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Psychometric properties of a revised Spanish 20-item Toronto Alexithymia Scale adaptation in multiple sclerosis patients

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KEYWORDS

20-item Toronto
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Abstract There have been a small number of investigations of alexithymia in multiple sclerosis (MS) using the 20-item Toronto Alexithymia Scale (TAS-20). However, the TAS-20 factor structure has not yet been evaluated in a MS patient sample, and earlier Spanish translations of this instrument require some improvement. We aimed to evaluate the factorial validity and reliability of an improved Spanish translation of the TAS-20 (the TAS-20-S). The TAS-20-S was completed by 221 MS patients. Confirmatory factor analysis was used to compare the fit of six different factor models. Internal consistency and retest reliability coefficients were also computed. The correlated three-factor model and the higher-order factor model made up of *Difficulty Identifying Feelings*, *Difficulty Describing Feelings*, and *Externally Oriented Thinking* achieved the best fit. Alpha coefficients ranged between .87 and .67; mean inter-item correlations ranged between .48 and .20; and retest correlations after 6 months ranged between .61 and .52. A high degree of alexithymia was present in 18.1% of the sample. Reliability and the traditional three-factor structure were demonstrated for the TAS-20-S, which can now be recommended for assessing an aspect of emotional processing in MS patients.

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PALABRAS CLAVE

Escala de Alexitimia
de Toronto;
Validez factorial;
Esclerosis múltiple;

Resumen En la esclerosis múltiple (EM) son escasas las investigaciones centradas en evaluar la alexitimia con la Escala de Alexitimia de Toronto (TAS-20). A pesar de ello, no se ha evaluado aún su estructura factorial en dicha población y, además, las anteriores traducciones al español necesitan modificaciones. Los objetivos del presente estudio fueron evaluar la validez factorial y la fiabilidad de una traducción mejorada en español de la TAS-20 (la TAS-20-S), la cual fue administrada en una muestra de 221 pacientes con EM. Se realizaron análisis factoriales confir-

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Prevalencia;
Estudio instrumental

matorios para comparar el ajuste de seis modelos factoriales. También se calcularon coeficientes de consistencia interna y de fiabilidad test-retest. Los modelos trifactorial correlacionado y el de orden superior conformados por *Dificultad en Identificar Sentimientos*, *Dificultad en Describir Sentimientos* y *Pensamiento Externamente Orientado* lograron el mejor ajuste. Los coeficientes alfa oscilaron entre 0,87 y 0,67; las correlaciones medias inter-ítem entre 0,48 y 0,20; y las correlaciones test-retest tras 6 meses oscilaron entre 0,61 y 0,52. El 18,10% de la muestra presentó niveles elevados de alexitimia. La TAS-20-S presentó una adecuada fiabilidad así como la tradicional estructura trifactorial, por lo que su uso es ahora recomendable para evaluar un aspecto del procesamiento emocional en EM.

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Alexithymia is a multifaceted dimensional personality construct that reflects a disturbance in affective information processing and social-cognitive functioning (Taylor & Bagby, 2012; Wingbermühle, Theunissen, Verhoeven, Kessels, & Egger, 2012). This construct encompasses difficulties in identifying subjective feelings and differentiating between feelings and the somatic sensations associated with emotional arousal, difficulty verbalizing emotional feelings to others, a restricted imaginal capacity, and an externally-oriented style of thinking (Taylor, Bagby, & Parker, 1997). There may also be associated impairments in recognizing emotions in human facial expressions, as demonstrated in studies with healthy volunteers (Kano, Fukudo, & Gyoba, 2003) and multiple sclerosis patients (Prochnow et al., 2011).

