



Twenty Years of the Food Cravings Questionnaires: a Comprehensive Review

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Abstract

Purpose of Review The Food Cravings Questionnaires (FCQs; Cepeda-Benito, Gleaves, Williams, & Erath, 2000) are among the most widely used instruments for measuring food cravings. In addition to the Food Cravings Questionnaire–Trait (FCQ–T) and the Food Cravings Questionnaire–State (FCQ–S), several modified versions have been developed as well. For their 20th anniversary, this article provides a comprehensive description of the FCQs and reviews studies on their psychometric properties and correlates.

Recent Findings The FCQs and their modified versions have excellent internal reliability. Expectedly, the FCQ–T (and its derivatives) has higher retest-reliability than the FCQ–S as the FCQ–S is sensitive to situational changes such as food deprivation and food intake. However, while the FCQ–T is largely unaffected by such momentary states, it is also sensitive to change during weight-loss treatments and other interventions. Factor structure of the FCQ–T and FCQ–S has only partially been replicated. Construct validity of the FCQs is supported by experimental and longitudinal studies that measured food craving and food consumption in the laboratory and with ecological momentary assessment.

Summary Numerous studies support reliability and validity of the FCQs and their modified versions, yet findings about their factor structures are inconsistent. Thus, using total scores or the short versions of the FCQs may be preferable.

Keywords Food · Craving · Hunger · Chocolate · Assessment · Psychometrics

Introduction

Food craving refers to an intense desire to consume a specific food [1]. This specificity differentiates it from general feelings of hunger, which can be alleviated by consumption of any type of food [2]. Craved foods usually have a high energy density due to their high carbohydrate and/or fat content. In North American and European countries, chocolate and chocolate-containing foods are the most commonly craved foods, particularly among women [3–8]. Food craving is a multidimensional experience as it includes cognitive (e.g., thinking about food), emotional (e.g., desire to eat or changes in mood), behavioral (e.g., seeking and consuming food), and

physiological (e.g., salivation) aspects [9]. Moreover, while the experience of a food craving is a transient state, there are also more stable individual differences in the frequency and intensity of experiencing food cravings in general (which is sometimes labeled *trait food craving* [10]).

Twenty years ago, Cepeda-Benito and colleagues developed the Food Cravings Questionnaires (FCQs), which are two self-report instruments for the measurement of the multi-dimensional nature of food craving as a state and trait [11]. The FCQs would turn out to be among the most widely used measures for the assessment of food cravings. As of this writing, the article by Cepeda-Benito and colleagues has been cited more than 200 times according to Web of Science and more than 400 times according to Google Scholar (Fig. 1). The FCQs have also been translated into several other languages and different modified versions have been developed. Therefore, the current article provides a detailed description of the FCQs and their modified versions, reviews their psychometric properties and correlates, and evaluates the scales in light of other self-report measures for the assessment of food craving.

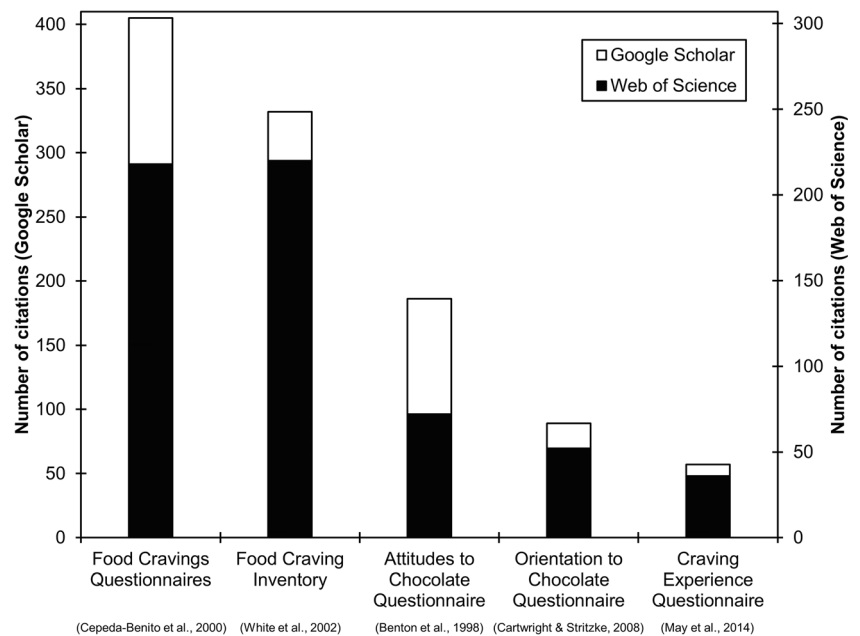
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Fig. 1 Citation numbers of different self-report measures for the assessment of food cravings (as of June 2019). Only food craving measures with at least 50 citations (according to Google Scholar) were included



Food Cravings Questionnaire–Trait

Description

The Food Cravings Questionnaire–Trait (FCQ–T) measures the frequency and intensity of food craving experiences in general. The questionnaire has 39 items and response categories range from 1 = *never* to 6 = *always* (Table 1). There are no inverted items. Responses to all items are summed up for a total score. Thus, higher scores represent more frequent and intense food cravings. Several subscale scores can be also calculated. The FCQ–T has been translated into at least seven other languages: Spanish [12], German [13], Italian [14], Portuguese [15, 16], Persian [17], Turkish [18], and Chinese [19].

