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Prognostic significance of two sub-categorization methods for the treatment of binge eating disorder: Negative affect and overvaluation predict, but do not moderate, specific outcomes

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Abstract

Given the absence of known predictors and moderators for binge eating disorder (BED) treatment outcome and recent findings regarding meaningful sub-categorizations of BED patients, we tested the predictive validity of two subtyping methods. Seventy-five overweight patients with BED who participated in a randomized clinical trial of guided self-help treatments (cognitive-behavioral therapy (CBTgsh) and behavioral weight loss (BWLgsh)) were categorized in two ways. First, a cluster analytic approach yielded dietary-negative affect (29%) and pure dietary (71%) subtypes. Second, research conventions for categorizing patients based upon shape or weight self-evaluation yielded clinical overvaluation (51%) and subclinical overvaluation (49%) subtypes. At the end of treatment, participants subtyped as dietary-negative affect reported more frequent binge episodes compared to the pure dietary subtype, and those with clinical overvaluation reported greater eating disorder psychopathology compared to the subclinical overvaluation group. Neither method predicted binge remission, depressive symptoms, or weight loss. Neither sub-categorization moderated the effects of guided self-help CBT and BWL treatments on any BED outcomes, suggesting that these two specific treatments perform comparably across BED subtypes. In conclusion, dietary-negative affect subtyping and overvaluation subtyping each predicted, but did not moderate, specific and important dimensions of BED treatment outcome.

Keywords

Binge eating disorder; Overweight; Predictors; Moderators; Negative affect; Overvaluation

Introduction

Binge eating disorder (BED) is characterized by recurrent binge eating without the inappropriate compensatory weight control methods that distinguish the condition from bulimia nervosa (BN). It is currently recognized as a prevalent and important clinical problem associated with high levels of eating disorder psychopathology, psychological distress, and medical comorbidity (Allison, Grilo, Masheb, & Stunkard, 2005; Johnson, Spitzer, & Williams, 2001). Although effective treatments have been identified for binge eating problems (Wilson, Grilo, & Vitousek, 2007), even among BED studies that have produced the most impressive results (Grilo, Masheb, & Wilson, 2005; Wilfley et al., 2002), a substantial proportion of patients do not achieve abstinence from binge eating and

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outcomes for weight loss have been unimpressive. Thus, it is important to find ways to predict response to treatments as this could facilitate the development of more targeted, effective interventions. Unfortunately, finding reliable patient predictors of treatment outcome has proven to be difficult (Wilson et al., 2007).

Stice and colleagues suggested statistical methods for sub-categorizing patients with binge eating problems, and cluster analytic studies of clinical patients with BN and BED have yielded two subtypes, a pure dietary subtype and a mixed dietary-negative affect subtype (Stice & Agras, 1999; Stice et al., 2001). Analyses based upon these models have shown that the two subtypes differ on eating, weight, and shape concerns as well as associated psychiatric and social maladjustment, such that the mixed dietary-negative affect subtype is a more pathological variant than the pure dietary subtype (Stice & Agras, 1999; Stice et al., 2001). These findings have been replicated in clinical and community patients with BN (Grilo, Masheb, & Berman, 2001; Stice & Fairburn, 2003), adolescent clinical groups (Grilo, 2004) and clinical patients with BED (Grilo, Masheb, & Wilson, 2001c), and the dietary-negative affect subtyping has been shown to be stable over time (Grilo et al., 2001c)).

Two studies have reported that the dietary-negative affect subtyping may be predictive of treatment outcomes. Stice and Fairburn (2003), in a 5-year naturalistic community study of patients with BN, found that dietary-negative affect subtyping prospectively predicted remission from binge eating, but not compensatory behaviors.Stice et al. (2001), in a treatment study of BED women receiving dialetic behavior therapy (DBT), found that dietary-negative affect subtyping predicted binge remission. In both of these studies, the pure dietary subtype had greater binge remission than the dietary-negative affect subtype.

