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Eating Disorder Examination-Questionnaire Factor Structure and Construct Validity In Bariatric Surgery Candidates

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Abstract

Objective—The Eating Disorder Examination-Questionnaire (EDE-Q) is increasingly used in studies with bariatric surgery patients although little is known about psychometric properties of this self-report measure in this clinical group. The current study evaluated the factor structure and construct validity of the EDE-Q in bariatric surgery candidates.

Methods—Participants were a consecutive series of 174 obese bariatric surgery candidates who completed the EDE-Q and a battery of behavioral and psychological measures.

Results—Confirmatory factor analysis (CFA) revealed an inadequate fit for the original EDE-Q structure but revealed a good fit for an alternative structure suggested by recent research with obese samples. CFA supported a 7-item, 3-factor structure; the three factors were interpreted as dietary restraint, shape/weight overvaluation, and body dissatisfaction. The three factors converged with other relevant collateral measures.

Conclusions—These factor analytic findings, which replicate recent findings from studies with diverse obese samples, demonstrated convergent validity. Implications of these findings for clinical assessment and research with bariatric surgery patients are discussed.

Keywords

bariatric surgery; obesity; eating disorder; body image; eating behavior; Eating Disorder Examination-Questionnaire

Introduction

Bariatric surgery is considered the most effective treatment for producing substantial and sustained weight loss in severely obese persons (1). Follow-up studies, however, have reported findings of weight regain or plateau as early as the first year following bariatric surgery (2). For example, Sjöström and colleagues (2) reported percent weight loss decreased from 38% one year post-surgery to 25% 10 years post-surgery in patients who

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underwent Roux-en-Y gastric bypass (RYGB) surgery, with similar patterns for other surgical procedures. Accordingly, research has increasingly focused on identifying psychosocial predictors of bariatric surgery outcomes (3) with particular attention to investigating the potential relation of eating-related psychopathology (e.g., binge eating, loss of control eating) to postoperative weight changes (4–6).

Assessment of disordered eating behaviors and associated features is challenging and most available methods have limitations (7,8). Problems range from uncertain or inadequate psychometric properties, such as low reliability and validity, to practical issues, such as time burden, costs, and training requirements associated with intensive clinician-delivered interviews. Self-report questionnaires (which can be readily and efficiently used) - developed initially to assess eating disorders (9) - have recently been used by investigators attempting to characterize disordered eating and associated psychopathology in diverse obese patient groups (10) including bariatric surgery candidates and patients (11–13).

One of the most commonly used self-report instruments is the Eating Disorder Examination-Questionnaire (EDE-Q) (9) which assesses various forms of eating and overeating behaviors, binge eating, and associated eating-disorder psychopathology. The EDE-Q is a 32-item measure that assesses directly the core behavioral features of eating disorders - such as binge eating and purging behaviors – and comprises four subscales that reflect associated eating-disorder psychopathology. The EDE-Q has generally received support as an adequately reliable (14,15) and useful screening and assessment measure of eating-related pathology, although its performance varies somewhat across different clinical and community samples (see 16). Much of the research to date has focused on the degree of concordance between the self-report EDE-Q and interview version of the EDE, and the utility of the EDE-Q as a screening and assessment method (16). Much less research, however, has addressed basic psychometric properties of the EDE-Q such as the factor structure and validity of the four subscales.

Factor analysis can be used to identify a small set of unobserved variables (latent variables or “factors”) which account for the covariance among a larger set of observed variables. Exploratory factor analysis (EFA) can be used to explore patterns in data while confirmatory factor analysis can be used to test specific hypotheses (i.e., how well data fit hypothesized factors) about the data. Since the scale structure of the EDE (both self-report and interview versions) was posited by the developers based on rational or clinical grounds, empirical tests using factor analysis (i.e., EFA to explore patterns and CFA to test data fit with hypothesized scales) is needed.

