Establishing The Optimal Male Cut-Off Point: Confirmatory Factor Analysis of The Eating Disorder Examination-Questionnaire (EDE-Q) in a Representative Sample of Spanish University Students

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Abstract

Purpose Although the EDE-Q is derived from the “gold standard” for the assessment of Eating Disorders (ED), its factor structure is controversial, particularly in male samples. The aim of the study was to examine the psychometric properties and factor structure of the EDE-Q, as well to establish a sensitive and specific cut-off point validated by EDE clinical interview.

Methods A series of Confirmatory Factor Analyses were performed among a representative sample of 796 male university students, of whom 139 were interviewed. Sensitivity and specificity were calculated by Receiver Operating Characteristic (ROC) analysis to determine the most appropriate cut-off value.

Results The original factor structure was not confirmed, showing a better fit with a 2-factor solution. For the Spanish male sample, a cut-off $\geq 1.09$ for at-risk of ED cases and $\geq 2.41$ for clinical cases presents an optimal balance between sensitivity and specificity.

Conclusions The establishment of specific cut-off points for males may help to reduce the under-diagnosis of ED in this population.

Level of evidence III Evidence obtained from well-designed case-control study.

1. Introduction

The Eating Disorders Examination Questionnaire (EDE-Q) [1] is derived from the “gold standard” for the assessment and diagnosis of eating disorders (ED), the Eating Disorders Examination interview (EDE) [2]. In addition to the cognitive features of ED, the EDE-Q includes items that assess behavioral symptoms as self-induced vomit, binge eating or excessive exercise, and is a brief, cost-efficient self-report instrument for exploring possible occurrence and severity of ED [3]. The EDE-Q has been widely used and has shown to be a valid and reliable instrument in both general population and clinical samples [4, 5, 6].

Originally, the theoretical structure of the EDE-Q is composed by 4 factors (i.e., Restraint, Eating Concern, Weight Concern and Shape Concern) and a global score. However, this structure has found little empirical support and is controversial [6, 7]. Since its development, the factor model of the EDE-Q has been tested through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) in multiple studies with samples differing in nationality, age, sex, sexual orientation or clinical status. Overall, of the more than 20 studies that have been conducted on this topic, only 2 have confirmed the original 4-factor, 22-item model. Retaining the original 22 items, there are 12 proposed factorial structures, from unifactorial to 4-factor alternatives, with those proposing factor models that merge the “Concern” subscales in some way being common. For short models there are also at least 9 alternatives to the original factorial model with fewer items [see 6 and 8 for review).

In recent years, ED behaviors are growing faster in men than in women [9]. Although the rates of anorexia nervosa and bulimia nervosa are lower than in women [10], the dual nature of male body dissatisfaction
(i.e., low body fat and high muscularity) lay them at risk for disordered eating [9, 11], with the average age of onset being around 19–20 years [12, 13]. Despite the need for robust instruments to explore this pathology among men and reduce the problem of under-diagnosed of male ED [9], research on the psychometric properties of EDE-Q in men remains low and samples are generally scarce [6]. Recent studies on male samples show different factor structures for the EDE-Q [8], supporting the hypothesis that the original factor model is not sensitive enough for males and more research is needed to clarify the weak and unstable structure [5, 14].

Screening for low prevalence pathologies such as ED inherently involves challenges [15], particularly in male samples where results with the usual cut-off points may not be adequately detecting at-risk cases [16, 17]. Sensitive and specific screening instruments validated with clinical interview are essential. In the Spanish population, studies that have examined the psychometric properties of the EDE-Q, including EFA and CFA, in males have been conducted mainly in samples of adolescents [18, 19]. The few that have collected adult samples have not conducted a clinical interview to contrast the findings [20, 16].

This wide range of alternative versions of the EDE-Q may make communication between researchers and clinicians difficult and affect the interpretation of findings [21]. The aim of this study is to extend the current literature by examining the psychometric properties and factor structure of the EDE-Q, as well to determine/stablish a sensitive and specific cut-off point validated by EDE clinical interview in a large non-clinical representative sample of Spanish university men.