A second meaningful sub-categorization method for BED is based on the degree of shape or weight self-evaluation (Grilo et al., in press). The excessive influence of shape or weight on one's self-evaluation— hereafter referred to as overvaluation—is considered by some a core feature across eating disorders (Fairburn & Harrison, 2003). The presence of overvaluation is necessary for the diagnoses of anorexia nervosa and BN, but not for BED (American Psychiatric Association, 1994). Recent studies of patients with BED, however, have found that overvaluation does not simply reflect overweight status or a concern commensurate with being overweight, but rather is an important clinical construct strongly associated with eating-related psychopathology and psychological functioning (Grilo et al., in press; Hrabosky, Masheb, White, & Grilo, 2007; Masheb & Grilo, 2000). BED patients categorized with clinical levels of overvaluation reported greater eating-related psychopathology and depression levels than those with subclinical overvaluation levels, suggesting that the clinical overvaluation group is a more pathological variant of BED than the subclinical overvaluation group. Such findings suggest that the importance of shape/weight overvaluation is a meaningful distinction among BED patients and is a potentially important diagnostic specifier relevant for DSM-V (Grilo et al., in press). The predictive value of overvaluation subtyping on BED treatment outcomes is unknown.

Given the absence of reliable predictors for BED treatment outcome and the recent advances in methods for identifying meaningful categorizations of BED patients, we were interested in the potential of these two subcategorization methods to predict treatment outcome. Thus, in the present study, we aimed to examine cluster analytic dietary-negative affect subtyping and overvaluation subtyping as predictors and moderators of treatment outcome among patients with BED. This was examined in a randomized controlled trial testing the efficacy of guided self-help cognitive-behavioral therapy (CBTgsh) and guided self-help behavioral weight loss (BWLgsh) treatments (Grilo & Masheb, 2005).More specifically we aimed to: (1) extend the predictive validity of dietary-negative affect subtyping for binge remission in

DBT delivered in traditional individuals sessions (Stice et al., 2001) to two guided self-help treatments (CBTgsh and BWLgsh) for BED, (2) extend previous findings for the predictive validity of dietary-negative affect subtyping by examining broad domains of BED treatment outcome (binge eating, eating disorder psychopathology, depressive symptoms, and weight loss), (3) compare the predictive validity of dietary-negative affect subtyping to the predictive validity of overvaluation subtyping, and (4) examine potential moderating effects of dietary-negative affect subtyping and overvaluation subtyping with guided self-help treatments for BED.

Methods

Participants

Participants were 75 adult patients who met DSM-IV (American Psychiatric Association, 1994) research criteria for BED and participated in a randomized comparative clinical trial of CBTgsh and BWLgsh from January 2000 to June 2004. Recruitment consisted of advertisements seeking participants who wanted to ‘‘stop binge eating and lose weight.’’ A detailed description of this clinical trial has been reported (Grilo & Masheb, 2005). Participants were required to be 18–60 years, have a Body Mass Index (BMI) of 27 or greater, and meet BED criteria. Exclusion criteria were: concurrent treatment for eating, weight, or psychiatric illness; medical conditions (diabetes) that influence eating or weight; severe current psychiatric conditions requiring other treatment (psychosis, bipolar disorder); and pregnancy. The study received approval by the institutional review board at Yale University School of Medicine, and all participants provided written informed consent.

Ninety consecutively evaluated individuals were randomized, based on the order accepted into the study, to: CBTgsh (n = 37), BWLgsh (n = 38), or wait-list control (n = 15). A computer-generated randomization list was prepared by an independent statistician, and randomization was concealed for each participant until completion of the baseline assessment. Only the 75 participants receiving active treatment (CBTgsh or BWLgsh) were eligible for the present study. These participants were 20–60 years (mean = 46.0, SD = 9.1); 81% (n = 61) were female, and 84% (n = 63) attended or finished college. The participant group was 73% (n = 55) Caucasian, 11% (n = 8) African American, 13% (n = 10) Hispanic American, and 3% (n = 2) of other ethnicity. Mean BMI was 35.3 (SD = 6.9).