Factor Structure

Cepeda-Benito and colleagues [11] found a nine-factor structure of the FCQ–T in two samples of undergraduate students:

- Having intentions and plans to consume food (Items 5, 18, 23)
- Anticipation of positive reinforcement that may result from eating (Items 9, 10, 15, 24, 38)
- Anticipation of relief from negative states and feelings as a result of eating (Items 16, 19, 21)
- Lack of control over eating (Items 2, 3, 22, 25, 26, 29)
- Thoughts and preoccupation with food (Items 6, 8, 27, 28, 31, 32, 33)
- Craving as a physiological state (Items 11, 12, 13, 14)

- Emotions that may be experienced before or during food cravings or eating (Items 20, 30, 34, 39)
- Cues that may trigger food cravings (Items 1, 35, 36, 37)
- Guilt from cravings and/or for giving into them (Items 4, 7, 17)

This factor structure was replicated in some studies, for example for the Spanish version (including a study in women with anorexia and bulimia nervosa [12, 20, 21]), the Italian version [14], and the Turkish version [18]. Moreover, full measurement invariance was found across American and Spanish participants [12]. Using a Portuguese version, one study could replicate the nine factors [16] whereas model fit was poor in another study [22]. Several studies could not replicate the nine-factor structure and instead suggested fewer factors. For example, an eight-factor structure was found in a sample of persons with overweight [23], a seven-factor structure was found in a sample of obese bariatric surgery candidates [24, 25], a six-factor structure was found for the German version [13] and Chinese version [19], a five-factor structure was found for the Persian version [17], and a four-factor structure was found for the Spanish version in a sample from Cuba [26]. Thus, while there is some support for the nine subscales of the FCQ–T, factorial validity may be limited in other cultures or languages and in specific populations (e.g., overweight persons).

Reliability

Internal reliability of the total scale is excellent ($\alpha > .90$) but lower for the subscales [11–14, 16–21]. Similarly, retest-reliability over few weeks was good for the FCQ–T total score

Table 1 Items of the Food Cravings Questionnaire–Trait

Items	Response categories					
	Never/not applicable	Rarely	Sometimes	Often	Usually	Always
1. Being with someone who is eating often makes me hungry.	1	2	3	4	5	6
2. When I crave something, I know I will not be able to stop eating once I start. ^a	1	2	3	4	5	6
3. If I eat what I am craving, I often lose control and eat too much. ^a	1	2	3	4	5	6
4. I hate it when I give in to cravings.	1	2	3	4	5	6
5. Food cravings invariably make me think of ways to get what I want to eat. ^{a,b}	1	2	3	4	5	6
6. I feel like I have food on my mind all the time. ^a	1	2	3	4	5	6
7. I often feel guilty for craving certain foods.	1	2	3	4	5	6
8. I find myself preoccupied with food. ^{a,b}	1	2	3	4	5	6
9. I eat to feel better.	1	2	3	4	5	6
10. Sometimes, eating makes things seem just perfect.	1	2	3	4	5	6
11. Thinking about my favorite foods makes my mouth water.	1	2	3	4	5	6
12. I crave foods when my stomach is empty.	1	2	3	4	5	6
13. I feel as if my body asks me for certain foods.	1	2	3	4	5	6
14. I get so hungry that my stomach seems like a bottomless pit.	1	2	3	4	5	6
15. Eating what I crave makes me feel better.	1	2	3	4	5	6
16. When I satisfy a craving I feel less depressed.	1	2	3	4	5	6
17. When I eat what I am craving I feel guilty about myself.	1	2	3	4	5	6
18. Whenever I have cravings, I find myself making plans to eat. ^a	1	2	3	4	5	6
19. Eating calms me down.	1	2	3	4	5	6
20. I crave foods when I feel bored, angry, or sad. ^a	1	2	3	4	5	6
21. I feel less anxious after I eat.	1	2	3	4	5	6
22. If I get what I am craving I cannot stop myself from eating it.	1	2	3	4	5	6
23. When I crave certain foods, I usually try to eat them as soon as I can.	1	2	3	4	5	6
24. When I eat what I crave I feel great.	1	2	3	4	5	6
25. I have no will power to resist my food crave. ^{a,b}	1	2	3	4	5	6
26. Once I start eating, I have trouble stopping. ^a	1	2	3	4	5	6
27. I cannot stop thinking about eating no matter how hard I try. ^{a,b}	1	2	3	4	5	6
28. I spend a lot of time thinking about whatever it is I will eat next.	1	2	3	4	5	6
29. If I give in to a food craving, all control is lost. ^a	1	2	3	4	5	6
30. When I'm stressed out, I crave food. ^b	1	2	3	4	5	6
31. I daydream about food.	1	2	3	4	5	6
32. Whenever I have a food craving, I keep on thinking about eating until I actually eat the food. ^{a,b}	1	2	3	4	5	6
33. If I am craving something, thoughts of eating it consume me. ^{a,b}	1	2	3	4	5	6
34. My emotions often make me want to eat. ^a	1	2	3	4	5	6
35. Whenever I go to a buffet I end up eating more than what I needed.	1	2	3	4	5	6
36. It is hard for me to resist the temptation to eat appetizing foods that are in my reach. ^{a,b}	1	2	3	4	5	6
37. When I am with someone who is overeating, I usually overeat too.	1	2	3	4	5	6
38. When I eat food, I feel comforted.	1	2	3	4	5	6
39. I crave foods when I'm upset.	1	2	3	4	5	6

