

**Investigating Best Factor Model Fit for the EDE-Q Among Dutch Patients Suffering  
from Binge Eating Disorder**

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### **Abstract**

Eating Disorder Examination Questionnaire (EDE-Q) is considered to be a practical alternative to the Eating Disorder Examination Interview. However, its factor structure is based purely on theoretical grounds. Empirical research has failed to replicate the original four factor model of EDE-Q, consisting of dietary restraint, eating concern, shape concern, and weight concern. Consequently, different factor structures have been suggested and tested. Only one study to this date has examined the factor structure of EDE-Q on a Dutch sample diagnosed with binge eating disorder. This paper aims to examine the factor structure of eating disorder examination questionnaire on a sample of Dutch patients with binge eating disorder ( $N= 256$ ). Best model fit was analyzed via confirmatory factor analysis. None of the proposed factor structures were an exact fit for this sample. The brief one factor model consisting of 8 items and measuring eating disorder pathology in general was found to be the best fitting model. These results implicate that EDE-Q only measures general eating disorder pathology, and not the specific facets of eating disorders. Further research is recommended to consider the effects of the COVID-19 pandemic, and gender differences in eating disorders on measurements of eating disorders, and to create a more psychometrically sound measurement tool to assess specific eating disorder facets or include additional materials to measure other aspects of eating disorder pathology.

**Key words:** Binge Eating Disorder, Eating Disorder Examination Questionnaire, Confirmatory Factor Analysis, Factor Structure

Eating disorders typically entail altered consumption of food associated with significant impairments in functioning and/or physical health (American Psychiatric Association, 2013). Binge Eating Disorder (BED) is characterized by eating until uncomfortably full in a discrete amount of time, accompanied by lack of control during the bingeing episode. The lifetime prevalence of BED in The Netherlands was estimated to be 0.9% in 2013 (Kessler et al., 2013).

The Eating Disorder Examination (EDE) is the first and the most widely used structured interview to assess eating disorder psychopathology, including BED (Cooper & Fairburn, 1987). The Eating Disorder Examination Questionnaire (EDE-Q) is EDE administrated as a questionnaire, using likert scales to measure the frequency of eating disorder related behaviors and cognitions within the last 28 days of test administration. EDE-Q was developed because EDE interview is time consuming and not always practical, for it needs to be administered by trained professionals (Cooper & Fairburn, 1987; Fairburn & Beglin, 1994). EDE-Q shows acceptable levels of agreement with EDE interview. Therefore, it can be used instead of EDE when necessary (Reas et al., 2006).

Empirical evidence supports the test-retest reliability of EDE-Q for BED patients, and male and female undergraduates (Reas et al., 2006; Rose et al., 2013). Furthermore, EDE-Q demonstrated high internal consistency on a community sample of women (Mond et al., 2004). However, the validity of EDE-Q should be further researched. The factor structure of EDE-Q was created on a theoretical basis without empirical investigation (Allen et al., 2011). Subsequently, studies show only moderate support for the factor structure of EDE-Q and report difficulty replicating the original four-factor structure model (Berg et al., 2012; Heiss et al., 2018). Consequently, different factor models of EDE-Q are proposed, raising questions about the four-factor structure of EDE-Q.

The original model of EDE and EDE-Q is a four-factor model. These factors are dietary restraint, eating concern, weight concern, and shape concern. Furthermore, answers of these subscales can be averaged to create a global eating disorder pathology score that indicates overall level of eating disorder pathology (Walsh et al., 2015). The alternative factor structures that were proposed are mostly investigated by exploratory factor analysis among non-Dutch patients suffering from anorexia nervosa, bulimia nervosa, or eating disorder not otherwise specified (EDNOS). One exception is the one-factor global model by Aardoom and colleagues (2012) who investigated the factor structure of EDE-Q among treatment seeking eating disorder patients in The Netherlands. The following are the most popular alternative factor models proposed for EDE-Q:

1. Three-Factor Model (Peterson et al., 2007): The weight and shape concern factors are combined, but dietary restraint and eating concerns are separate factors.
2. Two-Factor Model (Mannucci et al., 1997): The weight/shape/eating concern factors are combined into one subscale, and dietary restraint is the second subscale.
3. One-Factor Global Model (Aardoom et al., 2012): The global eating disorder pathology is found by averaging all item scores.
4. One-Factor Brief Model (Byrne et al., 2010): 8 items from EDE-Q are selected to construct one eating disorder pathology factor by averaging the scores.
5. Bi-Factor Model: All items are loaded to both the original four factors, and the global one factor, while controlling for the covariance between the original four factors.