Despite empirical evidence that alexithymia, and other related concepts, are associated with a wide variety of medical and psychopathological disorders and symptomatology (Balluerka, Aritzeta, Gorostiaga, Gartzia, & Soroa, 2013; Pascual, Etxebarria, Cruz, & Echeburúa, 2011; Taylor & Bagby, 2012; Taylor et al., 1997), the construct has been scarcely investigated in multiple sclerosis (MS). This is somewhat surprising given recent findings that this personality trait is a strong predictor of the most quality-of-life disabling condition in MS, namely, depression (Bodini et al., 2008; Feinstein, 2011; Gay, Vrignaud, Garitte, & Meunier, 2010). The strong association between depression and alexithymia in MS might be explained partly by evidence that negative emotions are processed predominantly by neocortical areas in the right hemisphere (Adolphs, Jansari, & Tranel, 2001), which have been found to show reduced activation in response to emotional stimuli in individuals with high degrees of alexithymia (Kano et al., 2003), thereby contributing to deficits in the cognitive processing and regulation of negative affects.

The objectives of the few empirical studies that assessed alexithymia in MS patients were to identify the facets of the construct that are most relevant to MS (Bodini et al., 2008; Chahraoui et al., 2008; Gay et al., 2010), and to estimate the prevalence of alexithymia among MS patients, although the samples in these studies were small in size (58 to 115 patients). In pursuing these objectives, alexithymia was measured with the 20-item Toronto Alexithymia Scale (TAS-20) (Bagby, Parker, & Taylor, 1994), which is the most frequently and widely-used instrument for assessing the construct (Taylor & Bagby, 2012). This self-report scale is

comprised of three factor scales that assess difficulty identifying feelings, difficulty describing feelings to others, and externally-oriented thinking. The TAS-20 has been translated into more than 24 different languages, and validated in clinical and/or nonclinical samples in Western, Eastern-European, East-Asian, and Middle-Eastern countries (Taylor & Bagby, 2012; Taylor, Bagby, & Parker, 2003).

To our knowledge, there are three existing Spanish adaptations of the TAS-20, two of which were developed in Latin-American countries - Mexico (Pérez-Rincón et al., 1997) and Peru (Loiselle & Cossette, 2001) - and one developed in Spain (Martínez-Sánchez, 1996; Páez et al., 1999). These adaptations of the scale have certain limitations. For example, the Mexican and Peruvian versions present some dialectical particularities when compared with the Spanish spoken in Spain. In addition, the Latin-American versions, and also the version developed in Spain, contain some items whose back-translation does not adequately reflect the meanings of the original English version of the items. Moreover, the indices and criteria used to evaluate goodness of fit of the three-factor model of the Spanish translations of the TAS-20 do not meet the standards that are currently employed in psychometric studies and recommended in Hu and Bentler's (1999) guidelines.

Some investigators have obtained a different factor structure for the TAS-20 in studies with patient samples (Kooiman, Spinhoven, & Trijsburg, 2002; Müller, Bühner, & Ellgring, 2003; Pérez-Rincón et al., 1997), suggesting that the factor structure might depend on the specific sample analyzed. Although a few studies have used the TAS-20 to assess alexithymia in MS patients, the reliability and three-factor structure of the scale have not yet been evaluated in this population. It is important to address this deficiency not merely to satisfy professionals in the measurement field (Carretero-Dios & Pérez, 2007), but also for clinical reasons as evidence for the validity of the scale will allow researchers to identify which of the TAS-20 factor scales are differentially related to other clinical outcomes in a more meaningful way (Briggs & Cheek, 1986). There is evidence, for example, that the *Difficulty Identifying Feelings* factor scale of the TAS-20 is stronger than the total scale in predicting fatigue and depression in MS patients (Bodini et al., 2008).

Given the above considerations, the aim of this instrumental study (Montero & León, 2007) was to work collaboratively with the developers of the original English

version of the TAS-20 to develop a revised and improved Spanish translation of the scale, and to evaluate its reliability and factor structure in a sample of patients with MS. This is the first study to assess alexithymia in a Spanish MS sample.

