

The Spanish version of the esophageal hypervigilance and anxiety score shows strong psychometric properties: Results of a large prospective multicenter study in Spain and Latin America

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Abstract

Background: Anxiety is a significant modulator of sensitivity along the GI tract. The recently described Esophageal Hypervigilance and Anxiety Score (EHAS) evaluates esophageal-specific anxiety. The aims of this study were as follows: 1. translate and validate an international Spanish version of EHAS. 2. Evaluate its psychometric properties in a large Hispano-American sample of symptomatic individuals.

Methods: A Spanish EHAS version was developed by a Delphi process and reverse translation. Patients referred for high-resolution manometry (HRM) were recruited prospectively from seven Spanish and Latin American centers. Several scores were used: EHAS, Hospital Anxiety and Depression Scale (HADS), Eckardt score (ES), Gastroesophageal Reflux Questionnaire (GERDQ), and the Brief Esophageal Dysphagia Questionnaire (BEDQ). Standardized psychometric analyses were performed.

Key Results: A total of 443 patients were recruited. Spanish EHAS showed excellent reliability (Cronbach's alpha = 0.94). Factor analysis confirmed the presence of two factors, corresponding to the visceral anxiety and hypervigilance subscales. Sufficient convergent validity was shown by moderate significant correlations between EHAS and other symptomatic scores. Patients with high EHAS scores had significantly more dysphagia. There was no difference in EHAS scores when compared normal vs abnormal or major manometric diagnosis.

Conclusions and Inferences: A widely usable Spanish EHAS version has been validated. We confirm its excellent psychometric properties in our patients, confirming the appropriateness of its use in different populations. Our findings support the

Abbreviations: AC, Absent Contractility; ANOVA, Analysis of variance; AS, Anxiety sensitivity; BEDQ, Brief Esophageal Dysphagia Questionnaire; EGJOO, Esophagogastric Junction Outflow Obstruction; EHAS, Esophageal Hypersensitivity and Anxiety Score; EHV, Esophageal Hypervigilance; ES, Eckardt Score; ESA, Esophageal Sensitivity Anxiety; GERD, Gastroesophageal Reflux Disease.; GERDQ, Gastroesophageal Reflux Questionnaire; HADS, Hospital Anxiety and Depression Scale; HRM, High-resolution manometry; IEM, Ineffective Esophageal Motility; PCFA, Principal component factor analysis; VA, Visceral anxiety.

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appropriateness of evaluating esophageal anxiety across the whole manometric diagnosis spectrum.

KEYWORDS

dysphagia evaluation, esophageal hypervigilance and anxiety score, esophageal-specific anxiety, high-resolution manometry, psychometric evaluation, reliability, validity

1 | INTRODUCTION

Esophageal symptoms are very common in the general population. Nevertheless, our capacity to fully explain these symptoms using current technology is limited. Monrroy et al. showed that 66% of symptomatic individuals have normal or minor findings (not causally related to symptoms) in high-resolution manometry (HRM).¹ In individuals with GERD symptoms, there is a fundamental lack of association between symptoms and reflux events in 26% of patients undergoing pH testing while not on PPI therapy and 49% while on PPI.² One of the main hypotheses to explain these discrepancies is the concept of esophageal hypersensitivity. It implies that some individuals can perceive symptoms from an otherwise normal intensity stimulus not expected to produce discomfort. According to current knowledge, this perception occurs when signals from mechanical and/or chemical receptors in the esophageal wall reach the cerebral cortex.³ Many of the involved nervous system structures are susceptible to modulation, which results in hypersensitivity.³

