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DEVELOPMENT AND VALIDATION OF THE OBSESSIVE COMPULSIVE EATING SCALE

by

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Abstract

Food cravings are common and have been implicated in eating-related pathology, including binge eating and bulimia nervosa. However, difficulties in defining and quantifying the phenomenon of craving, specifically for food, are well documented. Over the past decade there has been an increase in focus on the study of cognitive mechanisms underlying craving, in particular the role of intrusive cognitions and an associated affective elaboration (emotive imagery). While several measures are available to assess food cravings, they fail to fully capture the cognitive aspects of the craving experience. The present study was designed to develop and validate a measure of obsessive-compulsive aspects of food craving. The proposed 14-item Obsessive Compulsive Eating Scale (OCES) was developed based on the existing and well-validated Obsessive Compulsive Drinking Scale (OCDS), a self-report measure of obsessive thoughts about drinking and compulsive behaviors directed towards alcohol consumption. The OCES was administered to 224 respondents (57.4%, n=128 female). Results of a principal components analysis suggested a one-factorial structure of the OCES. Velicer’s MAP test and parallel analysis both confirmed the one-factorial model. The OCES had excellent internal consistency (Cronbach’s α=.91) and demonstrated good convergent and criterion validity. Taken together, findings suggest that the proposed OCES adds meaningfully to the body of measurements used to assess food cravings and their role in disordered eating patterns. By enhancing our understanding of this complex construct, the OCES can be used to improve treatments for disordered eating patterns.

**Keywords:** food cravings, Obsessive Compulsive Eating Scale (OCES), Obsessive-Compulsive Drinking Scale, psychometrics, assessment, eating disorders
Development and Validation of the Obsessive Compulsive Eating Scale

The term craving was newly introduced as one of the hallmark diagnostic features of substance use disorders in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), describing an intense desire or urge for the drug (American Psychiatric Association, 2013). However, in the research literature, cravings have long been implicated in a wide range of other clinical domains, from weight- and eating-related pathologies (Forman et al., 2007; Gendall, Sullivan, Joyce, & Bulik, 1997; Lafay et al., 2001; Sitton, 1991; Vander Wal, Johnston, & Dhurandhar, 2007; Wurtman & Wurtman, 1986) to behavioral addictions such as gambling disorder (Tavares, Zilberman, Hodgins, & el-Guebaly, 2005; Young & Wohl, 2009) and excess engagement in online social networking (Hormes, Kearns, & Timko, 2014), even to paraphilic disorders (Berlin, 2014) and pathological buying (Trotzke, Starcke, Pedersen, & Brand, 2014). Thus, craving is a common feature of otherwise disparate diagnoses and clinical presentations, and some have argued that the qualitative nature of cravings may not differ across various appetitive targets (May, Andrade, Panabokke, & Kavanagh, 2004; Pelchat, 2002). However, despite the widespread use and relevance of the craving construct, an empirically based understanding of the term is still lagging; the difficulty in defining, conceptualizing, and quantifying the term has been well documented (Drummond, 2001; Hormes & Rozin, 2010; Tiffany & Wray, 2012), and there lacks a complete understanding of the mechanisms involved in the etiology of craving (Lu, Grimm, Hope, & Shaham, 2004).

Theoretical perspectives, lab-based research findings, and neurobiological models point to the prominent role of cravings in the maintenance of addictive disorders, as well as their relevance to treatment outcomes. According to learning-based models of addictive disorders, both interoceptive (i.e., positive or negative mood states, physiological arousal associated with...
stress, memories and feelings associated with drug use) and exteroceptive cues (i.e., drug paraphernalia, places where drugs are sold or used, sounds reminiscent of drug reward) may serve as conditioned stimuli that exert discriminative control over drug-seeking behavior via craving (Stasiewicz & Maisto, 1993). Compared with exposure to neutral imagery or interoceptive control conditions, lab studies re-exposing drug dependent individuals to potent, drug-associated cues report significant increases in drug craving and subsequent drug use (Carter & Tiffany, 1999; Drobes & Tiffany, 1997). Relapse following treatment, which remains a critical clinical problem due to the exceedingly high rates, is often precipitated by exposure to these drug-associated cues. Based on findings by Lu et al. (2004), persistent and long-lasting molecular neuroadaptations are likely involved in reward craving and may increase the propensity to relapse after extended periods following withdrawal. Previous laboratory research has also shown that stress-induced drug craving is one of the primary triggers for a relapse episode in addicted individuals (Sinha, Catapano, & O'Malley, 1999; Sinha, Garcia, Paliwal, Kreek, & Rounsaville, 2006; Sinha et al., 2003). Based on these findings, elevated craving is implicated as one of the primary proximal precipitants to relapse episodes (McKay, 1999) and thus represents an important and vital area of study.

