Original article (short paper)

Validity of internal structure of the Competitive State Anxiety Inventory in a Brazilian sample

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Abstract—This study investigated internal structure validity of the CSAI-2. The sample comprised 172 in Brazilian athletes, both sexes and ages ranging from 14 to 58 years. The athletes attended to the following sports: basketball, soccer, handball, volleyball and jiu-jitsu. The CSAI-2 was collectively applied before training. Initially a confirmatory factor analysis was done, but the data did not fit the model. Then, an exploratory factor analysis was conducted and, although the parallel analysis pointed out the adequacy of a two factor model, the three factor model was the one that best explained the test's theory, with some items excluded from the analysis. The factor's precision was taken by means of Cronbach's alpha and item-total correlation index and showed good results.

Keywords: factor analysis, psychological assessment, psychometrics, psychodiagnosis

Resumo—"Evidência de validade de estrutura interna do *Competitive State Anxiety Inventory* em uma amostra brasileira." Este estudo investigou evidências de validade na estrutura interna do CSAI-2. Foram estudados 172 atletas brasileiros de ambos os sexos e idades entre 14 e 58 anos. Os atletas eram atuantes na seguintes modalidades esportivas: basquetebol, futebol, handebol, voleibol e jiu-jitsu. O CSAI-2 foi aplicado coletivamente antes do treino. Inicialmente foi realizada análise fatorial confirmatória, mas os dados não se encaixaram no modelo. Em seguida, foi realizada análise fatorial exploratória e, embora a análise paralela tenha indicado adequação do modelo de dois fatores, o modelo de três fatores foi a que melhor alternativa para explicar a teoria do teste, com alguns itens excluídos da análise. A precisão do fator foi avaliada por meio de alfa de Cronbach, e o índice de correlação item-total mostrou bons resultados.

Palavras-chave: análise fatorial, avaliação psicológica, psicometria, psicodiagnóstico

Resumen—"Evidencia de validez de la estructura interna del Competitive State Anxiety Inventory en una muestra brasileña." Este estudio investigó el evidencias de validez estructura interna CSAI-2. Se estudiaron 172 atletas brasileños de ambos sexos y con edades comprendidas entre 14 y 58 años. Los atletas activos en las siguientes actividades deportivas: baloncesto, fútbol, balonmano, voleibol y jiu-jitsu. El CSAI-2 se aplicó colectivamente antes del entrenamiento. Inicialmente, se realizó el análisis factorial confirmatorio, pero los datos no encajan en el modelo. A continuación, el análisis factorial exploratorio se realizó y, aunque el análisis paralelo indicó la conveniencia de una solución de dos factores, la solución de tres factores fue la que mejor explica la teoría de la prueba, con algunos elementos excluidos del análisis. El índice de precisión fue tomada por medio de índice alfa de Cronbach y correlación ítem-total y mostró buenos resultados.

Palabras clave: análisis factorial, evaluación psicológica, psicométrica, psicodiagnóstico

Introduction

The relationship between anxiety and athletic performance has been a topic of interest to coaches, athletes and researchers of sports psychology for years. The current situation in sport worldwide provides a particularly appropriate setting for the observation and study of anxiety. In real competition contexts, athletes are often exposed to repetitive, identifiable and predictable situations that cause ansiogenic behaviors. Specific sports are affected differently by these behaviors.

The adequate assessment of athletes' anxiety guides the planning of intervention programs, as well as its consequences (Hall, Kerr & Matthews, 2006; Harger & Raglin, 2009; Smith & Smoll Wiechman, 1999). Recent advances in the psychological tests led to improvements in the assessment of anxiety, although there is some confusion about the definition of the construct "anxiety."

The construct definition has undergone a series of refinements over the years and they were reflected in the operationalization of the measure and the development of instruments. Anxiety in sport performance is defined as a predisposition to somatic or cognitive responses to competitive situations in which the athletic performance outcome is evaluated. Although there is a large number of sources of threats in the sports context, the most evident would be the possibilities of failure or being

disapproved by significant others concerning one´s standard of excellence (Smith, Smoll, & Wiechman, 1999). From this perspective, Martens, Burton, Rivkin, and Simons (1980) developed a measure of the state of anxiety for specific sports, *the Competitive State Anxiety Inventory-2* (CSAI-2). Based on the Spielberger´s state-trace model, this instrument assesses separately the cognitive and somatic anxiety (Spielberger, 1966).

