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Confirmatory Factorial Analysis of the Brazilian Version of the Competitive State Anxiety Inventory-2 (CSAI-2)

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The aim of this study was to assess the factorial structure of the Brazilian version of CSAI-2, using several structures suggested in previous studies. Two samples consisted of Brazilian soccer players, 266 from regional level (age 22.87 ± 4.08 years; athletic experience 11.32 ± 4.15 years) and 263 from national level (age 23.16 ± 4.37 years; athletic experience 11.11 ± 4.78 years) were used. The CSAI-2 is a 27-item inventory that measures negativism, physiological activation and self-confidence in a competitive setting. The results of CFA according to the original structure showed some inadequacy of the model. The model proposed by Cox, Martens, Russell (2003), composed of three factors (17-item), demonstrated better adjustment to the regional level sample ($\chi^2/df = 1.871$, CFI = .934, GFI = .916, RMSEA = .057), while the model suggested by Coelho, Vasconcelos-Raposo, Fernandes (2007), composed of two factors (18-item), adapted better to the national level sample ($\chi^2/df = 1.701$, CFI = .924, GFI = .914, RMSEA = .052). When we analyzed the two samples together, Coelho et al. (2007) was the better model, because it displayed greater invariance. The use of this model was suggested in the assessment of intensity of negative thoughts and the subsequent confirmation of its psychometric properties is recommended.

Keywords: CSAI-2, confirmatory factorial analysis, Brazil.

El objetivo de este estudio fue evaluar la estructura factorial de la versión brasileña del CSAI-2, utilizando las estructuras sugeridas en estudios anteriores. Participaron dos muestras de jugadores de fútbol de Brasil, 266 de nivel regional (edad media = 22,87 ± 4,08 años y experiencia deportiva media = 11,32 ± 4,15 años) y 263 del nivel nacional (edad media = 23,16 ± 4,37 años; experiencia deportiva media = 11,11 ± 4,78 años). El CSAI-2 es un cuestionario compuesto por 27 ítems que miden la negatividad, la activación fisiológica y la auto-confianza en un entorno competitivo. Los resultados del AFC de acuerdo a la estructura original mostraron algunos desajustes del modelo. El modelo propuesto por Cox, Martens y Russell (2003), compuesto de tres factores (17 ítems), demostró un mejor ajuste en la muestra de nivel regional ($\chi^2/df = 1,871$, CFI = 0,934, GFI = 0,916, RMSEA = 0,057), mientras que el modelo propuesto por Coelho, Vasconcelos-Raposo y Fernandes (2007), compuesto por dos factores (18 ítems), se ajustó mejor en la muestra de nivel nacional ($\chi^2/df = 1,701$, CFI = 0,924, GFI = 0,914, RMSEA = 0,052). Cuando analizamos las dos muestras juntas, el modelo de Coelho et al. (2007) resultó ser mejor, ya que mostró una mayor invarianza. Se sugiere el uso de este modelo en la evaluación de la intensidad de los pensamientos negativos, a la vez que se recomienda la confirmación ulterior de sus propiedades psicométricas.

Palabras clave: CSAI-2, análisis factorial confirmatorio, Brasil.

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Initially, the concept of anxiety was proposed to diagnose mental pathology (Vasconcelos-Raposo, 1994, 2000), being popularized in the context of sports with the work of Martens (1977), with the objective of evaluating and explaining the emotional state that athletes experiences prior to competition.

Various authors contest the manner in which the term “anxiety” has been used in the athletic context, stating that the negative connotation that it holds may cause the erroneous understanding that anxiety is harmful to performance (Jones & Hanton, 2001; Jones & Swain, 1992). Jones and Swain (1992) suggest that when anxiety is interpreted by athletes as a benefit to performance, this positive emotional state should be called “excitation, activation, or motivation”. Taylor (1996) recommends the term “intensity”, since this is seen by athletes as contributing to optimal athletic performance.

Recently, Vasconcelos-Raposo (2000) also proposed that the concept of anxiety be rejected, and that a reclassification of the emotional state experienced by athletes in the sports context be conducted, since it is contradictory to the manner in which the term is used by clinical psychology. According to the Diagnostic and Statistical Manual of Mental Disorders -IV, the criteria that must be present to diagnose someone suffering from anxiety are: the anxious disposition must be continuous for at least one month; the symptoms must not be associated with any other mental disorder, and the subject must be at least 18 years old. According to this author, what is questioned is the use of this concept to classify the sensations and doubts that athletes may have in relation to their abilities during the moments immediately prior to competition, the use of the following terms being suggested: negativism when referring to the prevalence of negative thoughts; and physiological activation, due to the similarity with the physiological component of somatic anxiety.

