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ORIGINAL

Validation of the Eating Attitudes Test-26 in a Mexican female sample: confirmatory factor analysis and cut-off point

Validación del Test de Actitudes Alimentarias-26 en una muestra de mujeres mexicanas: análisis factorial confirmatorio y punto de corte

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Abstract. The objective of the present study was to determine the psychometric properties of the Eating Attitudes Test (EAT-26) in a sample of Mexican women, report its validity through confirmatory factor analysis, and to determine the cut-off point for the test. The sample consisted of 1088 women, aged between

12 and 27 years (= 19.31, *SD* = 2.94), from educational institutions of the metropolitan area of Mexico City and a Clinical Group of 108 patients, aged between 11 and 40 years (= 19.35, *SD* = 5.26). Regarding the results, the instrument obtained a Cronbach's alpha of .85 and .92 in community and clinical sample, respectively. The construct validity yielded four factors that explained 45.71% of the total variance. To corroborate the adequacy of the factor structure, a confirmatory factor analysis was performed, yielding the following validity indicators: *GFI* = 0.93*; CFI* = 0.90 and *RMSEA* = 0.055. Finally, a 0-4 scoring system was used for the Mexican population, as it was considered more appropriate. The cut-off point determined was ≥ 40 with a sensitivity of 0.75, and a specificity of .88. In conclusion, the findings from this study indicate that the EAT-26 shows acceptable reliability, and a meaningful factor in clinical and non-clinical samples of Mexican women.

Keywords: EAT-26, anorexia nervosa, confirmatory factor analysis, validation and reliability.

Resumen. El objetivo del presente estudio fue determinar las propiedades psicométricas del Test de Actitudes Alimentarias (EAT-26) en una muestra de mujeres mexicanas, reportar su validez mediante un análisis factorial confirmatorio y obtener el punto de corte para la prueba. La muestra consistió en 1088 mujeres, con edades entre 12 y 27 años (*M* = 19.31; *DE* = 2.94), provenientes de instituciones educativas de la zona metropolitana de la Ciudad de México y un grupo clínico de 108 pacientes, con edades entre 11 y 40 años (*M* = 19.35; *DE* = 5.26). En cuanto a los resultados, el instrumento obtuvo un alfa de Cronbach de .85 y .92 en muestra comunitaria y clínica, respectivamente. La validez de constructo arrojó cuatro factores que explicaron 45.71% de la varianza total. Para corroborar la adecuación de la estructura factorial, se realizó un análisis factorial confirmatorio que arrojó los siguientes indicadores de validez: *GFI* = 0,93; *CFI* = 0,90 y *RMSEA* = 0,055. Finalmente, se utilizó un sistema de puntuación de 0-4 para la población mexicana, ya que se consideró más apropiado. El punto de corte determinado fue ≥40 con una sensibilidad de 0.75, y una especificidad de .88. En conclusión, podemos señalar que el EAT-26 muestra una confiabilidad aceptable y una estructura factorial significativa en una muestra clínicas y comunitaria de mujeres mexicanas.

Palabras clave: EAT-26, anorexia nerviosa, análisis factorial confirmatorio, validez y confiabilidad.

Introduction

Anorexia nervosa (AN) and bulimia nervosa (BN) are the third most common chronic mental diseases among young people between ages 15 to 19 years old (Herpetz-Dahlmann, 2015; Peláez et al., 2005). These disorders are characterized by an intense fear of gaining weight, and extreme concern for body weight and shape, but also risky behaviors such as self-induced vomiting, fasting and excessive exercise to achieve or maintain low weight, which results in a significant deterioration in physical, psychological, and social functioning (Arija-Val et al. 2022).

To detect symptomatic behaviors of these disorders, several instruments have been designed. One of the most used instruments is the Eating Attitude Test developed by Garner and Garfinkel (1979), whose aim is to assess a wide range of behaviors and attitudes found in AN, highlighting that, at that time BN did not exist as an independent nosological entity, however, this instrument is also used for detection of BN symptoms.

The initial version of the EAT consisted of 40 items (EAT-40), however, Garner et al. (1982) performed a factor analysis of the original instrument and 14 items were removed because of their redundancy, and because they did not increase the predictive power of the

scale, leaving a total of 26 items (EAT-26) grouped into three factors: The first factor was *dieting* which refers to the avoidance of foods considered fattening, and the concern to become fat, the second factor was *bulimia* and *food concern*, these factors are related to recurrent thoughts about food and bulimic behaviors, and finally, the third factor corresponds to *oral control* which consists of self-control to avoid eating and the pressure of others to gain weight.

