Development and Validation of the Food-Craving Inventory

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Abstract

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Objective: The primary aim of this study was to develop and validate the Food-Craving Inventory (FCI), a self-report measure of specific food cravings.

Research Methods and Procedures: In a preliminary study, participants ($n = 474$) completed the initial version of the FCI. The results from this study were used in developing the revised FCI. Participants ($n = 379$) completed the revised FCI in the primary study designed to develop a self-report measure of specific food cravings.

Results: Common factor analysis yielded four conceptual factors (subscales) that were interpreted as high fats, sweets, carbohydrates/starches, and fast-food fats. Confirmatory factor analysis found that the four factors could be modeled as dimensions (or first-order factors) of a higher order construct—food craving. Test–retest and internal consistency analyses indicated good reliability for the total score and each of the subscales. Subscale scores were compared with scores on the Three Factor Eating Questionnaire and a conceptual measure of food craving. We found support for the content, concurrent, construct, and discriminant validity of the FCI.

Discussion: The FCI was found to be a reliable and valid measure of general and specific food cravings. The FCI can be used in research related to overeating and binge eating. Also, it may be useful in treatment studies that target obesity and/or food cravings.

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Introduction

Food craving has received increased attention from researchers in recent years (1–6). It has been suggested that food cravings play a role in maintaining excessive eating patterns observed in binge eating, bulimia, and obesity (7). Although anecdotal evidence suggests that food cravings precipitate binge eating, some research has failed to find that food craving leads to binge eating or obesity (4,7,8). Of particular importance is the finding that not all who crave foods develop disturbed eating patterns (3). There is limited agreement pertaining to the biological, psychological, and behavioral factors that determine food cravings. To date, three primary themes have been explored regarding the relationship between food cravings and eating disturbances. These are the physiological or homeostatic theories (5–11), learning theories involving sensory aspects of food (5,7,11–13), and psychological or affect-related theories (2,4,10,11).

Several studies have investigated the role of cravings for specific food classes (e.g., carbohydrates, sweets, and fats) and have demonstrated differences in the types of foods craved according to gender, age, hunger state, time of day, and phase of the menstrual cycle (1,2,5,12–20). Carbohydrate craving has been most frequently studied. Several investigative teams have hypothesized that neurotransmitters (e.g., serotonin) may play a role in carbohydrate cravings, obesity, and depression (5,10,21). Craving has also been viewed as an equivalent to addiction, and as such, is dependent on the ratio of dopamine to acetylcholine in the nucleus acumbens (22). Research on craving for specific foods or macronutrients has been limited by the absence of a reliable and valid measure of specific food cravings. A review of the food craving literature identified four measures for food cravings that have been used in previous studies (4,8,10,23). However, these scales either measure the construct of food craving in general or have not been

empirically validated. In developing this measure of specific food cravings, we found that there has been considerable disagreement about the definition of food cravings (2). Two definitions have been most commonly used: behavioral and subjective descriptions of food craving. To define a craving as behavior discounts the cognitive nature of the cravings (7) and does not differentiate cravings from hunger. Much of the literature to date has relied on participants' subjective interpretation of the term craving or has not delineated the point at which a desire for a particular food becomes a craving (2,7). With these issues in mind, we expanded the definition of craving proposed by Weingarten and Elston (7,8) (i.e., "an intense desire to consume a particular food or food type that is difficult to resist"). This definition adopts the perspective that food craving is an internal experience with cognitive and emotional (drive or motivational) properties. In the first of two studies, we tested for psychometric differences between two response formats to define craving: subjective vs. behavioral.