The concept of negativism is an alteration for a specific situation of a more general construct, being defined as a tendency to perceive competitive situations as threatening, and responding with feelings of apprehension or tension (Martens, 1977).

In the athletic context, Martens (1977) developed specific questionnaires for evaluations of the negativism state and trace, the Competitive State Anxiety Inventory-1 (CSAI-1) and the Sport Competition Anxiety Test (SCAT), and demonstrated that, in this context, these inventories evaluated the negativism better than more general measures (such as Trait Anxiety Inventory and State Anxiety Inventory). Later, Martens, Burton, Vealey, Bump and Smith, (1990) designed, constructed, and validated a multidimensional version of the CSAI-1, which they called the CSAI-2. Other scales, however, do exist, derived from the CSAI-2, and are also used for evaluation of the negativism state in the athletic context, such as the Directional Modification - CSAI-2 (directional interpretation of the symptoms) and the Mental Readiness Form (used in the field). The CSAI-2 is one of the most used instruments, being comprised of 27 items, grouped in three subscales (nine items each), which evaluate the intensity of physiological activation, negativism, and self-confidence in competitive sports situations.

Martens, Burton et al. (1990) conducted four initial studies with the purpose of testing the validity of the final structure of the CSAI-2, the results showing that this questionnaire has construct validity, and providing a solid support for good psychometric characteristics. From this time forward, the CSAI-2 has been seen as one of the most valid and trustworthy instruments for evaluation of negativism in the athletic context (Burton, 1998). Afterwards, various studies tested the psychometric properties of this questionnaire, questioning the validity of the original structure.

In respect to the homogeneity of the items, the original study demonstrated a strong internal consistency of the three CSAI-2 subscales, with Cronbach alpha coefficients that varied between .79 and .90 (Martens, Burton et al., 1990). Recently, various studies have confirmed this high internal consistency of the questionnaire the alpha values varying between .74 and .91 (Coelho et al., 2007; Iosifidou & Doganis, 2001; Lane, Sewell, Terry, Bartram, & Nesti, 1999; Tsorbatzoudis, Barkoukis, Rodafinos, & Grouios, 1998; Tsorbatzoudis, Barkoukis, Sideridis, & Grouios, 2002).

In respect to the factorial validity of the same instrument, various recent studies did not confirm the original structure (Coelho et al., 2007; Cox et al., 2003; Lane et al., 1999), three of these studies being about translation and adaptation of the questionnaire to Greek (Iosifidou & Doganis, 2001; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002). Five of the above mentioned studies presented a new factorial structure for the CSAI-2 (Coelho et al., 2007; Cox et al., 2003; Lane et al., 1999; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002). Table 1 summarized the new structures proposed.

Model 1, proposed by Lane et al. (1999), excludes the subscale for self-confidence, compared to the original model, its usefulness being criticized by having the results of the statistical analysis done (includes ten items created to evaluate negativism), and not of theoretical considerations inherent to the Multidimensional Theory. Model 2 results from two factorial studies for validation of the CSAI-2 in Greek (Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002) and the considerations suggested in the previous study, a model composed of only the negativism and physiological activation scales being proposed, and elimination of item 25, for having been developed to evaluate negativism yet having a strong influence on self-confidence. Model 3, suggested by Cox et al. (2003), maintains the tridimensional nature of the CSAI-2, having eliminated 10 items for load on more than one factor. Finally, Model 4, developed by Coelho et al.
(2007) results from a CFA of the factorial structure of the Portuguese version of the CSAI-2, suggesting use of only two correlated subscales, negativism and self-confidence.

The above mentioned studies indicated the need to conduct more studies to verify the factorial structure of the CSAI-2, and, especially, the scale translated and validated for Brazilian Portuguese. In fact, the existence of a valid scale for evaluation of the occurrence of negative thoughts provides a better comprehension of the negativism state in the athletic context. As such, the purpose of this study is to evaluate the factorial structure of the Brazilian version of the CSAI-2, using various structures proposed by the authors of the above mentioned studies (Coelho et al., 2007; Cox et al., 2003; Lane et al., 1999; Martens, Burton et al., 1990; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002), using CFA in two distinct samples (see figure 1).
Model 1
(Lane et al., 1999)

Model 2
(Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002)

Model 3
(Cox et al., 2003)

Model 4
(Coelho et al., 2007)

Figure 1 (Cont.). Models to test using CFA.
Methods

Sample

The first sample was composed of 266 male, Brazilian soccer players at the regional level in the Brazilian state of Rio Grande do Sul. All the elements of the study were over 16 years of age (22.87 ± 4.08) and had an average of 11 years of experience playing sports (11.32 ± 4.15).