Method

Participants

Two hundred and sixty-five outpatients with MS who came for their routine medical checkups at the University Hospital Virgen Macarena in Seville, Spain, were invited to participate in this study in 2011. However, 44 patients were not enrolled because they declined (14 patients) or lacked time to participate (7 patients); or because of the following exclusion criteria: cognitive impairment (13 patients); neurological comorbid conditions (5 patients); major psychiatric disorders (1 patient with chronic psychosis) or a significant mood disturbance at the time of assessment (2 patients); and other special conditions (2 patients pregnant). The final sample was comprised of 221 participants (83.4%), who were all diagnosed with multiple sclerosis according to the 2010 revised McDonald's criteria (Polman et al., 2011). The participants were involved through the convenience sampling technique. Sociodemographic data and information about the course of MS, functional disability according to the Expanded Disability Status Scale (EDSS), and pharmacotherapy were collected. The clinical and sociodemographic characteristics are presented in Table 1.

Instruments

The TAS-20 is a 20-item self-report instrument with each item scored on a 5-point Likert scale (Bagby et al., 1994). Total scores range between 20 and 100 with higher scores indicating greater degrees of alexithymia. The developers of the scale recommend the following empirically established cutoff scores: nonalexithymic cases: ≤ 51 ; borderline cases: 52-60; alexithymic cases: ≥ 61 (Taylor et al., 1997). The English version of the TAS-20 was adapted to the Spanish language in an iterative-process (Carretero-Dios & Pérez, 2005). First, the original English version was translated into Spanish by several university researchers in the field of clinical psychology, and with expertise in construction and adaptation of questionnaires, who also reviewed the existing Spanish adaptations of the TAS-20 and made corrections to items they thought had been inadequately translated. For example, a frequent mistake in translation was the use of "explain feelings" as a synonym for "describe feelings" when both verbs differentiate between a deeper emotional processing - analyze or explain - against a lighter one - describe -, and precisely the latter was the alexithymic characteristic of interest. Given the importance of reviewing the adequacy of a translation with statistical methods (Sireci, Yang, Harter, & Ehrlich, 2006), the new Spanish translation of the TAS-20 was also influenced by considering the inadequate psychometric functioning of some items in the earlier Spanish versions. Second, a Spanish-English bilingual PhD psychologist, who was familiar with the Spanish and

American cultures but not given access to the original English version of the TAS-20, made a back-translation of the new Spanish translation. Finally, this back-translated English version was then reviewed and compared with the original English version by the developers of the TAS-20. Moreover, a bilingual research assistant working in Canada also compared this back-translation with the Spanish version. Some further modifications were made until a consensus was reached about the final translation. The final Spanish adaptation of the scale (the TAS-20-S) was then pilot tested with 20 patients; the items were read to them to check if the items were correctly understood and to identify any difficulties in answering them. Only 8 items remained with the same or similar translation to the first version of the TAS-20 adapted in Spain.

Procedure

All patients were assessed individually by a trained psychologist (EFJ) during their routine checkups at the hospital after written informed consent was obtained. The TAS-20-S items were read by such psychologist, a method that has been used in other studies (Pérez-Rincón et al., 1997), given the MS patients' difficulties in understanding some of the items when they read the questionnaires by themselves. This procedure allowed us to avoid response tendencies and the problems with negatively-worded items reported in other studies (Loiselle & Cossette, 2001). The writing of this manuscript has followed the Hartley's (2012) guidelines. The study was approved by the Ethics Commission of Research of the University Hospital Virgen Macarena.

Data analysis

Confirmatory factor analyses were conducted using the matrix of polychoric correlations, as was carried out in other studies (Gorostiaga, Balluerka, Aritzeta, Haranburu, & Alonso-Arbiol, 2011), with Weighted Least Squares Means and Variances (WLSMV) estimation (Flora, LaBrish, & Chalmers, 2012). The goodness-of-fit indices computed and presented according to Hammervold and Olsson's (2012) classification were as follows: chi-square goodness-of-fit index; Weighted Root Mean Square Residual (WRMR) was selected as a measure of *absolute fit* and *residual-based fit*; the Tucker-Lewis Index (TLI) and the Comparative Fit Index (CFI) were selected as measures of *incremental fit*; and the Root-Mean-Square Error of Approximation (RMSEA) along with its 90% confidence interval was chosen as a measure of *parsimonious fit*. All these indices were interpreted simultaneously to overcome the limitations of each one (Carretero-Dios & Pérez, 2005; Hammervold & Olsson, 2012). The following standards were used to assess the model fit: a non-significant value of chi-square; WRMR ≤ 1 (Yu, 2002); TLI and CFI $\geq .90$ (Marsh, Hau, & Wen, 2004); and RMSEA $< .08$ (MacCallum, Browne, & Sugawara, 1996). Each of the TAS-20 items was specified as an indicator of only a single factor.