It is unclear whether biological, cognitive, learning, or some combination of these factors is responsible for the phenomenon of food cravings. However, there is evidence that people tend to crave particular classes of foods, especially sweets, carbohydrates, and high-fat foods (2,5,15,17,20,24). For example, a recent study investigated the frequency of food cravings for individual foods and found the highest frequencies of reported cravings for chocolate, pasta, desserts, steak, and chicken (24). However, existing craving scales measure the general experience of food craving, rather than the specific foods craved. For example, the conceptual food craving questionnaire of Hill et al. (10) consists of five items assessing the strength/intensity and frequency of food cravings. This scale is limited by the small number of items as well as its inability to assess cravings for different types of foods. Cepeda-Benito et al. (23) developed the State and Trait Food Cravings Questionnaire, which measures the stable (trait) and situational (state) dimensions of food cravings. This measure also focuses on the general aspects of food cravings rather than on the types of foods that people crave, i.e., specific food cravings. Harvey et al. (4) developed a measure requiring participants to rate the degree to which 40 different foods had been desired over the previous week. The scales consist of five subscales: low-fat protein foods, high-fat protein foods, complex carbohydrates, other fats, and miscellaneous. Although this scale measures specific foods craved, the subscales were determined by grouping foods in terms of macronutrient content. Furthermore, no psychometric tests of the reliability and validity of this measure were conducted.

The assessment of specific food cravings is an important objective in that cravings for specific types of foods (and subsequent consumption) have strong implications for obesity and related health problems. The development of a psychometrically sound measure of specific food cravings is an important first step for future research in this area regardless of the etiology of such cravings. Because previous research has suggested that individuals crave particular classes of foods, one aim of this investigation was to determine whether craving responses to different foods would yield a factor structure consisting of foods with similar macronutrient content (e.g., foods high in dietary fat). (Factor analysis is a data reduction technique used to discover simple patterns in the relationships among variables (or items). The technique is based on the covariance matrices of the individual items and seeks to discover whether observed variables can be explained in terms of a smaller number of variables called factors. Factors are determined solely on the basis of statistical properties; items load on a given factor according to their intercorrelations with other items of the scale. The meaning of a factor is based on the primary content of the items that load on a factor. In this study, we were interested in whether factors would be formed on the basis of similarities of foods, e.g., foods that were high in fat or high in sugar.) In the development of the Food-Craving Inventory (FCI), the internal consistency, test–retest reliability, and convergent and divergent validity of the subscales were tested. We also tested whether food craving should be conceptualized as one construct or as a multidimensional construct. The FCI was developed in two studies. In a preliminary study, two craving-response rating scales were tested and food items were reduced in number using a statistical procedure called factor analysis.

Preliminary Study

Research Methods and Procedures

Participants

The participants were 474 college students. The demographic characteristics of the sample are summarized in Table 1. The sample was primarily white, non-obese (i.e., body mass index [BMI] < 30 kg/m^2) women.

Assessment Measures

FCI. The FCI was designed to measure specific food cravings using two subscales: subjective cravings and consumption of particular foods. We chose to develop these subscales to distinguish between a craving for a food and consumption of that food. Because previous research had often defined craving as consumption, our intention was to determine whether craving and consumption were psychometrically different constructs. The first subscale (subjective) assessed the frequency of subjective cravings for 47 different foods. The foods were chosen according to the classifications provided by Harvey et al. (4) and additional foods were included on the basis of theory and literature

Table 1. Demographic characteristics of samples for preliminary and primary studies

