

Artigo Original

First validity evidences of the Brazilian brief Toronto Alexitimia Scale (BbTAS-12) using Exploratory Structural Equation Modeling with a sample of adolescents

Primeiras evidências de validade da versão reduzida da Escala Toronto de Alexitimia (BbTAS-12) através da Modelagem de Equação Estrutural Exploratória com uma amostra de adolescentes brasileiros

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RESUMO

Introdução: Alexithymia é um construto de personalidade caracterizado pela incapacidade subclínica de identificar e descrever emoções e um pensamento orientado para o exterior. **Objetivo:** testar o modelo teórico tridimensional proposto por Parker et al. (1994) (DDF, DIF, EOT), quando avaliado pela versão reduzida da Escala Toronto de Alexitimia (BbTAS-12). **Método:** a BbTAS-20 foi aplicada em uma amostra de 801 adolescentes (de 13 a 19 anos), de ambos os sexos (52,1% masculino) a qual serviu para se testar suas primeiras evidências de validade, através da Modelagem de Equação Estrutural Exploratória (ESEM) e da consistência interna. **Resultados:** os resultados do modelo geral (GFI = .99; AGFI = .97; $\chi^2_{gl} = 1,14$; RMSEA = .035; PCLOSE > .5;

CFI = .98; TLI = .97), o qual explica cerca de 51% da variância do construto, confirmam a estrutura testada em três dimensões. Tanto a consistência interna da escala total ($\alpha_t = .72$; $\hat{\Omega}_{\alpha_t} = .69$) quanto as dimensões teoricamente propostas ($\alpha_{DDF} = .67$; $\hat{\Omega}_{\alpha_{DDF}} = .68$; $\alpha_{DIF} = .73$; $\hat{\Omega}_{\alpha_{DIF}} = .73$; $\alpha_{EOT} = 0,56$; $\hat{\Omega}_{\alpha_{EOT}} = .57$) obtiveram resultados variando de aceitáveis à adequados. A consistência interna da escala total (BbTAS-12) mostra-se adequada, com exceção da dimensão EOT. Os resultados são discutidos considerando os estudos realizados com esta população em vários países. **Conclusão:** A BbTAS-12 é uma escala especialmente promissora para a medida da Alexitimia em adolescentes. No entanto, é possível melhorar o conteúdo de alguns itens considerando as habilidades de leitura e o contexto cultural dos adolescentes.

Palavras-chave: Validade; Fidedignidade; Adolescentes; Modelagem Exploratória.

ABSTRACT

Introduction: Alexithymia is a construct characterized by a subclinical inability to identify and describe emotions and an externally-oriented thinking. **Objective:** To test the three-dimensional theoretical model proposed by Parker et al. (1994) (DDF, DIF, EOT), when evaluated by a brief version of the Toronto Alexithymia Scale (BbTAS-12). **Method:** BbTAS-12 was used in a sample of 801 adolescents (from 13 to 19 years of age), of both genders (52.1% male), in order to test its first evidences of validity via Exploratory Structural Equation (ESEM) Modeling and the

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internal consistency index. **Results:** The results of the general model (GFI = .99; AGFI = .97; $\chi^2_{gl} = 1,14$; RMSEA = .035; PCLOSE > .5; CFI = .98; TLI = .97), are excellent and explain 51% of the construct variance, confirming also the three dimension-structure. Both the internal consistency of the total ($\alpha_t = .72$; $\Omega_{\alpha_t} = .69$) and the theoretically proposed dimensions ($\alpha_{DDF} = .67$; $\Omega_{\alpha_{DDF}} = .68$; $\alpha_{DIF} = .73$; $\Omega_{\alpha_{DIF}} = .73$; $\alpha_{EOT} = 0,56$; $\Omega_{\alpha_{EOT}} = .57$) showed results varying from acceptable to adequate. The internal consistency of the full scale (BbTAS-12) is adequate, with the exception of the EOT dimension. The results are discussed considering the studies conducted with this population in several countries. **Conclusion:** BbTAS-12 is an especially promising scale for the measure Alexithymia in Brazilian adolescents. However, it is possible to improve the content of some items considering the reading skills and the cultural context of adolescents.

