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Eating Disorder Examination Questionnaire (EDE-Q): Factor structure for adolescent girls and boys.

Hannah J White

Dr Emma Haycraft*

Dr Huw Goodwin

Prof Caroline Meyer

Loughborough University Centre for Research into Eating Disorders,

Loughborough University, Loughborough, UK.

* Address correspondence to: Dr Emma Haycraft, Loughborough University Centre for Research into Eating Disorders, School of Sport, Exercise & Health Sciences, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK.

Email: E.Haycraft@lboro.ac.uk, Tel. +44(0)1509 22860, Fax. +44(0)1509 223940.

Running head: EDE-Q ADOLESCENT FACTOR STRUCTURE

Abstract

Objective: To examine the factor structure of the EDE-Q among a sample of adolescents.

Method: A community-based sample of 917 adolescents (522 girls and 395 boys) aged 14 to 18 years completed the EDE-Q version 6.0 as part of a larger study. Participants were randomly assigned to one of two subsamples to enable separate analyses.

Results: A confirmatory factor analysis on the original four factor model of the EDE-Q produced an inadmissible model with a poor fit. Exploratory factor analysis using principal axis factoring produced an alternative three factor model of the EDE-Q among adolescents. The *Shape and Weight Concerns, Restriction* and *Preoccupation and Eating Concern* subscales accounted for 65% of the total variance. Subscale and global scores were significantly higher for girls than for boys. A high proportion of both girls (53.6%) and boys (30.5%) reported participating in at least one key eating disordered behaviour during the previous 28 days.

Discussion: The results of this study present three new subscales (*Shape and Weight Concerns, Restriction* and *Preoccupation and Eating Concern*) which are suggested for use in future research which uses the EDE-Q with community samples of adolescents.

Keywords: EDE-Q; Factor Structure; Adolescent; Shape and Weight Concerns; Restriction; Preoccupation and Eating Concern.

Eating Disorder Examination Questionnaire (EDE-Q): Factor structure for adolescent girls and boys.

The Eating Disorder Examination Questionnaire (EDE-Q)[1,2] is a self-report measure of eating psychopathology, based on the Eating Disorder Examination.[3] Research has found the EDE-Q to have good test-retest reliability,[4] internal consistencies,[4] temporal stability of attitudinal items[5] and criterion validity in distinguishing cases.[6] However, despite its extensive use, recent research has questioned the original four factor structure of the EDE-Q.[7-13] Furthermore, although it has been widely used with samples of adolescents[14-15], little is known about the factor structure of the EDE-Q among adolescents. To date, only one study has examined the factor structure among adolescents using a translation of the EDE-Q with Fijian girls aged 15 to 20 years.[9] In an attempt to replicate the original four subscales, Becker et al.[9] forced a four factor model. The original subscales were not supported due to discrepancies in item loadings; although there was support for a distinct restraint subscale.[9] Further exploratory examination of the factor structure is thus required among a sample of Western adolescent girls with the English version of the EDE-Q. In addition, little is known about the underlying factor structure of the EDE-Q amongst adolescent boys, even though it has been used in research with this population.[14] In summary, there is currently no valid factor structure proposed for the EDE-Q among adolescents. Therefore, the aim of this study is to examine the factor structure of the EDE-Q among a sample of girls and boys.

METHOD

Participants

Adolescents (N = 917; 522 girls and 395 boys) completed the EDE-Q as part of two cohort studies between 2010 and 2013. Educational establishments across varying locations within the UK who had pre-established links with the research centre were invited to participate in this research. Participants were recruited from those establishments who agreed to participate (68.8%). Adolescents who reported having sought professional help for their eating behaviour (or if they failed to answer the required question), or reported having contacted a doctor with concerns about their eating, shape or weight (n=35) were retained in the final sample as community samples ensure a range of eating psychopathology is represented within a sample.[1] The mean age of the sample was 15.2 years (SD 1.18, range 14 to 18). The sample was predominately white British (74.9%), although ethnicity data were missing for 15.5% of the sample. The mean age and gender adjusted BMI z score[16] for girls was 0.02 (SD 1.07, range -4.10 to 3.21) and for boys was 0.36 (SD 1.20, range -6.68 to 4.17). In order to conduct two separate factor analyses, the sample was randomly spilt into two. Sample one comprised 458 adolescents (257 girls and 201 boys) with a mean age of 15.3 years (SD = 1.18). Sample two comprised 459 adolescents (265 girls and 194 boys) with a mean age of 15.2 years (SD = 1.18).

