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An Examination of the Food Addiction Construct in Obese Patients with Binge Eating Disorder

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Abstract

Objective—The current study examined the psychometric properties of the Yale Food Addiction Scale (YFAS) in obese patients with binge eating disorder (BED) and explored its association with measures of eating disorder and associated psychopathology.

Method—Eighty-one obese treatment-seeking BED patients were given the YFAS, structured interviews to assess psychiatric disorders and eating disorder psychopathology, and other pathology measures.

Results—Confirmatory factor analysis revealed a one factor solution with an excellent fit. Classification of “food addiction” was met by 57% of BED patients. Patients classified as meeting YFAS “food addiction” criteria had significantly higher levels of depression, negative affect, emotion dysregulation, eating disorder psychopathology and lower self-esteem. YFAS scores were also significant predictors of binge eating frequency above and beyond other measures.

Discussion—The subset of BED patients classified as having YFAS “food addiction” appear to represent a more disturbed variant characterized by greater eating disorder psychopathology and associated pathology.

Keywords

binge eating; food addiction; substance use; drug use; emotional eating; obesity

Excessive food consumption and its relation to obesity and binge eating represents a pressing clinical and public health concern^{1,2}. A growing body of literature has found a number of similarities linking excess food consumption with addiction. First, animal models have found that rats given access to sugar, fat, or processed foods exhibit altered reward-related neural mechanisms that are implicated in addictive behaviors^{3,4}. Further, these rats exhibit behavioral hallmarks of addiction, such as tolerance, withdrawal, binge consumption, and continued use despite the receipt of negative consequences (i.e., electric

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shocks)^{3,4}. In humans, obesity and substance dependence have both been linked to similar neural markers, such as reduced DRD2 receptors^{5,6} and food and drug cravings are also associated with similar patterns of dopamine-related neural activation^{7,8,9}. Finally, many of the behavioral indicators of addiction also appear to be common in problematic eating behavior, such as loss of control, continued use despite negative consequences, and an inability to cut down problematic use¹⁰.

The concept of “food addiction” represents a controversial issue, for various reasons including the simple fact that drugs – unlike food – are not required for survival. This controversy is exemplified by the lack of an accepted definition of food addiction, despite accepted working definitions of eating disorders in both the clinical and research literature. Partly in response to these issues, Gearhardt and colleagues¹¹ developed the Yale Food Addiction Scale (YFAS) as an attempt to operationalize the concept of “food addiction.” The YFAS translates the substance dependence diagnostic criteria outlined in the Diagnostic and Statistical Manual IV-TR¹² to apply to eating behavior. The YFAS provides two scoring options, one option that measures food addiction “symptoms” and another option that provides a food addiction “diagnosis” based upon the substance dependence diagnosis in the DSM-IV-TR¹². In the initial validation, the YFAS exhibited adequate internal reliability, as well as convergent and incremental validity¹¹. Although encouraging, the initial validation of the YFAS utilized a non-clinical undergraduate sample and further psychometric examination using clinical samples is needed.

The examination of the YFAS in a clinical sample such as binge eating disorder (BED) may be useful in answering questions of validity. BED is characterized by recurrent binge eating (i.e., consumption of unusually large amounts of food in discrete times while experiencing a subjective sense of loss of control) without compensatory weight control behaviors, such as purging. Features associated with BED, such as periodic loss of control over consumption of food; eating when depressed or bored; feeling disgusted, depressed, or guilty after binge eating; eating until physically uncomfortable due to the amount of food just consumed, appear similar to features associated with substance dependence¹³. In a non-clinical sample, the YFAS predicted binge eating scores above and beyond existing measures of eating pathology¹¹. Thus, the examination of the YFAS in patients with BED is an important step in evaluating the validity of the food addiction concept in a clinical sample.

In the present study, we examined the nature of “food addiction” as assessed by the YFAS in obese patients seeking treatment for BED. This is the first psychometric evaluation of the YFAS in a clinical sample of obese patients with disordered eating and is an examination of the association between the food addiction concept and specific eating pathology and associated psychopathology. We considered pathological signs and symptoms, such as negative affect, difficulties in emotional regulation and self-esteem, that have been implicated clinically and empirically in substance use problems as well as eating/weight problems. Additionally, we examined whether the YFAS accounted for variance in binge eating frequency above and beyond other measures of eating pathology.