Keywords: Validity; Reliability; Teenagers; Exploratory Modeling.

RESUMEN

Introducción: La alexitimia es una construcción de la personalidad caracterizada por una incapacidad subclínica para identificar y describir las emociones y el pensamiento orientado hacia el exterior. **Objetivo:** Probar el modelo teórico tridimensional propuesto por Parker y otros (1994) (DDF, DIF, EOT), al ser evaluado por la versión reducida de la Escala de Alexitimia de Toronto (BbTAS-12). **Método:** Se aplicó la BbTAS-20 a una muestra de 801 adolescentes (13 a 19 años), de ambos sexos (52,1% varones), que se utilizó para probar su primera evidencia de validez, mediante el Modelo Exploratorio de Ecuaciones Estructurales (ESEM) y la consistencia interna. **Resultados:** Los resultados del modelo general (GFI = .99; AGFI = .97; $\chi^2_{gl} = 1,14$; RMSEA = .035; PCLOSE > .5; CFI = .98; TLI = .97), que explica alrededor del 51% de la varianza de construcción, confirman la estructura probada en tres dimensiones. Tanto la coherencia interna de la escala completa ($\alpha_t = 0,72$; $\Omega_{\alpha_t} = 0,69$) como las dimensiones teóricamente propuestas ($\alpha_{DDF} = 0,67$; $\Omega_{\alpha_{DDF}} = 0,68$; $\alpha_{DIF} = 0,73$; $\Omega_{\alpha_{DIF}} = 0,73$; $\alpha_{EOT} = 0,56$; $\Omega_{\alpha_{EOT}} = 0,57$) obtuvieron resultados que variaron de aceptables a adecuados. La consistencia

interna de la escala completa (BbTAS-12) es adecuada excepto para la dimensión EOT. Los resultados se examinan teniendo en cuenta los estudios realizados con esta población en varios países. **Conclusión:** BbTAS-12 es una escala especialmente prometedora para medir la alexitimia en los adolescentes. Sin embargo, es posible mejorar el contenido de algunos artículos teniendo en cuenta la capacidad de lectura y el contexto cultural de los adolescentes.

Palabras clave: Validez; Fiabilidad; Adolescentes; Modelo exploratorio.

INTRODUCTION

This study is part of a larger and continued research that aims to explore and describe the personality characteristics of adolescents of 13 to 19 years old, from the general Brazilian population. More specifically, it aims to evaluate the Alexithymia construct, through the proposition of a reduced version of the Toronto Alexithymia Scale (TAS-20) – the Brazilian brief Toronto Alexithymia Scale (BbTAS-12) – for adolescents. Its importance is based on the need to explore adaptation strategies that would allow teenagers to have a better understanding of the specific contents of the 20 items of the original Toronto Alexithymia Scale¹. Furthermore, studies have shown that the measurement of this construct with adolescents, through the TAS-20, do not present not very favorable results in the internal structure and precision of the scale^{2,3}. Finally, since several studies suggest that Alexithymia can have serious health consequences for adolescents⁴⁻⁶, the assessment of this construct in a valid and reliable way seems to be of great importance for this age group.

Alexithymia: theoretical aspects

The Alexithymia construct is defined as a three-dimensional personality feature⁷ and has been the target of great interest by researchers and clinicians in recent decades⁸. This term was introduced by Nemiah et al.⁹ to describe a set of characteristics presented by some of their patients. As theoretically explored by Nemiah et al.¹⁰, and more recently by several researchers¹¹⁻¹⁴,

