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Subtyping adolescents with bulimia nervosa

Eunice Yu Chen, PhD and Daniel le Grange, PhD

Eating and Weight Disorders Program, Department of Psychiatry, The University of Chicago, Chicago, IL, 60637, USA.

Abstract

Cluster analyses of eating disorder patients have yielded a “dietary-depressive” subtype, typified by greater negative affect, and a “dietary” subtype, typified by dietary restraint. This study aimed to replicate these findings in an adolescent sample with bulimia nervosa (BN) from a randomized controlled trial and to examine the validity and reliability of this methodology. In the sample of BN adolescents ($N=80$), cluster analysis revealed a “dietary-depressive” subtype (37.5%) and a “dietary” subtype (62.5%) using the Beck Depression Inventory, Rosenberg Self Esteem Scale and Eating Disorder Examination Restraint subscale. The “dietary-depressive” subtype compared to the “dietary” subtype was significantly more likely to: 1) report co-occurring disorders, 2) greater eating and weight concerns, and 3) less vomiting abstinence at post-treatment (all p 's <0.05). The cluster analysis based on “dietary” and “dietary-depressive” subtypes appeared to have concurrent validity, yielding more distinct groups than subtyping by vomiting frequency. In order to assess the reliability of the subtyping scheme, a larger sample of adolescents with mixed eating and weight disorders in an outpatient eating disorder clinic ($N=149$) was subtyped, yielding similar subtypes. These results support the validity and reliability of the subtyping strategy in two adolescent samples.

Keywords

bulimia; subtype; adolescent; depression; dietary restraint

1. Introduction

Models of binge eating posit the importance of dietary restraint and affect regulation in the maintenance of this behavior. Dietary restraint models are based on evidence that binge eating is the body's response to dieting (Grilo, Shiffman, & Carter-Campbell, 1994; Lacey, 1986 ; Polivy & Herman, 1993; Polivy & Herman, 1985) and that binge eating is prompted by an over-concern with weight and shape which leads to attempts to restrict food or diet (Fairburn & Cooper, 1989; McManus & Waller, 1995). Affect regulation models argue that binge eating is an attempt to influence, change, or control painful emotional states (Polivy & Herman, 1993; Wiser & Telch, 1999). Naturalistic and experimental studies (Telch & Agras, 1996; Westenhoefer, 1991) confirm that the induction of negative affect leads to binge eating and that the latter behavior leads to a reduction in negative emotional arousal (Deaver, Miltenberger, & Crosby, 2003). Binge eating, in the absence of other adaptive emotion regulation skills may become negatively reinforced as an escape behavior (Heatherton & Baumeister, 1991).

Corresponding Author: Dr Chen, Department of Psychiatry, 5841 S Maryland Ave, MC 3077, The University of Chicago, Chicago, IL, 60637, USA, Phone: 773 834 9101, Fax: 773 702 9929.

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The dual-pathway model (Stice, 1994; 2001) has integrated both dietary restraint and affect dysregulation as triggering binge eating. This dual-pathway model of binge eating has been supported by subtyping strategy studies involving adult samples with bulimia nervosa (BN) and binge-eating disorder (BED), both eating disorders typified by recurrent binge eating. These studies (Grilo, 2004; Grilo, Masheb, & Berman, 2001; Stice et al., 2001; Stice & Agras, 1999) consistently support the model that there may be two subtypes of individuals with BN and BED: 1) a “dietary-depressive” (or “dietary-negative affect”) subtype whose binge-eating is typified by greater negative affect, and a 2) “dietary” subtype whose binge-eating is typified by dietary restraint and less by negative affect.