2. Method

2.1. Participants

The data were obtained in an epidemiologic study of the prevalence of ED and Muscle Dysmorphia (MD) among male university students at Autonomous University of Madrid using a two-phase study with a control group. The first phase, the sample population was screened by questionnaire to detect students at risk of developing an ED or MD. The second phase, clinical interviews were conducted with the risk group (above a cut-off point). The control group was selected randomly from the students who scored below of risk cut-off point, using two students pairing stratified by academic year and school.

The survey was carried out in a sample of male students enrolled in the first and fourth academic year, between 2016-19 academic years. Of the 21 schools on the campus, 5 schools (i.e., Physical Activity and Sports Sciences, Physics, Computer Science Engineering, Business Administration and Management and Economics) with the highest number of male students enrolled were selected (i.e., over 70%). A total of 1634 students were targeted. To achieve a representative sample of the university campus by academic year and school, the sample design was proportionally stratified according to academic year and school, assuming a 95% confidence interval and 0.05 of sampling error. A total of 1088 students was identified as the desired sample size [22]. The final sample collected consisted of 850 Spanish male university students from different degrees (i.e., 78,1% response rate): (1) Physical Activity and Sports Sciences from
Polytechnic (n = 297, 91.1% response rate), (2) Physics (n = 92, 96.8% response rate), (3) Economics (n = 171, 77.7% response rate), (4) Computer Science Engineering (n = 114, 49.6% response rate) and (5) Business Administration and Management (n = 176, 81.1% response rate). The mean age of the sample was 19.8 (SD = 2.8).

Specifically for this study, to examine psychometric properties of EDEQ, fifty-four participants demonstrated >5% of missing data on the questionnaire or were non-Spanish students and were excluded (n = 796). Overall, 528 (66.3%) participants practiced sports at a non-competitive level (recreational exercisers) and the remaining 268 (33.7%) students competed at a national or international level in some sport (e.g., football, swimming, etc.). The mean Body Mass Index (BMI) was 22.4 (SD = 2.9).

Tests were administered at the classroom collectively and completed individually in electronic or paper. Permission to conduct the study was granted by the university’s deans and the participant's teachers.

2.2. Measures

In addition to self-reported sociodemographic data on age, weight and height, participants also respond to:

**Eating Disorder Examination (EDE-12, Version 12.0)** [2, 23] The EDE is a clinical interview developed to measure ED psychopathology over a 28-day period. It consists of 35 questions in which 22 items comprises four subscales, with the same response format of seven-points (i.e., 0–6): Restraint, Eating Concern, Shape Concern, and Weight Concern. The EDE-Global score is obtained by averaging subscales' scores. The presence and frequencies of key ED behaviors are not included neither subscales nor global score, however, these questions are used for coding the ED diagnosis. The interview manual indicates the diagnostic items of the EDE to establish a DSM-IV diagnosis, which has been adapted to DSM-5 diagnoses.

**Eating Disorder Examination-Questionnaire (EDE-Q)** [1, 16], asks directly about attitudes related to key features of ED psychopathology in a 28-day time frame. The 22 attitudinal items comprise the same four subscales, and responses are given on a 7-point Likert-type scale (0 = never to 6 = every day). The EDEQ-Global score is obtained by averaging subscales' scores. The remaining items assess the frequency of specific eating behaviors are not included in the subscales or in the global score. Studies of convergent validity comparing the EDE-Q with its interview equivalent (the EDE) have generally demonstrated good agreement between measures [24, 25, 26]. The Cronbach's alpha was .93 for the EDEQ-Global score for non-clinical men [10] The EDE-Q has a clinical significance cut-off point of ≥ 4 for EDEQ-Global score for both sexes [27]. In the current sample, the Omega coefficient was .93 for the EDE-Q Global score.