Participants are instructed to indicate how frequently each statement is true for them in general

^a Items included in the Food Cravings Questionnaire–Trait–reduced [58]

^b Items included in the abbreviated Food Cravings Questionnaire–Trait by Maranhão et al. [22]

($r > .80$) but lower for the subscale scores in several studies [11, 13, 17, 19, 23]. Thus, the FCQ–T is an internally reliable measure and scores are temporally stable. Yet, the scale is also sensitive to change during interventions, for example, in the course of obesity or eating disorder treatment. For instance, decreases in FCQ–T scores have been reported in cognitive-behavioral weight-loss interventions [27, 28], a food craving-related self-help intervention [29], heart rate variability bio-feedback training [30], neurofeedback training [31], approach bias modification training [32], and after bariatric surgery [33].

Validity

A plethora of studies have examined correlates of the FCQ–T, which are too numerous to be reviewed in detail here. Therefore, the description of studies in support of validity of the FCQ–T focuses on the strongest evidence from experimental and longitudinal studies. Yet, some correlates based on descriptive, cross-sectional studies are briefly described. First, sex differences have been consistently found with women having higher FCQ–T scores than men (e.g., [34]). Second, FCQ–T scores are associated with eating disorders and obesity. Specifically, individuals with bulimia nervosa and binge eating disorder have higher FCQ–T scores than individuals without eating disorders, and individuals with obesity have higher FCQ–T scores than individuals with normal weight [35–38]. Of note, however, is that the association between the FCQ–T and (binge-related) eating disorders is much stronger than the association with obesity and, similarly, the positive correlation between FCQ–T scores and body mass index is usually small (e.g., [13, 39]). Third, scores on the FCQ–T are weakly associated with many psychological variables (e.g., personality traits [40, 41]) and strongly associated with other constructs that can be summarized under the umbrella term “uncontrolled eating” such as binge eating, disinhibited eating, emotional eating, hedonic hunger, or food addiction [42, 43].

Construct validity of the FCQ–T is supported by studies that examined food cue reactivity (i.e., behavioral, cognitive-affective, or neural responses to food cues). For example, trait food cravers as identified with the FCQ–T showed a stronger approach tendency towards high-calorie food in a reaction time task than those with low FCQ–T scores [44] and stronger increases in state craving (as measured with the FCQ–S) during performance of a working memory task that included pictures of palatable foods [45]. Scores on the FCQ–T were also weakly correlated with higher craving intensity when participants had to imagine eating their favorite food [46]. Higher FCQ–T scores related to stronger reward-related brain activations [47] and behavioral disinhibition [48] in response to high-calorie versus low-calorie food stimuli. They also weakly correlated with a composite genetic index reflecting the

influence of multiple functional polymorphic dopamine markers, which have been associated with striatal dopamine signaling [49].

Predictive validity of the FCQ–T is supported by studies that examined food intake and changes in body weight. In a sample of children and adolescents, for example, higher FCQ–T scores related to higher liking ratings for high-calorie foods and a stronger tendency to select these foods for consumption in a bogus taste test [50]. In a prospective study, higher FCQ–T scores predicted lower weight loss after bariatric surgery [51]. Support for discriminant validity can be seen in that—as opposed to the FCQ–S—the FCQ–T is largely unaffected by momentary states such as hunger and satiety. For example, FCQ–T scores did not correlate with length of food deprivation (i.e., the time since the last meal) and did not differ substantially before and after eating breakfast [12, 20].

Food Cravings Questionnaire–State

Description

The Food Cravings Questionnaire–State (FCQ–S) measures the intensity of momentary food craving. The questionnaire has 15 items and response categories range from 1 = *strongly disagree* to 5 = *strongly agree* (Table 2). There are no inverted items. Responses to all items are summed up for a total score. Thus, higher scores represent more intense current food craving. Several subscale scores can be also calculated. The FCQ–S has been translated into at least five other languages: Spanish [12], German [13], Italian [52], Portuguese [15, 16], and Korean [53].