Diagnostic assessment

Diagnostic and assessment procedures were administered by trained and monitored doctoral-level (Ph.D.) research clinicians. DSM-IV (American Psychiatric Association, 1994) Axis I psychiatric disorder diagnoses were based on the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/P) (First, Spitzer, Gibbon, & Williams, 1996). Inter-rater reliability for Axis I and Axis II diagnoses ranged from k .58 to 1.0. k for current BED was 1.0. The DSM-IV BED diagnosis obtained using the SCID-I/P was confirmed by findings from the Eating Disorder Examination Interview—12th Edition version (EDE) (Fairburn & Cooper, 1993), a semi-structured investigator-based interview designed to assess eating disorder diagnoses. The EDE focuses on the previous 28 days except for the diagnostic items, which were rated for additional duration stipulations. For BED, the EDE was modified to include questions to assess the DSM-IV (American Psychiatric Association, 1994) requirement of a 6-month time frame. The EDE assesses the frequency of different forms of overeating, including objective bulimic episodes (OBEs; i.e., binge eating defined as unusually large quantities of food with a subjective sense of loss of control), and the number of days in which OBEs occurred for the previous month. The EDE has established inter-rater and test–retest reliability (Grilo, Masheb, Lozano-Blanco, & Barry, 2004).

Measures

Daily self-monitoring records were used to assess prospectively binge remission and binge frequency using the EDE definition (Grilo, Masheb, & Wilson, 2001a, 2001b). Binge remission was determined based upon the absence of binge episodes (i.e., OBEs as defined by the EDE) for the 28 days of daily self-monitoring records preceding the post-treatment assessment. Binge frequency was the number of binge episodes (OBEs) reported on 28 days of daily self-monitoring records prior to the post-treatment assessment. Research clinicians met briefly with participants each session to collect and check records for accuracy; incomplete records were completed at the session.

The Eating Disorder Examination-Questionnaire Version (EDE-Q) (Fairburn & Beglin, 1994) is the self-report version of the EDE Interview (Fairburn & Cooper, 1993). The Total EDE-Q is derived from the mean of the four EDE-Q subscale scores and represents a measure of overall eating psychopathology. The EDE-Q has received empirical support for its use with patients with BED (Grilo et al., 2001a, 2001b; Wilfley, Schwartz, Spurrell, & Fairburn, 1997), including good test–retest reliability (Reas, Grilo, & Masheb, 2006), although recent studies have found that the restraint scale is not associated with actual intake (Sysko, Walsh, Schebendach, & Wilson, 2005). Higher scores reflect greater severity or frequency.

The Three Factor Eating Questionnaire (*TFEQ*) (Stunkard & Messick, 1985) is a widely used self-report measure (Allison, Kalinsky, & Gorman, 1992), with subscales reflecting three key eating domains: cognitive restraint, disinhibition, and hunger. Studies of the TFEQ have reported adequate psychometric properties and construct validity (Allison et al., 1992; Stunkard & Messick, 1985), although the restraint subscale, like other self-report restraint measures, is not correlated with actual intake (Stice, Fisher, & Lowe, 2004). Higher scores reflect greater levels.

The Beck Depression Inventory (*BDI*) (Beck & Steer, 1987) 21-item version is a widely used inventory of the cognitive, affective, and somatic symptoms of depression. Studies have reported adequate internal consistency (coefficient a generally ranges .73–.95), acceptable short-term test–retest reliability, and convergent validity (Beck, Steer, & Garbin, 1988). Higher scores reflect greater depressive symptoms.

Body Mass Index (*BMI*; kg/m^2) was calculated from heights and weights measured at baseline evaluation, and again at post-treatment (12 weeks), using a medical balance-beam scale. Change in BMI (weight loss; baseline BMI minus post-treatment BMI) was calculated as a measure of BED treatment outcome.

Guided self-help treatments

Treatments were administered individually following a guided self-help approach previously used for BED (Carter & Fairburn, 1998; Grilo, Masheb, & Salant, 2005). The 12-week protocol included six brief (15–20 min sessions) individual meetings, and the following patient treatment manuals: *Overcoming Binge Eating* (Fairburn, 1995) for CBTgsh; and *LEARN Program for Weight Management* 2000 (Brownell, 2000) for BWLgsh. Treatments were provided by experienced doctoral research clinicians who focused on: (a) increasing motivation; (b) correcting any misunderstanding of the information; (c) clarifying skill-building exercises; and (d) collecting self-monitoring data.