this construct is fundamentally composed of three dimensions: (a) difficulty in identifying subjective feelings and in discriminating between feelings and body sensations (that accompany emotional excitement); (b) difficulty in verbally describing one's own feelings to other people; and, (c) a style of thinking oriented towards external stimuli. The investigation of the validity of this construct through the Toronto Alexithymia Scale (TAS-20) has been verified by many studies in several countries^{1, 8, 15, 16}. Since this term has been introduced⁹, more than half of a century of theoretical and empirical advances have been made. According to Luminet et al.¹⁷ the investigation of this construct can be divided into four major areas of research: (a) evaluation¹⁸ and cultural aspects¹⁹; (b) emotions^{17, 20, 21} and cognitive processes^{22, 23}; (c) biological aspects^{24, 25}; and, (d) psychosomatic disorders^{26, 27}. This present study is embedded within the first area of research, which is evaluation or the assessment of Alexithymia in a specific population.

Alexithymia: empirical aspects

Riefe et al.²⁸ mention that the TAS-20, as a three-dimensional measure of Alexithymia, has poorly valid and reliable rates when applied to adolescents. More specifically, some studies^{6, 29} have proposed the reduction in the number of items with the objective of improving the psychometric indexes of the scale⁶. Heaven et al.⁶ proposed the use of a brief version of the TAS-20, excluding the dimension Externally-Oriented Thinking (subscale EOT) based on its unreliability previous research with adolescents. Recently, Lapointe et al.¹⁶ presented a review with the results of 11 psychometric studies worldwide, using the TAS-20 with samples of adolescents (ages ranging from 12 to 19 years). This review presented the results of these studies according to the three categories of validity indexes related to the internal structure and precision of the TAS-20. Regardless of its country of origin, the results' range was as follows: (a) the absolute indices (GFI, AGFI) ranged from .83 to .94; (b) the parsimonious index tested (RMSEA) ranged from .05 to .08 with the exception of the original study conducted in Canada (1), which obtained a RMSEA index = .02; and finally, (c) the comparative index (CFI), that ranged from .85 to .96, with only two studies reaching the appropriate CFI \geq .95^{2, 30}. Yet, according to the Lapointe et al.¹⁶ literature review, as for the results of the precision

index, the Cronbach Alpha calculated by dimension showed that 7 of the 11 studies obtained indices higher than .70 in the DIF dimension (ranging from .52 to .84), 6 studies obtained indices higher than .70 in the DDF dimension (ranging from .60 to .81), and no study obtained indices higher than .70 in the EOT dimension (ranging from .40 to .68), confirming the assertion made by Heaven et al.⁶ that this subscale was "not reliably measured with adolescents"(p. 223)

Research questions

Considering the theoretical and empirical aspects presented above, the importance of assessing the occurrence of alexithymia in adolescents⁴⁻⁶, the importance of having measures that are appropriate for their cognitive and affective developmental stage¹, and based on the difficulty in obtaining more satisfactory psychometric indexes^{6, 29}, three research questions are hereby proposed: (i) How many and which are the intrinsic factors in the measure of Alexithymia in adolescents (13 to 19 years old), when evaluated by the Brazilian brief Toronto Alexithymia Scale (BbTAS-12)? (ii) Does the three-dimensional model, inherent to BbTAS-12, fit the available data? (iii) Is each of the dimensions evaluated by BbTAS-12 adequately accurate, so that the results obtained can be trusted? To answer these questions some ethical, methodological and statistical procedures are employed, which will be presented below.

Ethical and methodological procedures

The Research Ethics Committee of the Federal University of Rio Grande do Sul analyzed and approved - reference number: 2006569 - this research project, which included the participation of 801 teenagers, of both genders (n = 417 boys; 52.1%), with ages ranging from 13 to 19 years (M = 16.31; SD = 1.81). All teenagers were regularly enrolled in the equivalent of high school and college. The sample was chosen according to the availability of the participants' school schedule and the accessibility of the institutions. This is a non-random convenience sample chosen as recommended for studies in education and psychology³¹.

The young participants answered two instruments: a Bio-Socio-Demographic Questionnaire (controlling variables of gender and age) and a brief 12-items Brazilian version of the original Toronto Alexithymia Scale (TAS-20), theoretically divided in 3 dimensions: Difficulty of Describing Feelings (DDF), Difficulty of Identifying Feelings (DIF) and Externally-Oriented Thinking (EOT).