The EAT-26 has been translated into different languages and psychometric properties have been reported across different countries including: Saudi Arabia (al-Subaie et al., 1996), South Africa (Szabo & Allwood, 2004), Brazil (Nunes et al., 2005), Spain (Rivas et al., 2010; Veloso et al., 2010), Greece (Douka et al., 2009), Iran (Ahmadi et al., 2014), Colombia (Constaín et al., 2014), France (Maïano et al., 2013), Ireland (McEnery et al., 2016), United Kingdom (Lane et al., 2004), China (Kang et al., 2017) and in the United States has been validated in Hispanic and Caucasian population (Belon et al., 2011). In these studies, reliability indicators have been reported, such as internal consistency with a total Cronbach alpha ranging from 0.61 to 0.92 and a temporal stability of $r = 0.85$ for the total score and from $r = 0.26$ to $r = 0.90$ for the subscales.

Regarding the concurrent validity, it has been examined with the Binge Eating Scale (Dezhkam et al., 2009), while the construct and divergent validity were examined with the Beck Depression Inventory-II (Beck et al., 1996), and the Beck Anxiety Inventory (Beck et al., 1988). Finally, the convergent validity was examined with the Eating Disorders Inventory (Garner et al., 1983) and the Bulimia Test-Revised (Thelen et al., 1991). Factor analyzes have also been carried out to determine its factorial structure, showing proposals from three to seven factors. These structures have been examined by confirmatory factor analysis (CFA), finding adequate adjustment indexes. These analyzes have suggested smaller versions of the EAT ranging from 11 to 20 items (al-Subaie, 1998; Alsheweir, 2024; Dos Santos Alvarenga et al., 2010; King, 1989).

Considering that this instrument is a screening measure, its sensitivity has been 100% for most items, and its specificity higher than 80%. Finally, several cut-off points have been recommended, ranging from 11 to 21 (Al-Subaie, 1998; Alsheweir, 2024; Dos Santos Alvarenga et al., 2010; King, 1989). This brief analysis of the psychometric properties of the EAT-26 in different countries indicates the great diffusion and usefulness of this instrument, which is justified by its adequate reliability and validity indexes, highlighting the relevance to continue calculating its psychometric properties in new countries and populations.

In Mexico, the most used version has been the 40 item-version (EAT-40), validated in women by Alvarez-Rayón et al. (2004) and in men by Vázquez et al. (2010). Recently, Franco et al. (2016) presented the properties of the EAT-26 in a Jalisco-Mexico sample. It should be noted that none of the previous cases have conducted a CFA for the EAT-26, neither included a clinical sample to suggest a cut-off point.

Therefore, the present investigation aimed to determine the psychometric properties of the EAT-26 in Mexican women, to calculate its construct validity through confirmatory factor analysis, as well as to determine a cut-off point for Mexican women.

Method

Sample

Convenience samples consisting of two community samples and one clinical sample:

Group 1 (community sample 1)
The first community sample consisted of 688 women students, from 15 to 27 years ($\underline{X} = 20.25$ and $SD = 2.21$), from public educational institutions in the metropolitan area of Mexico City, this sample served to conduct the exploratory factor analysis (EFA).

Group 2 (community sample 2)
The second community sample consisted of 400 women students, from 12 to 27 years ($\underline{X} = 17.69$ and $SD = 3.32$), with this sample the CFA was performed.

Group 3 (Clinical Group)
A total of 108 female eating disorder patients aged between 11 to 40 years ($\underline{X} = 19.35$ and $SD = 5.26$), who were residents from the metropolitan area of Monterrey and Mexico City, patients from *Comenzar de*

Nuevo, international treatment center for eating disorders. The patients received the following diagnoses according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5, American Psychiatric Association [APA], 2013) 59.26% (*n* =64) of AN, 19.44% (*n* =21) of other specified feeding or eating disorder (OSFED), 17.59% (*n* =19) of BN, 3.70% (*n* =4) of binge eating disorder (BED).

Measure

The Eating Attitudes Test-26 was designed by Garner et al. (1982), which is a measure of attitudes and behaviors common among those with eating disorders. The EAT-26 consists of 26 items presented on a Likert-scale format with options ranging from "never" to "always." The EAT-26 yields a total score and three factors: dieting (α = .90), bulimia and food preoccupation (α = .84), and oral control (α = .83), explaining 40.2% of the total variance. A cutoff score of ≥ 20 has been described as optimal for identifying those at "high risk" for eating disorders.