Sub-categorizing participants and overview of analyses

Participants were sub-categorized twice, first by dietary-negative affect subtype and then by overvaluation subtype.

Dietary-negative affect subtyping

Following a previous study byGrilo et al. (2001c), BED dietary-negative affect subtype was determined using a cluster analysis of participants' scores (at baseline) on the following four scales: the EDE-Q dietary restraint subscale, the TFEQ cognitive restraint subscale, the BDI, and the RSES. The EDE-Q dietary restraint is one of the four subscales of the EDE-Q described above and measures attempts to restrict food intake. The TFEQ cognitive restraint subscale is one of the three subscales of the TFEQ described above and measures attempts at dietary control.

Cluster analysis (Statistical Package for the Social Sciences Quick Cluster algorithm) groups cases on the basis of similarity in levels of selected variables. Quick Cluster selects *k* participants (*k* is the number of cluster requested), with well-separated nonmissing values as initial centers, and then iteratively clusters participants into one of the groups on the basis of squared Euclidean distances. All cluster indicators were normally distributed. Cluster analysis in the present study revealed a mixed dietary-negative affect subtype ($n = 22$; 29.3%) and a pure dietary subtype ($n = 53$; 70.7%). This cluster analytic dietary-negative affect subtyping algorithm for BED yielded similar proportions of patients in each cluster as those reported in previous studies (Grilo, Masheb, & Berman, 2001; Grilo et al., 2001c; Stice & Agras, 1999; Stice et al., 2001). To examine whether a two-cluster solution best characterized the sample, we also inspected a three-cluster solution; the third cluster, however, comprised only two cases.

Overvaluation subtyping

The entire participant group was also categorized by shape/weight overvaluation levels following prior research conventions (Fairburn & Cooper, 1993; Goldfein, Walsh, & Midlarsky, 2000) that have recently been supported in BED (Grilo et al., in press; Hrabosky et al., 2007). Overvaluation subtyping was measured using two specific items from the EDE: Importance of Shape (i.e., "Over the past 4 weeks, has your *shape* influenced how you feel about (judge, think, evaluate) yourself as a person?") and Importance of Weight (i.e., "Over the past 4 weeks has your *weight* influenced how you feel about (judge, think, evaluate) yourself as a person?") The questions are asked separately in reference to each of the past 3 months. The two items were rated on a 7-point forced-choice scale anchored with 0 (No importance) to 6 (Supreme importance: nothing is more important in the subject's schema for self-evaluation). Composite scores were made based on the mean score for the past 3 months for each item.

Following the suggested clinical cut-off score of 4 of Fairburn and Cooper (1993) (i.e., moderate importance), participants were categorized as experiencing either clinical or subclinical overvaluation. The clinical overvaluation group ($n = 38$; 50.7%) included individuals who reported that their shape and/or weight was high on the list of things that influence their self-evaluation (i.e., score ≥4 on either overvaluation item). The subclinical overvaluation group ($n = 37$; 49.3%) included individuals who reported no influence or, at most, mild influence of shape or weight on their self-evaluation (i.e., score <4 on both overvaluation items). Given possible concerns about simple dichotomized groups, we also performed a cluster analysis using Quick cluster and the two EDE overvaluation items. This empirical method resulted in five participants moving from the clinical overvaluation group to the subclinical overvaluation group. All analyses that follow were run with both the clinical cut-off score method and the cluster analytic method. The pattern of results was the same for both methods, and we thus chose the clinical cut-off score method to be consistent with prior research (Fairburn & Cooper, 1993; Goldfein et al., 2000; Grilo et al., in press; Hrabosky et al., 2007).