The second sample was composed of 263 male, Brazilian soccer players, at a national level, throughout the entire Brazilian territory. All of the sample subjects were over 16 years of age (23.16 ± 4.37) and had nearly 11 years of athletic experience (11.11 ± 4.78).

Instruments

The Competitive State Anxiety Inventory-2, CSAI-2 was developed by Martens, Burton et al. (1990) to evaluate the intensity of negativism, physiological activation, and self-confidence in competitive situations. The Portuguese version of the CSAI-2 (Vasconcelos-Raposo, 1995), translated and semantically adapted to Brazilian Portuguese, was used for this study. The CSAI-2

Table 1

New factorial structures proposed for the CSAI-2

<table>
<thead>
<tr>
<th>Model</th>
<th>Author (year)</th>
<th>Sample</th>
<th>Statistics</th>
<th>Factors</th>
<th>Nº of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lane et al. (1999)</td>
<td>1213 athletes of various sports</td>
<td>CFA</td>
<td>Negativism, Activation</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Tsorbatzoudis et al. (1998)</td>
<td>170 elite athletes of team sports</td>
<td>EFA</td>
<td>Negativism, Activation</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Tsorbatzoudis et al. (2002)</td>
<td>2 samples - 238 elite athletes of team sports - 200 Tae-Kwon-Do athletes</td>
<td>CFA</td>
<td>Negativism, Activation</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Cox et al., (2003)</td>
<td>2 samples - 503 university athletes (internal competitions) - 331 university (1st division) and interscholastic athletes</td>
<td>CFA</td>
<td>Negativism, Activation, Self-confidence</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Coelho et al. (2007)</td>
<td>2 samples - 287 Physical Education and Sports students - 323 elite athletes of individual sports</td>
<td>CFA</td>
<td>Negativism, Self-confidence</td>
<td>9</td>
</tr>
</tbody>
</table>

Note. CFA- Confirmatory Factorial Analysis. EFA- Exploratory Factorial Analysis

Table 2

Values for adjustment measures for the regional level athletes

<table>
<thead>
<tr>
<th></th>
<th>Original Model a</th>
<th>Model 1 b</th>
<th>Model 2 c</th>
<th>Model 3 d</th>
<th>Model 4 e</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>717.481</td>
<td>461.526</td>
<td>416.195</td>
<td>217.051</td>
<td>246.113</td>
</tr>
<tr>
<td>$Df$</td>
<td>321</td>
<td>134</td>
<td>118</td>
<td>116</td>
<td>130</td>
</tr>
<tr>
<td>$P$</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>$\chi^2/df$</td>
<td>2.235</td>
<td>3.444</td>
<td>3.527</td>
<td>1.871</td>
<td>1.893</td>
</tr>
<tr>
<td>CFI</td>
<td>.840</td>
<td>.818</td>
<td>.818</td>
<td>.934</td>
<td>.908</td>
</tr>
<tr>
<td>GFI</td>
<td>.832</td>
<td>.833</td>
<td>.843</td>
<td>.916</td>
<td>.901</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.068</td>
<td>.096</td>
<td>.098</td>
<td>.057</td>
<td>.058</td>
</tr>
<tr>
<td>AIC</td>
<td>831.481</td>
<td>535.526</td>
<td>486.195</td>
<td>291.051</td>
<td>328.113</td>
</tr>
</tbody>
</table>

a) (Martens, Vealey et al., 1990),
b) (Lane et al., 1999),
c) (Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002),
d) (Cox et al., 2003),
e) (Coelho et al., 2007)
is comprised of 27 items, with responses scored on a Likert scale from 4 points (highest) to 1 (nothing). Each one of the three subscales consisted of 9 items, the value of each scale being calculated via the sum of the responses to the items. The values of each scale vary between a minimum of 9 and a maximum of 36.

**Procedures**

The questionnaires from the sample composed of regional level soccer players were collected in the respective clubs, authorization was previously requested for this purpose. The data for the national level soccer players were collected when the teams met to play in the city of Florianópolis, after having been granted authorization from the respective presidents. The questionnaires were filled out in a period of concentration for the games, at a maximum of 18 hours prior to play. All of the athletes signed the clear and free consent form.

**Statistical Treatment**

The programs SPSS 13.0 (Statistical Package for the Social Sciences) and AMOS 6.0 (Analysis of Moment Structures) were used for statistical treatment of the data. The psychometric properties of the CSAI-2 were verified with calculation of the Cronbach alpha and CFA, a reasonable value for internal consistency being an alpha greater than .70 (Tabachnick & Fidell, 1996).