Some researchers such as Burton (1990), Edwards and Hardy (1996), Jones (1995), Jones, Swain and Hardy (1993), among others, have questioned to what extent the CSAI-2 would be assessing state of anxiety. They argue that the test measures only the intensity of the symptoms, and not its direction or individual significance. Many of the anxiety symptoms may characterize positive affective states such as challenge or excitement, and an athlete who mark a high intensity on an item such as "I'm worried about this competition" may be reflecting not an aspect that could impair his performance, but a positive excitement state that can facilitate his or her performance. Since its first structure (CSAI-1) designed by Martens and colleagues (1980), the CSAI has been administered to athletes from different sports such as: volleyball, boxing, football, among others. The factor analysis usually has separated cognitive and somatic anxiety, and the precision rates in the original version ranged from 0.94 to 0.97.

In a review of the items modified from other instruments about state anxiety, the CSAI-2 reveals indicators such as fear of physical injury and generalized anxiety (Deffenbacher, 1980). After examination by several judges and after statistical analysis, the 102 initial items were left in the final 27. The factor analysis suggested a three factor structure, and one of them was the somatic anxiety. The cognitive factor was separated in two components, one indicating a positive self-confidence, and the other, negative factor of cognitive anxiety (Burton, 1989; Martens & et al, 1990). The initial psychometric properties of the CSAI-2 were determined in the study by Martens et al. (1990), in which the internal consistency for the three subscales ranged from 0.79 to 0.90. The concurrent validity was determined in studies by comparing the scores of athletes in competitive and non-competitive situations and by using correlation with performance in competitions. The positive cognitive component was strongly and positively associated with performance.

After that, many authors have used this instrument in the assessment of competition state-anxiety in various sports. This fact has made this test one of the most used in the assessment of anxiety in athletes until today in both the international and Brazilian sports arenas (Burton, 1989; Moraes, 2007). In a study with a Portuguese sample, Cruz et al. (2006) administered the CSAI-2 in 157 athletes from five sports. The authors performed an exploratory principal components analysis with varimax rotation that retained the same three factors, but pointed to a reduction in the number of items from 27 to 22 with 58% of variance explained and Cronbach's alpha ranging between 0.81 and 0.89. The items that were removed from the test were 2, 3, 4, 8 and 26.

Another study by Lane and colleagues (1999) also maintained in the analysis of the CSAI´s factor, the structure originally proposed by Martens and colleagues (1990). They administered the test in 1213 athletes and employed a confirmatory factor analysis that did not achieve good rates of adjustment for the three-factor structure. More specifically, the authors commented that the terms "Concerned" and "worried" are used in eight of the nine items on the scale of cognitive anxiety, which would not be enough to confirm that the athletes were experiencing negative thoughts. Athletes can just recognize the importance and difficulty of challenges and mobilize resources to solve them.

Also Tsorbatzoudis, Barkoukis, and Sideridou Grouios (2002) studied the CSAI-2 adaptation to a Greek language. Since they did not confirmed the three factors structure, the authors proposed the use of this test with 17 items with eight assessing cognitive anxiety and nine somatic symptoms. Such work led Cox, Martens and Russel (2003) to review the structure factor of the CSAI-2. In this version they found items saturated in more than one factor that were excluded from the analysis. Therefore, although the original structure maintained the three factors, the quantity of items was reduced to 17 items.

The literature review done by Craft, Magyar, Becker, and Feltz (2003) on the CSAI-2, pointed out that the main findings with this test suggest problems in psychometric properties of the different versions adapted to different languages. Conflicting results regarding the factorial validity and failure on demonstrating the interdependence of the three subscales that share common variance were found. Also, self-confidence was the strongest and most consistent predictor of sports performance.

In Brazil, although few studies use this test, some can be highlighted such as by Moraes, Lobo and Lima (2001) who applied the CSAI-2 48 hours previously to the competition to investigate sex differences in the state anxiety components in 275 athletes, ages between 12 and 14 years, who played during the Games of Hope. The authors did not find any significant difference between the sexes in the cognitive component. In contrast, the somatic component was typical of male athletes suggesting a higher tension by this group compared to women. The same trend was observed towards self-confidence. Also Moraes (1987) identified a higher score of self-confidence in men judo athletes than in women. This fact was explained by the author based on the influence that the family pressure would exercise on the practice of judo, since it is believed to be a "male sport."