In the context of deprivation or withdrawal thoughts about an appetitive target can resemble obsessional thinking (Modell, Glaser, Cyr, & Mountz, 1992; Modell, Glaser, Mountz, Schmaltz, & Cyr, 1992): Attempts to avoid or suppress thoughts about a rewarding or appetitive target typically result in a seemingly paradoxical increase in the frequency of those thoughts, which exacerbates their intrusiveness (Salkovskis & Reynolds, 1994; Wegner, 1994). In Obsessive Compulsive Disorder (OCD), recurrent and persistent thoughts (obsessions) drive the performance of a behavior (compulsion) in an effort to neutralize, prevent, or reduce the effect of
these thoughts (American Psychiatric Association, 2013). Obsessions and compulsions are often distressing, time-consuming, and difficult to control. Similarly, cravings for appetitive targets involve intrusive thoughts that are difficult to suppress, are associated with a behavioral urge, and, if an effort is being made to avoid the target or one is aware of the target’s unavailability, have the tendency to produce distress. Neuroimaging studies have also found shared anatomical circuits between OCD and the experience of craving (Volkow & Fowler, 2000). The experience of cravings can therefore be unwanted, difficult to control, and counterproductive to abstinence.

While the addiction framework most commonly refers to substance-related disorders, in recent years it has become increasingly applied to food (Ahmed, Guillem, & Vandaele, 2013; Gearhardt, White, & Potenza, 2011). Research on food cravings, especially within the realm of food addiction, is a new, emerging, and occasionally controversial (Avena, Gearhardt, Gold, Wang, & Potenza, 2012), area of study. Craving for food is a common phenomenon in Western cultures, present in both clinical (Forman et al., 2007; Gendall et al., 1997; Lafay et al., 2001; Lowe, 2003; Lowe & Levine, 2005; Vander Wal et al., 2007) and non-clinical samples (Weingarten & Elston, 1990; Zellner, Garriga-Trillo, Rohm, Centeno, & Parker, 1999). Women frequently report cravings for chocolate around the onset of menstruation (Hormes & Rozin, 2009), and high-calorie, sugary, and fatty foods during pregnancy (Orloff & Hormes, 2014). At a lower intensity and frequency, men tend to crave more savory foods, and not necessarily during a period of stress (Zellner et al., 1999). Even in a non-clinical sample, cravings were found to be associated with elevated levels of guilt and ambivalence (Weingarten & Elston, 1990). On a clinical level, the nature and severity of food cravings are thought to be reliable predictors of pathological eating patterns, potential triggers for overeating and binge episodes, especially in
overweight/obese, bulimic, and food addicted individuals (Franken & Muris, 2005; Potenza & Grilo, 2014). The study of food cravings is thus relevant for refining eating-related interventions.

Though it has been suggested that food cravings are attributable to biological and/or affective determinants, experimental findings have not consistently been able to support this, leading current models of food craving to focus on the underlying cognitive processes. Food craving is theoretically and qualitatively distinguishable from physiological need states, such as hunger or nutrient deficiency: While hunger refers to a physiological need state that can be satisfied by a wide variety of foods, food cravings are only satisfied by appetitive targets with very specific sensory profiles (Pelchat, Johnson, Chan, Valdez, & Ragland, 2004). Also unlike hunger, food cravings are relatively independent of consumption latency and have not been found to result from nutritional or caloric deficits (Beauchamp, Bertino, Burke, & Engelman, 1990; Weingarten & Elston, 1991). In addition, while many people seek out certain foods to alleviate negative mood states (Hill, Weaver, & Blundell, 1991; Lafay et al., 2001), studies have found that the credit given to craved foods for improving mood may be disproportionate to its actual effects and initial alleviation of negative mood states is often followed by an increase in guilt (Macdiarmid & Hetherington, 1995; Wagner, Ahlstrom, Redden, Vickers, & Mann, 2014). Thus, though a range of physiological and affective factors may play a role in craving, they are not sufficient to fully describe the construct.

Alternatively, some have recently argued that food craving largely refers to a cognitively motivated state (Kavanagh, Andrade, & May, 2005; Tiggemann & Kemps, 2005). A number of findings point to the role of mental imagery in craving, suggesting a strong and controlled cognitive process underlying this multidimensional construct. For example, findings have shown that directed instruction to construct a mental image of an appetitive target is very effective at
inducing craving, and the vividness of mental imagery correlates highly with its reported strength and salience (Drobes & Tiffany, 1997; Harvey, Kemps, & Tiggemann, 2005). Visual and taste imagery are commonly reported during craving episodes for a range of substances, including foods (May et al., 2004). And interfering with this mental elaboration using concurrent cognitive tasks that involve visuo-spatial skills or competing imagery have been found to effectively reduce levels of craving (Harvey et al., 2005; Kemps, Tiggemann, Woods, & Soekov, 2004; Versland & Rosenberg, 2007). In addition, craving has been associated with the same brain activation patterns present during the production of visual imagery (Wang et al., 2007). Therefore, there is a body of empirical support to suggest that cognitive factors play a central role in food craving.