Factor Structure

Cepeda-Benito and colleagues [11] found a five-factor structure of the FCQ–S in two samples of undergraduate students:

- An intense desire to eat (Items 1, 2, 3)
- Anticipation of positive reinforcement that may result from eating (Items 4, 5, 6)
- Anticipation of relief from negative states and feelings as a result of eating (Items 7, 8, 9)
- Lack of control over eating (Items 10, 11, 12)
- Craving as a physiological state (i.e., hunger) (Items 13, 14, 15)

The five factors were replicated in some studies [12, 16, 52], including one study in women with anorexia and bulimia nervosa [21]. In contrast to the FCQ–T, however, only partial measurement invariance was found across American and Spanish participants. Moreover, model fit of the five-factor model was poor in a study using a Portuguese version of the FCQ–S [22] and two studies suggested fewer than five factors

Table 2 Items of the Food Cravings Questionnaire–State

Items	Response categories				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I have an intense desire to eat [one or more specific foods]. ^a	1	2	3	4	5
2. I'm craving [one or more specific foods]. ^a	1	2	3	4	5
3. I have an urge for [one or more specific foods]. ^a	1	2	3	4	5
4. Eating [one or more specific foods] would make things seem just perfect.	1	2	3	4	5
5. If I were to eat what I am craving, I am sure my mood would improve.	1	2	3	4	5
6. Eating [one or more specific foods] would feel wonderful.	1	2	3	4	5
7. If I ate something, I would not feel so sluggish and lethargic.	1	2	3	4	5
8. Satisfying my craving would make me feel less grouchy and irritable.	1	2	3	4	5
9. I would feel more alert if I could satisfy my craving.	1	2	3	4	5
10. If I had [one or more specific foods], I could not stop eating it.	1	2	3	4	5
11. My desire to eat [one or more specific foods] seems overpowering. ^a	1	2	3	4	5
12. I know I'm going to keep on thinking about [one or more specific foods] until I actually have it. ^a	1	2	3	4	5
13. I am hungry.	1	2	3	4	5
14. If I ate right now, my stomach would not feel as empty.	1	2	3	4	5
15. I feel weak because of not eating.	1	2	3	4	5

Participants are instructed to indicate the extent to which they agree with each statement right now, at this very moment

^a Items included in the abbreviated Food Cravings Questionnaire–State by Maranhão et al. [22]

(four factors [23] and three factors [13]). Thus—similar to the FCQ–T—support for factorial validity of the FCQ–S is limited as factor structure could only be replicated partially.

Reliability

As for the FCQ–T, the FCQ–S has excellent internal reliability ($\alpha > .90$, [11–13, 54]). Retest-reliability is low (usually $r < .60$, [11, 55]). Yet, what would be considered insufficient values for a trait-related measure is indeed to be expected for the FCQ–S as a state-dependent measure. However, an interesting future avenue would be to examine retest-reliability of the FCQ–S under controlled conditions, for example, after a standardized fasting period or a standardized meal. If such conditions are kept constant across measurement points, it may well be that retest-reliability for the FCQ–S is high. More importantly, however, is that the FCQ–S is sensitive to change during various manipulations: scores increase during food cue exposure (e.g., food pictures) or exposure to real food [52, 54, 56–61] and decrease after exercise [62], methylphenidate ingestion [63], repetitive transcranial magnetic

stimulation [64, 65], infraslow neurofeedback training [66], and food intake [11, 23, 59].

Validity

Construct validity of the FCQ–S is supported by studies that examined associations with momentary states such as current food deprivation and affect. It has consistently be found that a longer food deprivation (i.e., the time since the last meal) relates to higher FCQ–S scores [12, 13, 20, 55, 58], and, in one study, higher current negative affect was moderately correlated with the FCQ–S as well [13]. In a sample of persons with Type 2 diabetes mellitus, higher FCQ–S scores (adapted to refer to carbohydrate-rich foods) related to higher HbA_{1c} levels (indicating long-term blood sugar levels). Moreover, they changed as a function glycaemic control: carbohydrate-related FCQ–S scores decreased in those with lower HbA_{1c} levels (indicating improved glycaemic control) and increased in those with higher HbA_{1c} levels at follow-up measurement.

Predictive validity of the FCQ–S has been supported by studies that examined hedonic responses to food cues and food consumption. For example, higher FCQ–S scores related

to more positive evaluations of high-caloric food in implicit measures such as the Affect Misattribution Procedure [67] and impulsive reactions to pictorial food stimuli [68]. Moreover, higher FCQ–S scores related to higher subsequent food intake in the laboratory [54]. Support for discriminant validity can be seen in that—as opposed to the FCQ–T—the FCQ–S shows weak or no relationships with trait-like eating behaviors (e.g., restrained or disinhibited eating as measured with the Three-Factor Eating Questionnaire [11]) and body mass index [13].

Modified Versions

General Food Cravings Questionnaires

The General FCQs are modified versions of the FCQs developed by Nijs and colleagues [69]. The modifications include translating the scale into Dutch, substituting the word *craving* with an appropriate Dutch description, and references to *one or more specific foods* included in the items of the FCQ–S were rephrased in more general terms (e.g., *something tasty*). For the General FCQ–T (G–FCQ–T), principal component analysis suggested a four-factor structure. Further inspection lead the authors to exclude 17 items, which either had low factor loadings on any of the four factors or loaded equally high on various factors. One additional item was removed because its content did not correspond with the factor on which it loaded. Thus, the G–FCQ–T consists of 21 items. The General FCQ–S (G–FCQ–S) consists of 15 items with a five-factor structure, similar to the FCQ–S.