Anxiety is one of the main proven modulators of sensitivity along the GI tract,⁴ including demonstrated associations with retrosternal pain and heartburn.^{5,6} Cisternas et al. showed that anxiety significantly correlates with bolus perception in healthy individuals, without any effect on esophageal manometry metrics.⁷ Carlson et al. found a significant correlation between esophageal symptoms and anxiety in symptomatic patients with and without major HRM diagnosis.⁸ Anxiety can be generalized or symptom/disease specific. Generalized anxiety can be evaluated using screening tools such as the Hospitalized Anxiety and Depression score (HADS)⁹ or diagnostic tools like some modules of the Structured Clinical Interview for the DSM-IV.¹⁰ Symptom-specific anxiety can manifest as visceral symptoms (visceral anxiety-VA) or as the misattribution of anxiety symptoms to be from a serious physical problem (anxiety sensitivity-AS). Even though generalized and symptom-specific anxiety strongly correlate, they are not the same construct. In one study, only 30% of individuals with high AS met DSM-IV criteria for any anxiety disorder.¹¹ It is also likely that VA is more closely related to symptoms than generalized anxiety as only VA was an independent predictor of an IBS diagnosis in a study of over 900 patients.¹² It has been suggested that gastrointestinal symptom-specific anxiety may perpetuate IBS symptoms even in the absence of external stressors.¹³

Anxiety is also associated with and perpetuated by hypervigilance, which is an attentional bias to threat-related stimuli.¹⁴ Focusing on the threat of certain bodily sensations increases the probability of perceiving it, creating a cycle of self-fulfilling prophecy

Key points

- A Spanish EHAS version has been developed and validated.
- We confirmed EHAS excellent psychometric properties.
- We confirmed the presence of two factors structure, corresponding to visceral anxiety and hypervigilance.
- Esophageal anxiety plays a role all across manometric findings.

as it relates to symptom perception and experience.^{15,16} In PPI-refractory GERD patients, hypervigilance may account for 50% of symptoms severity.¹⁷

Recently, Taft et al. described the Esophageal Hypervigilance and Anxiety Scale (EHAS), the first validated self-report measure to evaluate esophageal hypervigilance and visceral specific anxiety¹⁸ in a US English-speaking population. In its initial description, EHAS showed excellent reliability and validity to measure these constructs. Factor analysis demonstrated the existence of two factors, corresponding to the two domains. A recent multicenter study demonstrated a significant correlation between esophageal symptom severity and anxiety measured with EHAS.⁸

Standard consensus for principal component analysis and scale development suggests that findings should not be universally extrapolated without being tested in different populations and languages. This aligns with FDA guidelines of testing psychometric properties of patient-reported outcomes scores in local populations. Also, in the case of populations from other regions of the world, FDA recommends translation and cultural adaptations of the instruments.¹⁹

Thus, the aims of this study are as follows: (i) Perform a formal translation/cultural adaptation of EHAS to Spanish, intended to be widely used in Spanish-speaking populations. (ii) Perform a psychometric evaluation of EHAS in patients from Spain and Latin America.

2 | MATERIALS AND METHODS

2.1 | EHAS translation

One of the English-speaking researchers (DC) performed an initial EHAS translation to Spanish. We recruited six experts in esophageal diseases from Latin America and Spain. They participated in a

Delphi process, evaluating every phrase of the translation in terms of: (i) its congruency with the original English EHAS version. (ii) Its comprehensibility in wide populations in their own country. We used a 5-point Likert scale to evaluate agreement with the translation (0=Complete disagreement. 1 = Disagreement. 2 = Neither agree nor disagree. 3 = Agreement. 4 = Complete agreement). We considered a phrase approved if 80% of responses had a score ≥ 3 . Researchers were asked to propose changes in the translation for every item they scored 2 or less. Using these comments, a revision of the translation was done and the Delphi process was repeated until all items received a score ≥ 3 . The final Spanish EHAS version was used to develop a reverse translation (Spanish into English) by an independent professional translator (PC). Both original EHAS and reverse translation English versions were compared to be sure that the meaning of each item was maintained. This final revision was done by researchers involved in the development of the original EHAS version (TT and DAC).