A study that increases the need for more studies on this scale in Brazil was carried out by Ferreira (2008) in which the author administered this test and self-efficacy measures to 218 football players to identify the best predictors of performance. The only internal structure validity measure took by the author was Cronbach´s alpha for the scales of the CSAI-2 that ranged between 0.87 and 0.69. Only the self-confidence factor showed significant regression coefficients to predict the performance in football, although other CSAI-2 factors have shown significant low magnitude correlations with performance.

No further studies assessing internal structure of CSAI-2 were done in a sample of Brazilian athletes. This kind of research is important because this test as one of the most widely used in Brazil to assess competitive anxiety. Likewise, it is unknown whether these items would all be suitable for the Brazilian reality. Moreover, Brandão (2007) notes that most instruments about athletes assessment used in Brazil are not validated. So, this study investigated evidences for internal structure validity of the CSAI-2 in a Brazilian sample.

Method

Participants

Participants included 172 athletes of both sexes (61.6% male), ages from 14 to 58 years, (mean age= 21, SD = 5.99). The educational level also varied, ranging from elementary school (4.7%) to doctoral level (0.6%), with most participants (62.8%) presenting incomplete education at university level. The sports were the following: basketball (14.5%), soccer (28.5%), team handball (22.7%), jiu-jitsu (13.4%) and volleyball (20.9%). The research was conducted in clubs and sport teams in the city of São Paulo-Brazil. Most of these athletes (78%) have practices of three to five days a week, as well as two to three hours a day (76.2%). As for sports titles, 90.7% reported being involved with competitions once in their lives. These athletes attended to competitions for over 5 years and at least 10 times per year. Hence, these were experienced athletes regarding competitions.

Instrument

Competitive State Anxiety Inventory(CSAI-2)

This instrument has 27 items that describe symptoms of physical and cognitive anxiety and self-confidence. All behaviors are required to be evaluated in a four-point scale, ranging from nothing (1) something (2), moderate (3) and a lot (4), indicating the intensity of symptoms presented by the athletes in the described items. There is no time limit for completing the test. We adopt this version of the instrument and not the CSAI-2R, considering the higher quantity of items in this version and the fact that most of studies in Brazil adopted this form (Brandão, 2007).

Procedure

The CSAI´s was collectively administered before the training in each of the sport modalities by a psychologist or a physician properly trained. Only people who authorized participation or were allowed by their parents (in the case of minors) took part in the study. The time of participation took no more than 10 minutes. The test was administered in rooms previously selected by the clubs, in order to ensure the standardization of procedures. None of the participants were evaluated later than two months before a competition. Competitions were four months apart the time of assessment.

Results

Considering the three-factor structure of the CSAI-2 according to previous studies, we examined whether this would be sustained in the Brazilian athletes sample. We performed a confirmatory factorial analysis using the AMOS program version 16.0. Previous analysis was performed to verify the adequacy of confirmatory model (Tabachinick & Fidell, 2001). Initially, the omissions did not reach 5% of the data and no multicollinearity nor univariate or multivariate extreme cases problems were identified (information obtained by analysis of Mahalanobis and Cook's distance). The kurtosis values ranged from -1.328 to 0.036 and Skewness from 1.216 to -0.988. However, only two items (20 and 25) passed the limits of -1 and 1 in Skewness and 12 in Kurtosis. So, these data were moderately non normal, which justified the use of maximum likelihood method for estimating the parameters, as indicated by Arbuckle and Worthke (1999).

To test the fit model we employed the ratio between chi-square and degrees of freedom index (limit of 2), TLI (Tucker -Lewis Index), CFI (Comparative Fit Index), NFI (Normed Fit Index) with ideal values above 0.9, and RMSEA (Root Mean Square Error of approximation) with optimal value near or below 0.08. Figure 1 shows the structure of the CSAI-2 with their respective coefficients (which should be interpreted as regression coefficients). This figure presents a reproduction of the tested model, as well as the factor structure of the CSAI-2. The ellipses represent latent factors, and the rectangles the observed variables, the test items contained in each factors, each with a small circle associated representing error term. The unidirectional arrows indicate that each latent factor produces a response for each associated items. Nevertheless, the answers are not determined only by the factor but also by other unknown aspects (error terms). The bidirectional arrows suggest an interrelationship between the factors. All coefficients presented in Figure 1 were significant and greater than 0.45.