Measures and procedure

Institutional ethical approval was obtained prior to data collection. Where participants were under the age of 18, parental opt-out letters were distributed, or the school/college consented to participation in loco parentis. Participants also provided written consent to participate prior to completing the questionnaire as part of a larger collection of psychological measures. Questionnaire distribution was facilitated by each individual institution and hence information on participation rate is unavailable.

Eating Disorder Examination Questionnaire[2] (EDE-Q).

The 28-item EDE-Q (6.0)[2] contains 22 attitudinal questions which form four subscales (restraint, eating concern, shape concern and weight concern). The remaining questions assess frequency of episodes of laxative misuse, self-induced vomiting, excessive exercise and objective binge eating episodes over the previous 28 days. The EDE-Q has been shown to be valid and reliable.[4-6]

Statistical analyses

Confirmatory factor analysis (CFA) with AMOS was conducted using sample 1 to assess the goodness of fit of the original four factor structure of the EDE-Q with this adolescent sample. Maximum-likelihood estimation was used with bootstrapping as the data were non-normally distributed. It has been suggested that asymptotic distribution-free (ADF) would be the preferred estimation method with this type of data, however due to the requirements of a large sample size for ADF,[17] ML with bootstrapping was used instead. Goodness of fit is assessed through a variety of tests; in this instance the Comparative Fit Index (CFI), Normed Fit Index (NFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) and Root Mean Square Error of Approximation (RMSEA) were used. Values for the CFI and NFI should exceed 0.95, values for the GFI and AGFI should be above 0.90 and values for the RMSEA should be lower than 0.06 to indicate a good fit.[18,19]

After the CFA, an exploratory factor analysis (EFA) with principal axis factoring (PAF) was conducted on sample 2 using a promax rotation to allow for correlation between factors. In accordance with Kaiser[20], factors were retained with an eigenvalue above 1. All items loading above 0.30 were retained; a cut-off considered large enough to be regarded as significant.[21] A Spearman's one-tailed

correlation was conducted between the subscales generated to assess intercorrelation. Due to the non-normal distribution of the data, Mann-Whitney U tests were conducted to examine any differences on both the newly derived and original subscale and global scores. Firstly, they were run to examine any differences between girls' scores and boys' scores across samples 1 and 2. Secondly, to examine any gender differences between girls and boys in sample 2. All subsequent analyses were conducted solely on participants from sample 2. To examine the effect of age (in years) on the new subscale and global scores, Kruskal Wallis tests were conducted separately for girls and boys from sample 2. Pearson's Chi-Square tests were used to examine gender differences in participation in key eating disordered behaviors among sample 2. A significance level of $p<.05$ was adopted. Missing data were excluded from all analyses.

RESULTS

Missing data

Although missing data were excluded from all analyses, to examine the applicability of the EDE-Q among adolescents the level of missing data from both samples 1 and 2 should be reported. For the attitudinal items, the percentage of missing data ranged from 0.12% to 2.62% for sample 1 and 0% to 1.96% for sample 2. For the behavioral items, the percentage of missing data ranged from 1.97% to 6.77% for sample 1 and 1.34% to 6.75% for sample 2. It is noteworthy that the highest levels of missing data among both samples were for two of the behavioral questions; self-induced vomiting (sample 1 = 4.37%; sample 2 = 4.79%) and excessive exercise (sample 1 = 6.77; sample 2 = 6.75%). After listwise deletion, 440

participants were included within the CFA from sample 1, and 445 participants within the EFA from sample 2.

Confirmatory factor analysis (sample 1)

The model produced by the CFA conducted on the 22 attitudinal items was found to be inadmissible due to two regression weights above 1 (data not shown). It is also worth noting that due to several very high correlations ($r \geq 0.80$) between items, the covariance matrix produced was not a positive definite. Furthermore, the four-factor model provided a poor fit (x^2 (202) = 1198.11, $p < .001$) with goodness of fit values as follows; CFI = 0.88, NFI = 0.86, GFI = 0.79, AGFI = 0.73 and RMSEA = 0.11.