Based on the various factorial structures proposed in the above mentioned studies, a CFA was conducted with the two distinct samples. The method of estimation of the maximum likelihood was used in all of the models tested. The measurements of evaluation of the adjustments used to verify the adequacy of the model to the data were the following: ratio chi-square statistic/degrees of freedom ($\chi^2/df$), comparative fit index (CFI), goodness of fit index (GFI), root mean square error of approximation (RMSEA) and Akaie information criterion (AIC).

The ratio of $\chi^2/df$ has been used as an index for adjustment of the model, however, there is no consensus regarding the value which is considered as an appropriate adjustment, values less than three having been suggested (Aroian & Norris, 2005). The CFI evaluates the adequacy of the model in relation to the independent model, the values varying between 0 and 1, with values greater than .90 indicating appropriate adjustment (Byrne, 2001). The GFI measures the quantity relative to the variance and covariance explained together by the model, varying between 0 and 1, with values greater than .90 indicating appropriate adjustment (Byrne, 2001). The RMSEA analyzes the discrepancy in the adjustment between the estimated and observed matrices, varies between 0 and 1, with values between .08 and .1 indicating a mediocre model, and values greater than .1 indicating poor adjustment (Byrne, 2001). We used the AIC in comparisons of two or more models, lower values demonstrating greater adjustment of the model (Byrne, 2001).

**Results**

**Internal Consistency**

The internal consistency was reasonable for the three subscales of the CSAI-2, the values being slightly less for the total scale, in both samples. For the regional level players sample, the Cronbach alpha values were .632 for the total scale, .755 for the negativism subscale, .861 for

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Values for adjustment measures for the national level athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Original Model</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>742.732</td>
</tr>
<tr>
<td>$Df$</td>
<td>321</td>
</tr>
<tr>
<td>$P$</td>
<td>.000</td>
</tr>
<tr>
<td>$\chi^2/df$</td>
<td>2.314</td>
</tr>
<tr>
<td>CFI</td>
<td>.806</td>
</tr>
<tr>
<td>GFI</td>
<td>.828</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.071</td>
</tr>
<tr>
<td>AIC</td>
<td>856.732</td>
</tr>
</tbody>
</table>

$a_0$ (Martens, Vealey et al., 1990)

$b_0$ (Lane et al., 1999)

$c_0$ (Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002)

$d_0$ (Cox et al., 2003)

$e_0$ (Coelho et al., 2007)
the physiological activation subscale, and .690 for the self-confidence subscale. The values obtained for the national level players sample was .619 for the total scale, .745 for the negativism subscale, .802 for the physiological activation subscale, and .787 for the self-confidence subscale.

Confirmatory Factorial Analysis

The following tables present the values of the adjustment measures of the models proposed by the above mentioned authors (Coelho et al., 2007; Cox et al., 2003; Lane et al., 1999; Martens, Burton et al., 1990; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002), in relation to the regional level players (Table 2) and national level (Table 3).

As shown in Tables 2 and 3, the evaluation of the original model of the CSAI-2 suggested by Martens, Burtons et al. (1990), which assumes the existence of three correlated factors, demonstrates the inadequacy of the model for both samples. In fact, for the regional level sample, the adjustment measures presented the following values: $\chi^2/df = 2.235$, CFI = .840, GFI = .832 and RMSEA = .068; and the following values for the sample at the national level: $\chi^2/df = 2.314$, CFI = .806, GFI = .828 and RMSEA = .071.

The next model (Model 1), which results from elimination of the self-confidence scale, arising from the suggestion from Lane et al. (1999) that the inefficacy of the initial model may be due to the presence of self-confidence, demonstrated better adjustment in both samples than the previous model. The adjustment indexes for the regional sample are greater, and still unacceptable ($\chi^2/df = 3.444$, CFI = .818, GFI = .833, and RMSEA = .096). The adjustment indexes obtained from the national level sample are better, although they still demonstrate the model’s inadequacy ($\chi^2/df = 2.656$, CFI = .834, GFI = .871, and RMSEA = .079).

The third model tested (Model 2), resulting from the analysis conducted by Tsorbatzoudis et al. (1998; 2002) which suggests elimination of item 25, presents better adjustment indexes in both of the samples in comparison to the previous models, although still not acceptable. For the national level sample, the adjustment measures presented the following values: $\chi^2/df = 3.527$, CFI = .818, GFI = .843 and RMSEA = .098; and the following values for the sample at the national level: $\chi^2/df = 2.795$, CFI = .828, GFI = .873 and RMSEA = .083.

