermediate among those reported in other studies [3, 4, 35, 36], indicating that FC severity only was moderate.

Inline with previous data [3, 5–7, 12–15, 22], in our sample, FC was strongly associated with binge eating and weakly but significantly associated with BMI. The small correlation observed between FCQ-T-r and BMI is not unexpected; previous studies [13, 14] reported small correlation between BMI and the FCQ-T (<0.30) and the exact correlation coefficient ($r = 0.15$) found in the present study was found for the German FCQ-T-r [15]. Our results also suggest that FCQ-T-r was able to discriminate between people with clinical-level binge eating (BES scores ≥27) and those with probable binge eating (BES scores between 18 and 26). The ability of the FCQ-T-r in discriminating people with different levels of binge eating

was comparable to that of the 39-item FCQ-T. A randomly chosen individual with clinical-level binge eating had a 78 % of probability of having higher scores on the FCQ-T-r than a randomly chosen individual with probable binge eating, versus 76 % of probability of having higher scores on the 39-item FCQ-T [22].

Finally, consistent with previous findings [15, 24, 37, 38], we observed gender differences in FC, with female patients reporting higher scores on the FCQ-T-r than males. It is possible that women are more weight and shape concerned and that they more often try to restrict their eating [39], exposing themselves to the risk of inducing in FC [40]. At the biological level, these differences could reflect differences observed in women's reward system [41, 42] which could be secondary to modifications associated with the menstruation cycle [43, 44].

The study's contributions should be considered in light of its limitations. First, our clinical sample mostly consisted of slightly obese female patients; thus, results may be different in samples of patients with severe obesity, and/or in male patients. Second, obese patients and controls differed in major socio-demographic characteristics, raising the possibility that other covariates may explain the differences between groups. Third, we only administered self-report measures, which may have been biased due to social desirability. Moreover, this study was a reanalysis of existing data, that means the FCQ-T and not the FCQ-T-r was administered. Thus, future studies on the validation of the FCQ-T-r need to be done in which only the FCQ-T-r items are used.

Nevertheless, our results suggest that the FCQ-T-r may be considered a useful instrument for assessing food cravings, when time constraints impede the use of the 39-item version of the FCQ-T. In fact, the FCQ-T-r explained above 90 % of the variance of FCQ-T scores, correlated strongly with FCQ-T's items excluded from this short version, and correlations with, for example, BMI and binge eating severity were comparable to those reported in studies in which the full version was used [13, 22, 36]. However, it should be noted that the FCQ-T-r may only be able to capture a subset of aspects related to FC that are evaluated by the 39-item version. Thus, the full version should be administered when assessing the impact that different facets of FC may have on eating patterns. Future studies are needed to further evaluate the psychometric properties of the FCQ-T-r. For example, these studies should investigate test–retest reliability of the FCQ-T-r or further examine the utility of the cut-off score to successfully differentiate people with clinical-level binge eating versus those with probable binge eating. Lastly, investigating the invariance of the FCQ-T-r structure among samples from different countries could be interesting.

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