2.2 | EHAS psychometric evaluation. Patient selection and gathered information

Participants were prospectively recruited among adult patients being referred for a high-resolution esophageal manometry (HRM) due to esophageal symptoms from December 2018 to July 2019. Participant centers were Clínica Alemana de Santiago (Chile-CAS), Hospital Clínico de la Pontificia Universidad Católica de Chile (Chile-UC), Hospital San Ignacio-Pontificia Universidad Javeriana de Bogotá (Colombia), Hospital Universitario Germans Trias i Pujol-Badalona (Spain-Badalona), Hospital Universitario, Fundación Favaloro-Buenos Aires (Argentina), Hospital Clínico San Carlos, Universidad Complutense-Madrid (Spain-Madrid), and Universidad Veracruzana, Medical Biological Research Institute-Veracruz (Mexico).

Prior to HRM study, all patients completed paper forms with epidemiological data (age, gender, the reason for referral, previous foregut surgery). To evaluate convergent validity, several self-report symptomatic scores were filled by patients, for the evaluation of mood [EHAS and Hospital Anxiety and Depression Scale (HADS) and esophageal symptoms (Eckardt score, Gastroesophageal Reflux Questionnaire (GERDQ) and the Brief Esophageal Dysphagia Questionnaire (BEDQ)]. We used validated Spanish versions of each score.²⁰⁻²³

The EHAS is a 15-item measure that consists of two factors that evaluate esophageal hypervigilance and visceral specific anxiety.¹⁸ Each item is scored on a 0–4 Likert scale and the items are summed to yield total EHAS scores ranging from 0 to 60: higher scores indicating higher greater esophageal hypervigilance- and esophageal-specific anxiety. Two sub-scores can also be generated, one for Esophageal Hypervigilance (EHV; sum of six items) and one for Esophageal Sensitivity Anxiety (ESA; sum of nine items).

The HADS is a 14-item score consisting of two factors that evaluate depression and anxiety.⁹ It has been extensively validated and

demonstrated excellent diagnostic properties,^{9,24,25} being extensively used as a screening/diagnostic tool in different health conditions.²⁶ Each question (7 for anxiety and 7 for depression) is scored 0 to 3. Points are summed for the whole score and separately for each factor (anxiety and depression). A score of 11 or higher on any subscale indicates the probable presence of the mood disorder with a score of 8 to 10 being just suggestive of the presence of the respective state.

The Eckardt score is a 4-item measure (dysphagia, regurgitation, chest pain, weight loss) that was originally developed for use in patients with achalasia.²⁷ Each item is scored 0 to 3 and sum for the total score. It is the most used score in achalasia studies, including its use as response criterion for different treatments, with a score <4 is considered indicative of successful treatment in achalasia.^{28,29}

The GERDQ is a 6-item score that evaluates GERD symptoms during the last 7 days.³⁰ It has been extensively validated^{22,31,32} and is one the most used scores to evaluate GERD-related symptomatic burden. Each question is scored on a 4-point Likert scale. Four positive predictors (scored 0 to 3) and two reverse negative predictors (scored 3 to 0) are sum for the total score. GERDQ scores >8 are considered positive for a GERD diagnosis.

The BEDQ is a validated 10-item measure that scores dysphagia.³³ It includes 8 items that evaluate dysphagia related to different food consistencies, pain, and swallow-related cough over the previous 14 days. Each item is evaluated using a 6-point Likert scale that includes avoidance behaviors. The 8 Likert-scaled items are summed to yield scores ranging from 0 (asymptomatic) to 40, with greater scores indicating greater dysphagia severity. The BEDQ also includes two extra items that evaluate the number of food impaction and related emergency room visits. It has been recently validated in different populations, showing excellent psychometric properties.^{23,33}

HRM was performed per the standard protocol of ten 5-ml liquid swallows in the supine position. All studies were analyzed using Manoview ESO 3.0 analysis software (Medtronic). HRM diagnosis was assigned according to Chicago Classification v3.0.³⁴ For subgroup analysis, HRM diagnosis was classified by their relevance (Obstructive: Achalasia and Esophagogastric Junction Outflow Obstruction (EGJOO). Major: Distal Esophageal Spasm (DES), Jackhammer and Absent Contractility (AC). Minor: Fragmented Peristalsis (FP) and Ineffective Esophageal Motility (IEM). Studies were also classified by their pathophysiological mechanism (Obstructive: Achalasia and EGJOO. Hypertensive: DES and Jackhammer. Hypotensive: AC, FP, and IEM).