	Preliminary study (n = 474)				
BMI group	**Total sample**	**<20 (n = 109)**	**20 to 25 (n = 260)**	**25 to 30 (n = 85)**	**>30 (n = 19)**
BMI mean (SD)	22.54 (3.55)	18.77 (0.96)	22.05 (1.40)	26.57 (1.29)	32.41 (3.96)
Age mean (SD)	20.30 (2.98)	19.70 (1.40)	20.19 (2.75)	21.42 (4.63)	20.11 (1.71)
Percentage of total		23.00	54.85	17.93	4.01
Gender (percentage of group)					
Women	71.93	94.57	72.61	46.25	61.11
Men	28.07	5.43	27.39	53.75	38.89
Race (percentage of group)					
African American	8.83	4.81	7.63	16.05	15.79
Hispanic	2.65	1.92	2.41	4.94	0.00
Asian	5.74	9.62	6.43	0.00	0.00
White	78.59	78.85	79.12	75.31	84.21
Other	4.19	4.81	4.42	3.70	0.00
	Primary study (n = 379)				
BMI group	**Total sample**	**<20 (n = 38)**	**20 to 25 (n = 124)**	**25 to 30 (n = 120)**	**>30 (n = 75)**
BMI mean (SD)	27.00 (6.64)	18.46 (0.93)	22.17 (1.33)	27.14 (1.66)	36.03 (6.58)
Age mean (SD)	37.85 (13.80)	24.65 (7.10)	32.09 (13.17)	37.88 (13.94)	40.39 (11.13)
Percentage of total		10.02	32.72	31.66	19.78
Gender (percentage of group)					
Women	79.84	92.31	81.52	62.50	80.88
Men	20.16	7.69	18.48	37.50	19.12
Race (percentage of group)					
African American	30.30	23.08	20.00	32.99	40.58
Hispanic	1.10	0.00	1.05	1.03	1.45
Asian	2.40	11.54	2.11	2.06	0.00
White	64.10	61.54	73.68	61.86	55.07
Other	2.10	3.85	3.16	2.06	2.90

BMI, body mass index.

review. The second subscale (behavioral) was intended to measure the extent to which participants gave in to craved foods. Participants completed the subjective and behavioral subscales for the same 47 foods. A portion of the scale appears below.

A craving is defined as an intense desire to consume a particular food (or food type) that is difficult to resist.

Subjective. Over the past month, how often have you experienced a craving for the food? 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always/almost every day.

Behavioral. Of those times in the past month during which you craved a particular food, how often did you "give in" to the craving and eat the food? 1 = never, 2 = rarely (once or twice), 3 = sometimes, 4 = often, and 5 = always/almost every time.

Validation Measures

Three Factor Eating Questionnaire (TFEQ). The TFEQ is comprised of three scales measuring dietary restraint, disinhibition, and hunger (25). The disinhibition and hunger scales of the TFEQ were used to assess the concurrent validity of the FCI. Measures of internal consistency for the TFEQ subscales exceeded 0.80 and test–retest reliability estimates ranged from 0.91 to 0.93. The restraint scale was

used to assess discriminant validity, because previous research had shown that dietary restraint was not related to cravings (8).

Conceptual Craving Scale (CCS). An adaptation of a craving measure created by Hill et al. (10) was used to assess concurrent validity. The original scale used visual analog scales; the current adaptation was modified to conform to a 5-point Likert rating scale. The anchors for each item were modified according to the wording of the item (e.g., from never to always). Two items comprise the frequency subscale of the measure and three items form the intensity subscale.

Procedure

Participants completed a demographic questionnaire, FCI, TFEQ, and CCS.

Results

Exploratory factor analyses were conducted on the subjective and behavioral subscales to determine the extent to which various foods represented underlying factors. Because we suspected that all or some of the food craving factors were correlated, the common factors method of analysis, using an oblique (PROMAX) rotation of the correlation matrices, was used to identify three factors that could be meaningfully interpreted (26). The Scree plot indicated a three-factor solution. The three factors were labeled high fats, fruits and vegetables, and sweets. It should be noted that the subscales were labeled according to subjective interpretation of the items that loaded together on a single factor; no macronutrient analysis of the foods was conducted. The same conceptual factors emerged for both the subjective and behavioral subscales and accounted for 31.3% of the variance in the subjective scale and 33.5% of the variance in the behavioral scale.

To test concurrent and discriminant validity, correlation analyses were conducted among scores on the FCI, TFEQ, and CCS. The subjective and behavioral scales and their subscales were highly intercorrelated ($r_{(469)} = 0.70$, $p < 0.01$), indicating shared variance between the subscales. Neither the total scores of the FCI nor the subscales were correlated highly ($r < 0.35$) with the TFEQ or the CCS. However, the CCS subscales were correlated with the disinhibition and hunger scales of the TFEQ. Taken together, these results provided only modest support for the concurrent validity of the original FCI.