Psychometric properties of both the G–FCQ–T and G–FCQ–S are largely similar to the original FCQs. These include, for example, excellent internal reliabilities, adequate retest-reliability of the G–FCQ–T across three weeks, moderate-to-high correlations between the G–FCQ–T and other eating behavior traits, and no or small correlations between the G–FCQ–S and these eating behavior traits. Sensitivity to change of G–FCQ–S scores is indicated by decreased scores after food intake [69, 70] and increased scores after sleep deprivation [71]. Similar to the FCQ–T, the G–FCQ–T is also sensitive to change as demonstrated, for example, in decreased scores after bariatric surgery, energy-restricted diets, and mindful eating interventions [72–75].

Although the General FCQs were originally developed in Dutch, the English items are displayed in the article by Nijs et al. [69]. Accordingly, these English versions have also been used in several studies (e.g., [71, 72]). Moreover, the G–FCQ–T has been translated into Korean [76, 77]. Yet, it is unclear what the actual differences to the original FCQs are. When examining the English items of the G–FCQ–T (cf. Table 1 in the article by Nijs et al. [69]), it appears that these are equivalent to the items of the FCQ–T (Table 1). Thus, it seems that—at least when the scale is used in English and not in Dutch—the G–FCQ–T should rather be considered a 21-

item short form of the FCQ–T instead of representing a conceptually different questionnaire. For the G–FCQ–S, it seems that the only difference to the items of the FCQ–S (Table 2) is that items refer to *tasty foods* instead of *one or more specific foods*. Therefore, as craved foods are usually high-caloric and palatable [3], it appears that the conceptual differences between the G–FCQ–S and FCQ–S are minimal.

Food Cravings Questionnaire–Trait–Reduced

As outlined above, the FCQ–T has very high internal reliability and factor structure could only be replicated inconsistently. Moreover, many researchers only analyze (or report) FCQ–T total scores, which might be due to the fact that correlates of the FCQ–T are largely similar across the nine subscales. This motivated the development of a short version of the FCQ–T: the FCQ–T–reduced (FCQ–T–r, [58]). For the FCQ–T–r, 15 of the 39 items of the German FCQ–T that had the highest item–total–correlations were chosen (Table 1). Although the FCQ–T–r was originally developed in German [58], it has since been used and evaluated in English [78], Portuguese [79], French [80], Persian [81], Spanish [26], and Italian [82, 83] as well. A sum score of 50 discriminated between individuals with and without “food addiction” (as measured with the Yale Food Addiction Scale 2.0) with high sensitivity and specificity and has, thus, been proposed as a possible cut-off score that may indicate pathologically elevated, clinically relevant levels of trait food craving [84]. The FCQ–T–r has been recommended as a measure in studies on weight loss and weight maintenance by the Accumulating Data to Optimally Predict Obesity Treatment (ADOPT) Core Measures Project, which selected measures that are reliable, valid, brief, publicly available, and easily administered and scored [85].

The FCQ–T–r has a unidimensional structure [58], which was replicated in several studies [26, 78–80, 82, 83]. The FCQ–T–r has excellent internal reliability ($\alpha > .90$, [26, 55, 78–83]). Retest-reliability over two weeks was excellent for the Persian version ($r = .92$, [81]) and—considering the long time period of six months—was also good for the German version ($r = .74$, [55]). The FCQ–T–r is also sensitive to change as demonstrated, for example, in decreases of scores during a neurofeedback intervention [86] and during mindful eating interventions [87, 88].

Similar to the FCQ–T, construct validity is supported by studies that examined food cue reactivity in the laboratory. For example, higher FCQ–T–r scores predicted stronger increases in state food craving during performance of a working memory task that included pictures of palatable foods [58]. Predictive validity is supported by prospective studies. In female university freshmen, for example, higher FCQ–T–r scores at the beginning of the first semester predicted increases in disinhibited eating as well as decreases in perceived self-regulatory success in weight regulation at the end of the semester [89]. Scores on the FCQ–T–

r predicted thoughts about high-calorie snack foods in daily life as measured with ecological momentary assessment. Moreover, FCQ–T–r scores moderated the relationship between craving for and consumption of these foods in that experiencing a craving more likely translated into consumption of snack foods in individuals with high FCQ–T–r scores than in those with low scores [3]. Scores on the FCQ–T–r also predicted a higher intention–behavior gap in daily life as measured with ecological momentary assessment: those with higher FCQ–T–r scores were less likely to actually restrict their eating behavior on a given day when they intended to do so on the previous day [90]. Finally—similar to the FCQ–T—discriminant validity is supported in that scores on the FCQ–T–r were unrelated to length of food deprivation (i.e., the time since the last meal [55, 58]).