Overview of analyses

Participants classified as pure dietary subtype (53/75) were compared to those classified as mixed dietary-negative affect subtype (22/75) on demographic, psychiatric, and clinical variables at baseline using chi-square analysis for categorical variables and analysis of variance (ANOVA) for dimensional variables. Similarly, participants with clinical overvaluation (38/75) were compared to those with subclinical overvaluation (37/75) on demographic, psychiatric, and clinical variables at baseline using chi-square analysis for categorical variables and ANOVA for dimensional variables. The two sub-categorization methods were then tested as potential predictor variables by examining the main effects at post-treatment of dietary-negative affect subtyping and overvaluation separately using Wald statistics for categorical outcomes and analyses of covariance (ANCOVAs), controlling for baseline scores, for dimensional outcomes. A categorical measure of outcome was "remission" from binge eating, defined as zero binges (OBEs from daily self-monitoring) for the past 28 days. The interaction effects of categorization method and treatment condition were examined to test for potential moderating variables also using Wald statistics and ANCOVAs.

Results

Comparison of sub-categorization methods on demographic, psychiatric, and baseline characteristics

Table 1 summarizes the demographic, psychiatric and baseline characteristics of the dietary-negative affect subtyping derived from the cluster analysis. The two BED dietary-negative affect subtypes did not differ on age, gender, ethnicity, education, or age of BED onset, but a greater percentage of the dietary-negative affect group reported DSM-IV lifetime Axis I diagnoses, particularly anxiety disorders, than the pure dietary subtype (86% versus 62%; $\chi^2(1) = 4.25$, $p = .039$). With regard to baseline characteristics, the two BED dietary-negative affect subtypes did not differ on binge frequency or BMI, but the dietary-negative affect subtype reported greater eating disorder psychopathology and depressive symptoms than the pure dietary subtype *(*$F(1, 74) = 7.56$, $p = .008$; *and* $F(1, 74) = 173.8$, $p<.0001$*)*. Table 2 summarizes the demographic, psychiatric, and baseline characteristics of the overvaluation categorization derived from the EDE. The clinical and subclinical overvaluation BED groups did not differ on age, gender, ethnicity, education, DSM-IV lifetime Axis I diagnoses, or age of BED onset. With regard to baseline characteristics, overvaluation subtyping did not differ on binge frequency, depressive symptoms, or BMI, but the clinical overvaluation group reported greater eating disorder psychopathology than the subclinical overvaluation group *(*$F(1, 74) = 3.98$, $p = .050$*)*.

Comparison of sub-categorization methods on baseline measures used to create dietary-negative affect subtypes and overvaluation subtypes

As a manipulation check, ANOVAs were performed to compare the BED dietary-negative affect subtypes on baseline measures used to create the two clusters. As expected, there were no significant differences between the dietary-negative affect subtypes on Dietary Restraint (EDE-Q) and Cognitive Restraint (TFEQ), but participants with the dietary-negative affect subtype reported significantly greater BDI scores ($F(1, 74) = 173.8$, $p<.0001$) reflecting greater negative affect than the pure dietary subtype. ANOVAs were also performed to compare the BED categorization method based upon overvaluation subtyping. As expected, the clinical overvaluation group reported significantly greater Importance of Shape ($F(1, 74) = 129.1$, $p<.0001$) and Importance of Weight ($F(1, 74) = 109.1$, $p<.0001$) than the subclinical overvaluation group.

Comparison of sub-categorization methods as potential predictor variables

Table 3 summarizes Wald statistics and ANCOVAs performed to compare the BED categorization methods on post-treatment outcomes controlling for baseline scores. The main effects of dietary-negative affect subtyping were examined. There were no significant differences between dietary-negative affect subtypes on binge remission, Total EDE-Q, BDI, and change in BMI. Participants with the dietary-negative affect subtype, however, did report a greater frequency of binge episodes at the end of treatment compared to the pure dietary subtype ($F(1, 74) = 5.20$, $p = .026$) suggesting that dietary-negative affect subtyping is a predictor of binge frequency. The main effects of overvaluation subtyping were also examined. There were no significant differences between participants with clinical and subclinical overvaluation on binge remission, binge episodes, BDI, and change in BMI. Participants with clinical overvaluation, however, did report higher Total EDE-Q scores at the end of treatment compared to the subclinical overvaluation group ($F(1, 74) = 4.44$, $p = .039$), indicating that overvaluation subtyping is a predictor of eating pathology.