The study was approved by each Review Board's participant center and all participants gave informed consent.

2.3 | Statistical analyses

A priori power analyses (G*Power 3.1) indicated a minimum sample size of 150 was required for the principal components analyses of the EHAS (10 items per question; 10 × 15) based on standard acceptable samples for PCFA. Additional power analyses indicated a

minimum sample of 140 for one-way ANOVA, 352 for two-tailed independent samples t test, and 93 for chi-square tests with a medium effect size ($d = 0.5$), power of $\beta = 0.80$, and statistical significance of $p < 0.05$. Based on these findings, we aimed to recruit a minimum of 360 participants for the study.

Study data were imported from Microsoft Excel to SPSS v26 for Macintosh operating systems. Total scores were computed for the EHAS total and subscale scores, BEDQ, GERDQ, HADS Depression, and HADS Anxiety scores using published guidelines for each scale. Initial assessment of data normality using standard cutoffs for skewness and kurtosis (± 2.0) did not indicate the need for non-parametric tests. Descriptive statistics including mean (SD) for continuous variables and frequency (%) for categorical variables were calculated. Patients were categorized as "Low" or "High" esophageal hypervigilance/anxiety via median split of the total EHAS score. Cronbach's alpha measured internal consistency and the Guttman statistic determined split-half reliability of the total EHAS score. Principal components factor analysis (PCFA) with Varimax rotation evaluated the subscale structure of the EHAS for comparison to the original validation study. An eigenvalue greater than 1 determined factor loading (Keiser's criterion). Pearson's correlations determined convergent validity of the EHAS via relationships with the BEDQ, GERDQ, Eckardt, and HADS scores. Differences in EHAS between CC 3.0 diagnostic category, pathophysiological category, and study center were measured using one-way analysis of variance (ANOVA) with Tukey post hoc test. Differences in EHAS between genders and surgical history were measured using independent samples t tests. Additional t tests evaluated differences in BEDQ, GERDQ, and HADS scores for low versus high EHAS score groups. Chi-square with Fisher's exact test, when necessary, determined differences between CC 3.0 diagnostic groups and low/high EHAS groups. Statistical significance was set to $p < 0.05$ for all analyses.

3 | RESULTS

3.1 | EHAS Spanish translation process

In the first round of the Delphi process, 5/23 (22%) of the translated phrases scored ≤ 3 . The translation of these 5 phrases was corrected according to researchers' suggestions. A second-round Delphi process was performed and all the phrases were approved. The transverse translation was considered to maintain the original meaning. All the study measures were filled by patients in front of researchers and/or laboratory personnel. There were no difficulties in understanding the score phrases and each phrase received a respective answer. Supplementary Material shows the original and Spanish EHAS versions.

3.2 | Study sample

A total of 443 patients were recruited for the study. The demographic and clinical characteristics of the study sample are

TABLE 1 Demographic characteristics of study sample

Variable	N = 443
Age in years (Mean \pm SD)	52.59 \pm 15.24
Gender	
Male	39.1% (173)
Female	57.1% (253)
Not provided	3.8% (17)
Center	
Badalona, Spain	9.3% (41)
Bogota, Colombia	7.0% (31)
Buenos Aires, Argentina	10.8% (48)
Clinica Alemana, Chile	23.5% (104)
Madrid, Spain	3.2% (14)
Universidad Catolica, Chile	13.1% (58)
Veracruz, Mexico	23.0% (102)
Not provided	10.1% (45)

presented in Tables 1 and 2, respectively. Overall, the sample was middle aged (52.59 (15.24) years) with a greater proportion of females than males. Half of the participants were recruited from Chile and Mexico, with relatively equal distribution across the remaining centers. The main reason for referral was GERD (40%), followed by dysphagia (30%). Normal esophageal motility (53%) was the most common manometric diagnosis, followed by Ineffective esophageal motility (13.5%) and achalasia (16.2%); Table 1. No significant differences existed between males and females, study center ($p = 0.06$), previous esophagogastric surgery status nor by age for EHAS score.