To our knowledge, only two studies have investigated the factor structure of the *self-report* EDE-Q. One study (17) used EFA in a study of women with bulimic pathology and one study (18) utilized statistical tests of fit via CFA in a study with obese bariatric surgery patients; both studies failed to support the original 4-factor structure (i.e., subscales) of the EDE-Q. Hrabosky et al (18) using EFA and CFA methods produced a 12-item, 4-factor structure of the EDE-Q. The four factors included an over-eating disturbance factor (comprising binge eating and over-eating behaviors) and 3 additional factors consisting of 8 items. The Hrabosky et al (18) 8-item 3-factor structure (dietary restraint, body appearance concerns, and shape/weight overvaluation) is markedly different from the original EDE-Q scale structure.

All five studies to date that have investigated the factor structure of the original *interview* version of the EDE have also failed to support the adequacy of the hypothesized original 4-scale structure, including two EFA studies (19,20) and three CFA studies (21–23). Three of the studies produced disparate factor solutions (19–21), whereas two CFA studies (22,23)

with diverse obese subjects reported findings nearly identical to one another, supporting a 7-item 3-factor structure (restraint, body dissatisfaction, and shape/weight overvaluation). The modified EDE 3-factor structure identified in the two studies by Grilo and colleagues (22,23) was nearly identical to the 3 factors reported by Hrabosky and colleagues (18); the fourth overeating/binge-eating factor identified by Hrabosky et al (18) is generally assessed separately and not considered a subscale in the EDE-Q/EDE measures.

The purpose of the present study was to perform a CFA to test the factor structure of the EDE-Q in a series of obese bariatric surgery candidates, representing only the second such study with this patient group. We specifically aimed to test the original EDE-Q (9) structure and the recently identified 3-factor structures by Hrabosky et al (18) and Grilo et al (22,23). We also aimed to examine the construct validity of the factor structures (internal consistency and inter-correlations) and convergent validity with independent collateral assessment measures. We hypothesized that CFA would fail to support the original structure but would support recent alternative structures (18,22,23) and that the modified factors would demonstrate superior construct and convergent validity.

Methods

Participants

Participants were a consecutive series of 174 persons considering Roux-en-Y gastric bypass surgery at the Yale Bariatric Surgery Program and presenting to the Yale Center for Eating and Weight Disorders for psychological evaluations required as part of the bariatric surgery candidacy process. The study group of N=174 bariatric surgery candidates had a mean age of 42.9 (SD = 11.1) years and mean BMI of 50.2 (SD = 8.2). Of the 174 participants, 131 (75%) were women, 119 (68%) were Caucasian (31 (17.8%) were African American, 13 (7.5%) were Hispanic, and 11 (6.3%) were “other race/ethnicity), and 126 (74%) had attained at least some college education. Of the 174 participants, 64 (36.8%) were diagnosed with at least one lifetime psychiatric disorder, with affective disorders being the most commonly observed (N=39, 22.4%). Yale Institutional Review Board approval was given to use the information obtained in the psychological evaluation process for research purposes and participants provided written informed consent.

Assessment Measures

Participants completed a battery of self-report measures during preoperative evaluations performed by a multidisciplinary team. The battery consisted of the EDE-Q (9) as well as collateral measures of body image, depression, and self-esteem which allowed for evaluation of the convergent validity of the EDE-Q scales/factors. Participants’ height and weight were measured to calculate body mass index (BMI).

The *Eating Disorder Examination-Questionnaire* (EDE-Q)(9) self-report version consists of 32-items that assess the core symptoms of eating disorders and a range of eating-related psychopathology. The EDE-Q is based closely on the EDE interview (24). The EDE-Q assesses the frequency of different forms of problematic overeating behaviors, including binge eating (labeled *objective bulimic episodes* (OBEs) and different forms of inappropriate weight compensatory behaviors (e.g., purging methods). The EDE-Q has four subscales each consisting of 5–8 items: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern, which were the focus of the present study. The 23 items that comprise the four EDE-Q subscales are each rated using seven point forced-choice format (0–6), with higher scores reflecting either greater severity or frequency.

The *Body Shape Questionnaire* (BSQ) (25) is a measure of body dissatisfaction, reflecting primarily the degree of preoccupation and distress about one’s body shape. The BSQ, which

consists of 34 items, has been shown to have good psychometric properties, including good reliability and both concurrent and discriminant validity (26).