Method

Participants

Participants were a consecutive series of obese patients recruited for a treatment study who met full *DSM-IV* research diagnostic criteria for BED. Recruitment was conducted via newspaper advertisements seeking obese men and women who eat “out of control” and “want to lose weight” for treatment studies at a medical school-based specialty clinic. Participants were aged 28 to 64 years (mean = 47.47 years, *SD* = 8.43), 70.1% were female, 79.3% were Caucasian, 14.9% were Black/African-American, 4.6% were Hispanic, 1.1%

were Other. Approximately 82.6% reported at least some college education. Mean body mass index (BMI) was 40.58 kg/m² (*SD* = 6.63).

Procedures and Assessment Measures

The study was approved by the Yale Institutional Review Board and all participants provided written informed consent. Assessment procedures were performed by trained doctoral-level research clinicians. Axis I psychiatric disorder diagnoses, including BED, were determined using the Structured Clinical Interview for DSM-IV Axis I Disorders¹⁴ and the BED diagnosis was confirmed with the Eating Disorder Examination interview¹⁵. Participants also completed a battery of self-report questionnaires described below. Participants' height and weight were measured at the initial assessment appointment using a medical balance beam scale.

Eating Disorder Examination (EDE)—The EDE¹⁵ is a well-established investigator-based interview method for assessing eating disorder psychopathology^{16,17} with established reliability¹⁸. Except for diagnostic items that have specific duration criteria, the EDE queries the previous 28 days. Items are rated on a 7-point scale (0–6) with higher scores indicating greater frequency or severity of symptoms. The EDE assesses the frequency of different forms of overeating, including objective bulimic episodes (OBEs; i.e., consumption of unusually large quantities of food with a subjective sense of loss of control), which correspond to the DSM-IV definition of binge eating. The EDE also comprises four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) and an overall global score.

Yale Food Addiction Scale (YFAS)—The YFAS¹¹ is a 25-item self-report measure of addictive eating behaviors with high fat/sugar foods. Respondents are asked about the occurrence of eating behaviors during the past 12 months that are analogous to the diagnostic criteria for substance dependence. The scale uses a combination of Likert and dichotomous scoring options. The YFAS provides two scoring options, a “symptom” count version that indicates the number of dependence symptoms experienced in the past 12 months and a “diagnostic” threshold that is met when three or more “symptoms” are present during the past 12 months and clinically significant impairment or distress is endorsed. Given the frequent application of addiction-related terms to eating behavior in popular culture, no mention of addiction is included in the scale content. Further, the “diagnostic” version of the YFAS, relative to self-identification as a “food addict,” has significantly greater specificity at identifying clinically relevant disordered eating¹⁹. The preliminary validation of the scale found evidence of adequate internal reliability, convergent validity and incremental validity in predicting binge eating.

Beck Depression Inventory-II (BDI-II)—The BDI-II²⁰ is a 21-item measure of symptoms of depression such as sadness and feelings of guilt. Higher scores reflect higher levels of depression and negative affect. The BDI-II is a widely used and well-established measure with excellent reliability and validity²¹.

Difficulties in Emotion Regulation Scale (DERS)—The DERS²² is a 36-item measure of emotion dysregulation. Subscales from this measure tap into six different aspects of emotion dysregulation: 1) nonacceptance of emotional responses (Nonacceptance), 2) difficulties engaging in goal directed behaviors (Goals), 3) impulse control difficulties (Impulse), 4) lack of emotional awareness (Awareness), 5) limited access to emotion regulation strategies (Strategies) and 6) lack of emotional clarity (Clarity). The DERS uses Likert scoring on a 5-point scale, with higher scores reflecting greater emotion dysregulation.

Rosenberg Self-Esteem Scale (RSE)—The RSE²³ is a widely used measure of self-esteem which asks for respondents' degree of agreement with 10 statements such as "I feel that I have a number of good qualities." The RSE uses Likert scoring on a 4-point scale, with higher scores indicating higher self-esteem.