3.3 | Reliability and factor structure of the Spanish EHAS

The internal consistency of the Spanish EHAS was excellent (Cronbach alpha = 0.94) as was the split-half reliability (Guttman statistic = 0.89). The PCFA (both by Kaiser's and scree plot criteria) yielded two clear subscales (hypervigilance (EHV) and symptom-specific anxiety (ESA), which aligned with the original validation study; Table 3. The ESA subscale accounted for 54.5% of the variance in score, while the EHV scale accounted for 7.9%.

3.4 | Validity of the Spanish EHAS

Relationships between EHAS and measures of symptom severity, anxiety, and depression are presented in Table 4. Small to moderate significant relationships existed between the EHAS and all measures, indicating sufficient convergent validity of the translated scale. These findings remained when evaluating relationships between the two EHAS subscale scores with the BEDQ, GERDQ, Eckardt score, and HADS.

TABLE 2 Clinical characteristics of study sample

Variable	N = 443
Referral reason	
Chest pain	3.6% (16)
Dysphagia	30.0% (133)
GERD	40.0% (177)
GERD + Dysphagia	9.5% (42)
Oropharyngeal Dysphagia	1.4% (6)
Other	11.1% (49)
Chicago classification 3.0 diagnosis	
Absent contractility	5.2% (12)
Achalasia I	2.9% (13)
Achalasia II	11.7% (52)
Achalasia III	1.6% (7)
Distal Esophageal Spasm	1.8% (8)
EGJOO	4.7% (21)
Fragmented Peristalsis	0.2% (1)
Ineffective Esophageal Motility	13.5% (60)
Jackhammer	1.4% (6)
Normal	53.0% (235)
Pathophysiological Category	
Normal	53.0% (235)
Obstructive	21.0% (93)
Hypotensive	19.0% (84)
Hypertensive	3.2% (14)
Prior Esophagogastric Surgery	
No	88.5% (377)
Yes	11.5% (49)

Note: Details on the Pathophysiological classification are in the methods section.

Abbreviations: EGJOO, Esophagogastric Junction Outflow Obstruction; GERD, Gastroesophageal Reflux Disease.

3.5 | Performance of EHAS across clinical groups

To determine significant differences in EHAS score across esophageal patient groups, differences in score were measured by CC 3.0 diagnosis and categories; Table 5. Patients with normal manometry were excluded from these comparisons. We found no difference in EHAS across the whole CC3.0 spectrum nor when comparing specific diagnosis nor when comparing CC3.0 and pathophysiological categories; Table 5 and Figure 1. The proportion of High EHAS was similar across all CC3.0 categories (p ns). No differences were found in EHAS across CC 3.0 diagnosis or categories in patients referred for evaluation for dysphagia or those referred for GERD symptoms separately (p ns).

Next, patients without normal manometry were pooled into an "abnormal" group for comparison to those without pathology. No significant differences existed between patients with normal or any abnormal manometry findings for EHAS; Table 5.

TABLE 3 Rotated component matrix for EHAS items

EHAS Item number	Factor 1 (VA)	Factor 2 (HV)
7 (ESA)	0.807	
4 (ESA)	0.767	
5 (ESA)	0.763	
15 (ESA)	0.739	
6 (ESA)	0.723	0.414
8 (ESA)	0.714	
1 (ESA)	0.650	
14 (ESA)	0.645	
3 (ESA)	0.511	
9 (EHV)		0.864
10 (EHV)		0.864
12 (EHV)		0.724
13 (EHV)	0.472	0.660
11 (EHV)	0.524	0.630
2 (EHV)		0.476

Note: EHAS factor loadings of each item after Principal Component Factor Analysis with Varimax rotation. In parenthesis is the subscale the item belongs in the original English version (ESA, Esophageal Sensitivity Anxiety and EHV, Esophageal Hypervigilance). Factor loadings <0.4 are not displayed. Content of each item is depicted in Supplementary Material.