The next model (Model 3), which is derived from the suggestions from Cox et al. (2003) for elimination of 15 items that are loaded by more than one factor, presents good adjustment indexes for the regional level sample ($\chi^2/df = 1.871$, CFI = .934, GFI = .916 and RMSEA = .057). However, when the adjustment indexes for the national level sample are analyzed, and despite the values being better than those of the previous models, they are still not satisfactory ($\chi^2/df = 2.61$, CFI = .867, GFI = .883 and RMSEA = .079).

Model 4, suggested by Coelho et al. (2007), without the physiological activation scale, presents acceptable adjustment indexes for both the regional and national level samples. The values for the adjustment measures for the regional level sample are: $\chi^2/df = 1.893$, CFI = .908, GFI = .901 and RMSEA = .058; and for the national level sample: $\chi^2/df = 1.701$, CFI = .924, GFI = .914 and RMSEA = .052.

Simultaneously, when we compare the five models against each other using the AIC value, we verify that the original model from Martens, Burtons et al. (1990) is that which presents the highest values in both samples, which means poor adjustment (831.481 and 856.732 for the regional and national players, respectively). The model from Cox et al. (2003) is the one which presents the lowest values for the regional level players (291.051), and the model from Coelho et al. (2007) is that which presents the lowest values for the national level athletes (303.176), which means better adjustment.

Discussion

The purpose of this study was to evaluate the factorial structure of the Brazilian version of the CSAI-2, using a sample composed of Brazilian soccer players at different competitive levels. The CSAI-2 was considered a valid and trustworthy tool for evaluation of negativism, physiological activation, and self-confidence (Burton, 1998). However, its psychometric properties have recently been brought into question in several studies in terms of factorial validity (Coelho et al., 2007; Cox et al., 2003; Iosifidou & Doganis, 2001; Lane et al., 1999; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002).

The results from this study support the above mentioned authors in reference to the lack of factorial validity of the original study of the CSAI-2 (Martens, Burton, et al., 1990), verifying that the adjustment measures obtained demonstrate unacceptable values in both samples. In terms of the internal consistency of the subscales, the results confirm the existence of Cronbach Alpha values that are reasonable (they varied between .69 to .86). These values obtained in the three subscales, in both samples, corroborate data from other studies conducted (Coelho et al., 2007; Iosifidou & Doganis, 2001; Lane et al., 1999; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002). However, when the internal consistency of the complete scale is checked, it is verified that the values for alpha are lower to those for the subscales in both samples, which reinforces the multidimensional nature of the CSAI-2.

In respect to the sample of regional level Brazilian soccer players, it was verified that the model from Cox et al. (2003) reveals the most appropriate adjustment measures in comparison to the other models analyzed.
(Coelho et al., 2007; Lane et al., 1999; Tsorbatzoudis et al., 1998; Tsorbatzoudis et al., 2002). However, when we use the sample of national level Brazilian soccer players, we verify that the model which is best adjusted is that proposed by Coelho et al. (2007), revealing the most appropriate adjustment measurements.

Despite the differences found, the analyses of the results of both samples indicates that the best model appears to be that suggested by Coelho et al. (2007), using only the subscales for negativism and self-confidence correlated, to present a greater invariance between the two samples. On the other hand, strategies were used in the construction of this model for improvement of the adjustment indexes which prove the Multidimensional Theory (Coelho et al., 2007). Elimination of the physiological activation state appears, thus, to be sufficiently affected by the socially desirable type of error (the subject distorts their responses in a socially desirable manner) (Martens, Burton et al., 1990); and by the physiological activation state correlating less with performance than negativism, due to dissipating at the beginning of the sporting competition (Martens, Vealey et al., 1990).

The use of two samples of athletes in this study, in addition to allowing us to validate the factorial structure that we propose, provides an excellent support for its use with Brazilian soccer players at various competitive levels.

One of the main limitations of this study is the specificity of the sample used, since it only allowed us to validate the factorial structure proposed for the Brazilian sporting context studied. For this reason, we recommend further studies to reproduce the validity of the psychometric properties of the questionnaire in other samples, and analyzing other properties of the same instruments, such as test-retest fidelity.

From the analyses conducted, one may conclude that the use of a scale with two factors is preferable to a scale with three, as was originally proposed by Martens, Burton et al., for evaluation of negativism in the Brazilian sports context studied. The results of this study suggest adaption of the CSAI-2, with the negativism and self-confidence subscales correlated.

References


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