The adjustment values did not reach satisfactory results, only a few marginal rates (X2/gl = 2.26, CFI = 0.79, GFI =; NFI = 0.68, RMSEA = 0.086, TLI = 0.76). Considering this fact, we felt appropriate the employment of exploratory factorial analysis techniques to identify which would be a good structure underlying data.

To analyze a factorial data set, a minimum expected sample would be five participants per item on the scale. Considering this scale has 27 items, would be expected at least 135 participants to run this analysis (Hair, Anderson, Tatham, & Black, 1995; Tabachinick & Fidell, 1996). Thus, the number of athletes in the sample meets a minimum requirement to perform this analysis. Besides, other criteria must be met to ensure valid results on this analysis, two of them are the measure of sampling adequacy of Kaiser-Meyer-Olkin (KMO = 0.88) and Bartlett's sphericity test ($\chi^2 = 1835.51$, $df = 300$, $p = 0.000$) that suggested the possibility of extracting more than one factor in the items of the CSAI-2 in athletes, showing good results.

After that, we examined the amount of factors that should be kept in the analysis. Some methods are used for this purpose and will be presented in sequence. The scree plot is in Figure 2.

In this figure, the *y*-axis shows the eigenvalues, while in the *x*-axis is the number of factors. As suggested by Cattell (1966), using this chart is one of the procedures to identify the amount of factors to be extracted from a set of items.

In Figure 2 there is a greater discontinuity in the curve when the third factor is represented, suggesting the possibility of a three-factor structure. In turn, the Kaiser criteria assume that the factors with eigenvalues above 1 should be retained. That would be five factors. In spite of these methods of estimating the number of factors to be retained in a factorial analysis, the parallel analysis was used. This becomes necessary considering the limitations in the Kaiser criteria as well as in the scree plot

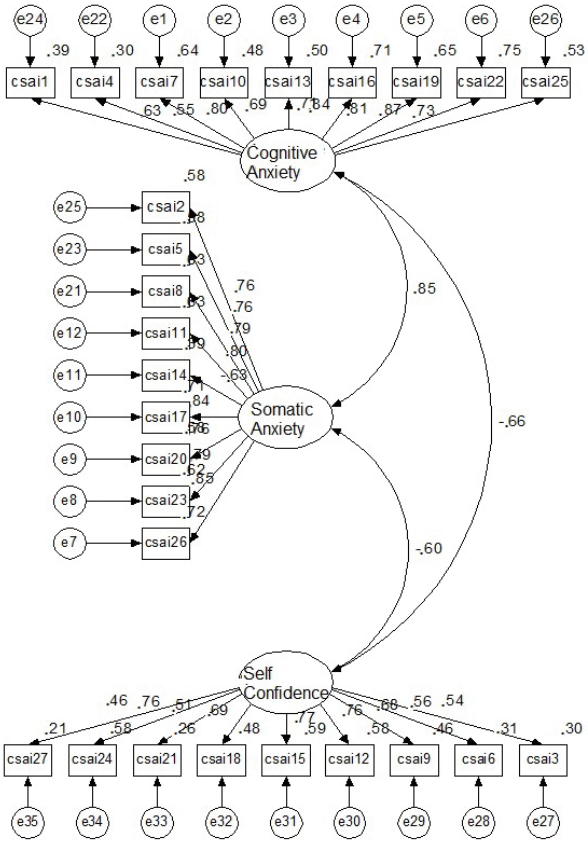

Figure 1. Three-factor model of the CSAI-2 (n = 172).

method. The first assumes that the precision of a component should not be negative when its eigenvalues are greater than one and present three main problems. First, the rule overestimates the amount of factors to be kept in the analysis of the correlation matrix (Gorsuch, 1983; Hayton, Allen, & Scarpello, 2004). Also with small samples, some factors with eigenvalues greater than one can occur simply as a result of sampling error. Finally, this is an arbitrary rule, differentiating between factors with eigenvalues below one and above this value (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

Also, the scree plot method works well with the strongest factors, but suffers with the subjectivity and ambiguity in determining the cutoff points that can lead to problems in interpretation. Defined points are less likely with smaller samples and when the proportion of variables in the factors is small (Linn, 1968). In an attempt to overcome these problems, the parallel analysis adjusts the effect of sampling error being an alternative based on the sample to the Kaiser criteria based in the population (Hayton, Allen, & Scarpello, 2004). The parallel analysis assumes that the validity of the underlying factor structure should have larger eigenvalues than the parallel components derived from random data. This requires same sample size and number of items, and researchers should not become interested in factors that do not take into account more variance than that drawn by random factors. Thus, real eigenvalues below or equal to the average random eigenvalues extracted in the parallel analysis are due to sampling errors (Hayton, Allen, & Scarpello, 2004; Horn, 1965).