The *Beck Depression Inventory* (BDI) (27) is a measure of depressive symptoms (both cognitive and somatic features). The BDI 21-item version has been shown to have excellent psychometric properties, including good internal consistency, adequate test-retest reliability, and strong construct and predictive validity (28).

The *Rosenberg Self-Esteem Scale* (RSES) (29) is a measure of global self-esteem comprising cognitive-evaluative and affective aspects of self-worth. The 10-item RSES has been shown to have excellent psychometric properties including good internal consistency, test-retest reliability, and construct validity (30).

Statistical Analysis

The original subscale structure of the EDE-Q was analyzed using internal consistency (Cronbach's alpha) reliability analyses and through confirmatory factor analysis (CFA; MPlus Version 6.11). Model estimation was based upon maximum likelihood. Imputation of missing data was based upon full information maximum likelihood; the proportion of missing data in EDE-Q variables for the full study group was minimal, ranging from 4.0% to 14.2%. A CFA was performed testing the fit of the original EDE-Q subscale structure (9) and a second CFA was performed testing the fit of the (similar) modified structures by Hrabosky et al (18) and Grilo (22,23). Model fit was evaluated on the basis of recommended standards (31) for different tests of model fit. The following fit statistics tests (along with recommended values reflecting their degree of fit) were performed: comparative fit index (CFI; criteria ≥ 0.900), Tucker-Lewis index (TLI; criteria ≥ 0.900), root mean square error of approximation (RMSEA; criteria ≤ 0.060), and standard root mean square residual (SRMR; criteria ≤ 0.080). The CFI and TLI are incremental fit tests – i.e., they compare the current model to the null model that all variables are uncorrelated; the CFI takes into account sample size and performs well even with small samples. The RMSEA and SRMS are absolute fit tests – i.e., they test how well a priori specified models fits the data and which model has the best fit. Concurrent validity of the original and modified (CFA-based) EDE-Q scales was explored using correlational analyses with external measures of body dissatisfaction, depression, and self-esteem.

Results

CFA of Original and Modified EDE-Q Scales

CFA performed to test the original EDE-Q scale structure (9) revealed a poor fit: CFI = 0.729, TLI = 0.690, RMSEA = 0.112, and SRMR = 0.107. The CFA for the alternative structure (18) showed considerably better fit with values exceeding (CFI, TLI) or approaching (RMSEA, SRMR) recommended standards: CFI = 0.942, TLI = 0.920, RMSEA = 0.079, and SRMR = 0.088. In contrast, the CFA based upon the modified EDE scale structure (22,23) showed a good fit: CFI = 0.991, TLI = 0.982, RMSEA = 0.055, and SRMR = 0.034. The factor loadings of the CFA for the modified EDE-Q structure with the best fit are shown in Table 1.

Psychometric Characteristics

Scores for the three newly created factors were calculated by computing the average score for the items that load on each respective factor. This scoring method, which follows the method for the original EDE-Q subscale scoring, is required in order to allow for direct comparison of factors since the factors/scales vary in their number of items. Table 2 summarizes the basic descriptive scores along with the internal consistency, and the

correlation findings among the factors for both the original EDE-Q and the (CFA-based) modified factors. Internal consistency of the (CFA-based) modified EDE-Q subscales ranged from alpha coefficients 0.694 (dietary restraint) to 0.959 (shape/weight overvaluation), an improvement over the observed alphas for the original scales (range 0.597 (weight concern) to 0.839 (shape concern). The correlations observed for the modified EDE-Q subscales (range 0.12 to 0.457) reflect less overlap and redundancy than those for the original scales (range 0.231 to 0.802).