Data Analytic Plan

Based upon the one-factor exploratory model found in the preliminary validation of the YFAS¹¹, a confirmatory factor analysis of the seven dichotomous "symptoms" was examined in the current study. Next, the association between the YFAS and demographic characteristics (e.g., age, gender, race/ethnicity) was examined through the use of chi-square and analysis-of-variance (ANOVA) tests. Chi-square analyses were then used to investigate the relation between the YFAS and lifetime Axis I psychiatric diagnoses. Additionally, correlations between the YFAS and measures of general psychopathology and eating psychopathology were examined. Finally, the incremental validity of the YFAS was investigated through the use of hierarchical multiple regression. To examine the unique variance accounted for by the YFAS, measures of eating psychopathology and the YFAS were entered as simultaneous predictors of binge eating (OBE) episodes frequency.

All measures were examined for normality and outliers. No outliers were identified for removal, but the Weight Concern subscale of the EDE and the frequency of OBE episodes exhibited moderately positively skewed distributions. Analyses were conducted using the log-transformed data for these two variables²⁴.

Results

YFAS Factor Structure

A confirmatory factory analysis for dichotomous data was conducted using the Mplus Version 6.0 statistical package²⁵ to confirm the single factor exploratory model found for the "symptoms" included in the YFAS (not including the clinical significance questions) in the preliminary validation. Examination of global fit indices and residuals indicated an excellent model fit: $\chi^2(14) = 15.08$, $p = .373$, RMSEA = .03, TLI = .98, and CFI = .99. The single-factor model accounted for 77.8 of the variance.

YFAS Food Addiction Classification: Associated Demographic and Clinical Features

The diagnostic threshold for "food addiction" based on the YFAS (i.e., three or more "symptoms" and clinically significant impairment or distress) was met by 56.8% of participants. Table 1 summarizes the frequency of the seven "symptoms" assessed by the YFAS separately for participants classified with and without YFAS "food addiction." The mean number of food addiction "symptoms" met on the YFAS was 4.56 ($SD = 1.9$). Of the participants that did not meet the YFAS "food addiction" threshold ($n = 35$), 57.1% endorsed three or more symptoms, but did not meet the threshold for clinical impairment or distress. Age, gender, race/ethnicity, and education did not differ significantly between participants classified with versus without YFAS "food addiction."

YFAS Food Addiction Classification: Associations with Psychiatric Co-Morbidity

Table 2 shows the relation between "food addiction" based on the YFAS and lifetime Axis I psychiatric diagnoses. Chi-square analyses revealed that YFAS "food addiction" classification was not significantly related to anxiety, alcohol, or drug use disorder diagnoses, but was significantly associated with greater likelihood of mood disorder diagnoses ($F = 10.09$, $p = .001$), specifically major depressive disorder (MDD; $F = 7.49$, $p = .006$).

YFAS Food Addiction: Associations with Measures of General Psychopathology

Table 3 summarizes the associations between YFAS scores and other measures of general psychopathology. YFAS scores were significantly correlated with higher negative affect, higher emotion dysregulation, and lower self-esteem.

YFAS Food Addiction: Associations with Measures of Eating Psychopathology

Table 4 summarizes the associations between YFAS scores and measures of eating disorder psychopathology. YFAS scores were significantly positively correlated with frequency of binge eating (OBEs) and with the EDE eating concern, EDE shape concern, and EDE weight concern subscales and with the global EDE summary score.

Incremental validity of the YFAS was assessed using hierarchical multiple regression. YFAS scores were entered along with other measures that are theoretically related to BED, namely negative/depressive mood (BDI scores) and eating disorder psychopathology (global EDE score), to predict the frequency of binge eating (OBE) episodes. These measures were entered in step one of the regression model with the YFAS entered in block 2. The EDE Global, $t = 1.44$, $\beta = .17$, $p = .155$, and BDI, $t = -.29$, $\beta = -.03$, $p = .775$, were not significant predictors of the frequency of OBE episodes, accounting for only 2.7% of the variance in binge eating episodes. After controlling for variance accounted for at step one of the model, the YFAS was a significant predictor in step two of the model, $t = 2.68$, $\beta = .27$, $p = .028$, accounting for 6.3% of unique variance in binge eating scores. The same pattern of results was observed with the diagnostic version of the scale, although this version of the YFAS only approached significance, $t = 1.82$, $\beta = .23$, $p = .073$.