Procedure

Regarding Group 1 and 2, educational institutions were requested for permission to apply the instrument. Once access was granted, the informed consent was sent to the parents/tutors of underage students. All participants that decided to participate voluntarily were instructed to complete the EAT-26, emphasizing the confidentiality of the data. The estimated time to complete the questionnaire was approximately 10 minutes.

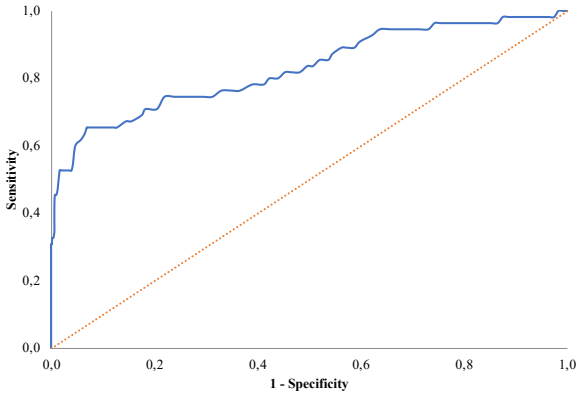
The clinical group was from a clinic that provides treatment to people with eating disorders and the EAT-26 was completed by patients at the initial interview.

When analyzing the data from an initial confirmatory factor analysis, a probable floor effect and a narrow distribution of scores were observed, so the alternative 0-4 scoring system was utilized following the scoring systems proposed for the EDI-3 using a similar Likert scale (Garner, 2004). In this way, items 1-25 were scored as follows: Always = 4, Usually = 3, Often = 2, Sometimes = 1, Almost never = 0, and Never = 0; meanwhile, item 26 was scored as: Always = 0, Usually = 0, Often = 1, Sometimes = 2, Almost never = 3, and Never = 4.

Statistical Analysis

Initially, the psychometric properties of EAT-26 were evaluated with the CFA of the original EAT-26 structure proposed by Garner et al. (1983). However, the adjustment rates were unsatisfactory, due to the poor variability of the data described above, it was chosen to recode into a new value system. However, the total score was adequate in the use of the EAT-26 as a screening tool and given its wide use at the international level, led us to perform an EFA considering the criteria proposed by Yela (1997) and with the value system of 0-4. Varimax rotation was used to minimize the number of items with high loads in each factor, and its structure was checked from the AFC. The ROC curve was used to determine the optimal cut-off point (figure 1).

Figure 1. ROC curve of the EAT-26 in detecting the presence of symptomatic



Results

Frequency distribution

he average of the total score obtained by Group 1 was $\underline{X}$ = 22.40 (*SD* = 13.37), the maximum level reached by the normality curve is between 10-15 scores, while Group 2 obtained a $\underline{X}$ = 20.90 (*SD* = 14.24). On the other hand, for the Clinical Group, the mean was $\underline{X}$ = 43.42

(*SD* = 27.90) and the peak of the normality curve is between the values 25-40.

Reliability analysis

Internal consistency was assessed using Cronbach's alpha and omega coefficients. In the community sample, both coefficients yielded a value of .85, whereas in the clinical sample Cronbach's alpha was .92 and omega was .93.

Analysis of construct validity

The EFA revealed four factors that explained 45.71% of the total variance (see Table 1). The first factor was named *bulimia*, the second *concern for thinness*, the third *food avoidance* and the fourth *social pressure for eating*. These factors obtained Cronbach alpha from .58 to .80. It is worth to mention that item 19 did not load in any factor and item 23 loaded on factor 2 with a loading of .32. These items were preserved, since its removal did not increase the alpha of the scale nor the factor, allowing using the EAT-26 similarly to the original version, making comparable the results with other countries.

Table 2 presents a comparison between the factors of the original EAT-40 and EAT-26 versions and the Mexican version of the EAT-26. Although the essence of the instrument –the number of originally proposed items– is preserved, some differences were observed.

Confirmatory factor analysis

To validate the adequacy of the structure yielded by the EFA, a confirmatory factorial analysis (CFA) was performed, obtaining the following adjustment indices: X^2 = 992.03 ($p \leq .001$), *GFI* = 0.93; *AGFI* = 0.90; *CFI* = 0.90; and *RMSEA* = 0.05.

Cut-offs point for the EAT-26

To discriminate cases at risk of eating disorders from those who are not at risk, a cut-off point ≥40 was determined through sensitivity (0.75) and specificity (0.88) analysis (see Figure 1). This analysis also provides the most appropriate value system to qualify the instrument. Table 3 shows that the value system 0 to 4 makes a screening of cases like the original system.