To examine the convergent validity of the original (9) and (CFA-based) modified EDE-Q factors, correlation (Pearson) coefficients were calculated between the EDE-Q subscales/factors and the three collateral measures (BSQ, BDI, and RSES). As is evident in Table 3, the correlation analyses indicated different patterns with the collateral measures for the modified EDE-Q and original EDE-Q subscales. In terms of Dietary Restraint, both the modified and the original Restraint subscale did not correlate, or were minimally correlated, with the validation measures which were conceptually distinct from restraint. Each of the remaining three original EDE-Q subscales showed a pattern of nearly *invariable* correlations with the three validation measures (i.e., 0.705, 0.818, and 0.707 with the BSQ, 0.505, 0.535, and 0.572 with the BDI, and 0.509, 0.466, and 0.500 with the RSE). In sharp contrast, correlations between the (CFA-based) modified body dissatisfaction and shape/weight overvaluation factors showed significant – albeit very different – patterns of associations with the three collateral measures (BSQ, BDI, RSE) suggesting good convergent/discriminant validity. Hotelling/Williams test for differences between two dependent correlations revealed that the shape/weight overvaluation factor correlated more strongly with the BDI ($t = 3.485$, $p=0.0006$) and the RSES (t=2.394, $p=0.018$) than the Body Dissatisfaction factor.

Discussion

This study examined the factor structure of the 32-item EDE-Q in a series of bariatric surgery candidates. CFA was used to test the original (9) and alternative factor structure supported by CFA methods for the EDE-Q with bariatric surgery patients (18) and a very similar 7-item 3-factor structure supported by two CFA studies (22,23) in obese patients. This study, like all previous empirical tests – two with the EDE-Q (17,18) and five with the EDE interview (19–23) – did not support the original EDE/EDE-Q scale structure. In the present study with bariatric surgery candidates, we observed support for the 7-item, 3-factor structure identified and subsequently confirmed by CFA for obese patients with BED (22,23). The three factors (labeled dietary restraint, body dissatisfaction, and shape/weight overvaluation) are highly similar to (but statistically improved per CFA fit-statistics) to the sole previous EFA/CFA study of the EDE-Q with bariatric surgery patients (Hrabosky et al., 2008). Methodologically, we note that CFA allows for statistical testing for goodness-of-fit for hypothesized structures and therefore represents a powerful examination.

The three (CFA-based) modified factors also showed improved psychometric performance over the original four EDE-Q scales. In terms of construct validity, the modified factors had improved internal consistency and they showed less overlap and redundancy than the case for the original scales. In terms of convergent and discriminant validity, the three modified factors evidenced divergent patterns of significant associations with the collateral measures; this is psychometrically and conceptually desirable. For example, the shape/weight overvaluation factor correlated significantly more strongly than did the body dissatisfaction factor with the RSE which is conceptually consistent with cognitive models of binge eating and body image (31) and which has been supported longitudinally among bariatric surgery patients (32). This contrasts sharply with the observed invariable pattern of correlations

between the original EDE-Q scales and the three collateral measures, which is psychometrically and conceptually undesirable.

Clinically, the findings, which appear reliable across recent studies, suggest that clinicians with limited time could efficiently assess for eating-disorder psychopathology using an abbreviated version of the EDE-Q. Clinicians working with bariatric surgery patients can use these seven items along with the EDE-Q items for assessing binge eating and purging behaviors to obtain preliminary information about broad and important eating-related clinical behaviors and features. Additional research seems indicated to establish further the construct and predictive validities of this abbreviated EDE-Q version, but the reliable findings observed across diverse obese persons provide some confidence about the utility of this version.

Our findings also contribute to an improved understanding of body-image concerns. Our findings for extremely obese bariatric surgery candidates, like previous studies with diverse obese patients groups (18,22,23), empirically demonstrate the distinction between a body dissatisfaction factor (comprising *both* shape- and weight-related dissatisfaction) and a shape/weight overvaluation factor. These CFA-based findings support clinical views regarding the distinctiveness between these affective and cognitive-evaluative aspects of body-image, a multi-dimensional construct (31). The distinction between these two body image constructs has been previously demonstrated in a prospective longitudinal study in a different cohort of bariatric surgery patients (32). Research with obese patient groups with binge eating problems has documented the concurrent and predictive validity of overvaluation of shape/weight (33–36).