Brazilian brief Toronto Alexithymia Scale (BbTAS-12). BbTAS-12 is a reduced 12-items version taken from the 20-items originally proposed in TAS-20, by Bagby, Taylor et al.³². The BbTAS-12 was developed to present to the academic community a brief instrument measuring the same three theoretically dimensions, originally proposed by Bagby et al.³², but with adequate metric properties that can be easily included in research with multiple instruments. To assess the response behaviors of these young people with respect to BbTAS-12, a Likert scale is used, graduated in 5 points, ranging from “strongly disagree” (1) to “strongly agree” (5). A high score indicates that the adolescent has alexithymic characteristics, revealing by this bias, a facet of his personality. The TAS-20 uses cutoff scoring: equal to or less than 51 = non-alexithymia, the range between 52 and 60 = possible alexithymia, scores equal to or greater than 61 = alexithymia. This research explores the first evidences of validity and reliability of the BbTAS-12, proposing as well, the proportional possible cut-off scores for this scale.

Statistical procedures

General item analysis will be conducted in order establish the pertinency and adequacy of the items using the following measures: means, standard deviations, medians, inter-item correlation matrix and corrected correlation item-total³³. The first research question will be answered through Exploratory Structural Equation Modelling (ESEM). The prerequisites of this analysis will be: the Kaiser-Meyer-Olkin ($KMO \geq 0.70$), the determinant of the correlation matrix ($|R| \neq 0$), and the Bartlett's Index ($p < 0.05$)³⁴. A Robust Diagonally Weighted Least Squares (RDWLS) analysis, followed by a Robust Promin rotation³⁴ will examine the exploratory factorial structure of the BbTAS-12. The number of factors will be tested using the optimal implementation of parallel analysis (PA) based on minimum rank factor analysis³⁵ using the method of

permutation of the raw data³⁶. The rotated loading matrix with loadings lower than the absolute 0,30 will be omitted³⁴. The second research question will be answered using the following model fit indexes: robust chi-square (a non-significant χ^2)³⁷; Normed chi-square ($\chi^2/df < 2$); goodness of fit ($GFI \geq .95$); adjusted goodness of fit ($AGFI \geq .95$); root mean square error of approximation ($RMSEA \leq .05$), probability close ($PCLOSE \geq .05$), comparative fit ($CFI \geq .95$); Tucker-Lewis coefficient ($TLI \geq .95$)³⁸. Finally, the Cronbach's Alpha ($\alpha \geq .70$)⁴⁰, the McDonald's Omega ($\omega \geq .70$)⁴¹ and the Greatest Lower Bound ($glb \geq .70$) will be used to answer the third research question^{42, 43}. For the analysis, both the IBM Statistical Software for the Social Sciences (SPSS v.26) with AMOS package and Factor (v 10.10.01)⁴⁴ were used.

Results

In order to answer the research questions of this study, the scores obtained by BbTAS-12 were computed according to guiding principles commonly accepted in specialized literature^{34, 35, 38, 41, 45-48}. The results obtained through general item analysis, the modeling of the exploratory structural equation (ESEM) and internal consistency calculations will be presented systematically and successively in the following pages. The importance of the formal and initial presentation of the general analysis of the items is highlighted, since it aims to demonstrate the reliability of the mean values observed. The reason for this is the concern with possible influences of aberrant cases, which would indicate that the means calculated may not adequately represent the behaviors inventoried, which in turn would complexify the choice of using parametric analysis^{49, 50}.