Comparison of sub-categorization methods as potential moderators

The interaction effects of categorization method and treatment group were also examined. As expected at baseline, no significant differences were found between the percentage of participants with either dietary-negative affect subtype receiving CBTgsh or BWLgsh ($\chi^2(1) = .19$, $p = .665$). Similarly, no significant differences were found between the percentage of participants with either clinical or subclinical overvaluation receiving CBTgsh or BWLgsh ($\chi^2 2(1) = 1.08$, $p = .298$). Thus, we tested for moderating effects at posttreatment. No significant interaction effects for dietary-negative affect subtype by treatment group on any of the treatment outcome measures (i.e., binge remission, binge episodes, Total EDE-Q, BDI, or change in BMI) were found. Similarly, there were no significant interaction effects for overvaluation subtyping by treatment group on any of the treatment outcome measures.

Discussion

Overall, dietary-negative affect subtyping and overvaluation subtyping were each predictors of specific and important, although different, dimensions of BED outcome. Dietary-negative affect subtyping was found to be a predictor of binge frequency such that participants with the dietary-negative affect subtype reported a greater frequency of binge episodes at the end of treatment compared to the pure dietary subtype. Overvaluation subtyping was found to be a significant predictor of eating disorder psychopathology; participants with clinical overvaluation had greater eating pathology at the end of treatment. Collectively, these findings suggest that negative affect has some role in the maintenance of binge eating, whereas overvaluation has a role in the maintenance of eating disorder psychopathology among patients with BED.

To investigate these two predictors, participants were grouped with two sub-categorization methods. In the first method, cluster analysis revealed two groups, that is, a mixed dietary-negative affect subtype ($n = 22$; 29.3%) and a pure dietary subtype ($n = 53$; 70.7%). Proportions in these groupings were similar to previous studies (Grilo, Masheb, & Berman, 2001; Grilo et al., 2001c; Stice & Agras, 1999; Stice et al., 2001; Stice & Fairburn, 2003). Also consistent with previous reports (Grilo et al., 2001c; Stice et al., 2001) were findings that the mixed dietary-negative affect subtype was a more pathological variant of BED as evidenced by the higher levels of depressive symptoms and greater psychiatric comorbidity than the pure dietary subtype. In the second sub-categorization method, participants were categorized as experiencing either clinical overvaluation ($n = 38$; 50.7%) or subclinical overvaluation ($n = 37$; 49.3%) using research conventions of Fairburn and Cooper (1993). The overvaluation subtype appeared to be a more pathological variant of BED as evidenced

by the higher levels of eating disorder psychopathology as compared to the subclinical overvaluation subtype. Thus, one clinical implication of these sub-categorization methods is that there are identifiable ways to find subtypes of BED patients who are both more pathological and less likely to have positive treatment outcomes.

While both sub-categorization methods predicted specific BED treatment outcomes, neither method moderated the effects of guided self-help CBT and BWL treatments on any of the outcomes tested. This suggests that guided self-help CBT and BWL perform comparably across BED subtypes.

The significant findings for predictors of treatment outcomes in the present study are important given the lack of reliable a priori predictors for BED outcome. Recent advances in identifying predictors of treatment outcome for BN and BED have included investigations of early treatment response as a predictor (Grilo, Masheb, & Wilson, 2006; Masheb & Grilo, 2007; Wilson, Fairburn, Agras, Walsh, & Kraemer, 2002). Rapid response, defined using receiver operating characteristic curves as a 65% or greater reduction in binge eating by the fourth week of treatment, has been shown to predict important treatment outcomes including binge frequency, binge remission, weight loss, and negative affect (Grilo et al., 2006; Masheb & Grilo, 2007). In comparison to rapid response, dietary-negative affect subtyping and overvaluation subtyping appear to have limited predictive utility for BED treatment outcomes. One major advantage of the two categorization methods presented in the current study, however, is that they represent patient characteristics known prior to initiating 4 weeks of specialized treatment. Future research should consider alternative categorization methods such as perhaps testing the joint effects of negative affect and overvaluation on the various specific psychological and pharmacological treatments.

