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Confirmatory factor analysis of 20-item toronto alexithymia scale in spanish patients with substance use disorder

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ABSTRACT

Alexithymia is highly prevalent in patients with substance use disorders (SUDs) and has been implied in SUD pathogenesis and treatment outcomes. However, the psychometric properties of the most-used instrument for evaluating alexithymia (the 20-item Toronto Alexithymia Scale, TAS-20) have been scarcely studied in relation to SUD patients. Specifically, only five psychometric studies have been performed with samples of SUD patients, and no studies have focused exclusively on Spanish patients with SUDs. Therefore, the aim of the present study was to examine the internal accuracy and reliability of the TAS-20 with a sample of Spanish SUD patients (n = 126; 75.4% male; mean age 43.7 ± 14.6 years). A reliability analysis and a confirmatory factor analysis were executed, considering that TAS-20 has a three-factor structure (difficulty identifying feelings [DIF]; difficulty describing feelings [DDF]; externally oriented thinking [EOT]). The results indicated that TAS-20's psychometric properties are acceptable for assessing alexithymia in Spanish patients with SUDs. However, the three-factor model of TAS-20 was found to fit only moderately well with the patient sample, with DIF and DDF being the most reliable and valid constructs. In contrast, the EOT factor needs further research and should be cautiously analyzed in the context of patients with addictions.

Keywords. Alexithymia; Confirmatory factor analysis; Psychometrics; Spanish; Substance use disorder; Toronto Alexithymia Scale

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ANÁLISIS CONFIRMATORIO FACTORIAL DE LA ESCALA DE ALEXITIMIA DE TORONTO DE 20 ÍTEMS EN PACIENTES ESPAÑOLES CON TRASTORNO POR USO DE SUSTANCIAS

RESUMEN

La alexitimia es altamente prevalente en pacientes con trastorno por uso de sustancias (TUS) y ha sido relacionado con la patogénesis y la evolución del TUS. Sin embargo, el instrumento más frecuentemente usado para la medición de la alexitimia (la Escala de Alexitimia de Toronto de 20 ítems - TAS-20) ha sido poco estudiado en cuanto a sus propiedades psicométricas en pacientes con TUS. Solamente cinco estudios han evaluado las características psicométricas de la TAS-20 en pacientes con TUS y ninguno en población española con TUS. Por lo anterior, se realizó un análisis factorial confirmatorio y de fiabilidad en una muestra de pacientes españoles con TUS (n=126; 75,4% hombres; edad media de 43,7±14,6 años). El análisis factorial confimatorio se realizó considerando que la TAS-20 tiene una estructura de tres factores (Dificultad para Identificar Sentimientos [DIF]; Dificultad para Describir Sentimientos [DDF]; Pensamiento Orientado hacia lo Externo [EOT]). En general, la TAS-20 tiene una

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propiedades psicométricas adecuadas en pacientes españoles con TUS. Sin embargo, el modelo clásico de tres factores de la TAS-20 se ajusta solo moderadamente bien en pacientes españoles con TUS, siendo los factores DIF y DDF los constructos fiables y válidos, mientras que el factor EOT necesita más investigación y debe analizarse con cautela en pacientes con adicciones.

Palabras claves. Alexitimia; Análisis factorial confirmatorio; Psicometría; Español; Trastorno por uso de sustancias; Escala Toronto de Alexitimia.

INTRODUCTION

Alexithymia refers a multidimensional trait that involves difficulties recognizing and/or describing feelings, difficulties differentiating feelings from bodily perceptions, a decrease in or absence of symbolic thinking, and an externally oriented cognitive style[1–4]. Alexithymia has been found in association with several psychiatric disorders, including substance use disorders (SUDs)[4–8]. SUD patients have been found to have higher levels of alexithymia; when analyzed as categorical, the prevalence of alexithymia has been reported to be as high as 67% in patients with SUDs[6,9]. In addition, alexithymia has been implied in the pathogenesis, cravings, comorbidities, and treatment outcomes related to SUDs[5,6,10–12].