Table 1 shows the first 27 real eigenvalues derived from item analysis as well as the average of the eigenvalues and 95th percentiles obtained from random data. The parallel analysis has a tendency to overestimate the number of factors so the average of the eigenvalues is analogous to adjust the rate of type I error. Hence the 95th is more conservative, equivalent to adjust the alpha values of 0.05 to the type I standard common error (Glorfeld, 1995).

Examining the results in Table 1 we ascertain that the first two observed eigenvalues are greater than those generated by the parallel analysis in both criteria (95 percentile and average) and then should be retained. Figure 3 presents this relationship.

Whereas most studies on the structure of the CSAI-2, conducted in other countries, suggested the separation of cognitive anxiety, physical anxiety and self-confidence, we find more appropriate to use the oblique rotation (direct oblimin, delta = 0) as we expected that these items should be correlated. The factors extraction method was the principal axes, as we sought the latent dimensions in the items and did not know the amount of error in the measures (Hair, Anderson, Tatham, & Black, 1995). Despite the many rules for identifying the appropriate number of factors to be extracted in a factor analysis, the comprehensiveness of the extracted factors must be always questioned since many of the identified structures may not make sense from the frame of the theory that based the items construction. Thus, we sought a factorial solution to produce psychometric properties and to provide a good theoretical interpretation.

Since the three criteria used to select the number of factors to be kept in the analysis showed no correlation, we choose to follow the parallel analysis, considering that this method overcomes some limitations of others. A first analysis was conducted restricting two factors using items with saturation above 0.30, as we chose the inclusion of items in scales that were more highly correlated with each factor, and a more compact scale (Hair, Anderson, Tatham, & Black, 1995). The results are in Table 2.

We noticed that the items referring to the physical and cognitive anxiety were grouped in one dimension, while the self-confidence items comprised a second factor. However, studies conducted with the CSAI-2, usually separated these

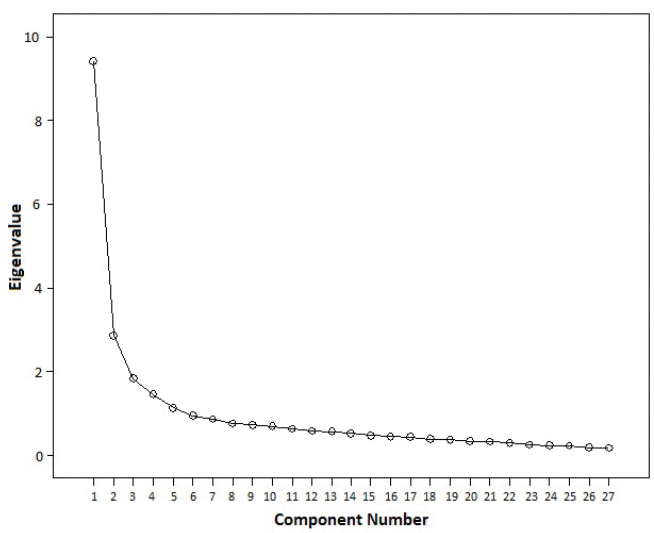

Figure 2. Scree plot for the CSAI-2 in athletes (n = 172).