Our study findings should be considered within the context of methodological strengths and weaknesses. Strengths include the strong randomized design and assessment methods. There are also several limitations as well as recent findings that restraint scales are not correlated with actual caloric intake (Stice et al., 2004). Clustering procedures have potential biases. In the present study we initially conducted a two-cluster solution for dietary-negative affect subtyping in an effort to replicate findings from previous studies. To increase confidence in this decision, we re-ran the cluster analysis and found that a two-cluster solution was superior to a three-cluster solution. Another potential bias in the dietary-negative affect subtyping is whether measures of restraint are needed as cluster variables. This is important given that the dietary-negative affect and pure dietary groups did not differ on these measures. Likewise, the use of restraint measures in cluster analytic methods may prove to differ for BN and BED patients as restraint scales have shown not to be correlated with actual intake (Stice et al., 2004). It may be, for example, that cluster analysis of negative affect and overvaluation yields a better predictor than the cluster analysis of negative affect and restraint.

Similar to cluster analytic strategies, utilizing cut-off scores to dichotomize patient samples also has potential biases. To minimize these biases, we performed analyses for overvaluation subtyping with both cutoff score and cluster analytic methods and found similar results. The prognostic significance of the categorization methods used in the present study may not generalize to other specialist treatments such as individual CBT or group-administered BWL, other forms of psychological or pharmacological intervention, or other treatments delivered by practitioners in diverse community settings. It is also possible that our inability to find moderating effects was partly due to the limited sample size.

In summary, these two sub-categorization methods each appeared to have specific, albeit limited, utility for predicting BED treatment outcomes. Given the importance of each

outcome predicted by these two methods (i.e., binge frequency and eating disorder psychopathology) and our limited knowledge of a priori predictors for BED treatment, future research should test the predictive utility of the joint effects of dietary-negative affect and overvaluation.

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Table 1

Demographic, psychiatric and baseline characteristics of participants by dietary-negative affect subtype

Characteristic	Dietary-negative affect (*n* = 22)	Pure dietary (*n* = 53)	Test statistic	*p*-value
Age, *mean* (SD)	45.8 (7.5)	46.1 (9.8)	.02	.884
Female, *No* (%)	17 (77.3)	44 (83.0)	.34	.561
Ethnicity, *No* (%)			2.46	.482
Caucasian	14 (63.6)	41 (77.4)		
African-American	4 (18.2)	4 (7.5)		
Hispanic-American	3 (13.6)	7 (13.2)		
Other	1 (4.5)	1 (1.9)		
Education, *No* (%)			3.22	.200
College	7 (31.8)	28 (52.8)		
Some college	10 (45.5)	19 (35.8)		
High School	5 (22.7)	6 (11.3)		
DSM-IV comorbidity lifetime, *No* (%)				
Any Axis I psychiatric disorder	19 (86.4)	33 (62.3)	4.25	.039
Major depressive disorder	13 (59.1)	21 (39.6)	2.38	.123
Dysthymia	3 (13.6)	2 (3.8)	2.43	.119
Anxiety disorders	14 (63.6)	11 (20.8)	12.86	.000
Age onset BED, *mean* (SD)	29.1 (12.4)	27.7 (14.2)	.17	.680
Baseline characteristics				
Binge frequency	14.0 (8.4)	15.3 (8.7)	.37	.546
Eating Disorder Pathology (EDE-Q)	4.1 (.7)	3.5 (.9)	7.56	.008
Symptoms of depression (BDI)	29.0 (6.4)	11.7 (4.6)	173.8	.000
BMI	36.6 (6.4)	34.8 (7.1)	1.02	.317

Note: Test statistic = chi-square for categorical variables (with continuity correction for 2 × 2 tables) and ANOVAs for dimensional variables. *p* values are for two-tailed tests. SD = standard deviation; No = number; BED = binge eating disorder.