Exploratory factor analysis (sample 2)

Due to the CFA producing an inadmissible model, an EFA was subsequently conducted to examine an alternative factor structure. It is worth noting that several items (2, 6, 10 and 12) were found to cross-load across different factors. However, these items were retained in the analysis to examine the factor structure based on the total 22 original items of the EDE-Q. The EFA conducted with the 22 attitudinal items produced a three factor model, as shown in Table 1. Scree plot analysis[22] also supported a three factor structure.

TABLE 1 ABOUT HERE

Factor 1, described henceforth as *Shape and Weight Concerns*, explained 54.94% of the total variance and contained 10 items exclusively from the original shape concern and weight concern subscales. These items focused on body dissatisfaction and the importance of shape and weight. Factor 2, described

henceforth as *Restriction*, explained 6.61% of the total variance and contained 5 items; four items from the original restraint subscale and one item from the shape concern subscale relating to fear of weight gain. Factor 3, described henceforth as *Preoccupation and Eating Concern*, explained 3.45% of the total variance and contained the remaining 7 items; all five items from the eating concern subscale, one item from the restraint subscale related to avoidance of eating, and one item from both the shape concern and weight concern subscales related to preoccupation (see Table 1 for item details). All three factors intercorrelated highly (*Shape and Weight Concern* and *Restriction* (r = 0.78, $p < .001$); *Shape and Weight Concern* and *Preoccupation and Eating Concern* (r = 0.74, $p < .001$); and *Restriction* and *Preoccupation and Eating Concern* (r = 0.74, $p < .001$)).

Participant scores

TABLE 2 ABOUT HERE

The mean scores for the *Shape and Weight Concerns* subscale, *Restriction* subscale, *Preoccupation and Eating Concern* subscale and global scores for participants from both samples are shown in Table 2. Global scores were calculated in the same manner as the original EDE-Q global score (mean of subscale scores). Mean scores for the original EDE-Q subscales for girls and boys from both samples are also shown in Table 2. No significant differences were found between sample 1 and sample 2 for both girls and boys for all new and original subscale and global scores (all $p > .05$). The following results are based on analyses conducted solely on girls and boys from sample 2. Girls reported significantly higher scores than boys on *Shape and Weight Concerns* (U = 11.27, $p < .001$, r = 0.53); *Restriction* (U = 8.93, $p < .001$, r = 0.42), *Preoccupation and Eating Concern* (U = 7.23, $p < .001$, r = 0.34)

and the global score (U = 10.70, $p < .001$, r = 0.51). Similarly, girls also reported significantly higher scores than boys on all of the original EDE-Q subscales (Restraint: U = 8.07, $p < .001$, r = 0.38; Eating Concern: U = 7.11, $p < .001$, r = 0.34; Shape Concern: U = 11.45, $p < .001$, r = 0.54; Weight Concern: U = 10.62, $p < .001$, r = 0.50) and global score (U = 10.75, $p < .001$, r = 0.51). No significant differences were found between age groups scores for *Shape and Weight Concerns, Restriction, Preoccupation and Eating Concern,* and global scores among girls (H(4) = 3.13, $p > .05$; H(4) = 1.66, $p > .05$; H(4) = 0.56, $p > .05$; H(4) = 1.76, $p > .05$) or boys (H(4) = 5.28, $p > .05$; H(4) = 5.06, $p > .05$; H(4) = 0.45, $p > .05$; H(4) = 3.19, $p > .05$). Likewise, no significant differences were found between age group scores for the original subscale or global score for girls (Restraint: H(4) = 1.07, $p > .05$; Eating Concern: H(4) = 1.58, $p > .05$; Shape Concern: H(4) = 3.66, $p > .05$; Weight Concern: H(4) = 0.59, $p > .05$; Global: H(4) = 1.39, $p > .05$) or boys (Restraint: H(4) = 3.85, $p > .05$; Eating Concern: H(4) = 0.79, $p > .05$; Shape Concern: H(4) = 3.49, $p > .05$; Weight Concern: H(4) = 3.37, $p > .05$; Global: H(4) = 3.17, $p > .05$).