None of the models mentioned above used a sample of BED patients. Because of the differences in psychopathology of different eating disorders, the results on other eating disorders cannot be generalized to BED psychopathology. So, research needs to investigate the factor structure of the EDE-Q for the assessment of BED (Berg et al., 2012). Furthermore, cultural factors have an impact on eating disorder symptomology (Allen et al., 2011). Thus, the results from different countries may not generalize to one another. Only the one-factor global model by Aardoom and colleagues (2012) is based on a Dutch sample seeking treatment for eating disorders. Therefore, there is a gap in literature in testing the factor structure of EDE-Q on Dutch BED patients.

The use of exploratory factor analysis (EFA) or confirmatory factor analysis (CFA) when investigating factor structures influences the robustness of the results. The advantage of using a CFA is that it is based on the a-priori hypotheses about the structure of the data. On the other hand, EFA creates a factor model based strictly on the existing data set, making it difficult to generalize to alternative samples (Allen et al., 2011). None of the factor models mentioned above equipped CFA to analyze model fit of EDE-Q to their samples. Thus, most of the factor analyses investigating factor structure of EDE-Q lack generalizability across alternative samples.

In conclusion, there is a gap in research that tests the validity of EDE-Q by testing which of the factor models fits best to patients suffering from BED in the Netherlands. This paper aims to address this gap by conducting CFA on a sample of Dutch BED patients. Specifically, each of the five models (including the original four-factor model) and the bifactor model will be tested using Dutch BED patients' EDE-Q results that were collected prior to this paper. The results of this study will have implications for accurate assessment of different aspects of eating disorder pathology in BED patients in the Netherlands.

It is hypothesized that that the original four factor model of EDE-Q in our sample is not supported, and that the one-factor global model fits best to a sample of Dutch patients suffering from eating disorders (Aardoom et al., 2012). Therefore, we expect to find that a global eating pathology factor will be the best fit for our sample.

## **Method**

### **Procedure**

Data were collected at Novarum center for eating disorders and obesity in Amsterdam, The Netherlands. Participants were referred to treatment by secondary health care facilities. All patients who met the inclusion criteria were invited to participate in the study. The potentially eligible participants were given written information about this study in an advisory session. If the outpatient was willing to participate, they received an informed consent form. After signing the informed consent form, participants were invited to complete assessments. Participants completed the EDE interview at the start and end of treatment (after 23 weeks). In addition, they completed an online version of EDE-Q translated to Dutch at the beginning of treatment.

### **Participants**

This study used an existing set of authorized, coded data that were collected between September 2019 and December 2020 at Novarum as part of a bigger study by van den Berg and colleagues (2020). The inclusion criteria for the invited participants were being older than 18 years old, having a BMI between 19.5 and 40, having moderate proficiency in Dutch, and willingness to provide contact and sign the consent form. Consequently, this study included 256 participants with an average age of 39.1 (SD = 13.3). The majority of the sample self-identified as female (N= 231, 90%), and males made up 10% of the sample (N = 21). Furthermore, the majority of the of the participants were born in the Netherlands (N = 223, 87.1%). There were no missing data. Table 1 and Table 2 describe the characteristics of the sample.

**Table 1**

*Mean Age and BMI of the Sample*

	Mean	SD
Age	39.1	13.3
BMI	47	105.8

**Table 2**  
*Characteristics of the Sample*

	<i>N</i>	<i>%</i>
Gender		
Male	21	10
Female	231	90
Weight Status		
Normal Weight	20	7.8
Overweight	44	17.2
Obese	191	74.6
Education Level (highest completed)		
Lower Vocational Education	6	2.3
Lower General Secondary Education	16	6.3
Senior General Secondary Education/ University Preparatory Education	27	10.5
Secondary Vocational Education	73	28.5
Higher Professional Education	85	33.2
Research University	48	18.8

## Measurement Tools

### *EDE*

The EDE is a semi-structured interview that measures eating disorder pathology in the past 28 days to 6 months on a 7-point likert scale, ranging from 0 to 6 (Cooper & Fairburn, 1987). The EDE assesses eating disorder pathology in four subscales: dietary restraint, eating concern, shape concern, weight concern. Internal consistency of EDE is poor for dietary restraint ( $\alpha = 0.63$ ), eating concern ( $\alpha = 0.60$ ), shape concern ( $\alpha = 0.68$ ), and weight concern ( $\alpha = 0.51$ ) for BED patients (Grilo et al., 2010). Inter-rater and test-retest reliabilities of EDE are very good for objective bulimic episodes. For subjective bulimic episodes, inter-rater reliability is excellent, but test-retest reliability is unacceptable (Grilo et al., 2004).