In the adult literature, Stice & Agras (1999) conducted a cluster analysis of 265 BN patients and demonstrated that 38% of this sample fitted the “dietary-depressive” subtype. This subtype reported moderate to severe depressed mood on the Beck Depression Inventory (BDI) ($M=29$, $SD=7$) and low self-esteem on the Rosenberg Self-Esteem Scale (RSE) ($M=19$, $SD=4$). On the Eating Disorder Examination (EDE) Restraint subscale, there was no difference in scores between the “dietary” subtype and the “dietary-depressive” subtypes (respectively, $M=3$, $SD=1$ and $M=4$, $SD=1$). The remaining percentage (62%) fitted the “dietary” subtype who reported lower depressed mood (mild to moderate) (BDI, $M=11$, $SD=5$) and greater self-esteem (RSE, $M=26$, $SD=5$). This “dietary-depressive” subtype compared to the “dietary” subtype, reported significantly more severe eating and weight concerns, higher rates of affective disorders, anxiety, poor impulse control and personality disorders, greater social maladjustment, and poorer response to treatment. Abstinence from binge eating and purging after treatment in the depressed group was less compared to the subtype whose binge-eating appeared to be driven by “dietary” restraint (16.9% versus 38.1%). This finding by Stice and Agras (1999) has been subsequently replicated in another adult BN sample by Grilo, Masheb and Berman (2001) ($N=48$). Cluster analysis found that the sample divided into the “dietary-depressive” subtype (56%) and “dietary” subtype (44%) with the former typified by significantly greater weight, shape, eating disorder concerns (using the EDE-Q, a questionnaire version of the EDE), and body dissatisfaction.

These findings have also been replicated in adult samples with BED (Stice et al., 2001). Stice et al., (2001) found that a “dietary-depressive” subgroup (63%), compared to the “dietary” subtype (37%), reported significantly greater objective binge eating, weight, shape, and eating concerns, significantly more lifetime Axis I and II diagnoses, poorer psychosocial functioning, and lower abstinence from objective binge eating after treatment (56% versus 94%). Grilo, Masheb and Wilson (2001) replicated some of these findings in women with BED, reporting that the “dietary-depressive” subtype was typified by greater weight, shape and eating concerns (although not objective binge eating), and significantly greater rates of major depression and dysthymia.

Although BN begins for many individuals in adolescence (Hudson, Hiripi, Pope, & Kessler, 2007), compared to the adult literature less has been published to characterize the disorder in these younger age samples. In this age group, one subtyping study (Grilo, 2004) used a sample of female adolescent psychiatric inpatients with features of eating disorders. The “dietary-depressive” (43%) subtype compared to the “dietary” subtype (57%) ($N=137$) was characterized by greater binge eating, eating-related psychopathology, body image dissatisfaction, personality disturbance, suicidality and report of childhood abuse.

Attempts have been made to establish the reliability and validity of subtyping eating disorder samples by dietary restraint and depressed mood. The reliability of the subtyping scheme has been tested by replicating these results in independent patient samples (Stice et al., 2001) or examining the stability of participants membership at different time points (Carlos, Masheb, & Wilson, 2001). In addition, these studies have examined the concurrent validity of the

subtyping approach by comparison of subtypes on a range of behavioral and psychological variables (Grilo, 2004) and by comparing one subtyping approach to that of an alternative subtyping approach. For instance, in addition to subtyping individuals on the “dietary-depressive” versus “dietary” subtyping scheme, samples have been subtyped on vomiting (Grilo, 2004), on major depression, and binge eating frequency (Grilo, Masheb, & Wilson, 2001). The predictive validity of this subtyping scheme has been evidenced by the findings that the “dietary-depressive” compared to the “dietary” subtype predicts poorer binge-purge abstinence outcome in adult BN (Stice & Agras, 1999). Similarly, a subtype of BED patients reporting a high degree of psychopathology versus a low degree of psychopathology (measured on the BDI and the Brief Symptom Inventory) reported greater post-treatment binge eating (Loeb, Wilson, Gilbert, & Labouvie, 2000).

The present study utilizes data from a unique sample of adolescent BN patients who participated in a randomized controlled trial of outpatient psychotherapy (Le Grange, Crosby, Rathouz, & Leventhal, In press). The primary aim of the present study was to examine whether these adolescents with BN can also be categorized into “dietary” and “dietary-depressive” subtypes as in the adult BN literature. Our hypotheses were that: 1) individuals in the “dietary-depressive” subtype compared to the “dietary” subtype report greater severity in bulimic behaviors and cognitions, 2) greater co-occurring psychological disorders, and 3) poorer treatment outcome. A second aim was to examine the concurrent validity of this subtyping scheme by comparing it to an alternate subtyping scheme based on vomiting. The third aim was to examine the reliability of this subtyping scheme by conducting the same analysis with an independent outpatient sample of adolescents with a range of eating and weight disorders.