**Muscle Dysmorphic Disorder Inventory (MDDI)** [28, 29] is a questionnaire of 13 items with a response range from 1 (never) to 5 (always) that evaluates body dissatisfaction from a male perspective related to muscle development. Likewise, the MDDI is divided into three subscales: drive for size (DFS), appearance intolerance (AI) and functional impairment (FI). The original version showed adequate reliability indexes
(range: $\alpha = .77$ to .85), as well as the Spanish version (range: $\alpha = .73$ to .85). In the current sample, the Omega coefficient was .89 for the MDDI total score.

2.3. Data Analysis

Statistical analyses were carried out using SPSS 25.0, Mplus 7.11 and RStudio, employing the $MNV$[30], $psych$[31], and $ROCit$[32] packages. Descriptive statistics (M ± SD) were calculated for all scale scores. The Mardia's test revealed that the EDE-Q items did not follow a multivariate normal distribution (skewness = 38873.39, $p < .001$; kurtosis = 256.93, $p < .001$). Since data were categorical and followed a non-normal distribution, CFAs were performed using robust Unweighted Least Squares (ULSMV). Items were set to load freely, except for one item per factor, which was set to 1 to ensure an identified model. The models under investigation were as follows: Model I: 4-factor structure [1]; Model II: 3-factor structure that retains two EDE-Q subscales (Restraint, Eating Concern) but collapses Weight and Shape Concern items [33]; Model III: 2-factor model that retains one EDE-Q subscale (Restraint) but collapses Eating, Weight and Shape Concern items [34]; and Model-IV: an unidimensional model for all EDE-Q subscale items [7]. Several fit indexes were considered: Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval, Tucker Lewis Index (TLI), and Comparative Fit Index (CFI). Values of CFI and TLI values close to .90, and RMSEA values < .08 were indicative of good fit [35, 36]. A Chi-square difference test ($\Delta \chi^2$) was used to compare models. Given the Likert-type nature of the EDE-Q [37], internal consistency was assessed through the Omega coefficient [38]; values of $\geq .80$ were considered adequate [39]. Kolmogorov-Smirnov tests showed that all scale scores were not normally distributed. Therefore, their concurrent validity was assessed using Spearman correlations with the MDDI scores. We also carried out sensitivity and specificity analyses for the EDE-Q total score with 139 interviewed males with the EDE. We used receiver operating characteristic (ROC) curves to determine the optimum cut-off score for males with ED diagnosis and risk of ED according to EDE interview criteria, using Youden's index, which indicates the balance between sensitivity/specificity. We estimated the Area Under the Curve (AUC) to assess the discrimination quality. In general, AUC = .70-.80 are considered acceptable, AUC = .80-.90 are considered as good, and AUC = .90 - 1.00 as excellent [40]. Lastly, we calculated the sensitivity as the true positive rate, the specificity as the true negative rate, the positive predictive value (PPV), and the negative predictive value (NPV).

3. Results

The first CFA (Model I) tested the fit of the original theoretical proposal [1]. Results of this analysis revealed a not positive definite matrix solution, indicating that this model was not acceptable. Fit statistic for the remaining model (II-IV) are presented in Table 1. Model IV showed poor fit to our data, while models II and III resulted in acceptable fit. The Chi-square difference test ($\Delta \chi^2$) revealed that Model-II showed better fit than Model-I. However, although $\Delta \chi^2$ indicated that Model-II showed better fit than Model-III, the difference in the remaining fit indexes was small (e.g., $\Delta TLI < .01$) [41]. Thus, we retained Model-III, as it was the model with better fit parsimony balance (see Fig. 1). This retained two-factor model shows significant positive moderate to high correlations with the EDE interview (see Table 2).
Means scores, standard deviations and internal consistency, as well as correlations among EDE-Q and MDDI scores, are presented in Table 3. The EDE-Q and its subscales showed acceptable to excellent internal consistency, with omega coefficient values above .70 for the Restrain subscale, and above .90 for the remaining scales.