The following six different factor models were tested and compared:

- 1) A unidimensional model in which all items load on one unique factor (Lambert et al., 1999).

Table 1 Clinical and sociodemographic characteristics of the multiple sclerosis patients (n = 221).

	Mean (SD)
Age (in years)	40.61 (9.65)
Months since diagnosis	101.43 (75.28)
Expanded Disability Status Scale (EDSS)	3.04 (1.83)
	% (n)
EDSS 0	4.10 (9)
Mild EDSS level (1-3.5)	61.50 (136)
Moderate EDSS level (4-6.5)	30.80 (68)
Severe EDSS level (> 7)	3.60 (8)
<i>Multiple sclerosis course</i>	
Relapsing remitting	77.80 (172)
Secondary progressive	17.70 (39)
Primary progressive	4.50 (10)
Disease modifying therapy: yes/no	76.90 / 23.1 (170 / 51)
Antidepressant medication: yes/no	27.10 / 72.9 (60 / 161)
Anxiolytic medication: yes/no	25.80 / 74.2 (57 / 164)
Female/male gender	63.03 / 36.7 (140 / 81)
<i>Marital status</i>	
Partner (married or stable relationship)	78.30 (173)
Single	14.09 (33)
Separated/divorced	5.90 (13)
Widow	0.90 (2)
<i>Educational level*</i>	
High	549.50 (110)
Secondary	29.90 (66)
Primary	20.4 (45)
<i>Employment status</i>	
Permanent/transient disability	35.30 (78)
Working	34.40 (76)
Unemployed/students	15.4 (34)
Sick leave	7.20 (16)
Adapted work	2.30 (5)
Housewives	1.80 (4)
Retired	0.50 (1)

*High level: completed university or a high level vocational training program; Secondary level: completed high school or a medium level vocational training program; Primary level: did not complete high school.

Note. SD = standard deviation.

- 2) An oblique two-factor model in which *Difficulty Identifying Feelings* (DIF) and *Difficulty Describing Feelings* (DDF) belong to the same factor (DIDF) and *Externally Oriented Thinking* (EOT) is isolated in another factor (Kooiman et al., 2002; Pérez-Rincón et al., 1997).
- 3a) The traditional oblique three-factor model made up of DIF, DDF and EOT, according to the developers of the TAS-20 (Bagby et al., 1994).
- 3b) A comparable hierarchical model was also tested in which DIF, DDF, and EOT were specified to indicate a second-order factor: *Global Alexithymia*.
- 3c) An alternative oblique three-factor model with DIF and DDF belonging to the same factor (DIDF); and EOT divided into two separate factors: *Pragmatic Thinking* (PR) - items 5, 8 and 20 - and *Lack of Importance of Emotions* (IM) - items 10, 15, 16, 18, and 19 (Müller et al., 2003).
- 4) An oblique four-factor model with DIF, DDF, PR and IM as separate factors (Müller et al., 2003).

To assess internal consistency reliability of the TAS-20-S, alpha coefficients and mean inter-item correlations (MICs) were computed for the best fitting factor model. A standard of .70 or higher was set for alpha coefficients and an optimal range of .20 to .40 for MICs (Briggs & Cheek, 1986). Finally, 85 of the participants were enrolled to evaluate retest reliability; these patients completed the TAS-20-S approximately 6 months ($M = 5.70$ months, $SD = 0.99$) after its initial administration. No missing data were found and no data transformations were carried out. All analyses were conducted with the program Mplus 6.1 (Muthén & Muthén, 2011) and the IBM-SPSS 19.0 statistical software package (SPSS, Inc., Chicago, Ill) for Windows PC.

Table 2 Standardized factor loadings for each model.