2. Method

2.1. Participants

A sample of 80 adolescents with BN (full and partial syndrome), who were enrolled in a randomized controlled psychotherapy trial was subtyped along dietary restraint and negative affect dimensions following the methodology of previous studies. The majority of participants were female (78/80, 98%) and Caucasian (64%). Mean age was 16 years old ($SD=1.6$) and mean duration of illness, 21 months ($SD=22.3$). Of the 80 patients, 37 (46%) met full criteria for BN and 43 (54%) presented with partial BN. The mean body mass index was 22.1 kg/m^2 ($SD=3.0$). For a full description of the participants, recruitment and the randomized controlled trial comparing family-based treatment and individual supportive psychotherapy, see le Grange et al. (Le Grange, Crosby, Rathouz, & Leventhal, In press).

2.2. Measures

All participants and their parents or legal guardians provided written informed consent for the assessments.

The Beck Depression Inventory (BDI) (Beck, 1987) is a 21-item questionnaire used to assess depressed mood over the last two weeks. The answer to each question is rated 0 to 3. It has been used in numerous studies of adolescent depression.

The Rosenberg Self Esteem Scale (RSE) (Rosenberg, 1989) is a widely used 10-item questionnaire measuring overall self-esteem that has been widely used in adolescent samples.

The Eating Disorder Examination (EDE) (C. Fairburn & Cooper, 1993) is a standardized assessor-based interview measuring the severity of current eating disorder psychopathology (over the last month) and generates eating disorders diagnoses. The frequency of eating disorder behavior (e.g., objective binge eating and vomiting), and the severity of eating disorder attitudes are assessed. The latter are assessed in four subscales: Dietary Restraint, Eating,

Weight and Shape concern subscales. It has acceptable reliability, discriminant and concurrent validity and has demonstrated sensitivity to change due to treatment (Fairburn & Cooper, 1993). It has been widely used in adult eating disorders and has found to be useful in the assessment of adolescents with eating disorders (Binford & le Grange, 2005).

The Schedule for Affective Disorder and Schizophrenia for School-Age Children (K-SADS) (Kaufman et al., 1997) is a semi-structured diagnostic interview designed to ascertain past and current episodes of psychopathology in children and adolescents. The K-SADS has good concurrent and predictive validity as well as high inter-rater reliability. It was used here to confirm current co-existing psychological disorders.

2.3. Data analysis

The primary aim was to replicate the subtyping analysis in an adolescent BN sample. The Quick Cluster Algorithm from SPSS-X (Statistical Package for the Social Sciences) was used following the methodology of Stice & Agras (1999). Given our a priori hypothesis, two clusters (k) were specified using scores on the EDE Restraint subscale, BDI and RSE. As in previous studies (Grilo, Masheb, & Berman, 2001; Stice & Agras, 1999), squared Euclidean distances were used as the distance measure and a nonhierarchical or iterative clustering algorithm, rather than a hierarchical algorithm was used as a nonhierarchical clustering is less sensitive to outliers and more prone to detect and correct early misclassifications. A multivariate analysis of variance was conducted to compare the derived subtypes on BDI, RSE and EDE Restraint scores. The second aim was to examine whether the “dietary-depressive” and “depressive” subtype differed on rates of bulimic behavior, weight, shape and eating concerns and rates of comorbid psychopathology. The third aim was to evaluate whether the two subtypes differed in response to treatment. Differences between groups for continuous measures utilized independent t tests. Eta squared was used in these comparisons to estimate the percentage of variance accounted for. Differences between groups for categorical measures utilized the chi-squared statistic. In situations where the cell frequencies dropped below five cases, Fisher’s exact test was used. For categorical data, effect sizes were estimated using odds ratios. Tests conducted were one-sided except where stated.

3. Results

3.1 Cluster Analysis

Cluster analysis revealed a two factor solution: a “dietary-depressive” subtype (30/80, 37.5%) and a pure “dietary” subtype (50/80, 62.5%). Table 1 summarizes the cluster analysis analysis of variance findings showing that although both subtypes endorsed similar dietary restraint, the “dietary-depressive” subtype reported more depressed mood and lower self esteem. The mean BDI score of the “dietary-depressive” subtype falls within the severe depression range (Beck, 1987), while the mean BDI score for the “dietary” subtype falls within the mild to moderate depression range.