In closing, we note potential limitations and future directions to consider. Our analyses, which involved CFA with notable advantages of statistical testing for goodness-of-fit for the hypothesized factor structures, were limited to cross-sectional tests of pre-surgical data only. The generalizability of the modified factor structure to post-surgical patients is uncertain. We also emphasize that the post-surgical period among bariatric patients requires assessment of additional and different eating behavior items that are not assessed on the EDE-Q version tested here. There are recently developed bariatric-surgery versions of the EDE/EDE-Q that contain eating items relevant to the postsurgical period such as, for example, vomiting, spitting out food, grazing, and dumping. We note, however, that those items – much like the standard EDE-Q items regarding binge eating and purging – would not influence the factor (or scale) structure of the EDE-Q. Longitudinal studies of both the stability of the factor structure and its predictive utility for bariatric surgery studies are needed.

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Table 1

Confirmatory factor analysis of the Eating Disorder Examination–Questionnaire.

	CFA Factor Loading		
Item	**Dietary Restraint**	**Shape/Weight Overvaluation**	**Body Dissatisfaction**
Restraint over eating	*1.000*		
Food avoidance	*0.911*		
Dietary rules	*0.977*		
Importance of weight		*1.000*	
Importance of shape		*1.054*	
Dissatisfaction with weight			*1.000*
Dissatisfaction with shape			*1.699*

Note: The Eating Disorder Examination-Questionnaire (EDE-Q) (9) is available on the Oxford University Centre Eating Disorders website. The first three EDE-Q items in this table were assessed for the "past for weeks only (28 days)" using a *frequency* scale ranging 0 to 6 (0 = 0 days, 1 = 1–5 days, 2 = 6–12 days, 3 = 13–15 days, 4 = 16–22 days, 5 = 23–27 days, and 6 = every day). The last four EDE-Q items in this table were assessed with a *severity* scale ranging 0 (denoting "not at all" to 6 (denoting "extremely"). The seven items in this table are as follows: "Have you been consciously trying to restrict the amount of food you eat to influence shape or weight?", "Have you attempted to avoid eating any foods which you like in order to influence your shape or weight?", "Have you attempted to follow definite rules regarding your eating in order to influence your shape or weight; for example, a calorie limit, a set amount of food, or rules about what or when you should eat?", "Has your weight influenced how you think about (judge) yourself as a person?", "Has your shape influenced how you think about (judge) yourself as a person?", "How dissatisfied have you felt about your weight?", and "How dissatisfied have you felt about your shape?"

Table 2

Internal consistency, descriptive, and correlational features of the original and modified Eating Disorder Examination - Questionnaire factors.

			Correlations		
Factor	**α**	**Mean ± SD**	**1**	**2**	**3**
Original EDE-Q					
1. Restraint	0.681	2.36 ± 1.38			
2. Eating Concern	0.739	1.98 ± 1.34	0.231 *		
3. Shape Concern	0.829	3.91 ± 1.28	0.304 **	0.726 **	
4. Weight Concern	0.597	3.40 ± 1.07	0.272 **	0.694 **	0.802 **

			Correlations	
Factor	α	Mean ± SD	1	2
Modified EDE-Q				
1. Dietary Restraint	0.820	3.13 ± 1.89		
2. Shape/Weight Overvaluation	0.959	2.98 ± 2.12	0.119	
3. Body Dissatisfaction	0.694	5.25 ± 1.21	0.144	0.457 **

* $p < .01$.

** $p < 0.001$.

Table 3

Correlational analyses between original and modified Eating Disorder Examination - Questionnaire factors and measures of body image dissatisfaction, depression, and self-esteem.

	EDE-Q Original Factors				EDE-Q Modified Factors		
Measure	**Restraint**	**Eating Concern**	**Shape Concern**	**Weight Concern**	**Restraint**	**Shape/ Weight Overval.**	**Body Dissat.**
Body Shape Questionnaire	0.284***	0.705***	0.818***	0.707***	0.159*	0.689***	0.559***
Beck Depression Inventory	0.054	0.505***	0.535***	0.572***	−0.047	0.554***	0.317***
Rosenberg Self-Esteem Scale	−0.020	0.509***	0.466***	0.500***	−0.139	0.484***	0.314***

* $p < .05$.

** $p < .01$.

*** $p < .001$.