Due to clinical and research implications, several instruments for measuring alexithymia have been developed[13]. The 20-item Toronto Alexithymia Scale (TAS-20) is the most known and widely used instrument and is considered the "gold standard" for alexithymia evaluation[2,14–16]. The authors of TAS-20 have recommended the use of confirmatory factor analyses (CFAs) to evaluate the validity of TAS-20 in different cultures and samples[17,18]. Accordingly, the reliability and validity of this scale have been clearly demonstrated with clinical and nonclinical samples in more than 30 languages and cultures [15,17–22]. CFAs have established (although controversial) that the structure of TAS-20 involves three factors: difficulty identifying feelings (DIF), difficulty describing feelings (DDF), and externally oriented thinking (EOT)[2,14–16,18,23]. It is important to note that a significant correlation has been found between DIF and DDF correlate; conversely, EOT has lower correlations with DIF and DDF (in clinical samples)[2,15,19,24]. Furthermore, some studies have reported the low internal reliability of EOT, especially in translated versions of the TAS-20[15,21,25]. Notably, a recent meta-analytic confirmatory factor analysis evaluated the dimensionality of TAS-20 using summary data from 62 studies, comprising more than 69000 subjects, and concluded that the three-factor approach to analyzing the TAS-20 fits better than any other solution[23].

TAS-20 has been used with samples of patients with alcohol use disorder and other SUDs, but few studies have performed CFAs to assess the psychometric properties and validity of TAS-20. To our knowledge, only five studies have evaluated TAS-20 using CFA, with samples comprised exclusively of patients with SUDs or alcohol use disorder (in English, Farsi, and Polish)[19,24–27]. Other CFAs have been performed with mixed psychiatric samples, which included patients with SUD[20,21,28,29]. Despite TAS-20 generally showing good psychometric properties (internal consistency, homogeneity, and construct validity) [19,21,25,26], there are still doubts about the use of factor models to assess SUD patients[20,24]. Plus, there are no CFA-based studies of TAS-20 in the context of the Spanish population with SUDs. Martínez-Sánchez (1996) translated TAS-20 into Spanish[30], and Páez et al. (1999) evaluated it using CFA with a Spanish population without any psychiatric disorders from two regions of Spain, which revealed a consistent performance of the scale and the three-factor model[22]. Although CFAs have been used with other Spanish-speaking populations in Latin America, none of the studies considered patients with SUDs[31–33]. This reveals a gap in research, as it is extremely important to determine the validity and reliability of psychological scales and instruments adapted for different populations, settings, languages, and cultures[17,34].

Due to the increasing interest in and prevalence of alexithymia in patients with SUDs, as well as the necessity for a precise instrument to assess alexithymia and compare the results with other investigations worldwide, the present study aimed to examine the scale's internal accuracy and reliability with a sample of Spanish SUD patients.

METHODS

Participants and procedures

This study was conducted in an outpatient SUD treatment center in Barcelona (Spain) from January 2018 to January 2019. Patients who had started a new treatment process and fulfilled the following inclusion criteria were considered for the study: patients over 18 years of age, meeting the SUD criteria given by the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5)[35], actively consuming substances, and able to understand and provide written informed consent prior to participation. The exclusion criteria were as follows: cognitive impairments, language barriers or insufficient fluency in Spanish, and current participation in any pharmacological trials. The study's objectives and methodology were thoroughly explained to the

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selected patients, and their doubts were resolved. Finally, the patients who were willing to participate signed an informed consent document. No financial compensation was provided to the participants. This study was approved by the hospital's ethics committee according to the World Medical Association's Declaration of Helsinki.

Measures

Sociodemographic and clinical variables

A specific questionnaire was designed ad hoc to collect and systematize data related to the participants' sociodemographic and SUD features.