TABLE 3 ABOUT HERE

Table 3 reports the proportion of girls and boys from sample 2 engaging in eating disordered behaviors (objective binge eating episodes; self-induced vomiting; laxative misuse; and excessive exercise) over the previous 28 days. The proportion of girls and boys who report participating in at least one of these behaviors (i.e., scoring a total of 1 or above on questions 14, 16, 17 and 18) was 53.6% and 30.5%. The medians of these behaviors were all 0. No significant relationships were found between gender and the proportion of participants who reported regular laxative misuse (≥4 times in 28 days), regular self-induced vomiting (≥4 times in 28 days), or regular participation in excessive exercise (≥20 times in 28 days). However,

significant relationships were found between gender and the proportion of participants who reported engaging in any, or regular objective binge eating episodes (≥4 times in 28 days) or any occurrence of excessive exercise, with higher proportions more likely among girls.

DISCUSSION

This study examined the factor structure of the EDE-Q among a community-based sample of adolescents and examined gender differences for girls and boys. The results indicate a three factor structure deviating from the original four factor model.[2,3] This comprises a *Shape and Weight Concerns* subscale (including items from the original shape and weight concern subscales), a *Restriction* subscale (containing four items from the original restraint subscale and an item related to fear of weight gain) and a *Preoccupation and Eating Concern* subscale (containing all five items from the original eating concern subscale and two additional items). Scores on all subscales and the global score were significantly higher for girls than boys. Furthermore, girls were more likely to report participating in eating disordered behaviors than boys, with the exception of any or regular laxative misuse, regular self-induced vomiting and regular excessive exercise.

The findings support research which has failed to substantiate the EDE-Q's original four factor structure.[7-13] However, it is worth acknowledging that the original subscales were mostly reproduced within the new model, aside from the combination of the original shape and weight concern subscales. Furthermore collapsing the original shape and weight concern subscales into one single factor is consistent with previous research on both the EDE and EDE-Q among women with bulimic

symptoms,[12] women from an outpatient eating disorder service,[23,24] female community samples,[23,24] treatment seeking obese females,[24] and adolescent girls.[25] This notion supports a model where adolescents have difficulty in distinguishing shape and weight as separate concepts, as found previously with obese adults.[10] Furthermore, support for separate restraint and eating concern subscales have also been provided previously.[9,12,13]

These findings support previous evidence that girls report more unhealthy concerns relating to their shape, weight and eating, and greater intentions to restrict intake than boys.[26] Furthermore, the findings are consistent with research reporting higher levels of self-induced vomiting, exercising to maintain or lose weight and binge eating with a loss of control among girls than boys.[27,28] However, in contrast to the results of this study previous research has reported a lack of gender differences in laxative use.[28]

This is the first known study to provide a factor structure for a sample of both adolescent girls and boys. It includes a large sample of adolescents from varying geographical areas around the UK. Although the majority of the sample was white British, with levels comparable to national statistics for England and Wales,[29] this homogeneity limits the external validity of these findings, and hence further research is required to examine and confirm the factor structure of the EDE-Q among adolescents from other ethnic groups. In addition, a lack of additional participant information (e.g., family socio-economic status) or use of random sampling methods further limits the sample's representativeness. A further limitation to this school-based study is that it has been suggested that body image dissatisfaction may lead to absence from school,[30] hence students with higher levels of eating psychopathology may be underrepresented within this sample.

A further confirmatory factor analysis among adolescents is required to confirm goodness of fit of the newly derived factor structure. In addition, the factor structure should be tested among a clinical sample of adolescents to assess validity. However, while it is important to establish factorial validity, an equally important criterion to consider is content validity; whether the content of the measure is representative of the domain under study.[31] The comprehensive development of the EDE[3] focussed specifically on the content of the measure, involving a range of methods (e.g., literature reviews, interviews with eating disordered patients) for item selection. Establishing the content of a measure is reflective of the research and literature of the field under study and is critically important; perhaps more so than the factors yielded.

While only a small proportion of missing data was observed for the attitudinal items, indicating applicability of these EDE-Q questions within adolescent samples, it is noteworthy that a reasonable number of respondents did not provide responses for the behavioral questions referring to self-induced vomiting and excessive exercise. This suggests that researchers may need to consider the clarity, wording and applicability of these questions when conducting future research among community samples of adolescents. Researchers and clinicians should examine whether the new subscales could be used to predict eating disorder onset among adolescents. However, in line with the complications encountered with the four-factor model outlined by the results of the CFA with the original EDE-Q subscales, the findings of this study propose a new factor structure for the EDE-Q which is suggested for use in future research which uses the EDE-Q with adolescent community samples.

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Table 1: Pattern matrix of the principal axis factoring analysis of EDE-Q attitudinal items for adolescent girls and boys from sample 2 (n = 445).