Item	Model 1		Model 2			Model 3a		Model 3c			Model 4			
			DIDF	EOT	DIF	DDF	EOT	DIDF	PR	IM	DIF	DDF	PR	IM
1	.853		.857		.872			.857			.872			
3	.548		.554		.571			.555			.574			
6	.806		.812		.824			.812			.825			
7	.684		.692		.711			.692			.710			
9	.832		.838		.855			.838			.855			
13	.731		.738		.757			.738			.755			
14	.730		.735		.751			.736			.751			
2	.793		.799			.877		.799				.876		
4	.617		.623			.665		.622				.666		
11	.597		.601			.648		.600				.648		
12	.420		.419			.456		.418				.456		
17	.564		.563			.616		.562				.615		
5	.263			.454			.446		.418				.417	
8	.469			.710			.698		.650				.651	
10	.237			.459			.464			.497				.497
15	.207			.339			.348			.364				.369
16	.287			.463			.459			.488				.469
18	.391			.528			.543			.548				.559
19	.195			.405			.416			.444				.454
20	.406			.640			.634		.593				.593	

Note. DIDF = Difficulty Identifying Feelings together with Difficulty Describing Feelings; DIF = Difficulty Identifying Feelings; DDF = Difficulty Describing Feelings; EOT = Externally Oriented Thinking; PR = Pragmatic Thinking; IM = Lack of Importance of Emotions. All factor loadings are statistically significant, $p < .001$.

Results

No statistically significant differences were found between the participants in the study and the nonparticipants ($n = 44$) in the variables of age [$F_{(1, 263)} = 0.118$, $p = .731$], gender [$\chi^2_{(1, 265)} = 0.104$, $p = .747$], EDSS [$F_{(1, 53.711)} = 2.895$, $p = .095$], and number of months since MS diagnosis [$F_{(1, 263)} = 0.473$, $p = .492$].

In the participant sample, the mean total TAS-20-S score was 46.68 ($SD = 14.38$); alexithymic cases: 18.1% of sample ($n = 40$), mean 68.15 ($SD = 5.24$); borderline cases: 20.4% of sample ($n = 45$), mean 57.09 ($SD = 2.73$); nonalexithymic cases: 61.5% of sample ($n = 136$), mean 36.92 ($SD = 7.63$).

Confirmatory factor analysis

Factor loadings for each item across models are presented in Table 2. All items demonstrated statistically significant substantial loadings ($\geq .30$) on their specified factor across models, with the exception of model 1. In model 1, items 19, 15, 10, 5 and 16 failed to reach this minimal loading

value. Correlations among factors across models are reported in Table 3. Correlations among factors were all moderate to large in size, ranging from .29 to .82. Based on the goodness-of-fit statistics evaluated (see Table 4), models 3a, 3b, and 4 achieved reasonable model fit. However, the specified higher-order model (3b) resulted in a small non-significant negative residual variance for DDF. Fixing this value to zero (resulting in a factor loading of 1.00) resulted in a reasonably fitting model that is nearly identical to the standard three-factor model (3a). All first-order coefficients were positive and statistically significant in this case,¹ and the second-order factor loadings for DIF and EOT were .79 and .56, respectively (all $p < .001$). Model 4 demonstrated a slightly better fit than models 3a and 3b; however, the correlation > 1.0 between IM and PR (also found in model 3c) is an indication that the two factors are not statistically distinguishable, making the results of this model inadmissible.² Overall, the standardized factor loadings from the traditional three-factor model (3a) were higher in the current study in comparison to those from the previous Spanish version of the TAS-20.

Reliability

Table 5 shows the MICs and alpha coefficients for the total TAS-20-S and three factor scales for the traditional three-factor model (3a). The MICs for the total scale and the DDF and EOT factor scales are in the recommended range of .20 to .40, indicating adequate item-to-scale homogeneity. Although the MIC for the DIF factor scale is outside this

¹Due to space limitations and the fact that factor loadings of Model 3b were very similar to those of Model 3a, these coefficients are not shown in Table 2 and are available upon request.