3.2. Comparison of the “dietary-depressive” and “dietary” subtype on bulimic behaviors and thoughts

There were no differences between the subtypes in age ($F(1,79)=0.63, p=.43$), ethnicity ($X^2(df,1)=1.23, p=.75$) or gender ($X^2(df,1)=1.23, p=.39$). Table 2 summarizes the differences between the two subtypes on bulimic behaviors and attitudes, derived from the EDE. The “dietary-depressive” subtype compared to the “dietary” subtype reported significantly greater eating and weight concerns, and greater total EDE scores.

3.3. Comparison of the “dietary-depressive” and “dietary” subtype on co-occurring disorders

The “dietary-depressive” subtype compared to the “dietary” subtype, as predicted, was characterized by a significantly greater number of co-occurring Axis I disorders (76.7% versus 54.0%, X^2 (df , 1)= 4.11, $p=.035$). An odds ratio of 2.79 suggested that individuals with a co-occurring Axis I disorder were more than twice as likely to belong to the “dietary-depressive” than “dietary” subtype. Because of the small number of co-occurring disorders, primary co-occurring Axis I disorders were divided in affective disorders and anxiety disorders. The “dietary-depressive” subtype compared to the “dietary” subtype, was characterized by a significantly greater number of co-occurring Axis I affective disorders (63.3% versus 38.0%, X^2 (df , 1)= 4.83, $p=.024$). An odds ratio of 2.82 suggested that, as expected, individuals with a co-occurring Axis I affective disorder were more than twice as likely to belong to the “dietary-depressive” than “dietary” subtype. There was no difference between subtypes for anxiety disorders (X^2 (df , 1)= 1.13, $p=.31$).

3.4 Comparison of the “dietary-depressive” and “dietary” subtype on treatment outcome

The dropout rate was similar for the “dietary-depressive” (20%) (6/30) and the “dietary” (6%) (3/50) subtype ($p=.07$, Fishers exact test). It was hypothesized that the “dietary-depressive” subtype would respond significantly poorer at the end of psychotherapy. For this hypothesis, objective binge eating and vomiting abstinence for the last 28 days on the EDE was used. This was based on intent-to-treat data. There were no group differences found for objective binge eating abstinence (X^2 (df , 1)= 0.54, $p=.32$). However, the “dietary-depressive” compared to the “dietary” subtype was found to report significantly less abstinence from vomiting at post-treatment (32.0% versus 57.4 %, X^2 (df , 1)= 4.23, $p=.035$). An odds ratio of 2.87 suggested that individuals with abstinence from vomiting were more than twice as likely to belong to the “dietary” than “dietary-depressive” subtype.

3.5. Subtyping by vomiting

As in Grilo (2004) an alternate subtyping strategy using vomiting frequency in the last 28 days was tested. This yielded two clusters, a high frequency group ($M=77.19$, $SD=26.85$, $n=21$) and a low frequency group ($M=18.44$, $SD=15.14$, $n=59$). The “dietary-depressive” and “dietary” subtypes were compared on the same psychological variables as above. As expected, the high vomiting frequency and the low vomiting frequency subtypes differed in objective binge eating frequency in the last 28 days ($F(1,79)=8.07$, $p=.006$, partial eta squared=.09), and vomiting abstinence post-treatment (10.5% versus 62.3% vomiting abstinence, X^2 (df , 1)= 14.99, $p=.000$). This suggests that subtyping by vomiting frequency produces two groups that are more similar than different from one another.

3.6. Reliability of the “dietary-depressive” versus “dietary” subtyping strategy

The reliability of the “dietary-depressive” versus “dietary” subtyping strategy was tested by replicating the findings with an independent adolescent sample with a range of eating and weight disorders. The data utilized here was an outpatient sample of 149 adolescents attending the eating and weight disorders program at the University of Chicago. These patients ranged in age from 7 to 19 years old ($M=15$, $SD=2$). The majority was female (89%). The sample comprised of 76.5% non-hispanic Caucasians, 9.4% Hispanic, 8.1% African-American, 2% Asian and 2% other. Body mass indices ranged from 12.6 to 48.4 ($M=19.9$, $SD=5.9$) and duration of the eating disorder symptoms ranged from 1 to 180 months ($M=18.9$, $SD=24.2$). Of the sample 22.1% reported symptoms consistent with anorexia nervosa, 32.9% had BN, and 37% met eating disorders not otherwise specified criteria (of which 10.1% had subthreshold BN). The same measures and data analysis strategy were used for this second sample as for the first with differences in the measures noted.