In an effort to integrate current data on both food and substance cravings, Kavanagh, Andrade, & May (2005) developed the Elaborated Intrusion (EI) Theory, which emphasizes the importance of mental imagery, while also addressing the role of other craving determinants, such as affect, anticipatory pleasure, and relief from physiological deficits, commonly referred to in food cravings. EI Theory distinguishes between two distinct levels of cognitive processing underlying episodes of craving; (1) intrusive thoughts about an appetitive target and (2) the elaboration on the thoughts that follows. According to this theory, Pavlovian associations (for example, conditioned need states or negative affect) trigger automatic, intrusive thoughts, which, if affective correlates are sufficiently strong and competing cognitive demands allow, subsequently lead into a phase of “mental embellishment,” contributing rich and vivid semantic and sensory material to the original intrusive thought. This embellishment not only works to elicit motivation to seek out the target, but also maintains the salience of it. Based on preliminary findings that test predictions of EI Theory in a population with alcohol use disorder, imagery is
found to be positively associated with greater intensity, duration, and frequency of craving episodes (Kavanagh, May, & Andrade, 2009).

While substantial evidence supports the key role of cravings in a variety of addictive and eating disorders as well as their value in predicting relapse in addicted individuals, difficulty in measuring this construct has been well-documented. In particular, the field is hard-pressed to produce a well-validated measure that adequately captures the underlying cognitive factors associated with food cravings. Typically, craving is assessed with single-item questionnaires in both clinical and research settings (Pavlick, Hoffman, & Rosenberg, 2009; Rosenberg, 2009), failing to capture the multiple dimensions that the construct encompasses. The most commonly used multi-item/multi-dimensional instruments for food cravings are the Food Cravings Questionnaires (FCQs) (Cepeda-Benito, Gleaves, Williams, & Erath, 2000), however the original factor structure of this scale has not been replicated consistently and, furthermore, it focuses mainly on the correlates and outward expressions/subjective experience of craving, rather than the underlying mechanisms. Other self-report measures focus on cravings for specific foods, such as chocolate (i.e., Attitudes to Chocolate Questionnaire (Benton, Greenfield, & Morgan, 1998; Muller, Dettmer, & Macht, 2008), and Orientation to Chocolate Questionnaire (Cartwright & Stritzke, 2008)), or food groups, such as sweets, or carbohydrates (i.e., Food Craving Inventory (White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002)). However, again, they do not adequately capture the cognitive features of craving and their utility in the broad assessments of cravings in clinical and research settings is therefore limited. Thus, the focus of the present study was to develop a valid and reliable measure of food craving that adequately captures the underlying cognitive aspects of the construct and can be used both clinically and in research to facilitate greater understanding of the craving construct.
Based on the striking parallels between OCD and cravings, Modell et al. (1992) developed the Yale-Brown Obsessive Compulsive scale for heavy drinking (Y-BOCS-hd), which modified the original Y-BOCS for OCD to quantify obsessive thoughts of drinking and compulsive alcohol use. Since then, the Y-BOCS-hd has been modified into the Obsessive Compulsive Drinking Scale (OCDS)(Anton, 2000), a valid and reliable 14-item self-report measure, which was designed to enhance reliability and generalizability of the original Y-BOCS-hd. The OCDS has high internal consistency and test-retest reliability, and has been found to be sensitive and specific to identifying problematic drug use. It has been adapted and translated widely and is used in both research and clinical settings to predict drug use behavior and measure outcome in treatment studies (Deas, Roberts, Randall, & Anton, 2001; Franken, Hendriksa, & van den Brink, 2002; Hitsman et al., 2010; Hormes, Coffey, Drobes, & Saladin, 2012; Janiri et al., 2004; Morgan, Morgenstern, Blanchard, Labouvie, & Bux, 2004; Schippers et al., 1997).

However, though much work has been done to apply the OCD paradigm to cravings for drugs of abuse in an effort to further the understanding of cognitive mechanisms involved in drug cravings, examining the potential overlap in food cravings still remains to be done.

This study sought to develop a food craving measure that specifically captures the cognitive mechanisms hypothesized to underlie craving etiology, comparable to those modified from the original OCDS, and adds meaningfully to the existing body of craving measurements.

**Method**

All methods were approved by the local Institutional Review Board. All respondents were informed of the nature and purpose of the study and consented prior to participation.
The development and validation of the Obsessive Compulsive Eating Scale (OCES) was conducted as part of a larger survey-based study assessing a range of aspects of food craving, ingestion, and avoidance. The measures described below were completed alongside several other survey assessments during a one-time lab visit.

Participants

Participants were 610 undergraduate students at a large University in the Northeastern United States. Inclusion criteria were at least 18 years old, and able to read and write in English. Response rate among those signed up for the study was 100%. Given evidence to suggest a high frequency of obsessive thoughts about appetitive targets specifically in individuals making a conscious attempt to avoid such targets, analyses presented here focused on the subset of 224 respondents (57.4%, n=128 female, mean age = 18.89, SD=1.91, range: 17-39 years, mean BMI = 18.89, SD = 1.91, range: 17-39) who reported any current avoidance of a specific food or food group. A majority of respondent (58.0%, n=130) self-identified as “white.” Participants received course credit for their participation.

Measures

Demographic and clinical variables. Demographic data for age, gender, and race/ethnicity were collected via a questionnaire designed for this study. Body mass index (BMI) was calculated from self-reported weight and height. Weight dissatisfaction was calculated by subtracting self-reported ideal from self-reported current weight.