Discussion

Careful review of the results of this preliminary study pointed to areas of improvement for the FCI. The three areas of concern were:

1. The participant pool consisted of college students. The age range was limited, and most participants had BMIs in the normal range (i.e., 20 to 25 kg/m^2). These characteristics of the sample limited the use of the scale with other groups.
2. The subjective and behavioral subscales were highly correlated, indicating a large amount of shared variance. As such, the subjective and behavioral scales did not seem to be measuring unique constructs.
3. The clinical use of the fruits and vegetables subscales was questioned.

Because of these observations, we revised the FCI and the reliability and validity of the revised measure was tested in the primary study. This preliminary study was informative in helping to distinguish between the subjective and behavioral constructs. In the next study, we elected to retain the subjective definition because participants may not have been able to discriminate between giving in to a craving and eating a specific food. Furthermore, the preliminary study allowed the identification of an initial factor structure that could be expanded to maximize clinical use.

Primary Study

Research Methods and Procedures

Based on the factor structure identified in the preliminary study, the scale was expanded to include more foods from the high fats and sweets categories. Foods that are high in carbohydrate content were also added. To assess content validity, these items were judged by eight persons in the field of eating behavior who assessed the representativeness of each item to its respective macronutrient category (fats, sweets, or carbohydrates/starches). The judges first assessed the classification of foods for the three macronutrient categories on a 7-point Likert scale ranging from not at all representative to very representative. Items that were judged to be in more than one category or that received low representativeness scores were eliminated. From this procedure, 37 items were retained. Of these, 14 items were hypothesized to form a fats subscale, 10 on a sweets subscale, and 13 on a starches (complex carbohydrates) subscale.

The behavioral scale was deleted based on the reasoning described previously. Furthermore, an attempt was made to recruit a more diverse participant sample by seeking more mature individuals with a range of BMI values from the community and university populations.

Participants

A total of 379 participants were drawn from university ($n = 85$) and community sources ($n = 294$). The demographic characteristics of the sample are summarized in Table 1. The age of participants ranged from 16 to 79 years. The sample was racially diverse and included individuals of varying BMI classifications. Approximately 38.8% of the

Table 2. Factor loadings of the Food-Craving Inventory—exploratory and confirmatory analysis*

	High fats		Sweets		Carbohydrates/ starches		Fast-food fats	
Fried chicken	**0.86**	*0.69*	−0.10		−0.21		0.20	
Sausage	**0.78**	*0.68*	0.09		−0.07		0.04	
Gravy	**0.61**	*0.67*	−0.18		0.14		0.24	
Fried fish	**0.73**	*0.67*	−0.03		0.06		0.01	
Bacon	**0.77**	*0.65*	0.00		0.05		−0.01	
Corn bread	**0.52**	*0.64*	0.14		0.31		−0.17	
Hot dog	**0.68**	*0.62*	0.09		−0.06		0.14	
Steak	**0.61**	*0.50*	0.04		−0.12		0.25	
Brownies	−0.03		**0.73**	*0.75*	0.16		−0.01	
Cookies	−0.12		**0.82**	*0.72*	0.03		0.12	
Candy	−0.11		**0.68**	*0.72*	−0.08		0.34	
Chocolate	−0.38		**0.84**	*0.63*	0.02		0.21	
Donuts	0.33		**0.61**	*0.63*	−0.06		−0.08	
Cake	0.15		**0.73**	*0.62*	−0.08		−0.01	
Cinnamon rolls	0.16		**0.69**	*0.62*	−0.09		−0.05	
Ice cream	0.20		**0.48**	*0.59*	0.06		0.04	
Rolls	0.25		−0.05		**0.63**	*0.71*	0.06	
Pancakes or waffles	0.03		0.41		**0.51**	*0.69*	−0.18	
Biscuits	0.22		0.01		**0.56**	*0.66*	−0.13	
Sandwich bread	0.04		−0.11		**0.72**	*0.64*	0.20	
Rice	0.24		−0.23		**0.60**	*0.64*	−0.05	
Baked potato	0.19		0.07		**0.50**	*0.59*	0.09	
Pasta	−0.04		−0.05		**0.68**	*0.52*	0.27	
Cereal	−0.25		0.12		**0.77**	*0.52*	0.12	
Hamburger	0.49		0.10		−0.10		**0.51**	*0.73*
French fries	0.14		0.00		0.14		**0.69**	*0.73*
Chips	0.21		0.04		0.02		**0.63**	*0.60*
Pizza	0.00		0.20		0.14		**0.57**	*0.56*