Toronto Alexithymia Scale

The Toronto Alexithymia Scale is an instrument that measures alexithymia by using 20 self-reported items rated from 1 (*strongly disagree*) to 5 (*strongly agree*). The higher the total score of the items, the greater the level of alexithymia[14,16]. Several studies have described the three-factor structure of TAS-20 (comprising DIF, DDT, and EOT) with clinical and nonclinical samples[14,15,24]. The Spanish version of the scale was used in the present study; its psychometric properties have been demonstrated by an exploratory factor analysis and a CFA of the general population to be similar to the original version[22,30]. Martínez-Sanchez (1996) reported a Cronbach's alpha value of 0.78 and a high test-retest reliability ($r = 0.716$; $p < .001$). Furthermore, the three-factor structure seen in the original version has also been found in the Spanish version via factor analyses[22,30].

Statistical analyses

As recommended by the original developers of TAS-20 and with the aim of comparing the results with those of past studies, a CFA was performed[14,15,18]. Specifically, a confirmatory maximum likelihood (ML) estimation was conducted. CFA offers an accurate assessment of the hypothetical or suggested factorial structure by using a diverse set of statistical tests, indicators, and indices[18,36,37]. As there is no gold standard for fit indices, the indices employed in previous CFAs of TAS-20 with nonclinical and clinical (SUD patients) samples were used in this study, namely the chi-square/degrees-of-freedom ratio (χ^2/df) ratio < 3, goodness-of-fit index (GFI) > 0.85, root mean square error of approximation (RMSEA) < 0.08, comparative fit index (CFI) > 0.90, and Tucker–Lewis index (TLI) > 0.90[36,38,39]. Despite the controversy regarding the use of the χ^2/df ratio, due to the ratio being influenced by sample size, it has long been employed as a fit indicator in CFAs of TAS-20 and was, therefore, considered in the present study[14,16,17,36,39]. RMSEA, CFI, and TLI are scarcely affected by sample size, while GFI is dependent on sample size[36,37,39,40]. Additionally, RMSEA is highly recommended for research on personality traits[40]. To compare the results of the present analysis with past CFAs of nonclinical (validation studies) and clinical SUD samples, the following factor models were considered:

- The unidimensional model (Model 1) included all 20 items of the Toronto Alexithymia Scale.
- The two-dimensional model (Model 2) considered DIF and DDF as a single factor (items 1–4, 6, 7, 9, 11–14, 17) and EOT (items 5, 8, 15, 16, 18–20).
- The three-dimensional model (Model 3) included DIF (1, 3, 6, 7, 9, 13, 14), DDF (items 2, 4, 11, 12, 17), and EOT (items 5, 8, 15, 16, 18–20).

These models were chosen after analyzing the most common models used in past SUD research[19,20,23–26,28,29] and past CFAs of the Spanish version of TAS-20[17,22]. Furthermore, the expected cross-validation index (ECVI) was used to choose the best models from those analyzed, taking into account that the lowest ECVI values would represent the best models[39].

The internal reliability of TAS-20 was evaluated by calculating Cronbach's alpha coefficients for each of the three factors and the scale as a whole. Pearson's correlation was also performed for the three factors and total TAS-20 score. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant. Although full information was available, a pairwise method was administered if it was needed. The CFA was conducted using JASP version 0.04.01, while all other analyses were executed using the SPSS version 21.

RESULTS

The initial screening revealed 204 potential subjects; 78 were excluded (no active substance use in 26 cases, language barriers in 21 cases, and lack of willingness to participate in 31 cases), and the final sample consisted of 126 patients. 75.4% were male, and the mean age was 43.7 ± 14.6 years. 86.8% had completed less than 8 years of education, and 67.7% were employed. The patients had a lifetime history of SUD in the following order of frequency (excluding tobacco): alcohol use disorder (62.8%), cocaine use disorder (61.7%), cannabis use disorder (60.6%), opioid use disorder (21.3%), and benzodiazepine use disorder (19.2%). Note that 57.4% of the sample used two or more substances.