Discussion

The current study examined the nature of “food addiction” as measured by the Yale Food Addiction Scale (YFAS) in treatment-seeking obese patients with BED. First, the YFAS exhibited a one factor model with excellent fit. Second, 57% of BED patients met the diagnostic threshold of the YFAS for “food addiction” and the majority of those who did not meet full criteria for food addiction did endorse three or more “symptoms”; this finding suggests a strong – albeit not full – association between BED and YFAS food addiction “symptoms.” Third, YFAS “food addiction” classification was significantly associated with the presence of lifetime mood disorder diagnoses (specifically, MDD) and YFAS scores were significantly associated with higher scores of negative affect and emotion dysregulation and lower self-esteem scores. Thus, the subset of BED patients classified as having YFAS “food addiction” appears to represent a more disturbed variant characterized by greater eating disorder psychopathology and associated psychological and psychiatric problems. Third, YFAS scores were significantly related to other measures of eating psychopathology, although there was no relation between YFAS “food addiction” scores and EDE restraint. Finally, in multivariate analyses, YFAS scores emerged as the sole predictor of the frequency of binge eating (OBE) episodes above and beyond other measures of eating disorder psychopathology and negative affect, which suggests evidence for the incremental validity of the YFAS.

The observed associations between the YFAS and negative affect, emotion dysregulation, and low self-esteem, coupled with the lack of a relation with restraint may be relevant to our understanding of binge eating triggers. For example, previous research has reliably found subtypes of BED (i.e., pure dietary and mixed dietary-negative affect)^{26,27}. Additionally, negative affect and mood dysregulation may trigger binge eating which perhaps serves as a coping strategy for the heightened emotional distress^{26, 28}. The presence of “food addiction” as assessed by the YFAS in obese patients with BED may be associated with an increased

frequency of binge eating perhaps given the need to cope with negative affect and low self-esteem, rather than as a result of overly restrictive dieting (i.e., as in restraint models) which may be more relevant for understanding bulimia nervosa. Such findings echo similarities with models of substance dependence, which highlight the role of depressed/negative mood and emotion dysregulation as triggers for substance use^{29–31}. Also noteworthy is our finding that the impulsivity subscale of the emotion dysregulation scale had the strongest specific relationship with YFAS “food addiction”. Impulsivity has been previously implicated as an important factor in the development of both substance use and eating disorders³². Thus, BED patients who meet criteria for YFAS “food addiction” appear to suffer from greater eating disorder psychopathology and associated difficulties with negative affect and emotional dysregulation.

The current study provides further support for the operationalization of “food addiction” as defined by the YFAS. Based on this definition, BED and “food addiction” are related, but do not totally overlap. An important area for future research will be the treatment implications of “food addiction” for individuals with BED and signs of addictive-like eating behavior. The current findings also have broader relevance to the emerging literature on the nature of “food addiction” and various resultant controversies and questions³³. Although food intake is necessary for survival, the marginal nutritional benefit of food consumption in some circumstances (e.g., calorically dense but nutritionally poor foods) may be outweighed by deleterious longer-term consequences to health. This type of food consumption appears perhaps most strongly associated with certain food types, notably highly processed foods with unusually high levels of added fat and sugar, which some evidence suggests are most likely to engender consumption patterns reminiscent of addictive behaviors³³. The YFAS asks specifically about eating behaviors with high fat/sugar foods but without use or reference to “addiction” terms in order to decrease possible response biases.

Although the current study has implications about the relation between BED and “food addiction” as measured by the YFAS, these must be considered within the context of several limitations. First, the current data are cross-sectional in nature and this precludes any comments either about causality or whether “food addiction” predicts a more chronic or severe course of BED. Prospective studies would be necessary to determine developmental trajectories and longitudinal studies would be needed to test the predictive utility of the measurement of “food addiction” for the course and outcome of BED³⁴. Additionally, we did not include a comparison group of obese patients who do not binge eat. Future research should examine “food addiction” in different samples of obese persons with and without co-existing BED. Further, a sample of participants with and without BED will allow for a greater understanding of the sensitivity and specificity of the YFAS in detecting a diagnosis of BED. Lastly, our participants were treatment-seeking and therefore generalizability to community samples or to non-treatment seeking obese persons with and without BED is unknown.