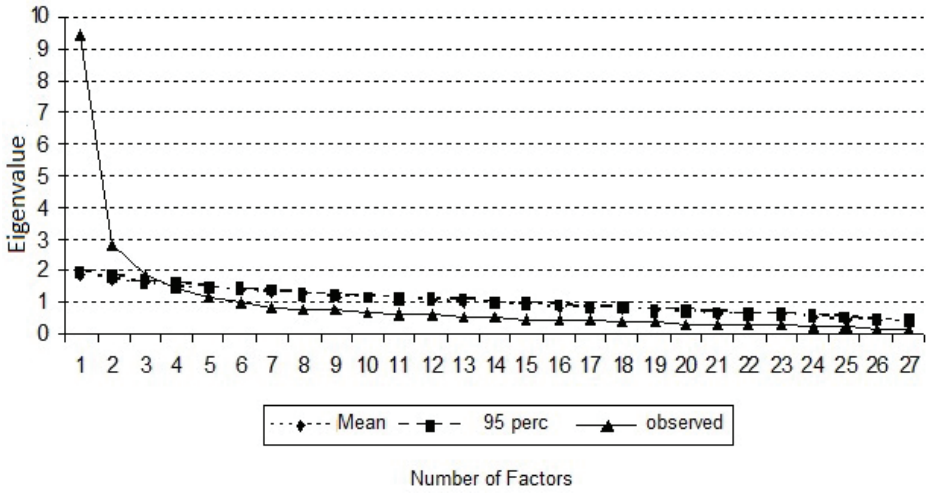

Figure 3. Eigenvalues generated randomly and observed for the CSAI-2 (n = 172).

three dimensions. In this context, we examined the three factors structure that had been suggested by the scree plot. This structure was the one that best represented the theoretical constructs. Furthermore, they explained a good amount of variance. The results of factor analysis, items factor loadings, their content, commonalities, amount of explained variance by factors and their eigenvalues are presented in Table 3.

The first factor was termed physical anxiety, with 11 items, and involves ansiogenic manifestations felt in the athlete's body. The second factor, with seven items represented self-confidence and demonstrate aspects of the athlete's confidence in his or her potential and mental relaxation. Finally, the third factor, named cognitive anxiety comprised seven items indicating, basically, exaggerated preoccupation with competition situations. The first factor explained 33.05% of variance, the second 8.88% and the third 5.15%. The total variance explained by the test items was 53%.

The structural matrix presents the simple correlations between variables and factors, considering both, the unique variance between the variables and factors and the correlation between them (the pattern matrix shows only the unique contribution of each variable on each factor). If the correlation between factors is high, it is difficult to distinguish which variables are only associated to each factor matrix (Hair, Anderson, Tatham, & Black, 1995). Also Thompson (2004) recommends the inclusion of this matrix, emphasizing that the exclusion of these coefficients results in loss of significant correlations of variables with factors. Analyzing these coefficients in Table 3, we ascertain that most of items had factor loadings in more than one dimension but were more strongly associated with one of them. The only item that can present some problem in this direction, due to a similar correlation between the two factors, was item 21. However, we kept it considering that the coefficient was negative in one of them, as well as the relevance of that item from the theoretical viewpoint.

The commonalities found by 16 items have had indexes below the 0.50, threshold established by statistics manuals considering that at least half the variance of each variable must be related to the factor (Hair, Anderson, Tatham, & Black, 1995). MacCallum, Widaman, Zhang, and Hong (1999) emphasized

Table 1. Eigenvalues observed and randomly generated (average and 95th percentiles) for the 27 factors generated for the CSAI-2 (n = 172).

Average	Percentile 95	Observed
1.844876	1.941928	9.424173
1.712345	1.793368	2.858796
1.602691	1.666829	1.832565
1.51455	1.580817	1.452901
1.443356	1.501788	1.129345
1.37299	1.435019	0.939963
1.310888	1.369476	0.856287
1.251576	1.298308	0.755569
1.196174	1.239041	0.720144
1.142779	1.187198	0.685619
1.095377	1.142483	0.624867
1.043999	1.093637	0.577827
0.995885	1.042256	0.557937
0.95173	0.992284	0.51985
0.9079	0.939562	0.467755
0.86148	0.897209	0.440868
0.818216	0.863234	0.428858
0.779834	0.829781	0.381608
0.736162	0.767289	0.368452
0.696812	0.732576	0.332394
0.660284	0.693543	0.319945
0.617886	0.658374	0.286421
0.581628	0.627453	0.24403
0.537848	0.575456	0.228589
0.490884	0.524288	0.218133
0.443608	0.47959	0.179406
0.388241	0.42586	0.167697

that when communalities are low, the role of sample size and the "overdetermination" (six or seven indicators per factor and a low number of factors) are important aspects in the recovery of the population factors. A 0.5 index is good to achieve this goal. When the commonalities are consistently below this value (the case of this study), to ensure a good recovery of population factors, the overdetermination of factors and large samples (over 100 subjects) are required. In this study, the structure identified of three factors with at least seven indicators in each factor and the sample size was above 100, fulfilling the criterion of MacCallum and colleagues (1999), suggesting the possibility of a good estimation of population factors. We also check the correlation between the factors which was low and negative between the factors of self-confidence and physical anxiety (r =- 0.26), moderate and positive among the factors of cognitive anxiety and physical anxiety (r = 0.50) and negative and moderate among the factors cognitive anxiety and self-confidence (r =- 0.30).