Obsessive Compulsive Eating Scale. The proposed Obsessive Compulsive Eating Scale (OCES) is a 14-item self-report questionnaire designed to measure obsessive-compulsive thought patterns, as they relate to cravings for avoided foods. It was developed based on the existing and
well-validated OCDS (Anton, 2000), a self-report measure of obsessive thoughts about drinking and compulsive behaviors directed towards alcohol consumption. In creating the OCES, items of the OCDS were re-worded to target thoughts and behaviors related to avoided food(s) (e.g., “How much of your time when you’re not drinking is occupied by ideas, thoughts, impulses, or images related to drinking?” changed into “How much of your time when you’re not eating this food is occupied by ideas, thoughts, impulses, or images related to avoiding this food?”), see Table 2 for exact wording of all OCES items). All item content on the OCES was kept identical to that on the OCDS with the exception of two questions about frequency of eating avoided food (item #8), which inquired about “how many hours” one spends obtaining and eating the avoided foods on days they eat their avoided food, instead of “drinks per day.” Items were rated on a scale of 0-4, with higher scores indicating more distress and interference. Of note, the OCDS has previously been modified in a comparable manner to capture the obsessive-compulsive aspects of cravings for cocaine (Hormes et al., 2012), smoking (Hitsman et al., 2010), and general drug use (Franken et al., 2002).

Food Craving Questionnaire-Trait-Reduced (FCQ-T-r). The FCQ-T-r (Meule, Hermann, & Kubler, 2014) is a valid and reliable 15-item, one-factorial version of the original 39-item FCQ-T (Cepeda-Benito et al., 2000), the most commonly used measure to assess experiences of general food cravings as a trait, including its affective, behavioral, and physiological dimensions. The FCQ-T-r was included in the present study to assess convergent validity of the proposed OCES with an existing measure of general food craving. In the current sample, the FCQ-T-r demonstrated excellent internal consistency (Cronbach’s α=.94).

Food Craving Inventory (FCI). The FCI is a widely used 28-item self-report measure used to assess specific food cravings (White & Grilo, 2005). Participants completed the two
versions of the FCI, assessing (1) “subjective cravings” for 28 different foods (Cronbach’s α=.91 in the present sample), along with (2) “frequency of consumption” of the same 28 foods (i.e., “giving in” to cravings, Cronbach’s α=.94), using a rating scale ranging from 1=”never” to 5=”always/almost every day” (White et al., 2002). The FCI was included in the present study in order to assess convergent validity of the OCES with an existing measure of specific food cravings.

**Binge Eating Scale** (BES). The Binge Eating Scale (Gormally, Black, Daston, & Rardin, 1982) is a 16-item self-report measure designed to measure the behavioral, emotional, and cognitive symptoms related to binge eating. Each item on the BES contains three or four answer options, reflecting a range of severity. Total scores on the BES range from 0 to 32, with higher scores indicating more severe symptoms. Based on the total score, individuals can be categorized into one of three groups according to established cut-off thresholds: no binge eating (score ≤ 17), mild to moderate binge eating (score of 18-26), and severe binge eating (score ≥ 27). In the current study, those who scored greater than or equal to 18 on the BES were classified as “binge eaters” and compared to “non-binge eaters.” Given evidence to suggest a role of cravings in the onset of binge eating episodes, the BES was included in the present study to assess criterion validity of the OCES by determining whether scores on the proposed OCES would be able to successfully differentiate binge eaters and non-binge eaters. In the current sample, the BES demonstrated excellent internal consistency (Cronbach’s α=.90).

**Yale Food Addiction Scale** (YFAS). The Yale Food Addiction Scale (Gearhardt, Corbin, & Brownell, 2009) is a 25-item self-report measure which quantifies addiction-like eating behaviors related to the consumption of hyperpalatable foods (i.e., tolerance, withdrawal, and cravings). The YFAS was developed based on the assumption that symptoms of “food
addiction” resemble those of substance use disorders. Responses are used to calculate a count of food addiction symptoms ranging from zero to seven. A diagnosis of food addiction can be made if an individual endorses three or more symptoms and indicates clinically significant impairment. In the current sample, the YFAS had good internal consistency (Cronbach’s α= .89). Given the hypothesized role of craving in the construct of “food addiction,” we expected to see a positive correlation between the OCES (as a measure of food craving) and the YFAS.

**Eating Attitudes Test** (EAT- 26). The EAT-26 (Garner, Olmsted, Bohr, & Garfinkel, 1982) is a widely used 26-item questionnaire used to assess eating attitudes and behaviors. It consists of three subscales, including “dieting” (13 items, Cronbach’s α=.88), “bulimia/food preoccupation” (six items, Cronbach’s α=.78), and “oral control” (seven items, Cronbach’s α=.58). Scoring is based on a six-point Likert-scale. Total scores range from 0 to 78, with higher scores indicating more eating disordered symptoms and concerns. A total score greater than 20 is widely considered indicative of disordered eating attitudes.

**Dutch Eating Behavior Questionnaire** (DEBQ). The DEBQ (van Strien, Frijters, Bergers, & Dafares, 1986) is a 33-item self-report measure that measures eating behavior characteristics on three subscales, assessing “emotional eating” (13 items, Cronbach’s α=.95), “external eating” (10 items, Cronbach’s α=.82) and “restrained eating” (10 items, Cronbach’s α=.92). Items are scored on a five-point Likert scale ranging from 0 (“never”) to 5 (“very often”), with higher scores indicating greater severity of symptoms.