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In the CFA, Model 1 fit only two of the five criteria (χ^2/df ratio and GFI), while Model 2 and Model 3 fit three of the five criteria (χ^2/df ratio, GFI, and RMSEA; see Table 1 for the results and comparisons with previous studies). The ECVI values were 3.502 for Model 1, 3.338 for Model 2, and 3.298 for Model 3. The factor loadings for each

Table 1 Current results and comparisons with other studies (general populations and patients with SUD in independent studies).

Study	Language (country)	Substance	Model factors	χ^2	*df*	χ^2/df	GFI	RMSEA	TLI	CFI
General population (validation studies)										
Bagby et al., 1994	English (Canada)	-	3 (Theorical)	Non-significant			>0,85			
			3	502,85	167	3,01	0,886			
Parker et al., 2003	English (Canada)	-	3 (Theorical)				>0,90	<0,08		>0,90
			3				0,98	0,060		0,97
Taylor et al., 2003[a]		-	3 (Theorical)			<5 (preferable <2)	≥0,85	≤0,08	≥0,80	
Páez et al., 1999	Spanish (Spain)	-	3	707,49	167	4,24	0,90			
Patients with any SUD										
Besharat, 2008	Farsi (Iran)	Any SUD	3				0,93	0,050	0,93	
Bressi et al., 1996	Italian (Italy)	Mixed sample (no specified %)[b]	3				0,95		0,90	
Cleland et al., 2005	English (USA)	Any SUD	2	400,62	169	2,37		0,080		0,81
			3	341,44	167	2,04		0,070		0,86
Haviland & Resie, 1996	English (USA)	Any SUD	3	501,36	167	3,00	0,80			
Loas et al., 2001	French (France)	Mixed sample (56.4% with SUD)[b]	2	596,51	169	3,52	0,91			
			3	557,41	167	3,34	0,92			
Meganck et al., 2008	Dutch (Belgium)	Mixed sample (3% with SUD)[b]	1	918,35	170	5,40		0,100		0,80
			2	672,23	169	3,98		0,086		0,86
			3	453,71	167	2,72		0,065		0,92
Müller et al., 2003	German (Germany)	Mixed sample (no specified %)[b]	1	373,1	170	2,19	0,84	0,077		
			2	320,4	169	1,90	0,87	0,066		
			3	309,3	167	1,85	0,87	0,065		
Scigala et al., 2020	Polish (Poland)	Alcohol	1	536,28	170	3,15		0,112	0,73	0,76
			2	1018,22	169	6,02		0,101	0,86	0,87
			3	506,49	167	3,03		0,108	0,75	0,78
Thorberg et al., 2010	English (Australia)	Alcohol	1	547,11	171	3,20		0,100		0,69
			2	348,73	165	2,11		0,070		0,85
				312,96	164	1,91		0,060		0,88
Current study: Spanish patients with SUD										
Current study	Spanish (Spain)	Any SUD	1	321,21	170	1,89	0,959	0,084	0,774	0,798
			2	298,65	169	1,77	0,964	0,078	0,805	0,826
			3	289,50	167	1,73	0,964	0,076	0,813	0,836

[a] Review article of the validations of TAS-20 using CFA in 18 languages and 19 countries.

[b] Samples included patients with psychiatric disorders and SUD

CFI: Comparative Fit Index; GFI: goodness-of-fit index; RMSEA: root mean square error of approximation; SUD: substance use disorder; TLI: Tucker–Lewis Index; USA: United States of America.

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model are given in Table 2. It is specifically important to note that in Model 3, all DIF as well as DFF (except item 4) factor loadings were higher than 0.35 and significant. Four of the eight EOT loadings were less than 0.35 (items 5, 8, 15, 20); three items were not statistically significant, which means that these items scarcely explained the variance (items 8, 15, 20).