3.7. Cluster Analysis for outpatient adolescent eating and weight disorders sample (N=149)

Again cluster analysis revealed a two factor solution: a “dietary-depressive” subtype (97/149, 65%) and a pure “dietary” subtype (52/149, 35%). Table 3 summarizes the cluster analysis of variance findings showing that the “dietary-depressive” subtype reported more depressed mood, lower self-esteem and greater restraint than the “dietary” subtype. On the EDE, the “dietary-depressive” subtype compared to the “dietary” subtype reported significantly objective binge-eating in the last month, greater eating, weight, shape and concerns, and total EDE scores. Using a general clinical interview no differences were found between the “dietary-depressive” or the “dietary” subtypes in rates of co-occurring Axis I disorders although there appeared to be a trend for a significantly greater percentage of anxiety disorders ($X^2 (df, 1) = 3.44, p=.06$).

4. Discussion

This study supports the findings that individuals with eating disorders can be subtyped in a “dietary-depressive” and “dietary” subtype (Grilo, 2004; Grilo, Masheb, & Wilson, 2001; Grilo, Masheb, & Berman, 2001; Stice & Agras, 1999; Stice et al., 2001). These results also extend previous findings by examining subtyping with a unique sample of adolescents with BN in a randomized controlled trial and investigating whether this subtyping predicts treatment outcome. Rates of each subtype were similar to those found in previous studies where approximately a third to a half of the sample fitted the “dietary-depressive” subtype. The cut-off scores on the BDI, RSE and EDE Restraint subscale scores for the “dietary-depressive” and “dietary” subtypes in the current inquiry were similar to that for adults (Grilo, Masheb, & Wilson, 2001; Grilo, Masheb, & Berman, 2001; Stice et al., 2001; Stice & Agras, 1999). As in previous studies (Grilo, 2004; Grilo, Masheb, & Berman, 2001; Stice & Agras, 1999), the “dietary-depressive” subtype reported significantly greater weight, eating concerns and total EDE scores. Similar to previous findings, a greater percentage of individuals had a co-occurring disorder in the “dietary-depressive” subtype compared to the “dietary” subtype (Stice & Agras, 1999). A significantly lower rate of post-treatment abstinence from vomiting was found in the “dietary-depressive” subtype (32%) compared to the “dietary” (57%) subtype in adult BN (Stice & Agras, 1999). This subtyping strategy appeared to create more distinct subgroups than one based on vomiting, as found in Grilo (2004), suggesting that there is some concurrent validity in the distinction it draws. Finally, the “dietary-depressive” and “dietary” subtyping strategy appeared to be reliable in that we also found this categorization in a sample of outpatient adolescents with eating disorders (Grilo, 2004).

Objective binge eating rates did not differ between subtypes in our adolescent BN sample. This differed from a prior study with adolescents (Grilo, 2004), which demonstrated that the “dietary-depressive” subtype reported greater objective binge eating. However, this may have been due to the greater heterogeneity of Grilo’s adolescent sample compared to the sample in the present study. Our findings are in keeping with two other adult studies of BN (Grilo, Masheb, & Berman, 2001; Stice & Agras, 1999) which also reported no differences between groups in objective binge eating.

The “dietary-depressive” subtype did not have greater shape concerns than the “dietary” subtype in the sample of adolescents with BN. This is contrary to previous findings with adult BN (Grilo, Masheb, & Berman, 2001; Stice & Agras, 1999) and adult BED (Grilo, Masheb, & Wilson, 2001; Stice, Agras, Telch, Halmi, Mitchell, and Wilson, 2001) and with adolescents with eating disorder features (Grilo, 2004). This may have been due to our modest sample size or that we utilized a selected adolescent group with BN for this analysis.

There are a number of limitations to the current study. The sample was modest in size and replication of the current findings in a larger sample will be advantageous (Stice & Agras,

1999). For the BN sample, the KSADS was used while a clinical interview was used for the mixed eating disorders sample. Also, our findings may have limited generalizability as only treatment-seeking individuals were utilized in the study. Our study relied on patient report and did not use multiple reporters (e.g., family members). Finally, our study design was cross-sectional rather than longitudinal and future studies are needed to examine this subtyping strategy in longitudinal designs.