General analysis of the items

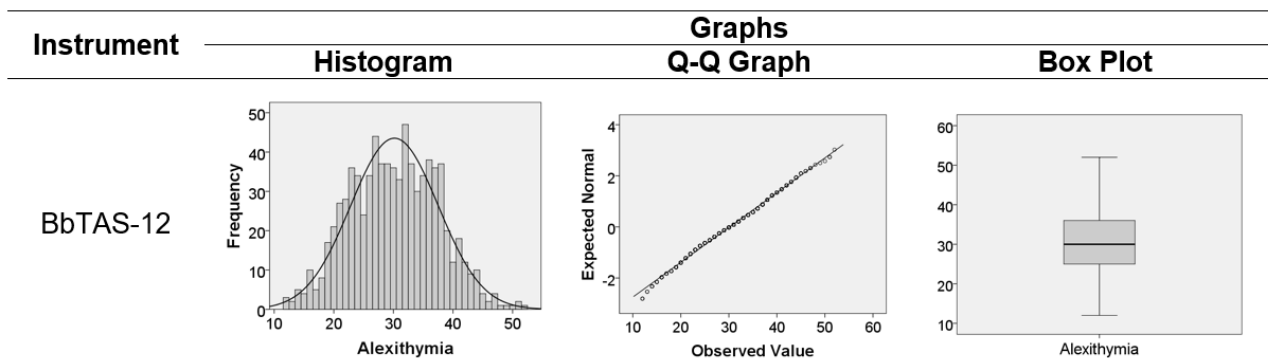
The means calculated for each one of the 12 items ranged from 2.01 to 3.05; with standard deviations ranging from 1.19 to 1.47. The total means per dimension are as follows: (a) DDF = 11.56 with a standard deviation of 3.70; (b) DIF = 9.31 with a standard deviation of 3.76; and, (c) EOT = 9.30 with a standard deviation of 3.15. This variability demonstrates an adequate homogeneity in the dispersion assessed. Additionally, these results indicate that on average, young people

answer the BbTAS-12 more negatively (*do not agree*) than positively. Two interpretations are possible: a) there was no predominant adherence either positively (values nearby 1) or negatively (values nearby 5) to any of the isolated items, which could indicate the absence of response variability - a condition that would prevent us to proceed with more robust statistical analysis; and b) such a phenomenon is expected, since the participants evaluated are students from the general population, and therefore the variable (or construct) alexithymia is not a characteristic of personality highly prevalent in non-clinical populations. The mean calculated for the total instrument was 30.17 (with a standard deviation of 7.34), which is relatively distant from the mean expected of 36 points. One-Sample t-test was used in order to test if this difference is statistically significant and the results ($t_{(800)} = -22.48$; $p < .05$) confirm this hypothesis. Thus, it can be interpreted

that the evaluated teenagers, on average, are not alexithymic. The median of inter-item correlations was satisfactory ($M = .31$) and no item revealed correlations with values below .18 or above .55. The median of the item-total correlations was desirable ($Mdn = .41$) and no item revealed correlations with the total scale below .30. These results reinforce the interpretation that items are appropriate and relevant.

Graphs 1 shows that there was no important distortion in the distribution curve of BbTAS-12 results (see histogram). The points of the observed values remained very close to the straight line of the expected values (see Q-Q chart) and, therefore, there was no presence of extreme values (aberrant cases) that could distort the results (see boxplot) and rule out the use of parametric statistics. All these results support the adequacy of the data under study and the continuity of analysis.

Graphs 1. Graphs with the representation data adherence to normality (n = 801).



Exploratory Structural Equation Modeling (ESEM)

In order to adequately answer the first of the three central questions of this research (how many and which factors are intrinsic to the Alexithymia variable?) it is necessary to explore the available data with the help of exploratory factor analysis calculations. But first, in order to guarantee the adequate interpretation of this analysis, the Kaiser-Meyer-Olkin coefficient ($KMO = .77$) was estimated, the Correlation Matrix Determinant (.10) was calculated and the Bartlett sphericity test was applied ($p < .01$). Their respective values indicate that the correlations between the items are sufficient - and even satisfactory - to proceed with the modeling of the exploratory structural equation. Also, the result of the information redundancy measurement ($|R|$ different from 0) indicates the absence of any kind of repetition of