Chocolate-Specific Versions

Chocolate version of the Food Cravings Questionnaire–Trait Rodríguez and colleagues [91] adapted both the English and Spanish FCQ–T for the assessment of chocolate cravings. For this, items were reformulated such that references to food were replaced with references to chocolate. The nine-factor structure and excellent internal reliability of the original FCQ–T was replicated, yet measurement was only partially invariant across British and Spanish women [91]. Validity of the scale was supported in that high trait chocolate cravers as identified with the chocolate-adapted FCQ–T ate more chocolate in a laboratory taste test than low trait chocolate cravers [92].

Chocolate version of the Food Cravings Questionnaire–Trait–reduced For the chocolate version of the FCQ–T–r, the term *chocolate* was incorporated into each item of the German FCQ–T–r, but the English items are also displayed in the article by Meule and Hormes [93]. In contrast to the FCQ–T–r, exploratory factor analysis suggested two factors: one related primarily to thoughts about chocolate and one related primarily to lack of control over chocolate consumption. Internal reliability was excellent for the total scale and the subscales [93]. There are no data on retest-reliability yet, but—similar to the FCQ–T–r—the chocolate-adapted version is sensitive to change as indicated by decreased scores over a ten-day period during which participants had to record their daily chocolate consumption at the end of each day [94].

Construct validity is supported by studies that examined chocolate cue reactivity. For example, trait chocolate cravers as identified with the chocolate-adapted FCQ–T–r rated chocolate pictures as more pleasant, thought more about chocolate following presentation of a pictorial chocolate cue, and showed higher activation in the striatum during this period than those with low chocolate-related FCQ–T–r scores [95]. Similar to the FCQ–T, higher scores on the chocolate-adapted

FCQ–T–r related to stronger approach tendencies towards chocolate stimuli in a reaction time task [96].

Predictive validity is supported by studies that examined chocolate intake. Higher chocolate-related FCQ–T–r scores predicted higher chocolate consumption in the laboratory in participants who showed increases in salivary flow during a chocolate exposure [93]. Furthermore, scores on the chocolate-adapted FCQ–T–r predicted chocolate craving intensity and frequency as well as chocolate consumption quantity and frequency in daily life as measured with ecological momentary assessment [94]. Similar to the FCQ–T and FCQ–T–r, discriminant validity is supported by the absent relationship of scores with current food deprivation (i.e., the time since the last meal [93]).

Chocolate version of the Food Cravings Questionnaire–State.

For the chocolate version of the FCQ–S, references to *one or more specific foods* in items 1–12 of the German FCQ–S were substituted with *chocolate*. The three items (13–15) for the measurement of hunger, which do not allow for a reference to specific foods (Table 2), were not changed. Although the scale was developed in German, the English items are also displayed in the article by Meule & Hormes [93]. In contrast to the original FCQ–S, a clear two-factor structure was found for the chocolate-adapted version representing a chocolate craving factor (Items 1–12) and a hunger factor (Items 13–15). Internal reliabilities were good for the two subscales and the total scale [93]. Similar to the FCQ–S, scores are sensitive to change as they increased during chocolate exposure [93]. Furthermore, scores on the chocolate-adapted FCQ–S increased during a two-week chocolate deprivation in trait chocolate cravers [97] and during approach–avoidance reaction time tasks with pictorial chocolate stimuli on touchscreen devices [94, 96].

Construct validity has been supported in that higher scores on the hunger subscale—but not on the chocolate craving subscale—correlated with longer food deprivation (i.e., the time since the last meal). Moreover, increases in current chocolate craving—but not increases in current hunger—correlated with increases in salivary flow during a chocolate exposure [93]. Predictive validity has been supported by studies that examined hedonic responses to chocolate cues and chocolate consumption. For example, higher scores on the chocolate-adapted FCQ–S related to more positive evaluations of chocolate-containing foods in implicit measures such as the Affect Misattribution Procedure and the Implicit Association Test [97]. When examining interactive effects between the chocolate craving and the hunger subscale, it was found that higher chocolate craving related to more positive evaluations of chocolate only in hungry participants [98]. Moreover, higher scores on the chocolate craving subscale—but not on the hunger

subscale—predicted higher chocolate consumption in the laboratory [93]. Similar to the FCQ–S, discriminant validity has been supported by absent relationships with body mass index [93].

Short Versions of the Portuguese Food Cravings Questionnaires

Recently, Maranhão and colleagues suggested abbreviated forms of a Portuguese version of the FCQs [22]. The short form of the FCQ–T consists of eight items, which stem from the original FCQ–T's subscales *thoughts or preoccupation with food* (4 items), *having intentions and plans to consume food* (1 item), *emotions that may be experienced before or during food cravings or eating* (1 item), *cues that may trigger food cravings* (1 item), and *lack of control over eating* (1 item; Table 1). The short form of the FCQ–S consists of five items, which stem from the original FCQ–S's subscales *intense desire to eat* (3 items) and *lack of control over eating* (2 items; Table 2). Both the abbreviated FCQ–T and the abbreviated FCQ–S had a unidimensional structure.