The strengths of the study were that it employed two unique outpatient samples of treatment-seeking adolescents, one of which was from a randomized controlled psychotherapy trial with adolescent BN. The findings generally replicate those of subtyping studies with adult BN (Stice & Agras, 1999; Grilo, Masheb, & Berman, 2001). The study also employed well-validated and reliable interview measures for ED assessment and that of co-occurring disorders for the adolescent BN sample. The study adds to the existing literature in providing more support for this subtyping strategy with adolescents. It also suggests a relationship between the “dietary-depressive” subtype and treatment outcome.

The finding that depressed mood in adolescent BN predicts poorer outcome and is associated with a greater likelihood of co-occurring disorders and poorer eating and weight concerns has implications for treatment. The challenge may be how to improve treatment for individuals with co-occurring BN and depressed mood, especially as ‘low or high affect’ subtype has been found to moderate treatment-outcome in adults with BED (Wilfley, Wilson, & Agras, 2006; Wilson, Wilfley & Agras, 2007). Improvement in treatments may involve longer, more intensive treatment or a treatment that targets depressed mood in addition to the eating disorder.

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Table 1
Means and standard deviations for the two subtypes from the cluster analysis of the adolescent BN sample (N=80).

	“Dietary” Subtype (<i>n</i> =50)		“Dietary-Depressive” Subtype (<i>n</i> =30)		<i>F</i> (1,79)	<i>p</i>	Eta
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
EDE Restraint	3.46	1.44	4.13	1.42	4.08	.047	.050
BDI	17.76	6.20	37.63	8.24	149.87	.000	.658
RSE	24.51	4.72	32.30	4.60	52.10	.000	.400

Note: Eta denotes partial eta squared. This represents the proportion of total variability of the membership in a cluster or subtype accounted by each of the three variables, EDE Restraint, BDI and RSE scores. EDE Restraint refers to the Restraint Subscale of the Eating Disorder Examination, BDI to the Beck Depression Inventory, and RSE, the Rosenberg Self-Esteem Scale.

Table 2
Differences between the two subtypes of adolescent BN on bulimic behaviors and attitudes from the EDE (N=80).

	“Dietary” Subtype (n=50)		“Dietary-Depressive” Subtype (n=30)		F (1,79)	p	Eta
	M	SD	M	SD			
Body Mass Index	22.47	3.27	21.41	2.28	2.42	.124	.030
Objective Binge eating	17.50	20.45	20.57	31.98	0.27	.602	.004
Vomiting	31.26	29.51	38.20	36.00	0.88	.352	.011
All purging	45.56	34.74	57.03	45.84	1.60	.209	.020
EDE Eating Concerns	2.61	1.22	3.42	1.35	7.67	.007	.089
EDE Weight Concern	3.57	1.29	4.46	1.34	8.73	.004	.101
EDE Shape Concern	3.93	1.33	4.43	1.15	2.95	.090	.036
EDE Total	3.39	1.03	4.11	1.02	9.25	.003	.106

Note: Eta denotes partial eta squared. EDE, Eating Disorder Examination.

Note: Objective binge eating and vomiting refers to the number of episodes in the last 28 days

Differences between the two subtypes from the mixed eating and weight disorders sample on bulimic behaviors and attitudes from the EDE (N=149).

Table 3

	“Dietary” Subtype (n=97)		“Dietary-Depressive” Subtype (n=52)		F (1,148)	p	Eta
	M	SD	M	SD			
EDE Restraint	1.75	1.55	3.74	1.51	55.45	.000	.281
BDI	8.58	5.27	30.94	7.31	447.53	.000	.759
RSE	20.00	5.22	29.43	4.26	121.84	.000	.462
Body Mass Index	19.76	6.18	20.11	5.52	0.11	.739	.001
Objective Binge eating	2.25	6.64	6.59	17.26	4.65	.033	.032
Vomiting	8.25	21.70	10.65	24.32	.37	.544	.003
EDE Eating Concerns	0.91	1.08	2.44	1.45	51.49	.000	.266
EDE Weight Concern	1.47	1.41	3.68	1.71	69.08	.000	.327
EDE Shape Concern	1.68	1.51	4.03	1.47	80.59	.000	.362
EDE Total	1.44	1.21	3.48	1.33	86.75	.000	.379

Note: Eta denotes partial eta squared. EDE, Eating Disorder Examination.

Note: Objective binge eating and vomiting refers to the number of episodes in the last 28 days