***Bold type** denotes the items on each subscale. The left column for each factor displays the factor loadings of the exploratory factor analysis. *Italic type* denotes the factor loadings from the confirmatory analysis. A criterion of 0.45 was used as the cutoff for inclusion on a factor.

sample had a BMI in excess of 27 kg/m^2, the cutoff for moderately overweight. A subset of the sample (n = 49) returned after 2 weeks to complete a retest. An additional subset of the sample (n = 138) completed the validation measures, which were the same as those used in the preliminary study.

Results

Exploratory Factor Analysis

Data from approximately one-half of the sample were randomly selected and used to conduct the exploratory factor analysis. Data were again analyzed using a common factor analysis with an oblique (PROMAX) rotation. The Kaiser-Meyer-Olkin measure of sampling adequacy and the Bartlett's test of sphericity were calculated to assess the appropriateness of the data for factor analysis. The Kaiser-Meyer-Olkin index was 0.894 and the Bartlett's test was highly significant ($p < 0.0001$), indicating that the data were appropriate for analysis. Items were retained if they had a factor loading of 0.45 or higher and if they loaded on only one factor. This procedure identified four factors that were interpreted as high-fat foods, sweets, starches (complex carbohydrates), and fast-food fat (Table 2). The Scree plot indicated a four-factor solution that accounted for 56.70% of the total variance. (To investigate the possibility

of gender-based food preferences driving the factor structure, a separate exploratory analysis was conducted using only female participants. The results yielded the same four-factor solution. There were not enough male participants to conduct the analyses for both genders; future research should investigate the stability of the factor structure across genders.) Furthermore, these four factors were strongly correlated (0.43 to 0.87), suggesting that modeling them as dimensions of a higher-order food craving construct was tenable. As in the preliminary study, the factors were labeled according to the perceived similarities of the foods loading together on one factor. No attempt was made to analyze the true macronutrient values of the foods. The fast-food fat factor was unexpected; it is likely that the macronutrient content of the foods in this factor does not differ considerably from the foods included in high-fat factor and that it emerged as a separate subscale due to the situational specificity or availability of these foods.

The high-fats factor consisted of 10 items that are high in caloric and fat content. The sample items included fried chicken, sausage, and butter. The sweets factor consisted of nine items and included items such as chocolate and ice cream. The starches factor has nine items such as baked potato and pasta. The final factor, fast-food fats, was not predicted. However, analysis of the four items that loaded on the fast-food fats scale identified a distinct theoretical difference from the high-fats factor. These items, although high in fat and calorie content, are also easily accessible and would be classified as junk food. These four items are pizza, hamburgers, French fries, and chips. (Interested readers are invited to contact the corresponding author for information regarding the frequency for which specific foods were craved.)

Confirmatory Factor Analysis

Using LISREL8, a series of confirmatory factor analyses on the remaining one-half of the sample was conducted. First, a model in which the four factors were treated as separate (but correlated) constructs (i.e., a first-order model) was estimated. The fit of this model was adequate, but not optimal because the root mean-square error of approximation (RMSEA) was 0.069 and the Comparative Fit Index (CFI) was 0.85. RMSEA values of 0.08 or less and CFI levels approaching 0.90 are considered desirable. Because these indices were not optimal, two items that had high loadings across multiple factors (i.e., pie and butter) were eliminated. When these items were removed from the model, the RMSEA improved to 0.065 and the CFI improved to 0.88, suggesting better fit. These revisions yielded a 28-item inventory with eight items on each of the high-fats, sweets, and carbohydrates/starches scale and four items on the fast-food fats scale.