the linear correlative links. All these data assure the relevance of factor calculations⁴⁹. A Robust Diagonally Weighted Least Squares (RDWLS) analysis, followed by Robust Promin rotation³⁴ was used to examine the exploratory factorial structure of the BbTAS-12 (see Table 1). An Optimal implementation of Parallel Analysis³⁵ with the permutation method of the raw data³⁶ served to determine that three factors were sufficient to explain the available data. They explain 50.84% of the total variance of the construct measured. Considering the fact that the communalities of the items are acceptable, this factorial solution is adequate. It is also noteworthy that this exploratory factorial solution was presented in a "pure" form (see Table 1), i.e. there was no significant double saturation in any of the items measured and furthermore, the items saturated considerably ($Sat_i \geq .32$) in their original factors.

Table 1. Exploratory results of the ESEM for the BbTAS-12 with teenagers aged from 13 to 19 (n = 801).

Dimension	Item	Brief content description (Portuguese)	M	SD	h ²	Factorial Matrix			
						3 factors			
						DDF	DIF	EOT	
DDF	1	Para mim, é difícil descrever meus sentimentos...	2.93	1.36	.61	.89			
	2	Sou capaz de descrever meus sentimentos...	3.05	1.33	.49	.78			
	7	Eu acho difícil descrever o que sinto para pessoas...	2.61	1.29	.25	.42			
	10	É difícil revelar meus sentimentos para amigos...	2.97	1.45	.17	.32			
DIF	4	Eu não sei identificar minhas emoções...	2.86	1.47	.39		.67		
	5	Eu fico confuso com as sensações do meu corpo...	2.01	1.19	.36		.64		
	8	Eu não sei o que se passa dentro de mim...	2.14	1.27	.55		.65		
	9	Frequentemente não sei porque estou zangado...	2.31	1.39	.39		.61		
EOT	3	Prefiro analisar os problemas a ter que descrevê-los...	2.25	1.19	.21			.40	
	6	Estar em contato com emoções é essencial...	2.13	1.19	.26			.50	
	11	Mesmo em silêncio sinto-me próximo dos outros...	2.51	1.29	.23			.49	
	12	Acho útil o exame de meus sentimentos...	2.42	1.28	.34			.60	
						Total	DDF¹	DIF²	EOT³
% of the variance by factor – extracted values							26.67	14.75	9.42
Alpha (Cronbach, 1951) total and by factor						.72	.67	.73	.56
Omega (McDonald, 1999) total and by factor						.69	.68	.73	.57
GLB (Greatest Lower Bound) of Woodhouse and Jackson (1977) total and by factor						.83	.73	.80	.58
Mean						30.17	11.56	9.31	9.30
Standard-deviation						7.34	3.71	3.76	3.15

Obs.: Extraction method: RDWLS (Robust Diagonally Weighted Least Squares); Rotation converged in 5 interactions. ¹Difficulty of Describing Feelings; ²Difficulty of Identifying Feelings, and ³Externally-Oriented Thinking.

As shown in Table 1, the content of item 10 of the DDF dimension presents the lowest factor saturation (.32), indicating that it is the most dissimilar content of the dimension and the highest factor saturation (.89), when considering the 12 items. The item 1 better represents the dimension in question.

The modeling procedure of the exploratory structural equation (ESEM) also allows answering the second central question of this research (does the three-dimensional model, inherent to BbTAS-12, fit the available data?). The results of the adequacy of the model are indicated in table 2.

Table 2. BbTAS-12 confirmatory results of the ESEM with teenagers aged from 13 to 19 (n = 801).

Structural Equation Modelling	Indexes							
	Absolut				Parsimonious		Comparative	
	χ^2	χ^2/df^1	GFI ²	AGFI ³	RMSEA ⁴	PCLOSE ⁵	CFI ⁶	TLI ⁷
Exploratory	65.97*	1.99	.99	.97	.03	1.0	.98	.97

* p < 0,05; ¹Normalize Chi Square ($\chi^2/df1 \leq 2$); ²Goodness of Fit Index (GFI $\geq .95$); ³Adjusted Goodness of Fit Index (AGFI $\geq .95$); ⁴Root Mean Square Error of Approximation (RMSEA $\leq .05$); ⁵Probability Close (PCLOSE $\geq .05$); ⁶Comparative Fit Index (CFI $\geq .95$); ⁷Tucker & Lewis Index (TLI $\geq .95$).