Table 2 Factor loadings according to models tested.

Items	Model 1	Model 2	Model 3
	DIF+DDF+EOT	DIF+DDF	DIF
1	0,984	0,987	0,984
3	0,873	0,877	0,116
6	0,770	0,778	0,775
7	0,933	0,921	0,925
9	1,048	1,060	1,070
13	0,980	0,975	0,978
14	0,788	0,790	0,793
			DDF
2	0,899	0,898	0,965
4	0,091*	0,076*	0,144*
11	0,542	0,539	0,640
12	0,642	0,642	0,697
17	0,633	0,622	0,656
		EOT	EOT
5	0,216	0,349	0,128
8	0,578	-0,057*	-0,054*
10	-0,074*	0,872	0,855
15	0,302	0,137*	0,151*
16	0,261	0,365	0,353
18	0,255	0,716	0,706
19	-0,043*	0,668	0,682
20	0,105*	-0,180*	-0,187*

* *p >0,05*, todos all other items were statistically significant.

DIF: difficulty identifying feelings; DDF: difficulty describing feelings; EOT: externally oriented thinking.

As seen in Table 3, all factors were highly correlated. According to Taber (2018)[41], Cronbach's alpha coefficient for the TAS-20 total score was robustly reliable in the current research (see Table 3). However, when each factor was analyzed in the present study, DIF was found to be robustly reliable, while DDF was moderately reliable and EOT was not satisfactory.

Table 3 Means, Cronbach's alpha reliability coefficients, and Pearson correlations for the TAS-20

	Media±DS	Alfa de Cronbach	DIF	DDT	EOT
DIF	19,99 ± 6,84	0,881	-		
DDF	14,60 ± 4,36	0,620	0,680*	-	
EOT	22,67 ± 4,48	0,499	0,391*	0,367*	-
Total	57,27 ± 12,84	0,831	0,901*	0,830*	0,682*

*$p < 0,01$

DIF: dificultad en identificar emociones; DDF: dificultad en describir emociones; EOT: pensamiento orientado a lo externo.

DISCUSSION AND CONCLUSIONS

To our knowledge, this is the first study to provide information on the psychometric properties of TAS-20 in the context of Spanish patients with SUDs. In general, the results are similar to other studies of clinical and nonclinical populations, since TAS-20 is a reliable and valid instrument[15]. The Spanish version of TAS-20 was found to have internal consistency, reliability, and validity when tested with a sample of SUD patients. Furthermore, the CFA revealed the better fit of the original three-factor structure than the other models analyzed, even though not all expected fit indices were achieved. However, important issues arise when deeply analyzing this three-factor model; these have been described in past studies conducted with SUD patients across different cultures and languages (especially regarding the EOT factor)[19–21,24,25,29].

DIF was the most robustly reliable factor in this study, and it had the best loading profile of all three factors (also, all DIF items were significant). DDF was found to be moderately reliable; all its items were significant and the loadings were higher than the cut-off value, except for item 4. This DDF loading profile is very similar to that reported by Thorberg et al. (2010), whose research focused on alcohol-dependent patients , item 4 loaded lower than the cut-off point and was not significant [24]. Surprisingly, the current study found the reliability of DDF to be slightly inferior (0.62) to those of previous investigations on SUD patients, which reported Cronbach's alpha values between 0.66 and 0.74[19,20]. Notably, several issues with the EOT factor were found in the current study. It was not reliable, and problems arose with the loadings in the CFA (not to mention the significance profile of those loadings). This is in line with