Two more models were then estimated: a model in which the four factors were treated as separate (but correlated) constructs (i.e., a first-order model) and a model in which the four factors were treated as dimensions (first-order factors) of an overall higher-order construct of craving. The models had highly similar fit indices (RMSEA = 0.88, CFI = 0.88 for both models) suggesting that the higher-order factor model fit the data. Furthermore, the correlations among the first-order dimension were high (0.54 to 0.81) and the loadings of these first-order factors to the higher-order craving construct ranged from 0.65 to 0.93 ($p < 0.01$). In summary, these analyses support modeling the specific food craving factors as four facets of one higher-order construct called food craving.

Reliability Analyses and Tests of Concurrent Validity

The entire sample was used to calculate the reliability and concurrent validity analyses. The reliability of the four subscales and the higher-order craving factor was calculated using coefficient-α, and the reliability indices of the scales were within acceptable ranges: total score = 0.93, high fats = 0.86, carbohydrates/starches = 0.84, sweets = 0.86, and fast-food fats = 0.76. Test–retest reliability coefficients were also within acceptable ranges: total score = 0.86, high fats = 0.91, carbohydrates/starches = 0.79, sweets = 0.87, and fast-food fats = 0.87.

The concurrent validity of the FCI was assessed using the CCS and the disinhibition and perceived hunger scales of the TFEQ. The pattern of correlations reveals that the FCI total score and the four subscales were highly and significantly ($p < 0.01$) correlated with the frequency scale of the CCS (total score = 0.68, high fats = 0.84, sweets = 0.78, carbohydrates = 0.87, fast-food fats = 0.76). The CCS intensity scale was significantly correlated with the FCI total score (0.33) and the sweets subscale (0.48). The FCI total score and all four subscale scores were highly correlated with perceived hunger (total score = 0.52, high fats = 0.31, sweets = 0.51, carbohydrates = 0.42, fast food-fats = 0.52), but only moderately correlated with disinhibition (total score = 0.27, high fats = 0.14, sweets = 0.37, carbohydrates = 0.19, fast-food fats = 0.18).

The discriminant validity of the FCI was assessed using the restraint scale of the TFEQ. Neither the FCI total score nor any of the FCI subscales were significantly correlated ($p > 0.1$) with dietary restraint as measured by the TFEQ, which supports the discriminant validity of the FCI.

Group Comparisons

Exploratory analyses found that obese individuals (BMI > 30 kg/m^2, $n = 88$) were more likely than normal-weight participants (BMI = 20 to 25 kg/m^2, $n = 115$) to crave high fats ($t_{(191)} = 3.075$, $p < 0.01$). The obese group had a mean fats subscale score of 2.41 (SD = 0.86) vs. 2.06 (SD = 0.76) for the normal-weight group. The obese and normal-weight groups did not differ in their cravings of any of the other three subscales or on the total craving score. The high-fats subscale scores were correlated with BMI

($r_{(355)} = 0.216$, $p < 0.001$). BMI was also related to the total craving score ($r_{(355)} = 0.128$, $p < 0.05$). None of the other FCI subscale scores was correlated with BMI.

We attempted to identify participants who craved a particular class of food while not endorsing cravings for other classes of foods. This classification of participants (labeled specific-cravers) was defined as participants who scored above the sample mean on one FCI subscale but below the mean on the other three FCI subscales. It should be noted that this definition is arbitrary and meant only to identify those individuals who were more likely to endorse cravings for a particular class of food (relative to the rest of the sample) while not reporting cravings for the other classes. The results revealed that only a small proportion of the sample ($n = 75$; 19.79%) could be classified as specific-cravers. Analysis of the specific-cravers revealed that 11 could be identified as high-fat cravers, 24 as sweet cravers, 18 as carbohydrate/starch-cravers, and 22 as fast-food fat-cravers. A χ^2 test for goodness of fit found that these proportions were not significantly different ($\chi^2_{(3)} = 5.27$, $p = 0.15$).