²The correlation matrix is available upon request from the authors.

Table 3 Correlations among the factors.

	Model 2	Model 3a	Model 3c		Model 4			
	EOT	DDF	EOT	PR	IM	DDF	PR	IM
DIF	.50			.58	.43			
DIF		.82	.41			.82	.54	.29
DDF			.61				.59	.63
EOT								
PR					1.04			1.03

Note. DIF = Difficulty Identifying Feelings; DDF = Difficulty Describing Feelings; EOT = Externally Oriented Thinking; PR = Pragmatic Thinking; IM = Lack of Importance of Emotions.
All correlations are statistically significant, $p < .001$.

Table 4 Goodness-of-fit indices of the factor models.

	1	2	3a	3b	3c	4
χ^2	599.683	440.767	388.316	388.821	437.819	370.562
df	170	169	167	168	167	164
p	< .001	< .001	< .001	< .001	< .001	< .001
RMSEA	.107	.085	.077	.077	.086	.075
90% confidence	.098-.116	.076-.095	.067-.088	.067 - .087	.076 - .096	.065-.086
CFI	.864	.914	.930	.930	.914	.935
TLI	.848	.904	.920	.921	.903	.924
WRMR	1.483	1.268	1.169	1.174	1.259	1.133

Note. RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; WRMR = Weighted Root Mean Square Residual.

Table 5 Alpha coefficients and mean inter-item correlations (MIC) for the 20-item Toronto Alexithymia Scale (TAS-20-S) and its factor scales (model 3a).

Factor scales	Cronbach's α	MIC	Retest reliability
DIF	.87	.48	$r = .52, p < .001$
DDF	.72	.34	$r = .61, p < .001$
EOT	.67	.20	$r = .56, p < .001$
TAS-20-S total	.86	.22	$r = .57, p < .001$

Note. DIF = Difficulty Identifying Feelings; DDF = Difficulty Describing Feelings; EOT = Externally Oriented Thinking.

optimal range, it is between .10 and .50, which is considered acceptable. The alpha coefficients range between .72 and .86 for the full scale and DIF and DDF factor scales, but for EOT the alpha coefficient is below the criterion of .70. The retest correlations for the full scale and three factor scales are all significant.

Discussion

In this pioneering study with a multiple sclerosis patient sample, our objectives were: a) to evaluate the factor structure of an improved Spanish translation of the TAS-20,

which we named the TAS-20-S; and b) to evaluate the reliability of the TAS-20-S and its factor scales.

Regarding the first objective, the three-factor model of the TAS-20 was confirmed in the Spanish multiple sclerosis patient sample. The traditional correlated three-factor model and a higher-order factor model were the best fitting, both showing comparable results. Therefore, the factor scales *Difficulty Identifying Feelings*, *Difficulty Describing Feelings*, and *Externally Oriented Thinking* were replicated as core facets of the alexithymia construct assessed by the TAS-20 (Taylor et al., 2003). Although the use of externally imposed cutoff values to assess the goodness of fit of a model has been questioned - e.g.,

because the widely used Hu and Bentler's (1999) guidelines have sometimes been misinterpreted and considered too demanding - (Marsh et al., 2004), in the current study most goodness-of-fit indices for both three-factor models (3a and 3b) were adequate and acceptable. However, WRMR values were slightly above the criterion level of ≤ 1 , and the chi-square goodness of fit was significant for all models. Although the four-factor model showed a slightly better fit, two factors (PR and IM) were statistically indistinguishable (correlation > 1). Therefore, the differentiation of the EOT factor into two separate factor scales was not justified in this sample in contrast to results obtained in some studies conducted with samples of patients with other diagnoses (Müller et al., 2003).