### *EDE-Q*

The EDE-Q is a 28-item questionnaire that assesses the frequency of disordered eating behavior and cognitions in the last 28 days. It measures this in the form of a 7-point likert scale ranging from 0 to 6 (Fairburn & Beglin, 1994). EDE-Q yields results in four subscales: dietary

restraint, eating concern, weight concern, shape concern. The average of these subscales yields a global score of eating disorder. The Dutch version of the EDE-Q is used in this study, which has good psychometric qualities. EDE-Q has good internal consistency for dietary restraint ( $\alpha = 0.85$ ), eating concern ( $\alpha = 0.81$ ), shape concern ( $\alpha = 0.83$ ), and weight concern scales ( $\alpha = 0.91$ ) (Aardoom et al., 2012).

### **Statistical Analyses**

SPSS version 25 was used to conduct a one-way ANOVA in order to test for the effect of gender in EDE-Q global scores. The correlations between the original four factors were calculated using Pearson's  $r$ . Values between 0.30 and 0.50 were considered as weak correlations, values between 0.50 and 0.70 were considered as moderately strong correlations. Pearson's  $r$  values between .70 and 0.90 were considered as a strong correlation.

AMOS version 27 was used to test the validity of five factor models of EDE-Q with a confirmatory factor analysis (CFA). To test the goodness of fit, five separate CFAs were conducted. The level of fit for each model was estimated using Chi-square goodness of fit test, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), normed fit index (NFI), Tucker-Lewis Index (TLI), incremental fit index (IFI) and root mean square of error approximation (RMSEA). The model was deemed as a good fit for the data if the Chi-square test is non-significant ( $p \leq 0.05$ ), rejecting the null hypothesis of a fitting model. Furthermore, GFI and AGFI values that were equal to or larger than 0.95 indicated an acceptable fit (Pituch & Stevens, 2016). When CFI, NFI, TLI, and IFI values were larger than 0.90, the model was deemed as an acceptable fit. RMSEA values of 0.05 or below were considered as indicating a good-fitting model. RMSEA values between 0.05 and 0.10 were considered indicative of an acceptable model (Hu & Bentler, 1999). Finally, the model statistics were compared to determine the best fitting model.

### **Ethics**

The original data collection by van den Berg et al (2020) was approved by MEC-U on 26.8.2019 with registration number R19.035. The current study was reviewed and approved by the Ethical Review Board of the Faculty of Social and Behavioral Sciences of Utrecht University on 20.11.2021 with reference number 21.2047.

### **Results**

EDE-Q showed acceptable internal consistency,  $\alpha = 0.71$ . Cronbach's alpha was good for shape concern scale ( $\alpha = 0.82$ ); acceptable for dietary restraint scale ( $\alpha = 0.73$ ); and poor for eating concern and weight concern scales respectively,  $\alpha = 0.67$ ;  $\alpha = 0.67$ . A one-way

ANOVA yielded significantly higher global EDE-Q score means for females ( $M = 4.58$ ,  $SD = 1.71$ ) compared to males ( $M = 3.87$ ,  $SD = 1.48$ ),  $F(1, 254) = 4.02$ ,  $p = 0.04$ .

EDE and EDE-Q scores were above the Dutch cut-off score of 1.76 (Table 3, Table 4), indicating clinically significant pathology (Aardoom et al., 2012).

None of the tested models showed an acceptable fit (Table 5). There is a strong correlation between weight concern and shape concern subscales ( $r = 0.81$ ,  $p < 0.00$ , 95%  $CI$  [0.73, 0.88]). Moderate relationship is found between shape concern and eating concern subscales ( $r = 0.58$ ,  $p < 0.00$ , 95%  $CI$  [0.48, 0.68]). Similarly, there is a moderate relationship between weight concern and eating concern subscales ( $r = 0.61$ ,  $p < 0.00$ , 95%  $CI$  [0.51, 0.71]). Lastly, there are weak relationships between eating concern and dietary restraint subscales ( $r = 0.32$ ,  $p < 0.00$ , 95%  $CI$  [0.21, 0.44]); shape concern and dietary restraint subscales ( $r = 0.30$ ,  $p < 0.00$ , 95%  $CI$  [0.18, 0.42]); and weight concern and dietary restraint subscales ( $r = 0.31$ ,  $p < 0.00$ , 95%  $CI$  [0.19, 0.42]).