Comparisons between Groups

It was carried out through the comparison between community samples (Group 1 and Group 2) versus the clinical sample. In the total score and in each factor of the EAT-26, we observed significantly higher scores in the Clinical Group regarding the community samples (Table 4).

Discussion

The aim of this research was to determine the psychometric properties of the EAT-26 in a sample of Mexican women, to explore its construct validity through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), as well as to obtain a cut-off point. Accordingly, a Cronbach alpha coefficient of .85 was obtained in community sample and .92 in clinical sample, indicating that the internal consistency of the instrument is appropriate.

For the validity of the construct was performed a factorial analysis with two community samples, yielded a structure of 4 factors: bulimia (a= 80), diet (a= 78), food avoidance (a= 66) and social pressure to eat (a= 58), which account for 45.71% of the variance. In addition, this structure underwent a CFA, where the good fit of the model was demonstrated through its indexes: X^2 = 992.03 ($p \leq .0001$), *GFI* = 0.93; *AGFI* = 0.90; *IFC* = 0.90; and *RMSEA* = 0.05.

On the other hand, the cut-off point proved to be relevant for distinguishing individuals at risk of developing AN or BN from those who are not. This was confirmed through between-group comparison analyses, which showed statistical differences in the clinical sample and smaller differences in the community sample groups (Group 1 and 2).

Regarding the proposed (0-4) scoring system, it turned out to be indicated as it allows better data

Table 1. Factor structure of the EAT-26 based on the exploratory factor analysis.

	Factor 1. Bulimia	**Factor 1. Bulimia**				
4	Me he atracado de comida, sintiendo que era incapaz de parar de comer.	Have gone on eating binges where I feel that I may not be able to stop.	.57			
9	Vomito después de haber comido.	Vomit after I have eaten.	.57			
21	Paso demasiado tiempo pensando en la comida.	Give too much time and thought to food.	.62			
22	Me siento incómoda después de comer dulces.	Feel uncomfortable after eating sweets.	.67			
24	Me gusta sentir el estómago vacío.	Like my stomach to be empty.	.74			
25	Tengo ganas de vomitar después de las comidas.	Have the impulse to vomit after meals.	.71			
	Factor 2. Preocupación por ser delgado	**Factor 2. Concern for thinness**				
1	Me aterroriza tener sobrepeso.	Am terrified about being overweight.		.77		
2	Procuro no comer, aunque tenga hambre.	Avoid eating when I am hungry.		.50		
3	Me preocupa la comida.	Find myself preoccupied with food.		.54		
5	Corto mis alimentos en trozos pequeños.	Cut my food into small pieces.		.52		
10	Me siento muy culpable después de comer.	Feel extremely guilty after eating.		.47		
11	Me ocupo en buscar estar delgada.	Am preoccupied with a desire to be thinner.		.64		
12	Pienso en quemar calorías cuando hago ejercicio.	Think about burning up calories when I exercise.		.69		
14	Me preocupa la idea de tener grasa en el cuerpo.	Am preoccupied with the thought of having fat on my body.		.66		
23	Hago dietas.	Engage in dieting behavior.		.32		
	Factor 3. Evitación de alimentos	**Factor 3. Food avoidance**				
6	Tengo en cuenta las calorías que tienen los alimentos que como.	Aware of the calorie content of foods that I eat.			.58	
7	Evito especialmente comer alimentos con muchos carbohidratos (p. ej. pan, arroz, papas, etc.).	Particularly avoid food with a high carbohydrate content (i.e., bread, rice, potatoes, etc.).			.58	
16	Evito comer alimentos que contienen azúcar.	Avoid foods with sugar in them.			.60	
17	Consumo alimentos dietéticos.	Eat diet foods.			.65	
18	Siento que los alimentos controlan mi vida.	Feel that food controls my life.			.60	
19*	Me controlo en las comidas.	Display self-control around food.				
26	Disfruto probando comidas nuevas y sabrosas.	Enjoy trying new rich foods.			.44	
	Factor 4. Presión social para comer	**Factor 4. Social pressure for eating**				
8	Siento que los demás preferirían que yo comiera más.	Feel that others would prefer if I ate more.				.67
13	Los demás piensan que estoy demasiado delgada.	Other people think that I am too thin.				.69
15	Al comer, tardo más tiempo que las otras personas.	Take longer than others to eat my meals.				.54
20	Siento que los demás me presionan para que coma.	Feel that others pressure me to eat.				.52
		Cronbach Alpha	.80	.78	.66	.58
		Explained variation (%)	14.27	11.98	11.68	7.78

Table 2. Comparison between the factors of the original versions of the EAT-40 and EAT-26 with the EAT-26 version for Mexican women.