Given evidence to suggest a link between cravings and eating disorder symptoms(Hormes & Timko, 2011), the EAT-26 and DBEQ were included in the present study to assess the nature of the association between scores on the OCES and eating disorder symptomatology and dietary restraint.
**Barratt Impulsiveness Scale** (BIS-11) The Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995), a 30-item self-report questionnaire, is a widely used, valid and reliable measure of (1) “attentional” (Cronbach’s α=.79), (2) “motor” (Cronbach’s α=.68), and (3) “non-planning” impulsivity (Cronbach’s α=.69). Previous research (Hormes & Meule, under review; Meule et al., 2014) has shown impulsivity to be positively associated with food cravings. The BIS was included here to examine the nature of the relationship between the OCES and impulsivity.

**Statistical Analyses**

OCES scores from the 224 food avoiding participants were initially subjected to confirmatory factor analysis in SPSS AMOS to assess the extent to which the proposed measure fits the two-factor structure (i.e., “obsessive” and “compulsive” subscales) of the original OCDS. Missing values, which ranged from 4-8% on any given variable, were replaced with the variable means. The confirmatory analysis showed a generally poor fit with the two factor model \[ \chi^2(76) = 257.63, p<.001, \text{NFI} = .83, \text{CFI} = .87, \text{AGFI} = .80, \text{RMSEA} = .10 \], therefore the scores were subjected to an exploratory principal components factor analysis (PCA) using SPSS version 22. The present sample of 224 exceeds the commonly accepted subjects-to-variables ratio of no less than 5:1 for determining appropriate sample sizes for factor analysis (Costello & Osborne, 2005; Gorsuch, 1983). The Kaiser-Meyer-Olkin measure of sampling adequacy was .90 and the Bartlett’s test of sphericity was statistically significant \[ \chi^2(91) = 1476.83, p < .001 \], supporting the suitability of the data for factor analysis. The proposed factor structure of the OCES was confirmed via parallel analysis and Velicer’s Minimum Average Partial (MAP) test using the

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1 NFI = non-normed fit index, CFI = comparative fit index, AGFI = adjusted goodness of fit index, RMSEA = root mean square error of approximation
FACTOR software (Baglin, 2014; Horn, 1965; Velicer, 1976). Cronbach’s alpha, Pearson’s product moment coefficients, and chi-square and independent-samples t-tests were used to assess the proposed measure’s internal consistency reliability, and convergent and criterion validity. Differences in scores on the OCES by gender, race/ethnicity (“white” vs. “non-white”), and weight status (“overweight”/BMI≥25 vs. “non-overweight”/BMI<25) were examined using independent samples t-tests.

**Results**

Participants self-identified (in overlapping percentages) as white/Caucasian (58.0%, n = 130), African-American (18.3%, n = 41), Asian (12.5%, n = 28), Hispanic/Latino (14.3%, n = 32), or “other” (3.1%, n = 7). Male participants on average reported BMI’s in the lower range of overweight and female participants on average reported BMIs in the upper range of normal [M = 25.81, SD = 4.22 vs. M = 24.67, SD = 4.12; t(201) = 1.92, p = .06, d = .27]. Just under one half of male (45.3%, n = 52) and just over one half of female respondents (53.1%, n = 60) indicated being within a normal BMI range (i.e., BMI = 18.5-24.9 kg/m²). Nearly one half of male (47.4%, n = 45) and one third of female respondents (33.6%, n = 43) indicated being overweight/obese (i.e., BMI ≥ 25.0 kg/m²), with a significant gender difference in prevalence (χ² = 4.33, p = .04, φ = .14). Females were significantly more dissatisfied with their weight than males [M = 14.17, SD = 15.36 vs. M = 7.48, SD = 27.74; t(212) = 2.24, p = .02, d = .30], as assessed by subtracting self-reported ideal from current weight. Less than one third of male (16.0%, n = 13) and nearly one third of female respondents (27.7%, n = 33) met criteria for binge eating (i.e., BES score ≥ 18).

Table 1 summarizes descriptives (by gender) for all measures included in the study.
Participants reported reasons for avoiding specific foods (in overlapping percentages) as follows: health reasons: 60.3% (n = 135), weight reasons: 64.3% (n = 144), appearance: 44.2% (n = 99), religious: 6.7% (n = 15), moral: 6.7% (n = 15), environmental: 3.1% (n = 7), cost: 5.4% (n = 12), taste: 17.0% (n = 38), and “other”: 2.2% (n = 5). There was no statistically significant difference in OCES scores by reason for avoiding food, even when including gender as a covariate. Avoided foods included a variety of different substances, including meat and other animal products, carbohydrates, foods perceived to be unhealthy due to high sugar, salt, or fat content, and highly processed foods.

**Principal Components Analysis**

Principal components analysis of the 14 items of the OCES revealed the presence of three components with eigenvalues above 1, accounting for a total of 62.76% of the variance (46.21%, 8.71%, and 7.85%, respectively). Inspection of the screeplot (Figure 1) revealed a clear break after the first component, suggesting a one-factorial structure. Velicer's MAP test and parallel analysis both confirmed the one-factorial structure of the OCES.