An ANOVA tested whether the various types of specific food cravers differed in terms of BMI and found that the groups differed significantly ($F_{(3,67)} = 3.708$, $p < 0.05$). Scheffe tests found that the high-fat cravers had a higher mean BMI (mean = 29.84, SD = 7.81) than the starch-cravers (mean = 23.01, SD = 4.26) but were not significantly different from either the sweet-cravers (mean = 26.01, SD = 5.00) or the fast-food fat-cravers (mean = 25.42, SD = 4.85). Only 14 specific cravers of any type completed the validity measures, preventing comparisons across these variables.

Discussion

The primary aim of this study was to develop and validate the FCI, a self-report measure of specific food cravings. A preliminary study found that the subjective and behavioral measures of food craving were highly correlated. Given this finding, in the primary study, only the subjective definition of food craving was used. From a face validity standpoint, the subjective scale seems to measure the construct of a food craving that either may be resisted or may lead to eating behavior. Food craving as measured by the FCI is a motivational (internal state) more like the construct measured by the perceived hunger scale of the TFEQ. The typical finding with the TFEQ is that perceived hunger and disinhibition are highly correlated (25). The conceptual craving scale used in this study was strongly related to both perceived hunger and disinhibition. However, the FCI was more highly correlated with the perceived hunger scale, lending support to the distinction between desiring a food in response to external stimuli (i.e., disinhibition) and craving a food as a result of an internal state (hunger). This distinction suggests that food craving may be best conceptualized as a motivational drive with affective components (10).

These results indicate that specific foods that are craved may be as informative as the general subjective experience of a craving, as measured by previous craving questionnaires (7,8,10,23). Our findings support the notion that food craving is best viewed as a single construct with four correlated dimensions related to specific food cravings. As such, food craving seems to be a single construct, indicating that general food cravings may be as informative as measures of specific foods craved. However, the measurement of specific foods seems to have additional merit, as evidenced by the fact that obese and non-obese participants differed across specific subscale scores but not in total scores.

Based on the findings of the first study, we hypothesized that factor analysis would identify three dimensions: craving for dietary fats, sweets, and starches. These three dimensions, plus a fourth (unexpected) factor called fast-food fats, were identified by factor analysis. Analysis of the food craving patterns of the participants in this study revealed that only a modest proportion of the sample could be identified as a specific craver of any particular class of food. However, it is interesting that at least some individuals report primarily craving particular food classes. Two of these food classes included foods high in carbohydrates, i.e., the sweets and starch scales. Carbohydrate craving has been a primary focus of craving research (5,10,21,24). The FCI may be useful for defining carbohydrate cravers, but the findings of this initial study suggest that specific carbohydrate craving is not common. The finding that fat cravers had higher BMIs compared with other specific cravers may be of interest to obesity researchers. In this sample, fat cravers had an average BMI (29.84 kg/m^2) that is near the typical cutoff BMI value (i.e., BMI $>$ 30 kg/m^2) for defining obesity. This finding suggests that at least a modest subgroup of obese adults have significant food craving that is specific to foods high in dietary fat. It would be of interest to study this subgroup in greater detail to determine whether they have biological, taste, or behavioral patterns that are different from other obese adults. Additional research is needed to determine the predictive validity of the FCI. Future research should investigate the degree to which self-reported cravings predict consumption of particular foods or food classes.

Narrowing the construct of food cravings to specific foods may allow better understanding of the biological, physical, and behavioral components of food cravings. A promising venue in understanding the link between cravings and various forms of disturbance seems to lie in both the frequency and the types of foods that are craved. From a theoretical/research perspective, the FCI may be a useful tool to define specific food cravings so that disturbed eating patterns that are specific to certain foods can be studied. Clinical applications of the FCI include nutritional planning in weight-loss treatment programs and measuring changes

in food cravings over the course of obesity or eating disorder treatment programs. For example, the FCI would be a useful tool to identify candidates likely to benefit from drug treatments aimed at specific or general food cravings. Also, the FCI could be used to measure changes in food craving as a function of drug or behavioral therapies.

Overall, the FCI seems to be a reliable and valid measure of general and specific food cravings. We hope that the FCI can be used to further our understanding of the role of specific and general food cravings in disturbed eating patterns associated with obesity.

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