Regarding the concurrent validity, the MDDI total score showed positive moderate significant correlation with the EDE-Q and its subscales (.35 − .52). There were also positive moderate to high correlations between the MDDI-AI subscale and the EDE-Q, especially with the EWSC subscale (rho = .62; p < .01) and the total score (rho = .60; p < .01). On the other hand, the EDE-Q showed low to moderate positive correlations with the MDDI-DFS and the MDDI-AI subscales (see Table 3).

ROC curves are presented in Figs. 2 and 3. The figures show the optimum cut-off scores for males with ED diagnosis and at risk of ED, respectively. The cut-off score for ED diagnosis males was an EDE-Q-Global score = 2.41, whereas for risk-of-ED males was an EDE-Q-Global score = 1.09.

Descriptive statistics for each group and AUCs are presented in Table 4. As shown, AUCs indicate that the probability for an ED male to obtain a higher EDE-Q-Global score than control males is 76.9%, whereas the probability for a risk-of-ED male to obtain a higher EDE-Q-Global score than control males is 77.4%. These values are considered acceptable. Sensitivity, specificity, PPV and NPV values for the optimum cut-off scores are presented in Table 5, alongside the values for the classic EDE-Q diagnostic score (i.e., EDE-Q total ≥ 4.00).

4. Discussion

To our knowledge this is the first study to examine the factor structure of the questionnaire EDE-Q, contrasting the findings with the EDE interview in a representative university sample of Spanish men to establish a cut-off point for optimal ED detection in this population.

In the present study, the EDE-Q shows good internal consistency, with high Omega coefficient values for both the total scale and the two subscales of the EDE-Q, similar to those obtained in other studies [5, 17]. Therefore, the EDE-Q is shown to be a valid and reliable instrument for use as a screening tool in Spanish males.

Consistent with other studies [42, 7], the original 4-factor structure of the EDE-Q was not confirmed. For the Spanish male sample, the EDE-Q showed a better fit in a two-factor solution with a Restraint subscale and a Weight-Shape-Eating Concern subscale without removing any items [34]. Both the EDE interview and the EDE-Q were constructed on a rational basis to represent the key psychopathology of eating disorders. Subsequent factor studies, however, mostly do not support the initial structure [1]. These first theoretical approaches are based on a female-centric approach that may not fit the male perspective in which cognitive aspects seem to belong to a single dimension of body image concern.
Given the dual nature of male body dissatisfaction and its associated behaviors, it is suggested that the EDE-Q be used in males in conjunction with more specific measures of male body reality [43]. The EDE-Q shows moderate to high convergence with the MDDI, indicating overlap between ED and MD symptomatology, except for the Restraint subscale which shows a lower association with the Drive For Size subscale of the MDDI. This difference is not surprising, as this subscale is aimed at exploring the desire for muscle mass gain, for which dietary restriction is counterproductive [11, 9].

The EDE-Q mean scores observed in our sample are consistent with those obtained in research with similar samples of men in Spain [16, 19] and in other countries [44, 42, 43, 45, 46]. In general, men score lower than women in studies using the EDE-Q [15, 20, 47, 44, 46]. However, this does not necessarily imply that there is no ED symptomatology in males, so it is systematically questioned whether the cut-off points established for the questionnaires imply a risk of under-diagnosis [9, 45]. This risk is particularly salient when exploring male samples, where body image concerns and behaviors differ from those of women and the difficulty of detecting at-risk cases is greater [9, 11]. The use of a proposed initially cut-off ≥ 4 [27] as a marker of clinical significance has been criticized in the literature, suggesting downward rectification for both female [20] and male samples [16]. In fact, studies using ROC curve analyses contrasting EDE-Q scores with EDE interview scores point in this direction. In female samples there is a variability of cut-off proposals for the EDE-Q (EDE-Q-Global Score range: 1.98-2.80) [15, 48, 49, 50], all below the Carter et al. [1] proposal, including the cut-off ≥ 3.10 proposed by Mond et al. [48] for overweight individuals. For male samples, the cut-off ≥ 1.68 proposed by Schaefer et al. [45] is also far from the original proposal. The analysis performed in the present study suggests that, for the Spanish male sample, a cut-off ≥ 1.09 for at-risk of ED cases and ≥ 2.41 for clinical cases presents an optimal balance between sensitivity and specificity.