The OCES demonstrated excellent internal consistency reliability (Cronbach’s α=.91). Factor loadings, Cronbach’s α for item deletions, item-total correlations, and means and standard deviations for individual items are presented in Table 2. Factor loadings ranged from .49 to .77 and item-total correlations were all significant at $p < .001$.

**Convergent validity**

As summarized in Table 1, there were significant and positive correlations between the FCQ-T-r, FCI, YFAS, EAT-26, DBEQ, BIS-11 and total scores on the OCES, ranging from small to large correlation coefficients ($r=.14$ (for the BIS-11 “attentional subscale”) to $r=.49$ (for
the YFAS)), suggesting good convergent validity of the proposed measure and positive associations with measures of eating disorder symptoms, food addiction, dietary restraint, and impulsiveness.

**Criterion validity**

Individuals meeting criteria for binge eating, as defined by a score of 18 or above on the BES (20.5%; n=46), obtained significantly higher total OCES scores compared to those who did not meet the threshold [M =14.51 SD = 10.17 vs M =7.62 SD = 7.53; t(198) = 4.26, p < .001, d = .77] (see Table 2 for means and SD on individual items of the OCES in binge eaters versus non-binge eaters). Overweight/obese individuals also scored significantly higher on the OCES compared to non-overweight/obese respondents [M = 11.36 SD = 9.29 vs M = 8.14 SD = 8.01; t(222) = 2.67, p < .01, d = .37].

There were no significant differences in scores on the OCES between men and women [M = 8.55, SD = 8.92 vs. M = 10.09, SD = 8.48; t(221) = 1.31, p = .19, d = .01] or between participants who self-identified as white/Caucasian (M = 9.17, SD = 8.62) versus those who did not [M = 9.76, SD = 8.77; t (222) = .50, p = .62, d = -.18].

**Discussion**

This study was designed to develop a measure of the cognitive aspects of eating behaviors (as they relate to avoided foods), with a focus on the obsessive-compulsive thoughts and impulses believed to play a role in persistent craving and recurring urges to eat avoided foods. We chose to focus on the cognitive aspects food cravings since the most widely used existing measures primarily attend to the behavioral, affective, and physiological aspects of food craving. Given the recent arguments that craving is largely a cognitive construct (Kavanagh et
al., 2005; Tiggemann & Kemps, 2005), we developed the OCES with the hope that it can be used to better evaluate these proposed underlying cognitive mechanisms.

The proposed new measure fits a one-factor structure, which does not mirror the two-factor structure of the existing Obsessive Compulsive Drinking Scale, on which it is based. The initial validation of the OCES as a one-factorial measure yielded evidence for excellent internal consistency and good convergent and criterion validity. The OCES successfully differentiated between binge eaters and non-binge eaters, as well as overweight/obese and non-overweight individuals, and was positively associated with existing measures of general and specific food cravings, eating disorder pathology, food addiction, restrained eating, weight dissatisfaction, and impulsivity. Though these associations were significant, the small to medium size of the correlation coefficients suggests that the proposed new measures captures aspects of the craving experience that are related but non-redundant with constructs captured by existing measures. Based on these preliminary analyses, the OCES demonstrates excellent psychometric properties and appears to capture unique aspects of food craving.

The divergence in structure of the OCES from the original two-factorial OCDS may be due to a couple of factors. First, the divergence may suggest that the underlying cognitive mechanisms of food cravings are qualitatively unique from those of cravings for other substances; while measures of cravings for cocaine and alcohol have been found to fit a two factor structure that distinguishes between obsessions and compulsions, these two dimensions may not be meaningful when it comes to food cravings. Secondly, the divergence may be due to the fact that our findings were not based on a clinical sample. As a result, the reported food cravings may not have reached the level of severity needed to fully capture the phenomenon of food cravings and its underlying mechanisms. Therefore, while the present findings show that
the OCES represents a valid and reliable measure of food cravings, its psychometric properties should be further examined using a clinical sample.

The OCES has both research and clinical applications. It adds meaningfully to the existing body of measures used to quantify craving, placing greater emphasis on the cognitive processes involved in craving, and, in doing so, may also be used to evaluate the current cognitive models of food craving. Clinically, as has been done with the OCDS, the OCES may be used to predict binge episodes and evaluate the effectiveness of treatments for pathological eating patterns. The OCES also reveals a potential target for weight and eating pathology related interventions. Findings suggest that exposure and response prevention (ERP) is a highly effective therapy for treating OCD (Abramowitz, 1996; Whittal, Thordarson, & McLean, 2005). Given the nature of the overlap between OCD and craving, and the fact that drug-use and relapse are often cue- and context-dependent, cue-exposure and response prevention to craved targets may be a potential avenue for treatment of problematic eating patterns. This paradigm has previously been applied to the treatment of bulimia nervosa and anorexia nervosa (Leitenberg, Rosen, Gross, Nudelman, & Vara, 1988; Steinglass et al., 2011). The OCES may be a useful tool to identify those who are likely to benefit from such craving exposure treatments, as well as to track treatment outcome and progress.