**Table 3**  
*EDE Scores*

	Mean	SD
Total Sample	3.04	0.91
Females	3.08	0.91
Males	2.69	0.87

**Table 4**  
*EDE-Q Scores*

	Mean	SD
Total Sample	4.51	1.70
Dietary Restraint	2.14	1.42
Eating Concern	2.84	1.40
Shape Concern	4.39	1.25
Weight Concern	3.94	1.18
Females	4.58	1.71
Dietary Restraint	2.14	1.43
Eating Concern	2.95	1.39
Shape Concern	4.47	1.19
Weight Concern	4.02	1.16
Males	3.87	1.48

Dietary Restraint	2.10	1.30
Eating Concern	1.88	1.14
Shape Concern	3.57	1.52
Weight Concern	3.18	1.19

**Table 5**  
*Fit statistics of different models*

Fit indices	X <sup>2</sup> (df)	RMSEA	GFI	AGFI	NFI	CFI	TLI	IFI
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Four factor model (Fairburn et al., 1993)								
	681.386(202)	0.09	0.80	0.75	0.74	0.80	0.77	0.80
Bifactor model (Fairburn et al., 1993)								
	651.662(186)	0.09	0.82	0.76	0.75	0.80	0.76	0.81
Three factor model (Peterson et al., 2007)								
	800.790(206)	0.11	0.78	0.73	0.70	0.75	0.72	0.75
Two factor model (Manucci et al., 1997)								
	871.319(208)	0.11	0.75	0.69	0.66	0.72	0.69	0.72
One factor global model (Aardoom et al., 2012)								
	1215.548(209)	0.14	0.67	0.60	0.53	0.57	0.53	0.58
One factor brief model (Byrne et al., 2010)								
	145.206(20)	0.16	0.89	0.80	0.86	0.87	0.82	0.87

### Discussion

The current paper is one of the few to examine the best model fit for EDE-Q factor structure on a sample of Dutch patients. There is lack of generalizability of EDE-Q factors structures across different cultures and various types of eating disorders. Therefore, this paper aims to address the gap in EDE-Q literature by testing its factor structure in Dutch patients with binge eating disorder (BED) using CFA. To our knowledge, it is one of the few studies to examine the best model fit for EDE-Q on a sample of Dutch patients specifically diagnosed with BED. Knowing the best fitting factor structure of EDE-Q for Dutch patients with BED can facilitate more accurate measurement of their symptoms, which can be used to track treatment outcomes.

The results indicate that none of the suggested factor models accurately fit Dutch patients with BED. Among the factor models, brief one factor model consisting of 8 items (Byrne et al., 2010) fit best to our data, meaning that EDE-Q does not specifically measure dietary restriction, eating concern, shape concern and weight concern. It rather measures global eating disorder psychopathology. This is in line with Aardoom and colleagues' (2012) study which suggested that a one factor model fits best to Dutch patients with eating disorders. Therefore, our hypothesis that a global one factor model would fit our data best is partially supported. In addition, an effect of gender on global EDE-Q scores was found. More specifically, females had higher EDE-Q scores compared to males.

There is little consensus among studies about the best fit model for EDE-Q. However, almost none of the studies supported the original four-factor model. The four-factor model was not supported for several populations, including Greek university Students (Giovazolias et al., 2013), Danish eating disorder patients (Lichtenstein et al., 2021), Saudi nationals (Melisse et al., 2021), Israeli nationals (Zohar et al., 2017), Malaysian university students (Taib et al., 2021), Japanese patients with eating disorders (Otani et al., 2021), French BED patients (Carrard et al., 2015), and Portuguese eating disorder patients (Machado et al., 2018). Our results further support that there is little empirical evidence for the original four factor model of EDE-Q.

There are also differences in factor structure of EDE-Q across genders. A three-factor structure was found to be the best fit for females, while a two-factor structure of EDE-Q was supported for males (Darcy et al., 2013). Another study found that a brief one-factor global EDE-Q model fits better to a female sample compared to a male sample (Tobin et al., 2019). This paper found that there are also differences in global EDE-Q scores between genders. More specifically, females seem to exhibit significantly higher eating disorder pathology than males. The overall prevalence of eating disorders differs little between sexes (Lipson & Sonnevile, 2017). The most common eating disorder in males is BED. However, paucity of research seems to suggest that loss of control over eating is more common among women and girls. Previous research posits that men can exhibit more muscularity-oriented eating pathology symptoms, in contrast to female-oriented symptom patterns that eating disorder research is based on (Mitchison & Mond, 2015). It was also found that the same scores on EDE-Q across genders may indicate different levels of eating disorder pathology, which further supports that the same measurements tools for eating disorder pathology should not be used across genders (Rand-Giovannetti et al., 2017). Therefore, different eating disorder symptom presentation in male BED patients may explain the difference in EDE-Q factor structures and global EDE-Q scores

across genders. However, lack of research in this area and underrepresentation of males in studies limits these conclusions.

