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Factor Structure and Construct Validity of the Eating Disorder Examination-Questionnaire in College Students: Further Support for a Modified Brief Version

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Abstract

Objective—The Eating Disorder Examination-Questionnaire (EDE-Q) is widely used in research studies across clinical and non-clinical groups. Relatively little is known about psychometric properties of this measure and the available literature has not supported the proposed scale structure. The current study evaluated the factor structure and construct validity of the EDE-Q in a non-clinical study group of young adults.

Method—Participants were 801 young adults (573 females, 228 males) enrolled at a large public university in the Midwestern United States 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 predominately overweight/obese samples. CFA supported a modified 7-item, 3-factor structure; the three factors were interpreted as dietary restraint, shape/weight overvaluation, and body dissatisfaction. Factor loadings and item intercepts were invariant across sex and overweight status. The three factors had less redundancy than the original EDE-Q scales and demonstrated improved convergent and discriminant validity in relation to relevant other measures.

Discussion—These factor-analytic findings, which replicate findings from studies with diverse predominately overweight/obese samples, supported a modified 7-item, 3-factor structure for the EDE-Q with improved psychometric characteristics. The findings provide further empirical support for the distinction between body dissatisfaction and overvaluation and have implications for assessment and research. These findings need to be replicated in samples of persons with

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eating-disorder psychopathology including those with anorexia nervosa, bulimia nervosa, and allied states.

Keywords

eating disorders; body image; eating behaviors; assessment; overweight

Introduction

The Eating Disorder Examination-Questionnaire (EDE-Q) (1), the self-report version of the EDE interview (2), assesses 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, which is widely used in research studies, has received support as an adequately reliable and useful screening and assessment measure of eating-related pathology (3,4), although its performance varies across different clinical and community samples (5). Much of the "assessment" research performed with the EDE-Q to date has focused on the degree of concordance between this self-report version and the interview EDE version and its utility as a screening and assessment method (e.g., 6–8). Less research, however, has addressed basic psychometric properties of the EDE-Q and EDE interview (5), such as the structure and validity of the four subscales, which were posited by the developers based on clinical grounds.

Factor analysis can identify a small set of unobserved variables ("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 (CFA) can used to test specific hypotheses about the data (i.e., to test how well data fit hypothesized factors). All five studies of the factor structure of the original interview version of the EDE failed to support the adequacy of the hypothesized 4-scale structure, including two EFA studies (9,10) and three CFA studies (11–13). Three studies produced disparate factor solutions (9-11) and two CFA studies, one with a clinical sample of patients with obesity and binge eating disorder (BED) (12) and one with a non-clinical sample of predominately overweight/obese Latina/os (13), reported findings nearly identical to one another. The two studies by Grilo and colleagues (12,13) identified and supported via CFA a 7-item 3-factor structure (restraint, body dissatisfaction, and shape/weight overvaluation) which demonstrated enhanced convergent and discriminant validity. This modified 3-factor structure (12,13) for the EDE interview was recently replicated via CFA in one study (14) and nearly identical to that of a second study (15) of the self-report EDE-Q in two clinical groups of obese bariatric surgery patients. The extension and replication of the 7-item 3factor structure in two studies of the EDE-Q is particularly noteworthy. Specifically, although several other studies have investigated the structure of the EDE-Q using a variety of EFA and CFA methods with various samples of adults (16-25), minimal evidence (24,25) supports the original 4-factor structure as the remaining studies reported an array of disparate solutions.

The purpose of the present study was to perform a CFA to test the factor structure of the EDE-Q in a non-clinical group of young adults. We specifically aimed to test the original

EDE-Q (1) structure and the recently identified 3-factor structures by Grilo and colleagues (12–14). We also aimed to examine the construct validity of the factor structures (internal consistency and inter-correlations) and convergent and discriminant validity with independent assessment measures. We hypothesized that CFA would fail to support the original structure but would support the modified brief 3-factor structure, and that the modified factors would demonstrate superior construct and convergent validity.

Methods

Participants

Participants were 801 young adults (573 females, 228 males) enrolled at a large public university in the Midwestern United States who volunteered to participate in research. Participants had an average age of 20.0 (SD = 2.5, range = 18–47) and average body mass index (BMI) of 23.5 (SD = 4.3) based on self-reported weight and height. The majority of participants (N=663, 82.8%) identified themselves as Caucasian. The study had Institutional Review Board approval and participants provided written informed consent.

Assessment Measures

Participants completed a battery of self-report measures, including the EDE-Q (1) as well as collateral measures of depression and self-esteem which allowed for evaluation of the convergent validity of the EDE-Q scales/factors. Participants self-reported their height and weight which were used to calculate BMI. Research has found high correlations (r's generally > 0.9) between self-report and measured weight and height (e.g., 26; see 27) and that the accuracy of self-reported weight and height is generally unrelated to eating disorder psychopathology and psychological factors (28).