We then evaluated patients categorized as either Low or High esophageal hypervigilance and anxiety for symptom severity and psychological distress. The median score of the EHAS was 37. Those scoring higher than 37, or "High" on the EHAS reported significantly worse dysphagia as measured by the BEDQ and Eckardt scores, more symptoms of reflux on the GERDQ, and greater anxiety and depression (all $p < 0.001$, Table 6). No differences existed between normal and abnormal manometry groups for low versus high EHAS.

4 | DISCUSSION

This study is the first to develop and validate a Spanish version of EHAS across multiple centers in Spanish-speaking countries. No patient reported difficulty in understanding or completing the items on the Spanish EHAS and EHAS scores were similar across all study centers, suggesting wide applicability. The factor structure and psychometric properties of the Spanish version were remarkably similar to original EHAS. This suggests the Spanish version is also a reliable and valid measure of esophageal hypervigilance- and symptom-specific anxiety in patients presenting with esophageal symptoms and that can be confidently used in Spanish-speaking countries.

In terms of the two-subscale structure of the EHAS, the large sample size and mean commonalities less than 0.6 suggests that Kaiser's criterion is met and clearly supports the existence of two factors (EHV and ESA). This is confirmed by the excellent fit of each item to the corresponding factor in the rotated component matrix (Table 3). Our study confirmed the bidimensional character of EHAS,

	EHAS	BEDQ	Eckardt Score	HADS Anxiety	HADS Depression	GERDQ
EHAS	-					
BEDQ	0.23**	-				
Eckardt Score	0.22**	0.69**	-			
HADS Anxiety	0.46**	0.28**	0.28**	-		
HADS Depression	0.41**	0.35**	0.27**	0.69**	-	
GERDQ	0.35**	0.30**	0.40**	0.30**	0.22**	-

TABLE 4 Pearson's correlations between EHAS, symptom severity, and psychological function

Abbreviations: BEDQ, Brief Esophageal Dysphagia Questionnaire; EHAS, Esophageal Hypervigilance and Anxiety Scale; GERDQ, Gastroesophageal Reflux Questionnaire; HADS, Hospital Anxiety and Depression Scale.

** $p < 0.001$.

confirms the adequate fit of the items to the original factors, and shows remarkably similar reliability and validity scores when compared to the original description. This suggests that in future studies

TABLE 5 Mean differences between in EHAS score by diagnostic manometric categories

	EHAS total (SD)	EHAS EHV (SD)	EHAS ESA (SD)
CC3.0 diagnosis			
Achalasia	33.76 (18.37)	13.44 (7.86)	20.32 (11.16)
EGJOO	34.43 (19.07)	13.95 (8.08)	20.48 (11.50)
Jackhammer	27.67 (11.86)	10.50 (3.99)	17.17 (9.06)
Distal Esophageal Spasm	38.25 (13.07)	14.13 (6.31)	24.13 (8.80)
Absent Contractility	29.91 (17.59)	14.70 (6.66)	15.22 (12.09)
Ineffective Esophageal Motility	33.57 (17.10)	14.80 (7.11)	18.77 (10.80)
Normal (ni)	34.03 (17.44)	14.66 (7.44)	19.37 (11.11)
p value	0.873	0.751	0.444
CC3.0 category			
Normal (ni)	34.03 (17.44)	14.66 (7.44)	19.37 (11.11)
Obstructive	33.91 (18.42)	13.56 (7.87)	20.35 (11.17)
Major	31.35 (15.99)	13.89 (6.28)	17.46 (11.35)
Minor	33.57 (17.10)	14.80 (7.11)	18.77 (10.85)
p value	0.856	0.606	0.573
HRM			
Normal	34.03 (17.44)	14.66 (7.44)	19.37 (11.11)
Abnormal	33.81 (17.10)	14.51 (7.33)	19.29 (11.10)
p value	0.627	0.370	0.938

Note: Mean (SD) values for total EHAS and Hypervigilance (EHV) and Visceral Anxiety (ESA) subscales. Categorization criteria are explained in the method section. p values for ANOVA and t test comparisons. (ni): not included in this comparison.