The findings of this study are supported by several strengths. Firstly, the sample size of this study is large enough ( $N = 256$ ) to provide sufficient power to the CFA that was conducted (Myers et al., 2011). The sample consisted of BED patients from different cities of the Netherlands. So, the results may be generalizable across The Netherlands. Furthermore, the use of CFA to test different factor models further supports the generalizability of the results to other Dutch BED patients (Allen et al., 2011). Moreover, this study specifically examined a sample of Dutch patients clinically diagnosed with BED. Given the theoretical limitations of generalizing results across different cultures and various eating disorder diagnoses, specifically examining this sub-population yields more robust results. The patients were diagnosed by using EDE interview conducted by trained professionals. This makes the diagnosis more accurate compared to a questionnaire, because there is more control over variables that might influence the answers to questions during an interview (Furr & Bacharach, 2014). In addition, the interview allows for further information to be gathered, for it is more flexible. More specifically, it allows the interviewer to ask follow-up questions until sufficient information is gathered for the diagnosis. To sum up, the sample size, robust statistical technique, and the specific sample with reliable diagnoses are some of the reasons why our results are relatively robust.

Despite the strengths, this study has several limitations. One of the weaknesses of this study is the ongoing COVID-19 pandemic that occurred halfway through data collection. In 2012, Aardoom and colleagues found that the Dutch BED patients had a relatively lower EDE-Q global score ( $M = 3.46$ ,  $SD = 0.98$ ,  $N = 112$ ) compared to our sample ( $M = 4.51$ ,  $SD = 1.70$ ,  $N = 256$ ). This suggests that there may potentially be a post-COVID increase in EDE-Q global results. However, small sample size of the study by Aardoom and colleagues (2012), and lack of significance testing of the difference between the two means limits this conclusion. Theoretically, the pandemic could exacerbate binge eating pathology in several ways. Disrupted daily routines and limited outdoor activities, along with exposure to anxiety-provoking media, consequently increased negative affect, can increase eating disorder symptoms. Social restrictions can decrease social support and reduce effective coping. Fears of contagion can increase eating restrictions specifically aimed to increase immunity (Rodgers et al., 2020). In addition, hoarding food from supermarkets in preparation for possible lockdowns could potentially worsen binge eating. Conversely, lockdowns could decrease binging by increasing social control over the patient, as the household quarantines at home

together. Therefore, effects of COVID-19 pandemic may have altered our data. The current paper did not take into account the possible effects of COVID-19 pandemic, so our results should be interpreted with caution.

In addition, significant effect of gender found on EDE-Q global scores may limit our results. There seems to be gender differences in the presentation of ED symptoms, including BED, and higher EDE-Q scores for females compared to males. However, it is unknown whether these differences impact the factor structure of EDE-Q for males and females. Even though in 2020 approximately 50% of the total population in the Netherlands were males (“Department of Economic and Social Affairs: Population Dynamics,” 2020), only 10% of our total sample were males. Consequently, our sample of males were too few to test the factor structure of EDE-Q for males separately. The underrepresentation of males is a pattern observable in most eating disorder research (Shingleton et al., 2015). Therefore, the underrepresentation of males in our study limits the generalizability of our results to male populations.

Further research should work on developing a measurement tool that validly measures different facets of eating disorder pathology across various populations. In addition, the influences of COVID-19 pandemic on eating disorder patients should be addressed both for treatment planning and data collection. Moreover, eating disorder research should aim to gather samples that are more reflective of the population in order to counteract the underrepresentation of males in this area. Lastly, a new measurement tool should be developed to measure different facets of eating disorder pathology more accurately across samples.

Although previous research and our results fail to show support for the original four factor structure and the generalizability of alternative factor structures of EDE-Q, it is still used widely in clinical practices. Therefore, the use of EDE-Q to measure facets of eating disorders in clinical practice should be limited. Two recommendations can be made. Firstly, the use of EDE-Q can be limited to specific populations with empirically supported factor structures. Secondly, different eating disorder pathology measurement tools can be developed to assess various dimensions of eating disorders.

Overall, the original four factor structure of EDE-Q is not supported. Clinical implementations and further research should take this into account when measuring binge eating disorder in the Dutch population.

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