* p < 0,05; ¹Normalize Chi Square ($\chi^2/df1 \leq 2$); ²Goodness of Fit Index (GFI $\geq .95$); ³Adjusted Goodness of Fit Index (AGFI $\geq .95$); ⁴Root Mean Square Error of Approximation (RMSEA $\leq .05$); ⁵Probability Close (PCLOSE $\geq .05$); ⁶Comparative Fit Index (CFI $\geq .95$); ⁷Tucker & Lewis Index (TLI $\geq .95$).

Internal Consistency

In order to answer the third question - regarding the accuracy of the measurement of each of the three dimensions of the Alexithymia

construct - the Cronbach Alpha, the McDonald Omega and the Greatest Lower Bound - GLB - by Woodhouse and Jackson were calculated. The results (see table 1) range from .56 to .83. In addition, the most consistent dimension is DIF

(with indices ranging from .73 to .80) and the least consistent is EOT (with indices ranging from .56 to .58). These reliability indices were very similar to those found in the TAS-20 reported by Bagby et al. (32), and Meganck et al.⁵¹

Discussion

This study presented the first evidences of validity for the internal structure and the precision of the Brazilian brief Toronto Alexithymia Scale (BbTAS-12), a reduced version of the well-known Toronto Alexithymia Scale (TAS-20), specific for the use with the adolescent population (13 – 19 years old). The importance of this study lies primarily in the difficulty of obtaining more satisfactory psychometric indices with this population^{6, 29} which can be affected by the possible lower reading comprehension skills¹ and the difficulty in understanding some of the cognitive-affective contents found in younger adolescents^{1, 29}.

The result of the means (M) with the participants in this study (30.17 ± 7.34) is proportionally comparable to the original North American study by Parker et al.¹ (31.43 ± 7.04), the Chinese study by Ling et al.⁵² (30.22 ± 5.96), and the French study by Zimmermann et al.³ (2007) (30.67 ± 8.08). The BbTAS-12 is satisfactorily comparable to the original instrument (TAS-20), through the proportional bias of the means and standard deviations, indicating that the use of either 12 or 20 items has little influence on the stability of results. It could be argued that the removal of 8 items could indicate a loss in content validity⁴⁹, however but the missing contents do not show evidences of having an effect on both the means and the standard deviations of the BbTAS-12. Moreover, considering that the means are satisfactorily comparable, it can be inferred that the cut-offs are also comparable, so the proportional cut-offs of BbTAS-12 are the following: the sum of responses of 31 points or less, indicates *non-alexithymia*; the sum of responses ranging from 32 to 36 suggests *possible presence of Alexithymia*; and, finally, results equal to or greater than 37 indicates *presence of Alexithymia*³². It should be noted that the average sum of responses of the Brazilian adolescents within this study (when compared with those mentioned above) indicate that they are in the range of *non-alexithymia*, so with these preliminary results, it may be concluded that the

BbTAS-12 is an adequate measure to assess the presence (or not) of alexithymia in adolescents.

The exploratory results of the ESEM were quite satisfactory. They did not significant double saturation, and none of the items explains less than 10% of the variance in the dimension of origin, which meets the current statistical-psychometric requirements^{49, 53, 54}. These results are consistent with the findings of several studies^{55, 56}. The 3-factor solution in the BbTAS-12 is consistent with the theory initially proposed by Nemiah et al.⁹ and tested by the TAS-20^{1, 32}.