The *Eating Disorder Examination-Questionnaire* (EDE-Q)(1) 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 (2) and research has found that the self-report and interview versions show acceptable concordance (6–8). The EDE-Q assesses the frequency of different forms of problematic overeating behaviors and 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 Personality Assessment Inventory - *Depression Scale* (PAI-DEP) (29) is a measure of depressive symptoms and levels. The PAI-DEP has demonstrated strong psychometric properties, including excellent internal consistency and concurrent validity, across both clinical and nonclinical populations (29,30) including eating disordered groups (31).

The *Rosenberg Self-Esteem Scale* (RSES) (32) is a measure of global self-esteem comprising cognitive-evaluative and affective aspects of self-worth. The widely-used RSES has demonstrated excellent psychometric properties including good internal consistency, test-retest reliability, and construct validity (33).

Statistical Analysis

Confirmatory factor analysis (CFA; MPlus Version 7.11) was used to evaluate the fit of three different factor structure models for the EDE-Q: (1) the *original* factor structure proposed by Fairburn and colleagues (1), (2) a modified factor structure proposed by Hrabosky and colleagues (15) for bariatric surgery candidates, and (3) a further modification of the original factor structure proposed and supported in three CFA studies by Grilo and colleagues (12–14). 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 less than 1% for all EDE-Q variables. Model fit was evaluated using two incremental fit tests, the comparative fit index (CFI; criteria 0.900) and the Tucker-Lewis index (TLI; criteria 0.900), and two absolute measures of fit, the root mean square error of approximation (RMSEA; criteria 0.060), and the standard root mean square residual (SRMR; criteria 0.080).

Factor and structural invariance of the CFA model across sex and overweight status (i.e., $BMI \le 25 \text{ vs.} > 25$) were evaluated by comparing the fully unconstrained model to models increasingly constrained in terms of factor loadings, item intercepts, residual item variance and factor means.

The concurrent and discriminant validity of the original and modified factor structures of the EDE-Q was explored using correlational analyses with other self-report measures of depression, self-esteem, and BMI.

Results

CFA of Original and Modified EDE-Q Scales

The CFA for the *original* EDE-Q factor structure provided a poor model fit: CFI = 0.803, TLI = 0.776, RMSEA = 0.132, and SRMR = 0.085. The CFA for both modified models (i.e., Hrabosky al al (15) and Grilo et al (12–14)) showed better fits than the original model with the Grilo et al (12–14) modified model showing the best fit. The fit indices for the Hrabosky et al (15) model met or approached recommended standards: CFI = 0.966, TLI = 0.954, RMSEA = 0.077, and SRMR = 0.061. Finally, the fit indices for the Grilo et al modified model (12–14) were all within the recommended ranges: CFI = 0.992, TLI = 0.984, RMSEA = 0.054, and SRMR = 0.009. The factor loadings of the CFA on the Grilo et al (12–14) modified EDE-Q structure are shown in Table 1.

Factor loadings and item intercepts were found to be invariant across sex (all p's > .120) and overweight (BMI <= 25 vs. > 25; N=205 with BMI > 25) status (all p's > .150). However, residual item variances and factor means were significantly higher for females (all p's < . 0001) and those with BMI > 25 (all p's < .035).

Psychometric Characteristics

EDE-Q subscales scores were created for the *original* and *modified* models by averaging items that load on each respective factor. Descriptive information, internal consistency coefficients, and correlations among scale scores are presented in Table 2. Internal

consistency coefficients for the *original* scales ranged from 0.827–0.912 and for the *modified* model ranged from 0.894–0.912. The inter-scale correlations observed for the *modified* EDE-Q subscales (range 0.535 to 0.750) reflect less overlap and redundancy than those for the *original* scales (range 0.705 to 0.925).

Correlations between (*original* and *modified*) EDE-Q scores and collateral self-report measures (depression, self-esteem, and BMI) are presented in Table 3. Of particular note, correlations between collateral measures and *modified* EDE-Q subscales were more variable than for the *original* EDE-Q scales, suggesting better convergent and discriminant validity.

Discussion

This study used CFA to examine the factor structure of the EDE-Q in a convenience sample of young adult college students. This study, like all previous empirical tests of the self-report and interview versions of the EDE - except for two (24,25) - failed to support the original hypothesized scale structure. In the present study with young predominately non-overweight adult college students, we observed further clear support for a 7-item, 3-factor structure identified and subsequently confirmed by CFA in three studies by Grilo and colleagues (12–14) with predominately overweight/obese clinical and non-clinical samples. The three factors have been labeled dietary restraint, body dissatisfaction, and shape/weight overvaluation. The factor loadings and item intercepts were invariant across men and women and by overweight status, although – as expected – factor means were higher for women and persons who are overweight.