Table 2

Demographic, psychiatric and baseline characteristics of participants by overvaluation subtype

Characteristic	Clinical overvaluation (*n* =38)	Subclinical overvaluation (*n* =37)	Test statistic	*p*-value
Age, *mean* (SD)	45.9 (9.3)	46.1 (9.1)	.01	.930
Female, *No* (%)	30 (78.9)	31 (83.8)	.29	.591
Ethnicity, *No* (%)			3.05	.384
Caucasian	29 (76.3)	26 (70.3)		
African-American	5 (13.2)	3 (8.1)		
Hispanic-American	4 (10.5)	6 (16.2)		
Other	0 (.0)	2 (5.4)		
Education, *No* (%)			3.07	.216
College	14 (36.8)	21 (56.8)		
Some college	17 (44.7)	12 (32.4)		
High School	7 (18.4)	4 (10.8)		
DSM-IV comorbidity lifetime, *No* (%)				
Any Axis I psychiatric disorder	28 (73.7)	24 (64.9)	.69	.408
Major depressive disorder	20 (52.6)	14 (37.8)	1.66	.198
Dysthymia	2 (5.3)	3 (8.1)	.24	.621
Anxiety disorders	14 (36.8)	11 (29.7)	.43	.514
Age onset BED, *mean* (SD)	28.8 (13.5)	27.4 (13.9)	.20	.657
Baseline characteristics				
Binge frequency	15.3 (8.3)	14.5 (8.9)	.15	.697
Eating Disorder Pathology (EDE-Q)	3.9 (.8)	3.5 (1.0)	3.98	.050
Symptoms of depression (BDI)	18.3 (9.5)	15.1 (.9)	2.20	.143
BMI	35.0 (7.3)	35.7 (6.6)	.20	.659

Note Test statistic =chi-square for categorical variables (with continuity correction for 2 × 2 tables) and ANOVAs for dimensional variables. *p* values are for two-tailed tests. SD =standard deviation; No =number; BED =binge eating disorder.

Table 3

Tests of dietary-negative affect subtyping and overvaluation subtyping as potential predictor and moderating variables

Treatment outcome measures, *mean* (SD)	**Dietary-negative affect**	**Dietary**	**Main effect**		**Interaction effect**	
	(*n* = 22)	**(*n* = 53)**	**Test statistic**	***p*-value**	**Test statistic**	***p*-value**
Binge remitted, *No* (%)	5 (22.7)	19 (35.8)	1.09	.296	.40	.528
Binge episodes (self-monitoring)	7.2 (8.5)	3.8 (6.1)	5.20	.026	.00	.949
Eating Disorder Pathology (EDE-Q)	3.4 (1.2)	2.6 (1.1)	3.09	.083	.14	.714
Symptoms of depression (BDI)	19.3 (12.1)	7.3 (6.0)	.22	.642	.29	.592
Change in BMI (weight loss)	3 (1.0)	4 (1.3)	.09	.766	.23	.634
	Clinical overvaluation	Subclinical overvaluation	Main effect		Interaction effect	
	(*n* =38)	(*n* = 37)	Test statistic	*p* value	Test statistic	*p* value
Binge remitted, *No* (%)	14 (36.8)	10 (27.0)	.53	.469	.18	.671
Binge episodes (self-monitoring)	4.4 (6.5)	5.2 (7.5)	1.33	.253	.22	.643
Eating Disorder Pathology (EDE-Q)	3.2 (.9)	2.5 (1.3)	4.44	.039	1.43	.237
Symptoms of depression (BDI)	12.4 (10.5)	9.1 (9.0)	.49	.486	.34	.561
Change in BMI (weight loss)	3 (1.0)	4 (1.4)	.21	.649	.22	.639

Note Interaction Effect = subtyping (dietary-negative affect and dietary) × treatment (CBTgsh and BWLgsh) for top half of table, overvaluation subtyping (clinical overvaluation and subclinical overvaluation) × treatment (CBTgsh and BW Lgsh) for bottom half of table. Test statistic = Wald statistic for categorical outcomes (i.e., binge remission), and ANCOVAs for dimensional outcomes covarying for baseline scores. SD = standard deviation; No = number; EDE-Q = Eating Disorder Examination-Questionnaire; BDI = Beck Depression Inventory; BMI = Body Mass Index.