The internal consistency coefficients of these factors were calculated by means of the Cronbach´s alpha and item-total correlations. These procedures are the most commonly used to estimate the internal consistency of test results between variables of personality and intelligence, enabling a comparison of results with other instruments. The results of this analysis showed to cognitive anxiety factor, alpha's coefficient of 0.85. The somatic anxiety presented 0.61index; and self confidence factor 0.82 index.

The precision data by the two methods showed satisfactory results with all items showing item-total correlations below 0.30, specified by Guilford and Fruchter (1978) as acceptable limit for this analysis. Also, all alpha coefficients reached the level of 0.60, indicated by the Brazilian Federal Psychology Council as a minimum. Soon, we must mention that the factors of the CSAI-2 showed adequate psychometric properties for assessment of this construct.

Table 2. Pattern matrix and correlation of the factors found by the analysis of principal axes. oblimin rotation for the two factors structure of CSAI-2 (n = 172).

	Pattern Matrix	
	1	2
17 My heart is pounding	0.811	
26 My body is tight	0.753	
8 My body is tense	0.751	
2 I feel nervous	0.749	
11 I feel my stomach tense	0.723	
23 My hands are sweaty	0.714	
5 I feel shaky	0.713	
13 I am worried about the pressure	0.705	
20 I feel my stomach hurt	0.681	
1 I am worried about this competition	0.678	
10 I am worried about the defeat	0.626	
22 I am worried about having a low performance and disappoint others	0.615	
19 I am concerned not to be reaching my goal	0.562	
16 I am worried about not having a good performance	0.552	
14 My body is relaxed	-0.535	
25 I am worried about not having the ability to concentrate	0.524	
3 I feel calm	-0.512	
7 I am worried because I think I cannot do very well in this competition as it could	0.432	
6 I feel comfortable	-0.395	
4 I have doubt about me	--*	--*
24 I am confident that I imagine myself reaching my goal		0.788
18 I am confident about my performance		0.771
15 I am confident with this challenge		0.744
9 I feel confident		0.693
27 I am confident despite being in a period of pressure		0.686
12 I feel safe		0.669
21 I feel mentally relaxed		0.355
Correlation between factors		-0.36

* Factor loading below 0.3.

Table 3. Pattern and structural matrix. h2. eigenvalues and explained variance found by the analysis of principal axes. oblimin rotation for the three factors structure of CSAI-2 (n = 172).

	Pattern Matrix			Structure Matrix			
	1	2	3	1	2	3	h^2
2 I feel nervous	0.681			0.725		0.422	0.532
17 My heart is pounding	0.673			0.748		0.506	0.595
11 I feel my stomach tense	0.651			0.691		0.419	0.493
14 My body is relaxed	-0.636	0.330		-0.663	0.458		0.538
3 I feel calm	-0.633			-0.629	0.382		0.463
5 I feel shaky	0.608			0.686		0.460	0.492
26 My body is tight	0.587			0.658		0.468	0.483
8 My body is tense	0.573			0.679		0.503	0.499
23 My hands are sweaty	0.568			0.657		0.473	0.465
20 I feel my stomach hurt	0.546			0.619		0.434	0.412
6 I feel comfortable	-0.510	0.334		-0.542	0.432		0.394
18 I am confident about my performance		0.700			0.704		0.496
24 I am confident that I imagine myself reaching my goal		0.694			0.743	-0.384	0.581
12 I feel safe		0.654		-0.410	0.708		0.558
15 I am confident with this challenge		0.633			0.708	-0.437	0.557
9 I feel confident		0.604			0.639		0.418
27 I am confident despite being in a period of pressure		0.501			0.493		0.292
21 I feel mentally relaxed		0.300		-0.350	0.381		0.216
22 I am worried about having a low performance and disappoint others			0.733	0.476	-0.321	0.804	0.660
19 I am concerned not to be reaching my goal			0.693	0.418		0.735	0.546
16 I am worried about not having a good performance			0.693	0.435	-0.344	0.760	0.596
25 I am worried about not having the ability to concentrate			0.590	0.412		0.658	0.446
7 I am worried because I think I cannot do very well in this competition as it could			0.546	0.373	-0.349	0.627	0.425
10 I am worried about the defeat			0.528	0.462		0.620	0.419
4 I have doubt about me			0.405			0.433	0.195
Total Variance Explained	33.05	8.88	5.15				
Eigenvalues	8.26	2.22	1.29				