In conclusion, there are gender differences in levels of eating pathology that are indicative of clinical concern [45]. However, most research using the EDE-Q, including many in recent years, continues to use cut-off ≥ 4 in males [3, 5], leaving significant numbers of potentially at-risk participants undetected and therefore untreated. In men, body image and eating pathology is more complex and the EDE-Q is limited in detecting muscle-oriented eating risk behaviours. In this sense, the development and further examination of a modified muscle-oriented version of the EDE-Q [51] that captures the domains of disordered eating relevant to males may be promising.

**Strength and limits**

The main strength of the study is its big sample size and the representativeness of the sample of undergraduate men students of Spain. Conducting clinical interviews in research is an indispensable requirement to contrast the results of the questionnaires and establish a correct diagnosis. However, its high cost makes it difficult to carry out, so the high number of clinical interviews conducted is another important strength of the study. However, results of this study should consider some limitations. Although the sample provided level-sport data, no invariance studies have been carried out in this respect. Also, no
data was collected on the ethnic or sexual diversity of the participants, so the results obtained in university students do not allow generalization of the results to other samples of males.

What is already known on this subject?

The factor structure of the EDE-Q has been explored in different samples with contradictory results. Particularly in the male population, the interview-based cut-off point is not sensitive for males, aggravating the problem of underdiagnosis.

What does this study add?

Our study explores the factor structure of the EDE-Q in a large representative sample of males, who also participated in a clinical interview. Our results provide the scientific community with a sensitive and specific cut-off point of the EDE-Q for males and represent a potential advance in the detection of ED in Spanish-speaking males.

Declarations

Compliance with ethical standards

Ethical approval Ethical approval was obtained from the Research Ethics Committee of the Autonomous University of Madrid (UAM, CEI-75-1368). All procedures performed in this study involving human participants were in accordance with the ethical standards and with de Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Written informed consent was obtained from all the surveyed participant.

Conflict of interest The authors declare that they have not conflict of interest.

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Availability of data and material Not applicable

Code availability Not applicable

References

1. Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire?. *International journal of eating disorders, 16*(4), 363–370. https://doi.org/10.1002/1098-108X(199412)16:4<363::AID-EAT2260160405>3.0.CO;2-%23.

2. Fairburn CG, Cooper Z (1993) The Eating Disorder Examination (12th ed.). In C. G. Fairburn, & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, and treatment* (pp. 317–360). New York: Guilford Press
3. Jennings KM, Phillips KE (2017) Eating Disorder Examination–Questionnaire (EDE–Q): Norms for a clinical sample of males. Arch Psychiatr Nurs 31(1):73–76. https://doi.org/10.1016/J.APNU.2016.08.004

4. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 22(3), 509–514. https://doi.org/10.1007/s40519-016-0276-6

5. & Murray, S. B. (2019). Confirmatory factor analysis and measurement invariance of the eating disorders examination-questionnaire across four male samples in Argentina. International Journal of Eating Disorders, 52(6), 740–745. https://doi.org/10.1002/eat.23075

6. Berg KC, Peterson CB, Frazier P, Crow SJ (2012) Psychometric evaluation of the eating disorder examination and eating disorder examination-questionnaire: A systematic review of the literature. Int J Eat Disord 45(3):428–438. https://doi.org/10.1002/eat.20931

7. Rand-Giovannetti D, Cicero DC, Mond JM, Latner JD (2017) Psychometric properties of the Eating Disorder Examination–Questionnaire (EDE-Q): A confirmatory factor analysis and assessment of measurement invariance by sex. Assessment 27(1):164–177. https://doi.org/10.1177/1073191117738046

8. Scharmer C, Donahue JM, Heiss S, Anderson DA (2020) Factor structure of the Eating Disorder Examination–Questionnaire among heterosexual and sexual minority males. Eat Behav 38:101403. https://doi.org/10.1016/j.eatbeh.2020.101403

9. Clinical psychology review, 57, 1–11. https://doi.org/10.1016/j.cpr.2017.08.001

10. Lavender JM, De Young KP, Anderson DA (2010) Eating Disorder Examination Questionnaire (EDE-Q): norms for undergraduate men. Eat Behav 11(2):119–121. https://doi.org/10.1016/j.eatbeh.2009.09.005

11. Pope HG, Phillips KA, Olivardia R (2000) The Adonis complex: The secret crisis of male body image obsession. Free Press, New York

12. Braun, D. L., Sunday, S. R., Huang, A., & Halmi, K. A. (1999). More males seek treatment for eating disorders. International Journal of Eating Disorders, 25, 415–424. https://doi.org/10.1002/(SICI)1098-108X(199905)25:4<415::AID-EAT6>3.0.CO;2-B.

13. Carlat DJ, Camargo CA, Herzog DB (1997) Eating disorders in males: A report on 135 patients. Am J Psychiatry 154(8):1127–1132. 10.1176/ajp.154.8.1127

14. Carey M, Kupeli N, Knight R, Troop NA, Jenkinson PM, Preston C (2019) Eating Disorder Examination Questionnaire (EDE-Q): Norms and psychometric properties in UK females and males. Psychol Assess 31(7):839–850. https://doi.org/10.1037/pas0000703

15. Mond JM, Hay PJ, Rodgers B, Owen C, Beumont PJV (2004) Validity of the Eating Disorder Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. Behav Res Ther 42(5):551–567. https://doi.org/10.1016/S0005-7967(03)00161-X

16. Penelo E, Villarroel AM, Portell M, Raich RM (2012) Eating Disorder Examination Questionnaire (EDE-Q). European Journal of Psychological Assessment 28(1):76–83. https://doi.org/10.1027/1015-5759/a000093
17. Penelo E, Negrete A, Portell M, Raich RM (2013) Psychometric properties of the Eating Disorder Examination Questionnaire (EDE-Q) and norms for rural and urban adolescent males and females in Mexico. PLoS One 8(12):e83245. https://doi.org/10.1371/journal.pone.0083245

18. Peláez-Fernández MA, Labrador FJ, Raich RM (2012) Validation of Eating Disorder Examination Questionnaire (EDE-Q)-Spanish version-for screening eating disorders. The Spanish Journal of Psychology 15(2):817–824. https://doi.org/10.5209/rev_SJOP.2012.v15.n2.38893

19. Peláez-Fernández MA, Labrador FJ, Raich RM (2013) Norms for the Spanish version of the eating disorders examination questionnaire (S-EDE-Q). Psicothema, 107–114. doi: 10.7334/psicothema2012.18

20. Villarroel AM, Penelo E, Portell M, Raich RM (2011) Screening for eating disorders in undergraduate women: Norms and validity of the Spanish version of the Eating Disorder Examination Questionnaire (EDE-Q). Journal of Psychopathology Behavioral Assessment 33(1):121–128. https://doi.org/10.1007/s10862-009-9177-6

21. Tobin LN, Lacroix E, von Ranson KM (2019) Evaluating an abbreviated three-factor version of the Eating Disorder Examination Questionnaire in three samples. Eat Behav 32:18–22. https://doi.org/10.1016/j.eatbeh.2018.11.003

22. Rica R, Sepúlveda AR (2021) Epidemiology of Muscle Oriented Eating Disorders and Muscle Dysmorphia at risk on representative male sample: A Two stage study with clinical interview. Body Image, 0–00

23. Grilo CM, Lozano C, Elder KA (2005) Inter-rater and test–retest reliability of the Spanish Language Version of the Eating Disorder Examination Questionnaire: Clinical and research implications. Journal of Psychiatric Practice 11(4):231–240

24. Black, C. M., & Wilson, G. T. (1996). Assessment of eating disorders: Interview versus questionnaire. International Journal of Eating Disorders, 20(1), 43–50. https://doi.org/10.1002/(SICI)1098-108X(199607)20:1<43::AID-EAT5>3.0.CO;2-4.

25. Wilfley DE, Schwartz MB, Spurrell EB, Fairburn CG (1997) Assessing the specific psychopathology of binge eating disorder patients: Interview or self-report? Behav Res Ther 35(12):1151–1159. https://doi.org/10.1016/S0005-7967(97)80010-1

26. Elder KA, Grilo CM (2007) The Spanish language version of the eating disorder examination questionnaire: comparison with the spanish language version of the eating disorder examination and test–retest reliability. Behav Res Ther 45(6):1369–1377. https://doi.org/10.1016/j.brat.2006.08.012

27. Carter JC, Aime AA, Mills JS (2001) Assessment of bulimia nervosa: A comparison of interview and self-report questionnaire methods. Int J Eat Disord 30:187–192. https://doi.org/10.1002/eat.1071

28. Hildebrandt T, Langenbucher J, Schlundt DG (2004) Muscularity concerns among men: Development of attitudinal and perceptual measures. Body Image 1(2):169–181. https://doi.org/10.1016/j.bodyim.2004.01.001

29. Sepúlveda AR, Rica R, Moreno A, Román FJ, Compte EJ (2019) Assessing the male body image: Spanish validation of two instruments. Psychiatry Res 272:483–490.
30. Korkmaz S, Goksuluk D, Zararsiz G (2014) MVN: An R package for assessing multivariate normality. The R Journal 6(2):151–162

31. Revelle W (2020) An introduction to the psych package: Part II Scale construction and psychometrics

32. Khan MRA, Brandenburger T (2020) ROCit: Performance Assessment of Binary Classifier with Visualization. R package version 2.1.1. https://CRAN.R-project.org/package=ROCIt

33. *International Journal of Eating Disorders, 40*(4), 386–389. https://doi.org/10.1002/eat.20373

34. Becker AE, Thomas JJ, Bainivualiku A, Richards L, Navar K, Roberts AL et al (2010) Validity and reliability of a Fijian translation and adaptation of the Eating Disorder Examination Questionnaire. Int J Eat Disord 43:171–178. https://doi.org/10.1002/eat.20675

35. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL (2010) Cluster Analysis. Multivariate data analysis, 7th edn. Hair JF, Edited by

36. Swami V, Barron D (2019) Translation and validation of body image instruments: Challenges, good practice guidelines, and reporting recommendations for test adaptation. Body Image 31:204–220. http://dx.doi.org/10.1016/J.BODYIM.2018.08.014

37. Dunn TJ, Baguley T, Brunsden V (2014) From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. British journal of psychology 105(3):399–412. https://doi.org/10.1111/bjop.12046

38. McDonald RP (1999) *Test theory: A unified treatment*. L. Erlbaum Associates

39. Nunnally JC (1976) Psychometric theory, 2nd edn. McGraw-Hill, New York.

40. Hosmer DW Jr, Lemeshow S, Sturdivant RX (2013) *Applied logistic regression* (3rd ed.) (pp. 173–181). John Wiley & Sons

41. Gignac GE (2007) Multi-factor modeling in individual differences research: Some recommendations and suggestions. Personality Individ Differ 42(1):37–48. https://doi.org/10.1016/j.paid.2006.06.019

42. Darcy AM, Hardy KK, Lock J, Hill KB, Peebles R (2013a) The Eating Disorder Examination Questionnaire (EDE-Q) among university men and women at different levels of athleticism. Eat Behav 14(3):378–381. https://doi.org/10.1016/j.eatbeh.2013.04.002

43. Darcy AM, Hardy KK, Crosby RD, Lock J, Peebles R (2013b) Factor structure of the Eating Disorder Examination Questionnaire (EDE-Q) in male and female college athletes. Body Image 10(3):399–405. https://doi.org/10.1016/j.bodyim.2013.01.008

44. Hilbert A, De Zwaan M, Braehler E (2012) How frequent are eating disturbances in the population? Norms of the eating disorder examination-questionnaire. PloS One 7(1):e29125. https://doi.org/10.1371/journal.pone.0029125

45. *International Journal of Eating Disorders, 51*(12), 1357–1360. https://doi.org/10.1002/eat.22972

46. McEntee ML, Serier KN, Smith JM, Smith JE (2021) The sum is greater than its parts: Intersectionality and measurement validity of the eating disorder examination questionnaire (EDE-Q) in Latinx
undergraduates in the United States. Sex Roles 84(1):102–111. https://doi.org/10.1007/s11199-020-01149-7

47. Reas DL, Øverås M, Rø Ø (2012) Norms for the Eating Disorder Examination Questionnaire (EDE-Q) among high school and university men. Eating Disorders 20(5):437–443. https://doi.org/10.1080/10640266.2012.715523

48. Mond, J. M., Myers, T. C., Crosby, R. D., Hay, P. J., Rodgers, B., Morgan, J. F., ... Mitchell, J. E. (2008). Screening for eating disorders in primary care: EDE-Q versus SCOFF. Behaviour Research and Therapy, 46(5), 612–622. https://doi.org/10.1016/j.brat.2008.02.003

49. Machado PP, Martins C, Vaz AR, Conceição E, Bastos AP, Gonçalves S (2014) Eating disorder examination questionnaire: psychometric properties and norms for the Portuguese population. European Eating Disorders Review 22(6):448–453. https://doi.org/10.1002/erv.2318

50. Machado PP, Grilo CM, Rodrigues TF, Vaz AR, Crosby RD (2020) Eating disorder examination–Questionnaire short forms: A comparison. Int J Eat Disord 53(6):937–944. https://doi.org/10.1002/eat.23275

51. Body Image, 9(2), 193–200. https://doi.org/10.1016/j.bodyim.2012.01.008

Tables

Table 1 to 5 is not available in this version of the manuscript.

Figures

Image not available with this version

Figure 1

The first CFA (Model I) tested the fit of the original theoretical proposal [1]. Results of this analysis revealed a not positive definite matrix solution, indicating that this model was not acceptable. Fit statistic for the remaining model (II-IV) are presented in Table 1. Model IV showed poor fit to our data, while models II and III resulted in acceptable fit. The Chi-square difference test ($\Delta \chi^2$) revealed that Model-II showed better fit than Model-I. However, although $\Delta \chi^2$ indicated that Model-II showed better fit than
Model-III, the difference in the remaining fit indexes was small (e.g., ΔTLI < .01) [41]. Thus, we retained Model-III, as it was the model with better fit/parsimony balance (see Figure 1). This retained two-factor model shows significant positive moderate to high correlations with the EDE interview (see Table 2).

**Figure 2**

ROC curves are presented in Figures 2 and 3. The figures show the optimum cut-off scores for males with ED diagnosis and at risk of ED, respectively. The cut-off score for ED diagnosis males was an EDE-Q-Global score = 2.41, whereas for risk-of-ED males was an EDE-Q-Global score = 1.09.

**Figure 3**

ROC curves are presented in Figures 2 and 3. The figures show the optimum cut-off scores for males with ED diagnosis and at risk of ED, respectively. The cut-off score for ED diagnosis males was an EDE-Q-Global score = 2.41, whereas for risk-of-ED males was an EDE-Q-Global score = 1.09.