Instrument	EAT-40 Garner & Garfinkel, (1979)	EAT-26 (Garner, Olmsted, Bohr y Garfinkel, 1982)	EAT-26 (México)
1st Factor	**Concern for food**	***Diet***	***Bulimia***
Items that are included		1,6,7,10,11,12,14,16,17, 22, 23, 24 y 26.	4, 9, 21, 22, 24 y 25
2nd Factor	**Body image for thinness**	***Bulimia and food preoccupation***	***Concern to be thin***
Items that are included		3, 4, 9, 18, 21 y 25.	1, 2, 3, 5, 10, 11, 12, 14 y 23
3rd Factor	**Vomiting and laxative abuse**	***Oral control***	***Food Avoidance***
Items that are included		2,5,8,13,15,19 y 20	6, 7, 16, 17, 18 y 26
4th Factor	**Diet**		***Social pressure to eat***
Items that are included			8, 13, 15 y 20
5th Factor	**Eating slow**		
Items that are included			
6th Factor	**Clandestine eating**		
Items that are included			
7th Factor	**Perceived social pressure to gain weight**		
Items that are included			

Table 3. Cut-off points through sensibility and specificity analysis.

Cut-off points from the original version			
Cut-off point	*Sensibility*	*Specificity*	*Percentage of cases that score above the cut-off point (N=1196)*
≥19	.709	.851	
≥20	.709	.868	14.46% (*n*=173)
≥21	.691	.885	
Cut-off points with a value system from 1 to 6			
≥83	.709	.795	
≥84	.709	.817	23.41% (*n*=280)
≥85	.691	.824	
Cut-off points with a value system from 0 to 4			
≥39	.770	.875	
≥40	.754	.886	16.13% (*n*=193)
≥41	.721	.898	

Table 4. Comparison between community samples (Group 1 and 2) and clinical group in the total score and in each factor of the EAT-26 (p< .001).**

	Group 1 (n = 688)	Group 2 (n = 400)	Clinical Group (n = 108)	F
Total score of EAT-26	$\underline{x}$ = 22.40[a] *SD* = 13.87	$\underline{x}$ = 20.90[a] *SD* = 14.24	$\underline{x}$ = 43.42[b] *SD* = 27.90	93.19**
Bulimia	$\underline{x}$ = 4.25[a] *SD* = 4.23	$\underline{x}$ = 3.86[a] *SD* = 4.16	$\underline{x}$ = 8.93[b] *SD* = 7.43	55.25**
Dieting	$\underline{x}$ = 8.36[a] *SD* = 6.00	$\underline{x}$ = 7.06[a] *SD* = 6.11	$\underline{x}$ = 17.20[b] *SD* = 11.46	99.62**
Food avoidance	$\underline{x}$ = 5.10[a] *SD* = 4.14	$\underline{x}$ = 5.10[a] *SD* = 3.72	$\underline{x}$ = 9.86[b] *SD* = 6.64	60.20**
Social pressure for eating	$\underline{x}$ = 3.65[a] *SD* = 2.97	$\underline{x}$ = 3.65[a] *SD* = 3.12	$\underline{x}$ = 579[b] *SD* = 4.62	22.01**

management, as well as greater usefulness of the instrument in community and clinical samples. The cut-off point was determined ≥40 with a sensitivity of 0.75, and a specificity of .88, which is pertinent for a screening instrument so widely used in a nationally and internationally scale, this will allow comparisons with others investigations.

Most validations of this instrument conducted in other countries have reduced the number of items, resulting in versions with 12 (Veloso et al., 2010), 13 (Douka et al., 2009) or 18 (Maïano et al., 2013) items. These reductions prioritize statistical considerations over clinical utility, leading to the removal of some of the original factors. In the present study, however, the original number of items was preserved to maintain the instrument's clinical utility.

A limitation of this study, as in previous research, is that both the EFA and CFA were conducted with non-clinical samples, which can produce floor effects and hinder replication of the original factorial structure. Although the present findings show adequate psychometric properties of the EAT-26 in a Mexican female sample, future studies should evaluate the proposed factorial structure in wider clinical samples to enable a more appropriate comparison with the original version of EAT-26 (Garner et al., 1982). This would clarify whether the differences in factorial structures stem from cultural factors or the passage of time—given that the American validation dates back to the early 1980s—rather than from the type of sample analyzed.

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