Recommendations

Different Versions of the FCQs

For the assessment of trait food craving, there are six versions, which differ in item content and number of items. The original FCQ–T has 39 items and does not specify certain foods that participants should think of when completing the scale [11]. There are three short versions of this questionnaire that have either 21 items (G–FCQ–T, [69]), 15 items (FCQ–T–r, [58]), or 8 items (abbreviated FCQ–T, [22]). For the original 39-item FCQ–T and for the 15-item FCQ–T–r, there are chocolate-adapted versions that include the very same items except that they specifically refer to chocolate [91, 93]. Thus, researchers have to decide whether they want to measure food craving in general or chocolate craving in particular and whether they need to do this more comprehensively by using the longer versions or more efficiently by using the shorter versions. Using the shorter versions may come at the expense of losing information as they assess fewer aspects of food craving than the full versions. For example, both the FCQ–T–r and the abbreviated FCQ–T do not include any items of the original FCQ–T's subscales *anticipation of positive reinforcement that may result from eating*, *anticipation of relief from negative states and feelings as a result of eating*, *craving as a physiological state*, and *guilt from cravings and/or for giving into them*. However, given the limited factorial validity of the FCQ–T, shorter versions may be preferred over the full versions, particularly when there is no need to analyze the subscales of the FCQ–T separately.

For the assessment of state food craving, there are three different versions of the FCQ–S with 15 items and one version with five items. The original FCQ–S measures state craving for one or more particular foods, yet these are not specified (i.e., each participant can think of different foods when completing the scale [11]). The G–FCQ–S measures state craving for tasty foods (i.e., the type of foods are broadly defined, but each participant can still think of different foods within the category of tasty foods [69]). The chocolate-adapted version of the FCQ–S measures state craving for chocolate-containing foods [93]. In addition, each of these three questionnaires include a hunger subscale, items of which do not refer to specific foods. The abbreviated FCQ–S only has five items, which do not include any items from the hunger subscale [22]. Thus, researchers need to decide for which type of foods they want to measure current food craving (unspecified, tasty foods, chocolate) and, in the case of the FCQ–S, whether they want to use the original 15-item version or the 5-item short form. The abbreviated FCQ–S may be preferred over the original version in certain cases (e.g., when the questionnaire is completed several times in a laboratory experiment). Yet, the original version may be preferable in studies in which assessment of current hunger provides essential information, as these items are not included in the short version.

Trait Vs. State Food Craving

In the previous sections, it has been demonstrated that the FCQ–T and FCQ–S both show discriminant validity, that is, that trait and state food craving are distinguishable concepts. While the FCQ–S is affected by momentary states and manipulations such as current food deprivation, food cue exposure, and food intake, the FCQ–T is largely unaffected by such factors and scores are more stable over time. However, this does not mean that the FCQ–T and FCQ–S are independent from each other—they are indeed positively (yet weakly) correlated [55]. It may be that individuals with high FCQ–T scores (i.e., trait food cravers) just have a higher likelihood to experience a food craving at the moment of data collection as they generally experience food cravings more frequently. Another possible explanation may be that the general setting in food-related studies (e.g., answering numerous questions on food and eating behavior) may induce stronger food craving in those with higher FCQ–T scores, which would be in line with the food cue reactivity findings described above. Thus, although trait and state food cravings can be differentiated, they are not independent from each other and researchers who assess both should expect that scores of the FCQ–T (or any of its derivatives) and the FCQ–S are correlated.

Craving Vs. Hunger

A food craving refers to a strong desire to eat a specific type of food while feelings of hunger refer to the absence of fullness [99]. Moreover, a food craving can also occur without being hungry, that is, food deprivation is not a necessary condition for experiencing food cravings [100]. The FCQ–S includes a subscale for measuring hunger (Items 13–15; Table 2) and the FCQ–T includes a subscale entitled *craving as a physiological state* (Items 11–14; Table 1), which partially assesses feelings of hunger. Yet, is it possible to differentiate between craving and hunger when using the FCQs?

As stated above, factorial validity of the FCQ–T is limited, that is, differentiating between the nine subscales may not be meaningful. Moreover, the *craving as a physiological state* subscale had the lowest internal reliability of all subscales in one study [13], and none of the hunger-related items are included in the short versions of the FCQ–T, which were developed through item reduction based on factor analyses [69], item-total correlations [58], or conceptual considerations (i.e., including only items that assess core aspects of food craving [22]). Thus, it may be that the hunger-related items of the FCQ–T are psychometrically unsound. This interpretation would also be in line with findings from other measures that include hunger-related items such as the hunger subscale of the Three-Factor Eating Questionnaire. Here, it has been found that—although the questions do not refer to the present moment—scores on the hunger subscale were influenced by participants' current hunger level [101]. Taken together, these findings suggest that it may be hard for participants to evaluate feelings of hunger in general (and their impact on eating) and to differentiate them from current hunger.