Discussion and final considerations

The CSAI-2 is one of the most used tools in the assessment of athletes' competition anxiety. Nevertheless, in Brazil, only few studies have been conducted with this test to establish its psychometric properties, assessing Brazilian athletes with foreign standards. Minor impact on the analysis used to determine the structural validity of this instrument was observed by the means of the Cronbach's alpha (Ferreira, 2008). In that context, we tried to establish some of the psychometric properties of the CSAI-2. Despite the lack of studies in Brazilian athletes, we choose to test the factor structure already found in other countries for that instrument, since this could be different in Brazilian athletes. Therefore, we adopted a confirmatory factor analysis model to restrict the factors according to CSAI-2 literature.

Data analysis showed that the three-factor model was inadequate, with marginal fit coefficients, despite the measures of good association between variables and all with significant magnitude. This fact is consistent with most research using this test in its numerous attempts to adapt to different languages and countries. One example is the study by Lane and colleagues (1999) that did not confirmed the three dimensions structure, and identified a number of problems on items related to content validity as well. This difficulty was pointed in a literature review made by Craft et al. (2003) who stressed that the adapted versions in different countries of the CSAI-2 did not confirmed the three-factor structure.

Indeed, authors in different parts of the world searched for valid alternatives to the CSAI´s structure. This was the concern of Tsorbatzoudis, Barkoukis, and Sideridou Grouios (2002), who, after identifying problems in shaping the structure of three factors in the Greek adaptation of this test, performed an exploratory factorial analysis and suggested the use of this test with only 17 items of anxiety cognitive and somatic. The problem

with this type of structure lies in the fact that the self-confidence factor is the better predictor for athletic performance (Craft et al., 2003; Freeman, 2008).

Hence, we choose not to maintain the two factors structure proposed in the parallel analysis that put together the cognitive and a somatic anxiety in one factor and left the self-confidence in a second. The dimension one in the two factor solution is strictly related to anxiety components and one could suggest CSAI's unidimensionality. We must think whether the self-confidence dimension is a construct related to anxiety or not. In fact, the correlational analysis pointed out negative coefficients between cognitive and somatic anxiety and self-confidence with low coefficients, indicating assessment divergence in these constructs. That is, if we assume that CSAI-2 assesses competition state anxiety, and this dimension is not an anxiety component, this configures a construct validity problem. This must be better investigated in further research adopting other models of statistical procedures to assess dimensionality.

In spite of this, we wanted a clearer separation of the test's underlined constructs usable in Brazil, than we choose to follow the scree plot and maintain the same three factors of the original version. After that, two items were removed from the final analysis, (13 and 1) because of their low factor loadings, leaving 25 items in the final version that explained 53% of variance. This amount was less than that founded by Cruz et al. (2006). They also reduced the quantity of items of the CSAI-2 retaining 22 items in three dimensions in the Portuguese version. The items retained in this research were not the same and the alpha coefficients were higher. At all, the results are consistent with those of Martens et al. (1990). Also Cox, Martens, and Russell (2003) reviewed the CSAI-2 structure and suggested the same three dimensions, but with 17 items. The current data obtained with the Brazilian athletes sample revealed the suitability of 25 items, also in three dimensions.

Suggestions for further research would be to explore the unidimensionality of the test, since the factors are correlated and the items had high item-total correlations. The self-confidence factor must be revised to its adequacy to the competition anxiety construct. Still, other studies could be done based on other models of item analysis such as the *item response theory* or Rasch model that present ways to optimize items rating scales, which could also affect the test's factor structure; or to identify biased items by sport or other groups with differential item functioning analysis.

Still, authors such as Burton (1990), Edwards and Hardy (1996), and Jones (1995), among others, argue that the state anxiety measured by the CSAI-2 only assesses the symptoms severity, and not its direction or individual significance. This aspect could be better explored in subsequent investigations, and some items could be modified in order to clarify what effects are expected in each symptom, which also was proposed by Lane et al. (1999).

Finally, the results enable this instrument in the final form to use in research to assess athletes' anxiety in competition. Finally, we suggest caution in the interpretation of other Brazilian research made with this instrument in his original format. It might be worth to select a larger sample for each sport modality to determine standards for this test in Brazil.

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