The three CFA-based and replicated modified factors also showed improved psychometric performance over the original four EDE-Q factors. In terms of construct validity, the modified factors had improved internal consistency and they showed less overlap and redundancy than the original scales. In terms of convergent and discriminant validity, the three modified factors had slightly more divergent patterns of significant associations with collateral measures. For example, BMI (based on self-reported weight and height) was more strongly associated with body dissatisfaction than with shape/weight overvaluation, which has generally been unrelated to measured BMI in clinical studies (34).

Our findings are based on data provided by young adult college students who volunteered to participate in research. Findings from this non-clinical sample of convenience may not generalize to other non-clinical community samples, to clinical samples of patients with eating disorders, or to different age groups. Future research should attempt to replicate this proposed factor structure in addition to testing the original structure in clinical and non-clinical study groups comprising the full range of eating disorders (including anorexia nervosa, bulimia nervosa, and eating disorder not otherwise specified) across weight and age groups.

With the above context in mind, we suggest that the CFA findings provide further evidence for the distinction between body dissatisfaction and shape/weight overvaluation (35). These CFA findings, now replicated consistently across non-clinical and clinical groups across different weight categories support clinical views regarding the distinctiveness between

body dissatisfaction and overvaluation – i.e., a specific cognitive-evaluative aspect of bodyimage considered a core feature of eating disorders (35). These CFA findings converge with earlier EFA findings that the two overvaluation items loaded separately from the other body image items (23). Research with clinical groups has demonstrated the concurrent (34) and predictive (36,37) validity of overvaluation of shape/weight.

Our CFA findings here, based on a non-clinical predominately non-overweight young adult sample, which now have been replicated across several studies with predominately overweight/obese clinical and non-clinical groups, suggest that clinicians with limited time could efficiently screen for eating-disorder psychopathology using a modified brief version of the EDE-Q. Clinicians can use these seven items along with the EDE-Q items for binge eating and purging behaviors to obtain preliminary information about broad and important eating-related clinical behaviors and features. Although additional research is needed to establish the construct and predictive validities of this brief EDE-Q version, the reliable findings observed across several different non-clinical and clinical groups provide some confidence regarding the potential utility of this version.

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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	0.984		
Dietary rules	0.977		
Importance of weight		1.000	
Importance of shape		0.908	
Dissatisfaction with weight			1.000
Dissatisfaction with shape			0.931

Note: The full text and items along with scoring information for the Eating Disorder Examination-Questionnaire (EDE-Q) (1) is available on the Oxford University Centre Research Eating Disorders (CREDO) website. The first three items listed 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 next four items listed 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 how you think about (judge) yourself as a person?", "Have you felt about your weight?", and "How dissatisfied have you felt about your shape?"

Table 1

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Table 2

Internal consistency, descriptive, and correlational features of the original and modified factor models of the Eating Disorder Examination -Questionnaire (EDE-Q).

				orrelations	
Factor	ರ	Mean ± SD	1	7	3
Original EDE-Q					
1. Restraint	0.856	1.64 ± 1.58			
2. Eating Concern	0.827	0.98 ± 1.28	0.721**		
3. Shape Concern	0.912	2.01 ± 1.62	0.709**	0.757**	
4. Weight Concern	0.863	2.25 ± 1.62	0.705**	0.738**	0.925^{**}
				Corre	lations
Factor		đ	Mean ± SD	1	7
Modified EDE-Q					
1. Dietary Restraint		0.894	2.14 ± 2.01		
2. Shape/Weight Ove	rvaluation	0.916	2.48 ± 1.86	0.542^{**}	
3. Body Dissatisfacti	uo	0.915	2.41 ± 1.89	0.535**	0.750*

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Table 3

Correlational analyses between original and modified Eating Disorder Examination - Questionnaire (EDE-Q) factors and self-report measures of depression, self-esteem, and body mass index.

Grilo et al.

		Original]	EDE-Q Factors			Modified EDE-Q Facto	rs
Measure	Restraint	Eating Concern	Shape Concern	Weight Concern	Restraint	Shape/Weight Over-valuation	Body Dissatisfaction.
PAI Depression ¹	0.262^{***}	0.377^{***}	0.272^{***}	0.269^{***}	0.151^{***}	0.211***	0.246^{***}
Rosenberg Self-Esteem Scale	-0.178^{***}	-0.325^{***}	-0.259^{***}	-0.245***	-0.096**	-0.198^{***}	-0.254^{***}
Body mass index ²	0.099^{**}	0.161^{***}	0.190^{***}	0.225^{***}	0.100^{**}	0.097**	0.255***
Note:							
^I PAI = Personality Assessment	Inventory;						
² Body mass index is based on se	elf-reported he	ight and weight.					
$* \\ p < .05.$							
** $p < .01.$							
*** $p < .001.$							