Abbreviations: EGJOO, Esophagogastric Junction Outflow Obstruction.

EHAS can be used simultaneously in Spanish- and English-speaking patients.

The significant but moderate correlation between ESA and EHV supports the concept that esophageal hypervigilance- and symptom-specific anxiety are much related, but distinct constructs. The ESA includes phrases like "I can't seem to keep my symptoms out of my mind", "These symptoms overwhelm me", "These symptoms frighten me" (see Supplementary Material), which can be associated with catastrophic interpretation of esophageal sensations. As is seen in anxiety sensitivity and panic disorder, esophageal anxiety could contribute to a vicious cycle, perpetuating symptoms and predicting recurrence.^{35,36}

The EHV subscale includes phrases like "I am aware of sudden changes in my esophagus" and "I notice my symptoms even if I am busy with another activity". Attention has been shown to affect perception independent of mood. Specifically, manipulating attention alters the intensity of perception of a stimulus but not its unpleasantness, whereas manipulating mood has the opposite effect.³⁷ Activation of different areas of the cerebral cortex involved in central processing of pain is known to modulate these relationships.³⁷ In the present study, we found the correlation between ESA and symptom severity measured via the Eckardt and BEDQ scores is twice as large as the relationship between EHV and symptom severity. Additionally, the ESA subscale explains significantly more variance in total EHAS score, similar to the original EHAS validation study. We can speculate that EHV drives perception of esophageal sensations but ESA has a stronger effect over amplification/experience of symptoms. Additional studies that separately evaluate bolus perception and dysphagia burden will be necessary to address this hypothesis.

We could not find any difference in EHAS according to manometry findings, neither using CC3.0 diagnostic categories nor using pathophysiological categories. This is not in line with the ancient concept that individuals with functional disorders are anxious and individuals with "organic" disorders are not. In fact, Carlson et al. recently showed that EHAS predicted dysphagia burden better in patients with than without major manometric diagnosis,⁸ suggesting interactions between esophageal function and hypervigilance/anxiety as modulating factors for dysphagia severity. The findings of the

FIGURE 1 Total EHAS according to CC3.0 diagnosis. Mean total EHAS values. In parenthesis is the number of patients in each category. Bars represent standard deviation. AC, Absent Contractility; DES, Distal Esophageal Spasm; EGJOO, Esophagogastric Junction Outflow Obstruction; IEM, Ineffective Esophageal Motility