The current study included the recommended incremental fit indices (TLI and CFI), which were not computed in earlier confirmatory factor analytic studies of Spanish adaptations of the TAS-20 (Loiselle & Cossette, 2001; Páez et al., 1999). These indices are currently regarded as essential for assessing goodness of fit (Hu & Bentler, 1999) because TLI and CFI are relatively unaffected by sample size, and both detect model misspecification (Jackson, Gillaspay, & Purc-Stephenson, 2009). Although the CFI and TLI values in the MS patient sample did not reach the level of $\geq .95$, which is considered acceptable according to Hu and Bentler's (1999) demanding guidelines, relaxing the criterion standard to $\geq .90$ resulted in these fit indices indicating an adequate fit (Marsh et al., 2004). Moreover, the TLI and CFI values obtained in the current study exceed values reported in earlier studies for Dutch, Italian, Japanese, and Mandarin translations of the TAS-20 (Taylor et al., 2003; Zhu et al., 2007).

As was found when an improved Greek adaptation of the TAS-20 was developed (Tsaousis et al., 2010), the values of the goodness-of-fit indices for the TAS-20-S were better than those reported for earlier Spanish versions of the scale (Páez et al., 1999), and also supported the traditional three-factor model rather than a two-factor model (Pérez-Rincón et al., 1997). Moreover, regarding the three-factor model 3a, the factor loadings of 10 of the 12 items modified were higher in the current revised Spanish version in comparison to the first Spanish version of the TAS-20 administered to samples in Spain and Mexico (Martínez-Sánchez, 1996; Páez et al., 1999). This is consistent with other studies showing that the use of both judgmental and statistical techniques to ensure item comparability across languages can improve the psychometric properties of psychological measures (Sireci et al., 2006).

The estimates of internal consistency reliability were good for the total TAS-20-S and for the DIF and DDF factor scales, with particularly high alpha coefficients for DIF and the total scale. Although the alpha coefficient for the EOT factor scale was below the recommended standard of .70, and questionable according to George and Mallery (2003), the total scale and the DDF and EOT factor scales were within the optimal range of .20 to .40 for the mean inter-item correlations (MICs), which is a more appropriate index of a scale's cohesiveness (Briggs & Cheek, 1986).

Moreover, the alpha coefficient for EOT was higher than has been reported for most other language adaptations of the TAS-20 (Taylor et al., 2003; Tsaousis et al., 2010; Zhu et al., 2007). Although the MIC for the DIF factor scale was outside the optimal range, it was less than .50, which is considered acceptable for multifactor scales (Briggs & Cheek, 1986). Thus all three factor scales of the TAS-20-S can be considered homogeneous, and can be scored along with the TAS-20-S total score in studies with MS populations.

Although retest reliability of the TAS-20-S was demonstrated over a 6-month interval, the correlations were lower in magnitude than those reported in other studies with medical patient samples and with a similar time interval between assessments. For example, the retest correlation of the total TAS-20 was .66 in a sample of women with breast cancer after a 6-month follow-up (Luminet, Rokbani, Ogez, & Jadoulle, 2007). The lower temporal stability of the TAS-20-S in the current study may possibly be accounted for by the neurodegenerative nature and variable course of MS.

The prevalence of alexithymic cases in this larger MS sample than previously investigated was 18.1% and 20.4% for borderline cases, which is in the range found in two other studies with MS patients - 13.8% in Italy (Bodini et al., 2008) and 23.2% in France (Gay et al., 2010) - using the same cut-off points. The prevalence rates of alexithymia are similar to the prevalence rates of depression in MS (Wood et al., 2013); hence the problems in emotional processing are not negligible in MS and neuropsychological interventions to address these impairments are required (Wingbermhühle et al., 2012). Other research with various clinical populations has shown that treatments aimed at reducing alexithymia can result in better biopsychosocial outcomes (Beresnevaité, 2000; Melin, Thulesius, & Persson, 2010; Tulipani et al., 2010).

In conclusion, the results of the current study support the factorial validity of the TAS-20-S and indicate that it is a reliable instrument that can be used to assess an important aspect of emotional processing in MS populations. In particular, the scale might be used to investigate the clinical relevance of each of the three facets of the alexithymia construct in MS that may suggest a need for specific treatment interventions. Further research is needed to evaluate the psychometric properties of the TAS-20-S in community and other clinical samples, including assessment of the convergent and discriminant validity of the scale³.

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³The TAS-20-S is available upon request from the authors.

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