EDE-Q item	Shape and Weight Concerns	Restriction	Preoccupation and Eating Concern
Dissatisfaction with shape (SC)	**0.97**	-0.01	-0.07
Discomfort seeing body (SC)	**0.95**	-0.05	-0.01
Avoidance of exposure (SC)	**0.92**	-0.14	0.05
Dissatisfaction with weight (WC)	**0.88**	0.07	-0.03
Importance of weight (WC)	**0.75**	0.07	0.11
Prescribed weighing (WC)	**0.73**	-0.15	0.17
Importance of shape (SC)	**0.71**	0.04	0.13
Feelings of fatness (SC)	**0.62**	0.37	-0.10
Desire to lose weight (WC)	**0.56**	0.50	-0.16
Flat stomach (SC)	**0.47**	0.46	-0.12
Dietary rules (R)	-0.06	**0.84**	-0.02
Restraint over eating (R)	0.04	**0.77**	0.02
Food avoidance (R)	0.08	**0.73**	-0.02
Empty stomach (R)	-0.12	**0.61**	0.36
Fear of weight gain (SC)	0.31	**0.40**	0.20
Preoccupation with shape or weight (WC/SC)	-0.02	0.20	**0.72**
Eating in secret (EC)	0.03	-0.15	**0.64**
Preoccupation with food, eating or calories (EC)	-0.10	0.21	**0.64**
Social eating (EC)	0.36	-0.20	**0.63**
Avoidance of eating (R)	-0.14	0.41	**0.47**
Fear of losing control over eating (EC)	0.22	0.13	**0.46**
Guilty after eating (EC)	0.31	0.18	**0.39**
Eigenvalue	12.41	1.79	1.20

Percentage of variance	54.94	6.61	3.45
Cronbach's alpha	0.96	0.88	0.88

Note: *Original subscale allocations are shown in brackets: SC = Shape Concern; WC = Weight Concern; EC = Eating Concern; R = Restraint.*

Table 2: Mean scores and standard deviations for both newly derived and original EDE-Q subscales for adolescent girls and boys from both sample 1 and sample 2.

EDE-Q Subscale	Girls		Boys	
	Sample 1	Sample 2	Sample 1	Sample 2
Shape and Weight Concerns	2.43 (1.85)	2.62 (1.88)	0.95 (1.33)	0.76 (1.08)
Restriction	1.51 (1.62)	1.71 (1.67)	0.58 (1.01)	0.55 (0.97)
Preoccupation and Eating Concern	0.87 (1.16)	1.01 (1.22)	0.41 (0.79)	0.33 (0.73)
Global Score	1.61 (1.42)	1.77 (1.43)	0.63 (0.89)	0.54 (0.84)
Restraint (Original)	1.25 (1.45)	1.42 (1.51)	0.50 (0.89)	0.49 (0.91)
Eating Concern (Original)	0.91 (1.20)	1.03 (1.22)	0.45 (0.89)	0.34 (0.75)
Shape Concern (Original)	2.27 (1.77)	2.49 (1.82)	0.90 (1.26)	0.70 (1.01)
Weight Concern (Original)	1.99 (1.75)	2.16 (1.75)	0.74 (1.11)	0.63 (1.01)
Global (Original)	1.61 (1.42)	1.77 (1.42)	0.63 (0.90)	0.54 (0.84)

Table 3: Proportion of adolescent girls and boys from sample 2 engaging in key eating disordered behaviors as measured by the EDE-Q and Pearson Chi-Square scores for gender comparisons.

Key behavior	Any occurrence (%)		Pearson's Chi-Square test			Regular occurrence (%)		Pearson's Chi-Square test		
	Females	Males	x^2	df	P value	Females	Males	x^2	df	P value
Objective binge eating episodes	27.76	12.70	14.80	1	<.001	12.17	5.29	6.17	1	.013
Self-induced vomiting	8.27	2.19	7.30	1	.007	2.36	1.09	0.95	1	NS
Laxative misuse	5.30	1.59	4.21	1	.040	2.27	1.59	0.27	1	NS
Excessive exercise	42.23	24.86	13.76	1	<.001	6.77	3.95	1.56	1	NS

NOTE: Excessive exercise was described as having "exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories". Regular occurrence was defined as ≥ 4 times over 28 days for all behaviors, except for excessive exercise (≥ 20) as reported previously.[3]