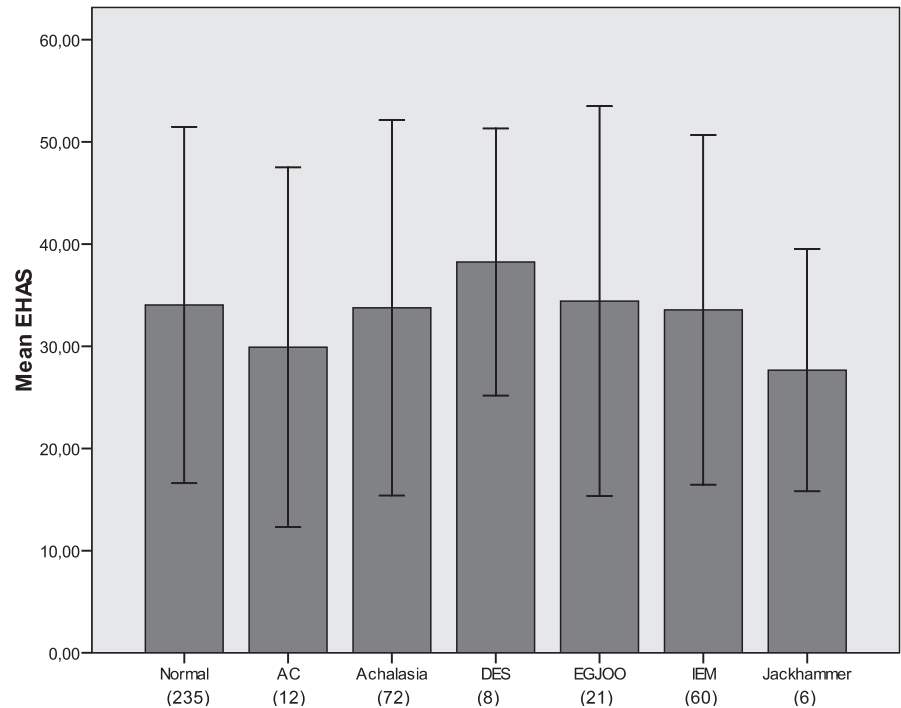


TABLE 6 Mean differences in symptom severity and psychological distress between in low EHAS and high EHAS score patients

	Low EHAS	High EHAS	<i>p</i>
BEDQ	8.68 (9.5)	12.04 (11.6)	0.001
Eckardt Score	3.60 (2.6)	4.37 (2.8)	0.004
HADS Anxiety	4.80 (3.3)	8.26 (4.5)	<0.001
HADS Depression	2.89 (2.6)	5.58 (4.0)	<0.001
GERDQ	5.43 (4.2)	8.14 (4.7)	<0.001

Note: EHAS scores are split according to the median value of the sample.³⁷

Abbreviations: BEDQ, Brief Esophageal Dysphagia Questionnaire; EHAS, Esophageal Hypervigilance and Anxiety Scale; GERDQ, Gastroesophageal Reflux Questionnaire; HADS, Hospital Anxiety and Depression Scale.

present study support the appropriateness of using EHAS across all CC 3.0 diagnostic categories, including patients with previous foregut surgery.

Anxiety and symptoms can have complex temporal relationships: anxiety or hypervigilance may be the primary driver of symptoms in some individuals, but in others may be a consequence of the esophageal disorder. Prior research demonstrates a bi-directional association between anxiety and GI symptoms.^{38,39} Koloski et al. evaluated 1900 individuals in a prospective random population study during 1 year. Among individuals with both any mood disorder and IBS or functional dyspepsia at follow-up, the functional gastrointestinal diagnosis preceded the mood disorder in two thirds of cases.³⁹ A prospective study with serial anxiety and esophageal symptoms evaluations will be necessary to test that hypothesis.

We found significant correlations between EHAS and GERDQ, BEDQ, and Eckardt symptom scales. Patients scoring “high” on the EHAS reported significantly more symptoms on each of these scales. This further supports the role of anxiety and hypervigilance in esophageal symptom experience and reporting,⁴⁰⁻⁴² underscoring the importance of routinely evaluating these two constructs to fully understand patient symptom burden.

This study has some limitations that should be considered when interpreting the results. First, we did not perform cognitive interviews to demonstrate that our Spanish version is easily understood by patients. Nevertheless, we have enough indirect information through patient report during completion of the scale to support its appropriate applicability. The correlation of the Spanish EHAS with other measures of specific anxiety and anxiety sensitivity and the temporal correlation between anxiety and symptoms should be assessed in future studies. This study's strengths include a large sample size and the multicentric/multicultural construction and testing of the Spanish EHAS.

In summary, we confirm strong psychometric properties of EHAS in different Spanish-speaking populations. The Spanish EHAS version can be widely used in research and clinical practice. We also further elucidated the importance of anxiety and hypervigilance in modulating esophageal symptom experience.

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CONFLICT OF INTEREST

No competing interests declared.

AUTHOR CONTRIBUTIONS

DC contributed to conception and study design, recruitment, data acquisition, analysis and interpretation, manuscript drafting, editing, critical revision, and final approval; TT contributed to data analysis and interpretation, manuscript editing, critical revision, and final approval; DCA contributed to study conception, data interpretation and manuscript editing, critical revision, and final approval; HM contributed to study design, recruitment, data acquisition, analysis and interpretation, manuscript drafting, editing, critical revision, and final approval; EG, PR, AH, AAF, AL, CB, AD, AV, JA, JRT, ARL, JPD, IM, and JS contributed to patient recruitment, manuscript critical revision, and final approval; all authors approved the final manuscript version.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author (DC), upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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