One limitation of this study, and the proposed scale in general, is that the assessment of craving is temporarily divorced from the actual experience of craving. One of the many challenges in the assessment of cravings is due to the subjective and fleeting nature of the craving experience (Andrade, May, & Kavanagh, 2012). The OCES questionnaire asks that subjects answer questions based on the course of the past week. Attempts to recall previous experiences of cravings may be too far divorced from the craving episode to accurately capture
the experience. Follow-up studies may seek to utilize ecological momentary assessment to capture cravings in real-time, or compare ratings on the OCES following a lab-based craving induction paradigm to ratings divorced in time from the craving experience.

In conclusion, the OCES is a brief and easy to administer self-report measure of food cravings. In the current study, it demonstrates excellent psychometric properties and may be a useful tool in the assessment of the cognitive aspects of food cravings and their role in the maintenance of weight and eating related disorders. Use of this scale may also help to further our understanding of the mechanisms involved in craving and the cognitive patterns that likely underlay this hallmark feature. Future research should attempt to replicate findings reported here using a clinical population of respondents with disordered eating behaviors.
Table 1. Demographics, Body Mass Index, and Scores on the OCES, YFAS, EAT-26, DBEQ, BIS-11, BES, FCI, FCQ-T-r, in the Total Sample and in Male versus Female Respondents and correlations with Total Scores on the Obsessive Compulsive Eating Scale (OCES).

<table>
<thead>
<tr>
<th></th>
<th>Total (n=224)</th>
<th>Men (n=95)</th>
<th>Women (n=128)</th>
<th>Statistic</th>
<th>Correlation with OCES scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI</strong></td>
<td>25.17 (4.19)</td>
<td>25.81 (4.22)</td>
<td>24.67 (4.12)</td>
<td>F(1,201)=3.72, p&gt;.05, η_p^2=.02</td>
<td></td>
</tr>
<tr>
<td>Race*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Caucasion</td>
<td>57.8(129)</td>
<td>58.9(56)</td>
<td>57.0(73)</td>
<td>χ^2=.08, p&gt;.05, Φ=.02</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>18.4(41)</td>
<td>14.7(14)</td>
<td>21.1(27)</td>
<td>χ^2=1.47, p&gt;.05, Φ=-.08</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>12.6(28)</td>
<td>14.7(14)</td>
<td>10.9(14)</td>
<td>χ^2=.72, p&gt;.05, Φ=.06</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>14.3(32)</td>
<td>13.7(13)</td>
<td>14.8(19)</td>
<td>χ^2=.06, p&gt;.05, Φ=-.02</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3.1(7)</td>
<td>4.2(4)</td>
<td>2.3(3)</td>
<td>χ^2=.63, p&gt;.05, Φ=.05</td>
<td></td>
</tr>
<tr>
<td><strong>OCES</strong></td>
<td>9.44(8.69)</td>
<td>8.55(8.92)</td>
<td>10.09(8.48)</td>
<td>F(1,221)=1.71, p&gt;.05, η_p^2=.01</td>
<td></td>
</tr>
<tr>
<td><strong>FCQ-T-r</strong></td>
<td>37.61(12.4)</td>
<td>33.12(11.19)</td>
<td>41.00(12.24)</td>
<td>F(1,198)=21.89, p=.00, η_p^2=.10</td>
<td></td>
</tr>
<tr>
<td>FCI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.44***</td>
</tr>
<tr>
<td>Craving Frequency</td>
<td>2.27(.65)</td>
<td>2.22(.71)</td>
<td>2.31(.60)</td>
<td>F(1,184)=.86, p&gt;.05, η_p^2=.01</td>
<td></td>
</tr>
<tr>
<td>Giving In</td>
<td>1.94(.70)</td>
<td>1.92(.76)</td>
<td>1.95(.65)</td>
<td>F(1,184)=.09, p&gt;.05, η_p^2=.00</td>
<td></td>
</tr>
<tr>
<td><strong>BES</strong></td>
<td>12.34(8.03)</td>
<td>10.33(7.35)</td>
<td>13.71(8.22)</td>
<td>F(1,198)=8.83, p=.00, η_p^2=.04</td>
<td></td>
</tr>
<tr>
<td><strong>YFAS</strong></td>
<td>20.74(11.64)</td>
<td>18.95(11.19)</td>
<td>22.10(11.84)</td>
<td>F(1,190)=3.49, p&gt;.05, η_p^2=.02</td>
<td></td>
</tr>
<tr>
<td><strong>EAT-26</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.49***</td>
</tr>
<tr>
<td>Dieting</td>
<td>.68(.60)</td>
<td>.57(.59)</td>
<td>.76(.61)</td>
<td>F(1,186)=4.43, p&lt;.05, η_p^2=.02</td>
<td></td>
</tr>
<tr>
<td>Bulimia</td>
<td>.26(.48)</td>
<td>.21(.45)</td>
<td>.29(.50)</td>
<td>F(1,186)=1.39, p&gt;.05, η_p^2=.01</td>
<td></td>
</tr>
<tr>
<td>Oral Control</td>
<td>.41(.40)</td>
<td>.44(.44)</td>
<td>.40(.37)</td>
<td>F(1,186)=0.54, p&gt;.05, η_p^2=.00</td>
<td></td>
</tr>
<tr>
<td><strong>DEBQ</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.13***</td>
</tr>
<tr>
<td>Emotional</td>
<td>2.31(.92)</td>
<td>1.99(.91)</td>
<td>2.55(.86)</td>
<td>F(1,182)=18.87, p&lt;.001, η_p^2=.38 ***</td>
<td></td>
</tr>
<tr>
<td>External</td>
<td>3.04(.65)</td>
<td>2.87(.68)</td>
<td>3.17(.60)</td>
<td>η_p^2=.09</td>
<td></td>
</tr>
<tr>
<td>Restrained</td>
<td>2.85(.93)</td>
<td>2.55(.89)</td>
<td>3.09(.90)</td>
<td>F(1,182)=10.03, p&lt;.001, η_p^2=.30 ***</td>
<td></td>
</tr>
<tr>
<td>BIS-11</td>
<td>2.18(.48)</td>
<td>2.18(.50)</td>
<td>2.19(.47)</td>
<td>F(1,188)=.01, p&gt;.05, ηp²=.00</td>
<td>.14*</td>
</tr>
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</tr>
<tr>
<td>Attentional</td>
<td>2.03(.40)</td>
<td>2.04(.36)</td>
<td>2.02(.42)</td>
<td>F(1,188)=.11, p&gt;.05, ηp²=.00</td>
<td>.16*</td>
</tr>
<tr>
<td>Motor</td>
<td>2.27(.42)</td>
<td>2.25(.40)</td>
<td>2.29(.44)</td>
<td>F(1,188)=1.71, p&gt;.05, ηp²=.01</td>
<td>.15*</td>
</tr>
</tbody>
</table>