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past reports of EOT's poor internal consistency in clinical and nonclinical samples across several languages and cultures[15,17,20]. Furthermore, only two studies with samples of SUD patients reported Cronbach's alpha values higher than 0.60[25,26]. Some authors have argued that these issues may be due to instrument design, as they occur globally across languages, cultures, and samples[29]. From a cross-cultural perspective, some EOT items may be influenced by social and cultural factors due to culture shapes how emotions/feelings are shared or the appropriate behaviors for communicating feelings (e.g., items 15 or 18) [15,23,42]. In addition, some authors have argued that the language and conceptual ideas of EOT items are challenging to translate and adapt[15,42]. Nevertheless, the DIF and DDF results of the present study are in line with previous studies; both components are usually described as the most reliable and valid factors of TAS-20 in clinical and nonclinical populations [15,19,20,24–26]. Therefore, DIF and DDF can be considered the best factors for characterizing alexithymia in SUD patients when TAS-20 is used[19,24], while EOT should be cautiously interpreted[24,27]. Notably, some authors have proposed modifying the EOT factor when TAS-20 is applied to samples of SUD patients [24,25]. Furthermore, keeping in mind that TAS-20 was originally created for analyzing the total score obtained [15], a recent study conducted by the original developers of TAS-20 concluded that the scale is indicative of a single construct in a *bifactor model*[43]. Therefore, using individuals factors of TAS-20 may be questionable, and the total score should primarily be used in research and clinical practice[43].

This study had certain limitations. First, the sample size was small; however, several CFAs of TAS-20 have been conducted with similar or even smaller samples[17]. Nevertheless, to compensate for this, fit indices that are scarcely affected or unaffected by sample size were used. Second, only three models (the most analyzed factor models in the literature) were analyzed. While other researchers have executed several CFAs with different models, these have not been replicated across cultures[19,20]. In contrast to the above limitations, however, this study was the first to perform a CFA of TAS-20 with Spanish SUD patients. Furthermore, all participants met the DSM-5 criteria for SUDs, whereas previous studies used former criteria or did not specify diagnosis criteria[19,24–26,28].

Based on the results of the present study, it can be concluded that the Spanish version of TAS-20, which was developed by Martínez-Sánchez (1996)[30], has relaible psychometric properties in the context of Spanish patients with SUDs. However, the three-factor model of this instrument does not seem to be fully applicable to Spanish patients with SUD. Therefore, factor-based interpretations of this instrument should primarily rely on DIF and DDF. Additionally, as previous studies have stated[24,25], further research on the use of TAS-20 for assessing SUDs is needed, and the EOT factor should be cautiously analyzed in patients with addictions.

CONFLICT OF INTERES

Dr. Palma-Álvarez has received fees as speaker for Angelini, Casen Recordati, Exeltis, Lundbeck, MSD, Mundipharma, and Takeda. Dr. Ros-Cucurull has received fees as speaker for Janssen-Cilag, Lundbeck, Otsuka, Pfizer, Lilly, Servier, Rovi, Juste. She has received financial compensation for projects with Lundbeck, Esteve, Pfizer, Rovi, Exeltis, Servier, and Eisai. She has received financial compensation for her participation as a board member of Janssen-Cilag. She has no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict. Dr. Ramos-Quiroga has received fees as speaker from Janssen-Cilag, Shire, Lilly, Ferrer, Medice, and Rubió. He has received research funding from Janssen-Cilag, Lilly, Ferrer, Lundbeck, and Rubió. Dr. Grau-López has received fees to give talks for Janssen-Cilag, Lundbeck, Servier, Otsuka, and Pfizer. Dr. Roncero has received fees as speaker for Janssen-Cilag, Ferrer-Brainfarma, Pfizer, Indivior, Lundbeck, Otsuka, Servier, GSK, Rovi, Astra, Gilead, MSD, Sanofi, and Exeltis. He has received financial compensation for his participation as a board member of JanssenCilag, Lundbeck, Gilead, MSD, Indivior, and Mundipharma. He has carried out the PROTEUS project, which was funded by a grant from Reckitt-Benckiser/Indivior. He received a medical education grant for Gilead. The other authors do not have any potential conflict of interest.

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