In this study, the confirmatory results of ESEM are also rather very satisfactory. All indexes rank as "excellent"^{39, 53}. As for absolute indexes (that allow us to assess whether the matrices of variance and covariance observed are statistically similar to those estimated), the results are consistent with the original Anglo-Canadian study¹ and with the French-European⁵⁷ and Italian⁵⁸ studies. However, in this present study, we obtained more satisfactory indexes than most of the studies surveyed^{3, 29, 30, 51, 52, 56, 59}. As for the parsimonious indexes (although similar to the absolute indexes, they include a statistical correction that allows the correction of an inadequate initial chi-square adjustment), the results of this study are also more satisfactory than the vast majority of the studies surveyed^{2, 3, 29, 30, 51, 52, 56, 59, 60}, with the exception of the original study¹ with the 13 and 14 year old participants. Finally, regarding the comparative adjustment indexes (which compare the hypothetical model to zero,) the results of this study are more satisfactory than most of the studies surveyed as well^{3, 29, 51, 52, 56, 60, 61}, but are consistent with the original study¹, with the Italian², and with the Turkish³⁰.

In general, the results of the internal consistency of the total scale are very encouraging. The calculated Alpha is consistent with most of the studies surveyed^{1-3, 29, 30, 51, 52, 56, 57, 61} with the exception of the original study, specifically with the 13 to 14-year-old sample¹, which obtained acceptable results. Concerning the 3 dimension solution of the BbTAS-12, DIF results are satisfactory and consistent with the original study¹ regarding the 17 and 18 year-olds, as well as with most of the studies surveyed^{29, 30, 51, 52, 56, 57, 61}. As for DDF, the results are acceptable and comparable to the original study¹ regarding specifically with the 13 and 14 year-olds, as well as with the studies of Säkkinen et al.⁵⁶, Meganck et al.⁵¹, Craparo et

al.², and Bolat et al.³⁰. However, our results were neither as satisfactory as the original study¹ with regards to the sample of teenagers from the 15 to 18 years of age, nor with the studies by Ling et al.⁵², Loas et al.⁵⁷, Loas et al.²⁹ and Zimmermann et al.³. Finally, the EOT showed unsatisfactory results, which are fundamentally comparable to all the studies surveyed. The only exception was the 17 and 18-year sample from the original study that obtained acceptable results¹. It should be noted that the EOT dimension seems to be problematic in the majority of studies conducted worldwide^{17, 62}. According to Ryder et al.¹⁹, differently from DDF and DIF, the EOT dimension is not evaluated in terms of difficulties (difficulty in describing or identifying feelings), but rather in terms of preferences regarding the expression of one's emotional life. Consequently, the EOT scores may significantly vary depending on the study's cultural context. This means that high scores in this dimension do not necessarily imply the presence of difficulties in the processing of emotions⁶³. For example, higher EOT scores were found in various studies with samples of Chinese students⁶⁴⁻⁶⁶. The authors have suggested that in the culture aforementioned, emotions and symptoms are usually processed and verbalized in terms of somatic experiences. Furthermore, in the Chinese culture there seems to be a greater importance on keeping the harmony within social and interpersonal relationships and less emphasis on the inner emotional experiences of individuals⁶⁷. Finally, in a quantitative and qualitative study conducted by Loïselle et al.⁶³ with American and Peruvian participants, the latter expressed the difficulty in understanding and responding to negatively worded items (which affects many of the EOT items), and furthermore, while answering the TAS-20, they did not tend to rely on introspection, but rather on externally oriented thinking.

Conclusion

We found evidences that the BbTAS-12 can be considered as a very promising and adequate version to be used with the Brazilian adolescent population. Exploratory modelling analysis showed a three-dimension model, consistent with the results of the original study of the TAS-20. Confirmatory ESEM analysis showed excellent indexes when compared to various studies presented. The reliability results were

satisfactory with the exception of the externally-oriented thinking dimension (EOT) that seems to be affected by cultural biases. In conclusion, the BbTAS-12 seems to be a very good version to be used in future studies with Brazilian adolescents. However, we suggest that the translation and the adaptation of the EOT items should be revised considering, if possible, the cultural context in which the study is conducted.

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