*Respondents reported on their race in overlapping percentages, i.e., they could choose more than one category

*p ≤ .05, ***p ≤ .001
Table 2. Obsessive Compulsive Eating Scale Factor Loadings, Internal Consistency (Item Deletion), Item-Total Correlations, and Mean Scores in Binge Eaters vs. Non-Binge Eaters.

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loadings</th>
<th>Cronbach’s α (item deletion)</th>
<th>Item-total Correlations</th>
<th>Binge Eaters M (SD)</th>
<th>Non-Binge Eaters M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. How much distress or disturbance do these ideas, thoughts, impulses, or images related to avoiding this food cause you when you’re not eating it?</td>
<td>.77</td>
<td>.90</td>
<td>.70</td>
<td>1.12(.96)</td>
<td>.48(.84)</td>
</tr>
<tr>
<td>6. How successful are you in stopping or diverting these thoughts when you’re avoiding this food?</td>
<td>.75</td>
<td>.90</td>
<td>.69</td>
<td>1.15(1.12)</td>
<td>.64(.91)</td>
</tr>
<tr>
<td>9. How much does your avoiding this food interfere with your work functioning? Is there anything that you don’t or can’t do because you avoid it?</td>
<td>.74</td>
<td>.90</td>
<td>.68</td>
<td>.69(1.00)</td>
<td>.37(.75)</td>
</tr>
<tr>
<td>10. How much does avoiding this food interfere with your social functioning? Is there anything that you don’t or can’t do because of your avoiding this food?</td>
<td>.72</td>
<td>.90</td>
<td>.66</td>
<td>.67(.99)</td>
<td>.52(.98)</td>
</tr>
<tr>
<td>11. If you were prevented from eating your avoided food when you desire to eat it, how anxious or upset would you become?</td>
<td>.72</td>
<td>.90</td>
<td>.66</td>
<td>1.06(1.13)</td>
<td>.49(.87)</td>
</tr>
<tr>
<td>2. How frequently do these thoughts occur?</td>
<td>.70</td>
<td>.90</td>
<td>.62</td>
<td>1.06(.98)</td>
<td>.51(.71)</td>
</tr>
<tr>
<td>14. How much control do you have over your desire to eat your avoided food?</td>
<td>.68</td>
<td>.90</td>
<td>.63</td>
<td>1.12(1.07)</td>
<td>.48(.69)</td>
</tr>
<tr>
<td>1. How much of your time when you’re not eating this food is occupied by ideas, thoughts, impulses, or images related to avoiding this food?</td>
<td>.68</td>
<td>.90</td>
<td>.61</td>
<td>1.35(.95)</td>
<td>.62(.77)</td>
</tr>
<tr>
<td>8. On the days that you eat your avoided food, how many hours do you spend obtaining and</td>
<td>.66</td>
<td>.90</td>
<td>.60</td>
<td>.89(1.19)</td>
<td>.42(.80)</td>
</tr>
</tbody>
</table>
eating the food, and dealing with any consequences of having eaten the avoided food?

13. How strong is the drive to consume your avoided food?

How much do these ideas, thoughts, impulses or images related to avoiding this food interfere with your social or work (or role) functioning? Is there anything that you don’t or can’t do because of them?

12. How much of an effort do you make to resist consumption of your avoided food?

5. How much of an effort do you make to resist these thoughts or try to disregard or turn your attention away from these thoughts as they enter your mind when you’re not eating your avoided food?

7. How many days each week do you eat your avoided food?

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Figure 1. Eigenvalues from the principal components analysis.
References:


