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The Eating Attitudes Test (EAT-26): Reliability and Validity in Spanish Female Samples

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This paper focuses on the validation of the Spanish form of the Eating Attitudes Test (EAT-26; Garner, Olmsted, Bohr & Garfinkel, 1982) across two studies. Participants in Study 1 were 778 females recruited from community settings (aged 12-21). Study 2 included 86 females recruited from clinical and 86 females from community settings (aged 12-35). Results from Principal and Simultaneous Component Analyses showed a unidimensional structure of the EAT-26 item scores. Reliability analyses supported the internal consistency of the scale. Study 1 also explores the ability of the EAT-26 to discriminate between subjects with Eating Disorder (ED), Symptomatic or Asymptomatic by means of ROC analyses and using results from the Questionnaire for Eating Disorder Diagnoses (Q-EDD; Mintz, O'Halloran, Mulholland, & Schneider, 1997) as criterion. The EAT-26 demonstrated good specificity but insufficient sensitivity to detect a full or partial ED. Study 2 explores the ability of the questionnaire to discriminate between subjects with and without ED. The EAT-26 demonstrated good specificity and moderate sensitivity to detect ED. Clinical and theoretical implications of these results are discussed.
Keywords: Eating Disorder, assessment, factor structure, reliability, criterion validity.

Se presentan dos estudios que contribuyen a la validación de la versión española del Test de Actitudes Alimentarias (EAT-26; Gardner, Olmsted, Bohr & Garfinkel, 1982). En el Estudio 1 participan 778 mujeres de población general (12-21 años). El Estudio 2 incluye 86 mujeres que acuden a un centro clínico con un problema de TCA y 86 mujeres de población general (12-35 años). Los resultados de los Análisis de Componentes Principales y Simultáneos muestran una estructura unidimensional en estas puntuaciones del EAT-26. El análisis de la fiabilidad indica una adecuada consistencia interna. En el Estudio 1, utilizando como criterio el Cuestionario de Diagnóstico de TCA (Q-EDD; Mintz, O'Halloran, Mulholland, & Schneider, 1997), los resultados de un Análisis ROC exploran la capacidad del EAT-26 para discriminar entre sujetos con un Trastorno de la Conducta Alimentaria (TCA), Sintomático o Asintomático. Las puntuaciones del EAT-26 muestran aceptable especificidad pero insuficiente sensibilidad para detectar un TCA completo o parcial. El Estudio 2 analiza la capacidad del cuestionario para discriminar entre sujetos con y sin TCA. El EAT-26 muestra aceptable especificidad y moderada sensibilidad para detectar un TCA. Las implicaciones clínicas y teóricas de estos resultados se discuten.
Palabras clave: Trastorno de la Conducta Alimentaria, evaluación, estructura factorial, fiabilidad, validez de criterio.

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The present study focuses on the validation of the Spanish form of the Eating Attitudes Test-26 (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982), a short version of the EAT-40 (Garner & Garfinkel, 1979). The EAT-40 was originally developed for measuring eating behaviour and attitudes commonly observed in patients with anorexia nervosa (AN) (Garner & Garfinkel, 1979). The development of the items was based on clinical descriptions of AN phenomenology and criteria provided by Feighner, et al. (1972) to diagnose this eating disorder (ED). Over time, the EAT has became one of the most broadly used self-reports in the field of ED in a variety of cultures (Castro, Toro, Salamero, & Guimera, 1991; Choudry, & Mumford, 1992; De Leon, Ruiz, & Camacho, 2008; Koslowsky, et al., 1992; Leichner, Steiger, Puentes-Neuman, Perreault, & Gottheil, 1994; Nasser, 1986, 1997; Neumaerker, Dudeck, Vollrath, & Neumaerker, 1992; Pereira, et al., 2008; Ranzenhofer, et al., 2008; Ujiie, & Kono, 1994).

Considering the low factorial loadings obtained for 14 of the 40 items included in the original version, Garner et al. (1982) subsequently provided the short-version of the questionnaire, the EAT-26. Agreement between the long and short EAT versions has proved to be high, with a correlation coefficient of .98 for the total score (Garner et al., 1982). The EAT-26 has also demonstrated good internal consistency (Doninger, Enders, & Burnett, 2005; Garner et al., 1982; Jorquera, et al, 2006; Nunes, Camey, Olinto, & Mari, 2005; Pereira et al., 2008). Test-retest reliability of the questionnaire however is controversial. Even though several studies have reported a good test-retest reliability, with coefficients ranging from .84 to .89 (Banasiak, Wertheim, Koerner, & Voudouris, 2001; Carter & Moss, 1984), the stability of the EAT-26 total score seems to be moderate over 2 years (Wood, Waller, & Gowers, 1994), and low over 4 years (Nunes, Camey, Olinto, & Mari, 2005). Various reasons could account for these inconsistencies, including differences in the samples across the studies, and also changes in eating behaviour and attitudes over time.

The factorial structure of the EAT also remains controversial. Perhaps the most widely adopted factorial model consists of three factors, initially labelled Dieting, Oral Control, and Bulimia and Food Preoccupation (Garner et al., 1982). Nevertheless, a number of factorial analyses of the EAT-26 items have been conducted, with most solutions yielding three (Dotti, & Lazzari, 1998; Johnson, & Belford, 2004; Jorquera et al., 2006; Pereira et al., 2008), four (Koslowsky et al., 1992; Mumford, Whitehouse, & Choudry, 1992) or five factors (Doninger, Enders, & Burnett, 2005; Dotti, & Lazzari, 1998). Moreover, Ocker, Lam, Jensen, and Zhang (2007) have recently reported poor fits for both the three and the four-factor models by means of Confirmatory Factor Analysis (CFA). The best solution in this study consisted of four factors, but it was based on only 16 items.

An additional major concern in the field is the criterion validity of the EAT. In this regard, previous research has explored the validity of the EAT-26 for identifying subjects with AN when DSM criteria are used as the criterion. Specifically, the validity of the cut-off score of 20 initially proposed by Garner et al. (1982) has been assessed. Overall, results indicate that the questionnaire remains a suboptimal screening instrument of AN in non-clinical setting. In particular, high false-positive rates and a low positive predictive power for classifying cases of AN have been reported (see for a review Garfinkel & Newman, 2001 and Mintz & Kashubeck-West, 2004). The same problem arises when the cut-off score of 20 is used for identifying AN and/or bulimia nervosa (BN) in non-clinical young females (Nunes et al., 2005).

Mintz and O'Halloran (2000) have thoughly discussed several reasons that might explain the high false-positive rates obtained with the EAT. In particular, the authors have pointed out that given the changes over time in both DSM (American Psychiatric Association, 1994) and ICD (World Health Organization, 1992) criteria for AN as well as the broadening of the range of ED included in the classifications, the EAT is probably no longer a measure of AN, but an assessment tool for capturing undifferentiated ED. Therefore, high scores on the EAT-26 would indicate the presence of AN, BN, or Eating Disorders not Otherwise Specified (EDNOS). Consistent with this hypothesis, the majority of subjects with a DSM-IV diagnosis of AN, BN or EDNOS in a sample of 136 non-clinical females, with age ranging from 18 to 41, scored above 20 in the EAT-26 (Mintz & O`Halloran, 2000). The accuracy percentage reached 91%. False-negative and false-positive percentages were .23 and .06 respectively, and sensitivity and specificity values reached .77 and .94 respectively. Similar findings were obtained for the commonly used cut-off score of 30 in the EAT-40.

Even though several additional researches in the field have shown that accuracy values increase if the EAT-26 (Dotti, & Lazzari, 1998) and the EAT-40 cut-off scores are used for detecting the presence of any ED in non-clinical samples (Canals, Carbajo, & Fernández Ballart, 2002; De Irala, et al., 2008; Santonastaso, et al., 1996), false-positive percentages continue to be too high. Furthermore, sampling procedure used by Mintz and O'Halloran (2000) could have resulted in a selection bias that might account for these discrepant findings. In order to obtain an adequate sample size of females with clinical conditions, the authors pre-screened for ED and targeted participants with such disturbances. Thus, the number of ED in their sample reached a high percentage (23%) that could have led to an inflated picture of criterion validity of the EAT cut-off scores in their study, as the authors actually pointed out.

Moreover, several authors have suggested a review of the commonly used EAT cut-off scores for detecting ED in order to improve accuracy values (Koslowsky et al., 1992).

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In this regard, Al-Adawi, Dorvlo, Burke, Moosa and Al-Bahlani (2002) found that a cut-off point of 10 in the EAT-26 gave the best compromise between sensitivity (64%) and specificity (38%) for identifying AN in a general sample of adolescents, including males and females with a mean age of 15.29 years. In the same line, recent findings indicate that a cut-off score of 11, instead of 20, could provide better sensitivity and specificity rates for identifying subjects with BN, Binge Eating Disorders (BED) or EDNOS among obese patients attending medical nutritional services (Orbitello, et al., 2006). Results from ROC analyses applied to the Spanish version of the EAT-40 also show that accuracy values of the test are high if a cut-off score lower than 30 is used for detecting any DSM-III-R eating disorder among non-clinical females (100%, 93%, and 18% for sensitivity, specificity, and positive predictive value respectively) (Canals et al., 2002). De Irala et al. (2008) also found that the best diagnostic prediction in a non-clinical setting was obtained with a EAT-40 cut-off point lower than the score recommended by the authors.

An additional issue concerning the criterion validity of the EAT is related to sub threshold conditions. The EAT has proved to be useful in differentiating among subjects with DSM-IV eating disorders, sub threshold or symptomatic forms -namely those clusters of signs and symptoms that do not fall into the diagnostic categories of the DSM or the ICD- and without symptoms of ED (asymptomatic) (Mintz & O´Halloran, 2000). These findings not only support the EAT as a continuous measure of ED, but also suggest that it could be useful in identifying symptomatic cases, those at risk of developing clinical conditions. Indeed, previous research shows that high scores on the EAT may indicate the presence of abnormal eating behaviour and attitudes that do not necessarily reach threshold criteria for a clinical diagnosis (Álvarez, Vázquez, Mancilla, & Gómez-Peresmitré, 2002; Dotti, & Lazzari, 1998; King, 1989; Nasser, 1994; Pereira et al., 2008). Moreover, the high false-negative rates found in several studies (Rodriguez-Cano, Beato-Fernandez, & Belmonte-Llario, 2005) could be explained if the EAT is conceptualised as a general measure of abnormal eating behaviour and attitudes, instead of as a tool for measuring clinical forms.

In sum, findings concerning criterion validity of the EAT are inconsistent, and suggest that new and broader conceptualisations of what the EAT measures could explain such discrepancies (Mintz, & O´Halloran, 2000). It is not clear if the EAT, in general, and the EAT-26, in particular, should be conceptualised as a measure for detecting individuals meeting DSM or ICD criteria for any ED, for differentiating among subjects with clinical ED, symptomatic, and asymptomatic conditions, or only for detecting sub threshold forms characterised by the presence of abnormal eating behaviour and attitudes that increase the risk of developing a clinical condition.

Further research drawing on these new conceptualizations of the test is needed, and this constitutes one of the main objectives of this work. In addition, while the reliability and the factorial structure of both the short and the long versions of the EAT have been previously addressed in Spanish samples (Castro et al., 1991; De Irala et al., 2008; Jorquera et al., 2006), the criterion validity has been assessed only for the EAT-40, and using the DSM-III criteria. Furthermore, no study has been performed to date to explore whether accurate cut-off scores may be established for differentiating between the three above hypothetical groups.

According to the above considerations, two studies were performed in order to evaluate psychometric properties of the Spanish version of the EAT-26. Study 1 was conducted with a non-clinical sample, while Study 2 was performed in a clinical sample of patients with ED, since the low prevalence of ED in non-clinical settings may result in poor accuracy rates. Both studies addressed the reliability of the questionnaire, a further evaluation of items dimensionality, and the criterion validity when results from the Questionnaire for Eating Disorder Diagnoses (Q-EDD; Mintz, O´Halloran, Mulholland, & Schneider, 1997; Spanish version by Rivas, Bersabé, & Castro, 2001) are used as criterion.

Study 1

Study 1 concerns the factor structure, the reliability, and the criterion validity of the EAT-26 for differentiating between subjects with full forms of ED, symptomatic, and asymptomatic conditions.

Method

Participants

The initial sample consisted of 976 females (age ranging from 12 to 21). Participants were recruited from fourteen private and public high schools in the area of Malaga, Spain. Only data from those respondents who completed all of the items of both the EAT-26 and the Q-EDD, and who reported that they answered with ‘much’ or ‘total’ sincerity, were selected for this study. Applying these criteria, selected participants were 778 - 68.5% with ages ranging from 12 to 16, and 31.5% with ages ranging from 17 to 21 (mean age = 15.62; *SD* = 2.03; range = 12-21 years). A total of 36 subjects (4.6%) met DSM-IV criteria for an ED according to results from the Q-EDD. Prevalence rates for AN, BN, and EDNOS were, respectively: .5% (n = 4), .6% (n = 5), and 3.5% (n = 27). A total of 217 participants (27.9%) were classified as “symptomatics”, and 525 (67.5%) were “asymptomatics”.

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Materials

The *Eating Attitudes Test* (EAT-26; Garner et al., 1982) is a 26-item self-report questionnaire. Items are presented in a 6-point forced-choice Likert scale ranging from 1 ("never") to 6 ("always). The total score is obtained re-coding scores as follows: scores from 1 to 3 are re-coded as 0, 4 is re-coded as 1, 5 as 2, and 6 is recoded as 3. The only exception is item 25 whose answers score as follows: 1 as 3, 2 as 2, 3 as 1, and 4 to 6 as 0. The EAT-26 total score ranges from 0 to 78.

In addition to the EAT-26, participants completed the *Questionnaire for Eating Disorder Diagnoses* (Q-EDD; Mintz et al., 1997; Spanish version developed by Rivas et al., 2001). The Q-EDD is a 50-item self-report questionnaire that operationalises DSM-IV criteria for eating disorders (APA, 1994). Diagnoses are generated by a scoring manual that consists of flowchart decision rules. Subjects who meet diagnostic criteria for an eating disorder are classified into the following categories: anorexia nervosa (AN), bulimia nervosa (BN), and eating disorder not otherwise specified (EDNOS). Subjects without an eating disorder are classified as symptomatic or asymptomatic. The Q-EDD was therefore used to classify individuals into the asymptomatic, symptomatic, and eating disordered categories of the ED continuum.

Some psychometric properties of the Spanish version of the Q-EDD have been explored in two previous studies among high school students and outpatients with ED (Rivas et al., 2001). Inter-scorer agreement was high (κ = .80-.92). Q-EDD diagnose also demonstrated good convergence and divergence validity with respect to EAT-26 and BITE scores. Overall, the findings of the Spanish version of the Q-EDD are consistent with previous research (Callahan, et al., 2003; Mintz et al., 1997; Mulholland, 2000), highlighting the satisfactory psychometric properties of the questionnaire.

Finally, height and weight measurements were also taken of all participants in order to estimate the Body Mass Index (BMI=kg/m^2) to confirm the diagnosis of Anorexia.

Procedure

After obtaining informed consent from the parents of the participants or from the participants when they were above 18 years old, the questionnaires were administered to the students during group test sessions in their classrooms. They were informed that the aim of the research was to study eating behaviour of Spanish adolescents. Participation was voluntary and anonymous, and had no effect on the students´ academic standing. The questionnaires were administered collectively in the participants' classrooms. Finally, height and weight measurements were taken of all participants.

This research was reviewed and approved by an institutional review board.

Results

Factor structure and reliability

Principal Component Analysis was used for exploring the dimensionality of the questionnaire. Results are shown in Table 1. According to the Unidimensionality Index $UI = (\lambda_1 - \lambda_2)/(\lambda_2 - \lambda_3)$ (Martínez Arias, 1995, p. 297), the items clearly satisfied unidimensionality 9.70. The one-factor solution accounted for 36.77 % of the variance. Most loadings were greater than .30, except for items 4, 8, 13, 15, 19, and 25 whose loadings varied from .042 to .270. Item 13 showed a poor loading (-.042). Kaiser-Meyer-Olking (*KMO*) index was .904 in this sample.

Homogeneity indices were greater than .40, except for items 4, 8, 13, 15, 19, and 25. In particular, item 13 presented a low homogeneity index. Cronbach's alpha coefficient was .904, and it increased only slightly (.905 – .914) if items with low homogeneity were deleted (see Table 1). Thus, the EAT-26 seems to show a unidimensional structure with a high internal consistency, even though some items must be revised.

When the Q-EDD subgroups were separately considered, *KMO* indices were .743, .895, and .909 for the ED, Symptomatic, and Asymptomatic groups, respectively. Unidimensionality indices (*UI*) were *UI* = (11.068 - 3.186) / (3.186 - 2.408) = 10.13, *UI* = (9.011 - 2.521) / (2.521 - 1.557) = 6.73, and *UI* = (7.786 - 2.128) / (2.128 - 1.473) = 8.64 for the ED, Symptomatic, and Asymptomatic groups, respectively. The one-factor solution accounted for 42.57%, 34.66%, and 29.95% of the variance, and internal consistency coefficients were .927, .904 and .853 in the ED, Symptomatic and Asymptomatic groups, respectively.

Cut-off points and criterion validity

Each optimal cut-off point has been estimated by Receiver Operating Characteristic (*ROC*) curve nonparametric analysis. As the prevalence and the cost of misclassifications - associated with false positive and false negative - have a large effect on clinical efficacy –but not on clinical accuracy measured by Area Under Curve (*AUC*) – the effect of prevalence on EAT-26 efficacy has been adjusted using the *ROC MACRO PROGRAM* for SPSS (Bonillo, Doménech, & Granero, 2000; Zweig & Campbell, 1995). 'Prevalence' in this study is taken as the base rate or the subject proportion of the sample showing a state of ED (Symptomatic, ED) classified by Q-EDD.

The first cut-off point differentiating between *Asymptomatic* and *Symptomatic* subjects has been determined from the base rate of Symptomatic subjects (.29). The cut-off point is 19 and the *AUC* is .70 which shows a moderate accuracy of EAT-26 measure in identifying clinically important degrees of ED (*Asymptomatic* and *Symptomatic)* in subjects classified by Q-EDD (see Figure 1).

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Table1
Factor Structure and Item Analysis of EAT-26 in the Community Sample (*n*=778)

	Factor Structure		Analysis of items	
Item	Eigenvalue	Loading	*HI*	α if item is deleted
1	9.559	**.643**	**.577**	.898
2	2.152	**.790**	**.735**	.896
3	1.388	**.823**	**.771**	.894
4	1.259	.246	.214	.906
5	1.155	**.426**	**.400**	.902
6	.925	**.450**	**.410**	.902
7	.885	**.684**	**.632**	.897
8	.817	.256	.284	.904
9	.735	**.514**	**.466**	.902
10	.692	**.781**	**.717**	.896
11	.648	**.768**	**.699**	.895
12	.614	**.707**	**.647**	.896
13	.562	-.042	-.003	.909
14	.510	**.787**	**.732**	.894
15	.501	.248	.249	.905
16	.457	**.702**	**.637**	.898
17	.407	**.716**	**.642**	.897
18	.392	**.537**	**.490**	.900
19	.377	.270	.226	.906
20	.352	**.459**	**.464**	.901
21	.335	**.666**	**.620**	.898
22	.308	**.802**	**.747**	.895
23	.280	**.773**	**.704**	.896
24	.253	**.756**	**.704**	.896
25	.221	-.234	.154	.914
26	.215	**.577**	**.524**	.900
	% Var = 36.77		α = .904	

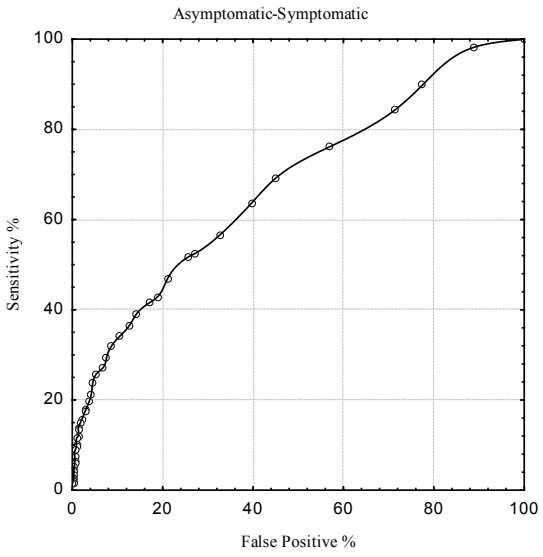

Figure 1. ROC curve of the EAT26 in detecting the presence of Symptomatic in the Community sample.

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From the cut-off of 19, efficacy indices of EAT-26 measure to discriminate between *Asymptomatic* and *Symptomatic* are: sensitivity 25.81%, specificity 94.67%; overall accuracy 74.53%; positive predictive power 66.67% and negative predictive power 66.67%.

The second cut-off point differentiating between *Symptomatic and ED* subjects has been obtained from the base rate of *ED* (.14). The cut-off is 44 and the *AUC* is .73 showing a moderate accuracy of EAT-26 measure in identifying clinically important degrees of ED (*Symptomatic and ED)* in subjects classified by Q-EDD (see Figure 2).

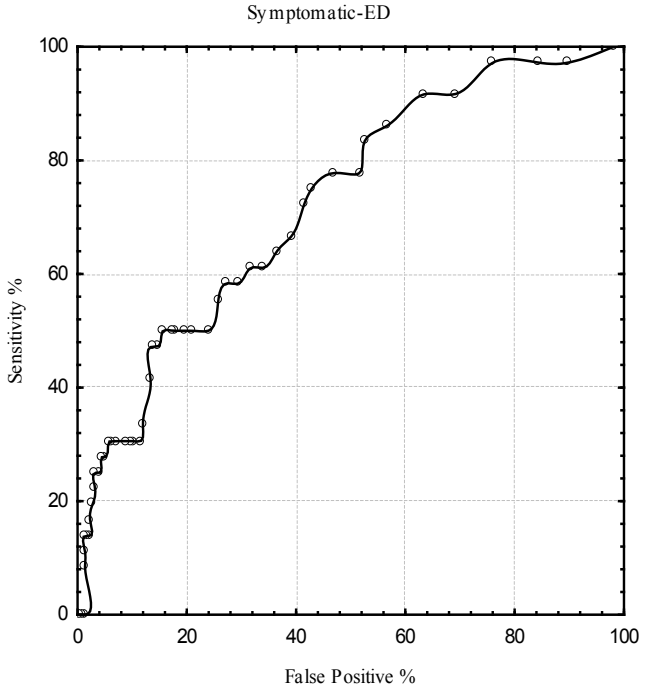

Figure 2. *ROC* curve of the EAT26 in detecting the presence of ED in the Community sample.

From the cut-off of 44, efficacy indices of EAT-26 measure to discriminate between *Symptomatic* and *ED* are: sensitivity 25.00%, specificity 96.77%; overall accuracy 86.56%; positive predictive power 56.25%; and negative predictive power 88.00%.

Inter-group differences in EAT-26 scores

The Jonckheere-Terpstra test was used to examine the trend of the EAT-26 scores among the three groups. Results showed a significant download trend (standard *J-T* statistic = 9.807; $p < .001$), with the highest EAT-26 scores in the ED group and the lowest in the Asymptomatic group. The EAT-26 median was higher in the ED group (*Mdn* = 22; Range = 1-56) than in both the Symptomatic (*Mdn* = 9; Range = 0-75) and the Asymptomatic (*Mdn* = 4; Range = 0-53) groups.

Study 2

Study 2 was aimed at further examining reliability, factor validity, and criterion validity of the EAT-26 in a Clinical group of females and in a Control group matched in sex and age to clinical subjects.

Method

Participants

A total of 172 females participated in the study, 86 outpatients with ED, and 86 normal controls matched with cases in sex and approximate age. Only data from those respondents who completed all of the items of both the EAT-26 and the Q-EDD were selected for this study. A total of 156 subjects completed all the items: 77 (49.4%) in the Clinical group (mean age = 18.70; *SD* = 4.50; range = 12-35), and 79 (50.6%) in the Control group (mean age = 18.48; *SD* = 4.32; range = 12-35). According to results from the Q-EDD, base rates for AN, BN, and EDNOS in the Clinical group were, respectively: 3.2% (*n* = 5), 10.9% (*n* = 17), 35.3% (*n* = 55). A total of 13 participants (8.3%) in the Control group were Symptomatics and 66 (42.3%) were Asymptomatics.

Materials

Study 2 included the same questionnaires used in Study 1: the EAT-26 and the Q-EDD.

Procedure

Participants in the Clinical group were recruited from subjects consecutively attending several psychology clinics and community mental health centres in the area of Malaga, Spain. Clinical staff advised the head of the research group of any possible case of ED. A psychologist qualified to diagnose ED visited the different centres to administer the Q-EDD and the EAT-26. All questionnaires were self-administered. According to results from the Q-EDD, subjects meeting ED criteria were selected to participate in the study.

Each case was matched with a control of the same sex and approximate age. With this aim, undergraduate students from the Faculty of Psychology, Malaga University, Spain, were requested to invite a relative or someone within their social environment (colleague, friend, etc.) to participate in the study. Subjects were then invited to come to the Faculty of Psychology to complete the Q-EDD and the EAT-26. Only data from participants without ED according to results

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Table2
Factor Structure and Item Analysis of EAT-26 in the Case - Control Group (n = 156)

	Factor Structure		Analysis of items	
Item	Eigenvalue	Loading	*HI*	α if item is deleted
1	12.088	**.739**	**.693**	.934
2	2.423	**.818**	**.789**	.934
3	1.525	**.885**	**.846**	.932
4	1.218	**.348**	**.285**	.939
5	1.029	**.319**	**.328**	.939
6	.919	**.646**	**.599**	.936
7	.809	**.807**	**.774**	.934
8	.693	.263	**.303**	.939
9	.603	**.708**	**.657**	.935
10	.556	**.893**	**.852**	.932
11	.513	**.795**	**.728**	.934
12	.470	**.702**	**.652**	.935
13	.431	-.096	-.049	.943
14	.375	**.836**	**.790**	.933
15	.351	.098	.134	.941
16	.283	**.767**	**.745**	.934
17	.273	**.846**	**.808**	.933
18	.268	**.783**	**.730**	.934
19	.238	.138	.136	.941
20	.199	**.464**	**.504**	.937
21	.177	**.831**	**.794**	.933
22	.148	**.865**	**.809**	.932
23	.134	**.828**	**.788**	.933
24	.110	**.830**	**.795**	.933
25	.089	-.203	.255	.943
26	.079	**.762**	**.717**	.934
	% Var = 46.50		α = .938	

from the Q-EDD were selected to participate in the study. The questionnaires were administered individually to all the subjects. Finally, height and weight measurements were taken of all participants, in order to estimate the *BMI*.

This research was reviewed and approved by an institutional review board.

Results

Similar statistical analyses to those performed in Study 1 were conducted on data from participants in the Study 2. In addition, Simultaneous Component Analysis (*SCA*) was conducted on data from participants in both Study 1 and Study 2, in order to explore a common factorial structure underlying EAT-26 items.

Factor structure and reliability

Based on the Unidimensionality Index $UI = 10.76 > 5$, the EAT-26 items clearly satisfied unidimensionality. The one-factor solution accounted for 46.5 % of the variance in the Case-Control group. Most items showed high factorial loadings (> .30), except items 8, 13, 15, 19, and 25 (see Table 2). In particular, items 13, 15 and 19 showed too low loadings. *KMO* index was .919. All the items showed Homogeneity Indices greater than .30, except items 13, 15, and 19. Cronbach's alpha coefficient was .938, and it does not change if items with low homogeneity were eliminated (see Table 2)

Common Structure in Community and Case-Control Participants

SCA explores whether a common unidimensional structure can be considered simultaneously in two samples - the Community (Study 1) and the Case-Control (Study 2) - in this work. If the variance accounted for by *SCA* is considerably lower than the variance accounted for by *PCA*, the search for a common structure for the two samples should be seriously questioned (Kiers, 1990; Rivas, 1999).

However, this is not the case for the results in this study. Percentages of variance accounted for were 35.02 (*PCA*) and 35.09 (*SCA*) among the Community sample, and 46.50 (*PCA*) and 46.45 (*SCA*) among the Case-Control sample. The common structure accounted for 42.67% of the total variance (*SCA*). Table 3 shows the loadings for the factor structures obtained with the *SCA* in both samples.

Table3
Common Factor Structure of EAT-26 in the Community and Case - Control Groups

	SCA[1]-Community	*SCA*[1]-Case-Control
Item	Loading	Loading
1	**.598**	**.745**
2	**.776**	**.821**
3	**.788**	**.890**
4	.234	**.348**
5	**.412**	**.329**
6	**.445**	**.645**
7	**.691**	**.806**
8	.259	.266
9	**.521**	**.705**
10	**.761**	**.896**
11	**.728**	**.801**
12	**.673**	**.707**
13	-.032	-.096
14	**.382**	**.842**
15	.240	.106
16	**.726**	**.763**
17	**.745**	**.840**
18	**.565**	**.777**
19	.269	.141
20	**.469**	**.466**
21	**.695**	**.825**
22	**.830**	**.858**
23	**.797**	**.824**
24	**.782**	**.825**
25	-.241	-.203
26	**.606**	**.756**
	% Var = 35.09	% Var = 46.45
	% CommonVar = 42.67	

[1] *SCA*: Simultaneous Component Analysis

Cut-off point and criterion validity

The cut-off point 23 that differentiates between subjects with (ED) and without (non ED) eating disorders has been determined from the proportion of subjects (.49) showing an ED - classified by the Q-EDD - in the Case-Control group. *AUC* is .9 which shows a high accuracy of the EAT-26 measure in identifying clinically important degrees of ED (*ED* and *non ED)* in subjects classified by the Q-EDD (see Figure 3).

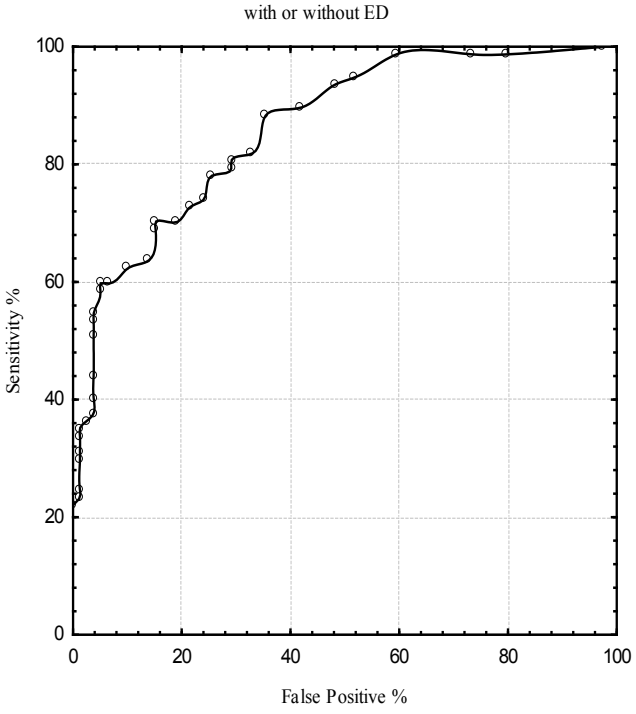

Figure 3. ROC curve of the EAT26 in detecting the presence of ED in the Case-Control Group.

From cut-off 23, validity indices of the EAT-26 measure to discriminate between *ED* and *non ED* are: sensitivity 59.74%, specificity 94.94%; overall accuracy 76.92%, positive predictive power 92%, and negative predictive power 70.75%.

Inter-group differences in EAT-26 scores

The Mann-Whitney test was used to examine differences between *ED* and *non ED* groups in EAT-26 scores. Between-groups differences were statistically significant (U = 838.5; $p < .001$): the EAT-26 median was higher in the *ED* (*Mdn* = 27; Range = 1-69) than in the *non ED* group (*Mdn* = 5; Range = 0-44).

Discussion

Overall, the rates of full ED found in Study 1 converge upon past estimates from studies on adults (e.g., Austin, et al., 2008; Grave, Calugi, & Marchesini, 2008; Isomaa, Isomaa, Marttunen, Kaltiala-Heino, & Bjorkqvist, 2009; Peláez-

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Fernández, Labrador, & Raich, 2008; Toro, et al., 2006). According to results from the Q-EDD measurements, 4.6% of the participants met full criteria for ED, and 27.9% were classified into the symptomatic category, suggesting that Spanish females in mid-adolescence engage in disordered eating behaviours with a surprisingly high frequency**.**

Results from studies 1 and 2 indicated that several EAT-26 items should be revised. In particular, items 8, 13, 15, 19, and 25 showed a low homogeneity index and/or factorial loading in both studies. In addition, item 4 compromised the internal consistency of the questionnaire in Study 2. Nevertheless, results from reliability analyses provided evidence for the internal consistency of the questionnaire even if all the items are included: Cronbach's alpha coefficient was excellent (> .90) in both studies, and it remained above .85 when each of the three groups was separately considered in Study 1. Taken as a whole, these results are consistent with previous findings related to the internal consistency of the EAT-26, and suggest that the instrument consists of items that measure a single construct.

On the other hand, results from both Study 1 and 2 support the conceptualization of the EAT-26 as a unidimensional measure of disordered eating behaviour and attitudes**.** The one-factor solution accounted for a considerable percentage of the total variance (36.77% in Study 1, and 46.5% in Study 2). The one-factor solution also accounted for a sufficient percentage of the variance when ED, Symptomatic and Asymptomatic subgroups were considered separately in Study 1 (42.57%, 34.66%, and 29.95%, respectively). Moreover, results from the *SCA* analysis supported a unidimensional structure underlying the EAT-26 items across two independent groups (clinical-control group and non-clinical group). Indeed, the unidimensional structure of the EAT-26 would justify the use of the EAT-26 total score, and might also explain discrepant factorial solutions found in previous studies (Doninger et al., 2005; Dotti & Lazzari, 1998; Garner et al., 1982; Johnson & Belford, 2004; Jorquera et al., 2006; Koslowsky et al., 1992; Mumford et al., 1992; Ocker et al., 2007; Pereira et al., 2008)

On the other hand, results from Study 1 are consistent with the conceptualisation of ED as a continuum. Scores on the EAT-26 in Study 1 followed an orderly downward progression, with subjects classified into the ED category scoring the highest, followed by individuals with sub threshold levels, and Asymptomatics scoring the lowest. Results from the Jonckheere-Terpstra Trend test indicated that the questionnaire was able to detect such decreasing trends among the groups. These findings are consistent with previous research supporting the continuity hypothesis for specific forms of ED, highlighting the fact that sub threshold and full forms are quantitatively rather than qualitatively different from each other (e.g., Mintz, & O'Halloran, 2000; Striegel-Moore, et al., 2000; Tylka, & Subich, 2003). Findings in these studies also replicate those reported by Mintz and O´Halloran (2000) for both the EAT-40 and the EAT-26, suggesting that the questionnaire is able to detect differences between sub threshold and undifferentiated forms of ED in clinical and non-clinical settings.

The implications of these findings include the importance of sub threshold presentations of ED, and the utility of the EAT-26 as a continuous measure of disordered eating phenomenology. In this regard, it is well known that young women who report sub threshold forms of ED not only suffer diminished well-being, but should also be considered at risk of developing more severe eating problems (e.g., Austin et al., 2008; Shisslak, Crago, & Estes, 1995). Thus, failure to recognize and address such conditions may hinder advances in understanding ED, since knowledge about the clinical implications of subclinical presentations continues to be limited (Austin et al., 2008; Krug, et al., 2009; Striegel-Moore et al., 2000; Tylka, & Subich, 2003). In the meantime, the challenge of caring for individuals with subtle conditions continues to be uncertain, given the lack of current agreement concerning their diagnostic status and a dearth of well-established treatment guidelines. Therefore, as a number of authors have pointed out, increased attention might be focused on sub-threshold levels of ED, and further research aimed at developing interventions to prevent and treat these dysfunctional states is needed. In this regard, the EAT-26, as a continuous measure of disordered eating phenomenology, might help to improve understanding and, therefore, prevention and treatment.

On the other hand, ROC analyses were performed in Study 1 to establish two cut-off points for differentiating between the three categories provided by the Q-EDD. Cut-off scores of 19 and 44 provided the points for better differentiating between the groups. The Asymptomatic category is estimated in the EAT-26 total score within the 0-19 interval**.** Indeed, the large majority of subjects in the Asymptomatic group yielded a maximum score of 19. Specifically, a percentage of 94.7% were correctly classified as Asymptomatic when this cut-off score was used and only a low percentage of subjects without symptoms exceed the estimated threshold of 19 (5.3%).

Results in Study 1 also showed that scores above 19 on the EAT-26 indicate the presence of significant symptomatology of ED being present at either clinical or subclinical levels. These results question the traditional use of the cut-off score of 20 for detecting only full forms of ED in non-clinical settings, since scores on the EAT-26 above 20 also seem to indicate the occurrence of subtle conditions (De Irala et al., 2008; Al-Adawi et al., 2002; Canals et al., 2002; Koslowsky et al., 1992; Orbitello et al., 2006).

Overall, the aforementioned results suggest that when the EAT-26 is used to identify subjects without any symptoms of ED, the questionnaire yields high accuracy percentages for specificity, i.e., a low false-positive rate. Such results are largely similar to those reported by Mintz and O´Halloran (2000), who found a specificity value of

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94% when the cut-off score of 20 was used for differentiating between subjects with and without a diagnosable ED. These results are, however, in contrast with most research in this area which describes the high false-positive rate of the EAT when used to obtain specific ED (see for a review Garfinkel, & Newman, 2001; Mintz, & Kashubeck-West, 2004; Nunes et al., 2005).

On the basis of our results and those reported by Mintz and O'Halloran (2000), one explanation for the high rates of false-positives found in previous research might be that a number of subjects with sub threshold levels of ED are classified as presenting a full form of ED when the traditional cut-off score of 20 is used. Indeed, a number of participants with subclinical but not full forms of ED (i.e., Symptomatics) scored above 19 on the EAT-26 (25.8%) in Study 1. Previous research has also found that when the definition of a "case" is broadened to include partial syndromes, the positive predictive value of the EAT-26 improves (see Garfinkel, & Newman, 2001). Findings in Study 1 suggest, therefore, that scores on the EAT-26 above 19 may indicate the presence of subtle conditions.

In any case, by using the cut-off points provided by *ROC* analyses in Study 1, the EAT-26 showed low sensitivity for detecting either Symptomatic conditions or full forms of ED. The percentage of subjects correctly classified into the original groups using the thresholds of 19 and 44, respectively, was low: 25.8% in the Symptomatic group and 25% in the ED group. The rates of individuals classified as Asymptomatic but presenting either diagnosable forms of ED or sub threshold conditions – i.e., false-negatives – were substantial. Most females meeting full criteria for ED scored below the threshold of 44 on the EAT-26 (75%). Similarly, a large number of Symptomatic subjects achieved scores below the threshold of 19 (74.2%). Thus, the majority of false-negatives are due to the fact that a number of subjects with full forms of ED or sub threshold conditions displayed scores below 44 or 19 on the questionnaire.

The above results concerning the sensitivity of the EAT-26 are largely in contrast with those reported by Mintz and O´Halloran (2000), who found a high value (.77) when the cut-score of 20 was used for differentiating between subjects with and without full forms of ED. An explanation for the differences in the estimated values of sensitivity may lie in the sampling procedures used in the two studies. As highlighted above, the authors pre-screened for eating disorders and targeted participants with such disturbances in order to obtain an adequate sample size. Thus, the percentage of ED in their sample reached 23%, as compared with 4.6% in our Study 1. As the authors point out, the high base rate of ED in their sample probably led to an inflated picture of criterion validity in their study. Indeed, our data suggest that when the analyses are conducted on a random non-clinical population – therefore with a lower proportion of ED - the sensitivity of the EAT-26 becomes insufficient. Thus, it is possible that the sampling procedure used in previous research resulted in a selection bias that may account for the discrepant findings. Indeed, results from Study 1 are consistent with previous findings showing that when the EAT is used for detecting undifferentiated ED -including AN, BN, and EDNOS-, the positive predictive power improves while the sensitivity of the questionnaire decreases (Rodriguez-Cano et al., 2005; Vetrone, Cuzzolaro, Antonozzi, & Garfinkel, 2006).

In any case, the high rate of subjects with either ED symptomatology or full forms of ED scoring below 19 is surprising. In this regard, some features of the eating phenomenology might also play a role in missing established cases. For instance, it has been estimated that more than 15% of anorexics score below the cut-off point because of denial regarding the eating problem (Garfinkel & Newman, 2001; Newton, Butler, & Slade, 1988). How such features can affect EAT scores in non-treatment-seeking samples as compared to clinical samples is unknown. In this regard, it is possible that they are more frequent in the former, increasing the rate of false-negatives, not only for AN but also for other clinical and subthreshold forms. Indeed, results from Study 2, including clinical subjects with ED support this hypothesis, at least partially. In Study 2, a cut-off score of 23 showed a higher sensitivity than the cut-off score found in Study 1 for detecting subjects with full forms of ED. Specifically, the percentage of subjects correctly classified into the ED group increased to 59.7%, and the false negative percentage decreased to 40.3%. A lower level of awareness regarding abnormal eating behaviour and attitudes and/or a greater denial of abnormal behaviour in non-clinical samples when compared to clinical subjects could explain the poorer accuracy values in the former.

In sum, findings in this study provide cross-cultural evidence that the EAT-26 may be used without cut-off scores as a continuous measure of abnormal eating behaviour and attitudes in non-clinical samples, replicating findings reported by Mintz and O´Halloran (2000), and supporting the construct validity of the eating disorder spectrum. However, when cut-off scores for differentiating between ED, Symptomatic, and Asymptomatic groups were explored, the EAT-26 demonstrated good specificity but insufficient sensitivity. Thus, while scores above 19 can be taken as an accurate indication of ED symptomatology in non-clinical samples, a score below this cut-off should require further assessment. The low performance values of the EAT-26 in non-clinical settings, in particular the high false negative rates found in these and other studies (Rodriguez-Cano et al., 2005), could reflect the inadequacy of using self-report tools for measuring abnormal behaviour in subjects who deny such abnormalities or present a lack of awareness regarding them.

Nevertheless, variability in the EAT scores across different countries is not surprising. As Garfinkel and Newman (2001) highlighted, eating attitudes and behaviour vary considerably across different cultures, since specific

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EAT items may have different cultural meanings. Therefore, further cross-cultural examination of the criterion validity of the EAT, drawing on the new conceptualizations of the questionnaire, is needed.

Some limitations of these studies should be pointed out. Firstly, cut-off scores provided in these and similar studies largely depend on sample characteristics (in particular, sample sizes and types of ED or conditions considered in the studies) as well as on the instruments and procedures used during assessment, diagnostic, and data analyses. Given the number of differences across the studies in these and other variables, it is difficult to compare these results with previous evidence and, hence, cut-off scores provided in this study should be used with care. Secondly, DSM-IV-R diagnosis was established using a self-report instrument, the Q-EDD, given the sound psychometric properties of this assessment tool and its low cost when compared with structured interviews in general population samples. Nevertheless, further research evaluating the criterion by structured interviews should be carried out. Lastly, the test-retest reliability and divergent validity of the EAT-26 has not been addressed in this study. Future research exploring the divergence between the EAT-26 and instruments measuring different constructs is needed.

In spite of the above limitations, several strengths of the present studies may be highlighted. Firstly, participants were recruited from several schools, health or clinical centres in several areas of Malaga and Province to avoid selection and other types of bias. Secondly, ED was assessed by the same procedure and instruments in both studies. Thirdly, cut-off scores were obtained by a nonparametric estimation of the *ROC*, which takes into account the base rate of ED (AN, BN and EDNOS) and Symptomatic conditions in Study 1, and the percentage of ED in Study 2.

In sum, the Spanish version of the EAT-26 demonstrated good specificity and moderate sensitivity to detect full forms of ED. Results suggest that the accuracy rates might improve if the questionnaire would be used as a tool for measuring undifferentiated rather than specific DSM or ICD eating disorders. These findings suggest that the questionnaire could be useful as screening instrument if used into a two-stage ED identification protocol which often includes not only a questionnaire but also a diagnostic interview applied to possible cases (Peláez-Fernández et al., 2008).

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