In summary, the current study provides psychometric and clinical findings regarding the YFAS in a clinical sample of obese patients with BED. “Food addiction” as indicated by the YFAS is associated with lifetime mood disorders (specifically, MDD), greater negative affect and emotion dysregulation, and lower self-esteem, in addition to greater eating disorder psychopathology in obese patients with BED. Thus, the subset of BED patients classified as having YFAS “food addiction” appear to represent a more disturbed variant.

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Table 1

Endorsement Rates for Yale Food Addiction Scale “Symptoms”

	Did Not Meet Symptom Criteria	Met Symptom Criteria
Consumed More Than Planned	35 (57.3%)	47 (42.7%)
Unable to Cut Down or Stop	1 (1.2%)	81 (98.8%)
Great Deal of Time Spent	27 (32.9%)	55 (62.1%)
Important Activities Given Up	44 (53.7%)	38 (46.3%)
Use Despite Consequences	20 (24.7%)	61 (75.3%)
Tolerance	35 (43.2%)	46 (56.8%)
Withdrawal	37 (45.1%)	45 (54.9%)
Impairment or Distress	31 (38.3%)	50 (61.7%)

Table 2

Relation between the Yale Food Addiction Scale and Axis I Disorders

	Food Addiction (n=46)	No Food Addiction (n=35)	Test Statistic	P Value
All Mood Disorders			10.09	.001**
No	10 (23.3%)	19 (59.4%)		
Yes	33 (76.7%)	13 (40.6%)		
MDD			7.49	.006**
No	12 (27.9%)	19 (59.4%)		
Yes	31 (72.1%)	13 (40.6%)		
All Anxiety Disorders			2.25	.133
No	18 (41.9%)	19 (59.4%)		
Yes	25 (58.1%)	13 (40.6%)		
Alcohol Use Disorders				
No	32 (74.4%)	23 (71.9%)	.061	.805
Yes	11 (25.6%)	9 (28.1%)		
Drug Use Disorders				
No	33 (76.7%)	24 (75.0%)	.031	.861
Yes	10 (30.3%)	8 (25.0%)		

Note. MDD, Major Depressive Disorder

** Chi-Square is significant at the 0.01 level (2-tailed).

Table 3

Correlations between the YFAS and General Psychopathology¹

	YFAS Symptom	BDI	RSES	DERS Non-Accept	DERS Goals	DERS Impulse	DERS Aware	DERS Strategy	DERS Clarity
BDI	.35**	1							
RSES	-.27**	-.79**	1						
DERS Non-accept	.25**	.52**	-.47**	1					
DERS Goals	.29**	.57**	-.61**	.39**	1				
DERS Impulse	.39**	.50**	-.42**	.49**	.61**	1			
DERS Aware	.17	.47**	-.50**	.49**	.25**	.35**	1		
DERS Strategy	.35**	.74**	-.70**	.72**	.70**	.75**	.47**	1	
DERS Clarity	.27**	.46**	-.44**	.55**	.39**	.45**	.81**	.55**	1

Note: YFAS, Yale Food Addiction Scale; BDI, Beck Depression Inventory; RSES, Rosenberg Self Esteem Scale; DERS, Difficulties in Emotion Regulation

** Correlation is significant at the 0.01 level (1-tailed).

¹The Diagnostic version of the YFAS exhibited the same pattern of significant results with general pathology.

Table 4

Correlations between the YFAS and Other Measures of Eating Psychopathology²

	YFAS Symptom	EDE Restraint	EDE Eating	EDE Shape	EDE Weight	EDE Global	OBE Episodes
YFAS Symptom	1						
EDE Restraint	.03	1					
EDE Eating	.26**	.24**	1				
EDE Shape	.21*	.22*	.47**	1			
EDE Weight	.20*	.22*	.44**	.79***	1		
EDE Global	.22*	.59**	.74**	.83**	.82**	1	
OBE Episodes	.28**	.09	.22*	.26**	.20*	.23*	1

Note. YFAS, Yale Food Addiction Scale; EDE, Eating Disorder Examination; OBE, Objective Bulimic Episodes.

* Correlation is significant at the 0.05 level (1-tailed).

** Correlation is significant at the 0.01 level (1-tailed)

²The diagnostic version of the YFAS exhibited the same pattern of significant results with eating pathology.