While assessment of hunger feelings with the FCQ–T seems to be problematic, it may be that the differentiation between current food craving and hunger is more straightforward. There is, indeed, some evidence for this. As described above, length of food deprivation correlated with current hunger, but not current craving in a study with the chocolate-adapted version of the FCQ–S [93]. Moreover, only current chocolate craving, but not current hunger, related to chocolate cue-induced salivary flow and chocolate consumption. Thus, it seems that current craving and hunger can indeed be differentiated, at least in certain circumstances.

In contrast, both craving and hunger increased during chocolate cue exposure [93]. This is in line with other studies showing that scores on both the craving-related subscales and the hunger subscale of the FCQ–S usually increase during food exposure (e.g., [57]). Thus, it seems that although food craving and hunger can be differentiated in certain circumstances, they are not independent from each other and can also co-occur. An interesting future avenue would be to examine whether this is a methodological artifact as it may be hard for participants

to differentiate between food craving and general feelings of hunger when completing the scale. For example, studies may investigate whether providing clear definitions of and highlighting the differences between both constructs in the questionnaire's instructions lead to a clearer differentiation (e.g., with increases only in food craving during food cue exposure and hunger scores remaining stable). Furthermore, it may be worthwhile to examine interactive effects between food craving and hunger when predicting food consumption or other outcome variables, which have rarely been considered in the extant literature [98].

Comparison with Other Food Craving Measures

There are several self-report measures for the assessment of food cravings other than the FCQs, the most widely used of which is the Food Craving Inventory (FCI; Fig. 1; [102]). The FCI measures the frequency of cravings for specific foods over the past month, which can be separated into four classes: high-fat foods, sweet foods, carbohydrate-rich foods/starches, and high-fat fast foods. As the FCQ–T and its derivatives refer to food cravings in general or to one specific food (e.g., chocolate), researchers may want to prefer using the FCI when cravings for different type of food groups need to be assessed. However, because the FCI names specific foods, it necessitates cultural adaptations when applied in different countries. Indeed, there are other versions for which the type of foods were adapted to be more suitable for the British [103], Spanish [104], German [105], Japanese [106], and Brazilian [107] population. These different versions include different foods, numbers of items, and subscales, and may, therefore, not be comparable across studies. Thus, the FCQ–T and its short versions may be more suitable for cross-cultural research [91, 108].

For the assessment of chocolate craving, alternative measures are the Attitudes to Chocolate Questionnaire (ACQ) and the Orientation to Chocolate Questionnaire (OCQ; Fig. 1). The ACQ has been originally developed as a three-dimensional, 24-item questionnaire [109]. Yet, subsequent studies showed that a 22-item, two-factor structure should be preferred, which includes a factor for chocolate craving and a factor for feelings of guilt associated with chocolate consumption [110–112]. The OCQ is a 14-item, three-dimensional questionnaire measuring chocolate craving (approach), avoidance of chocolate, and guilt [113]. The chocolate-adapted FCQ–T (but not the chocolate-adapted FCQ–T–r) includes a subscale on feelings of guilt after eating chocolate as well. Thus, researchers who want to measure chocolate-related guilt in addition to chocolate craving, but want to do this with a shorter questionnaire than the chocolate-adapted FCQ–T, may want to prefer using the ACQ or OCQ. Moreover, the OCQ additionally measures avoidance behavior in relation to chocolate, which are not included in the other questionnaires.

If researchers need to measure both trait and state food craving, an alternative measure is the Craving Experience Questionnaire (CEQ; Fig. 1). It includes a 10-item form for measuring current craving strength and a 10-item form for measuring craving frequency [114]. Each form has three subscales: intensity, imagery, and intrusiveness. For each form, the type of substance/food can be specified as well as the time point (for the strength form) or the time frame (for the frequency form) that the items refer to. Thus, the scales are well suited for comparative studies that measure craving for different substances (including food). The rationale behind the CEQ was to develop a craving measure that purely assesses the cognitive aspects of craving experiences (i.e., craving intensity, cognitive images and intrusive thoughts about the substance) without confounding other aspects such as consumption behavior and outcome expectancies. Thus, it differs from the rationale behind the FCQs that aimed to develop measures to assess the multidimensional nature of craving experiences (including all the aforementioned aspects). Future research is needed that examines whether the two measures produce divergent findings in food craving studies or whether findings with both scales may actually have more commonalities than differences although they were derived from different approaches.

Besides these food craving measures, there are others such as the Control of Eating Questionnaire [115], the Questionnaire on Craving for Sweet and Rich Foods [116], or the Food Approach and Avoidance Questionnaire [117]. However, these have yet received little attention in the literature. Comprehensive overviews of different food craving questionnaires are also provided elsewhere [118–120].

Conclusions

The FCQs and their modified versions have excellent internal reliability. Expectedly, the FCQ–T (and its derivatives) has higher retest reliability than the FCQ–S as the FCQ–S is sensitive to situational changes such as food deprivation and food intake. However, while the FCQ–T is largely unaffected by such momentary states, it is also sensitive to change during weight-loss treatments and other interventions. Numerous experimental and longitudinal studies support validity of the FCQs. Yet, evidence for factorial validity is inconsistent, and, thus, the use of total scores or of short versions may be preferable.

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