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Factor Structure and Predictive Validity of the Arabic Competitive State Anxiety Inventory-2 Revised (CSAI-2R) Among Tunisian Athletes

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Abstract

Competitive State Anxiety Inventory-2 Revised (CSAI-2R) is widely used in sport psychology, and very little has been done to investigate the psychometric suitability of the measure in Arabic or North African teenager athletes. The instruments used in the measurement of the state anxiety and self-confidence in the athletic situations will require a culturally-diverse set of circumstances. The test aimed to determine factorial, internal, and predictive validity of Arabic version of CSAI-2R on a sample of athletic teenagers in Tunisia. Hundred athletes (average age = 14.49 +- 1.40 years) filled in CSAI-2R and Sport Competition Anxiety Test (SCAR) and Trait self Confidence Inventory (TSCI). The data reviewing was done using the assistance of Exploratory and Confirmatory Factor Analysis (EFA and CFA) to ensure the three-factor model of cognitive anxiety, somatic anxiety and self confidence. In order to measure the reliability, the Cronbach a, o, McDonald and performance scores were employed in which the criterion-related validity was considered. Arabic CSAI-2R has a good model fit (kh2/df = 2.14; CFI = 0.94; TLI = 0.92; RMSEA = 0.05) and a strong fit among the factors (a = 0.84-0.91; o = 0.86-0.90). It was discovered that the cognitive and somatic anxiety should be expected to be correlated with self-confidence and demonstrates construct validity. The results have established that Arabic version of CSAI-2R is a valid and reliable scale, which measures the competitive state anxiety among Tunisian teenage athletes. The psychometric strength of it validates its application in the research and applied sport psychology studies in Arabic- speaking situations.

Keywords: Competitive State Anxiety Inventory-2 Revised; Arabic validation; Reliability; Confirmatory factor analysis; Adolescent athletes

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1. Introduction

Psychometric testing has emerged as a fundamental component of modern sport psychology since it allows researchers and practitioners to quantitatively measure abstract psychological constructs with precision and reliability. Athletes experience numerous psychological states during competitions which may influence the results of performance such as anxiety, motivation, arousal, and confidence. The measurement of these constructs using psychometrically sound measures is very essential in understanding what athletes think, feel, and do in the face of pressures (Hardy and Jones, 1994). Without effective precautions, the interpretation of both emotional and cognitive responses may be affected or culturally infected and yield insincere results on athlete behaviour and mental performance (Byrne, 2016). Among these constructs, anxiety has received an immense amount of empirical research due to its strong association with variability of sport performance and mental readiness in sporting events. State anxiety is normally explained as a relatively short-lived affective condition through apprehensive or tense emotions of the individual in a competitive condition whilst trait anxiety is a general disposition of perceiving sports conditions as life-threatening (Martens et al., 1990). It has also been found that the two dimensions have an effect on perception and reaction of athletes to stress depending on the degree of competition, sporting type and individual coping mechanisms (Jones, Swain, and Cale, 1990). The self-confidence, in its turn, is a defensive tool, which assists in overcoming the impact of anxiety and helps to engage in the activity and complete the task. It is an attitude of belief that an athlete possesses as far as whether he/she can deliver desirable performances under pressure or not (Woodman and Hardy, 2003)(Silva, L. and All 2022). Self confidence coupled with anxiety affects how the athletes react to the demands during competition and how they cope with emotions surrounding performance (Eysenck and Calvo, 1992).

Proper evaluation of these constructs is highly dependent on good and established psychometric tests that have conceptual, linguistic, and cultural similarities among groups (McDonald, 1999). The better-known tool of doing so is the Competitive State Anxiety Inventory-2 Revised (CSAI-2R) that was created by Martens et al. (1990). CSAI-2R shows that three subopes of competitive anxiety exist, in other words, cognitive anxiety, somatic anxiety, and self-confidence. It provides a multidimensional view of the psychological readiness of athletes prior to and during the sports event that could be subjected to theoretical study and intervention. Different studies have confirmed its factorial validity, internal reliability,

and predictive capacity in samples of Western, Asian, and European countries (Woodman and Hardy, 2003). Notwithstanding, little use of the CSAI-2R in the Arab world, especially in North Africa, has been recorded. Though the tool has been translated into various languages, most versions are not rigorously psychometrically validated, particularly in adolescent athletes, who might differently perceive emotional and anxiety-related words based on cultural and linguistic differences (Martinent et al., 2010). Researchers working in Tunisia and other Arab-speaking countries have tended to apply translated Western scales without performing confirmatory analyses or assessing reliability indices. It is also a practice that presents some serious threats to

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measuring accuracy of cultural and linguistic translation may alter the meaning of items or factor structure.

Adaptation to psychometrics does not simply mean linguistic translation: statistical testing is needed to make sure that the instrument measures the same things across cultures that the underlying constructs are the same. These include factorial structure, reliability, and validity tests that should be done to make sure that the instrument does not lose its theoretical integrity (Kline, 2016). Additionally, for applied sport psychology in Arab-speaking environments, the determination of strong psychometric properties of commonly utilised tools such as the CSAI-2R can greatly enhance diagnostic accuracy, intervention planning, and cross-cultural research comparability. Besides cross-cultural issues, the adolescent age group is also a special target for validation exercises. Adolescent sport participants undergo rapid psychological and emotional growth, which influences responses to anxiety and stress in a manner that may differ from adults. Thus, psychometric reliability and factorial validity test of the CSAI-2R on the adolescents ensures that the scale measures developmental variance, in addition to keeping pace with the theoretically developed models of adults. The current research attempted to fill in these methodological and cultural gaps in order to test a psychometric validation of Arabic version of CSAI-2R on Tunisian adolescent athletes. In particular, the research will be directed to assess the factorial, internal, convergent and discriminant and predictive validity of the tool. Factorial structure and model fit indices were CFI, TLI, RMSEA, and kh2/df, which were tested with the aid of the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Cronbach alpha and McDonald om were applied to measure the internal consistency reliability. The predictive validity was researched to determine the correlation of CSAI-2R subscale with other substances closely related to it such as self- confidence and trait anxiety. By conducting such test on these psychometric attributes, the study may come to the conclusion whether The Arabic CSAI-2R has the theoretically based three factors construct previously found in the research of construct validation (Craft et al., 2003). It also takes interest to determine whether the Arabic version works equally well with both males and female subjects and with the disparate level of experience or not is the same and this is what research will cast its broader application in sport psychology research and practice. Ultimately, the research on the CSAI-2R validation in the Arabic young athletes will not only ensure standardisation of psychological tests scores in a global context in the sporting arena, but will also encourage culturally sensitive methods to the analysis of competitive anxiety and self-confidence in different groups of athletes.

2. Method

2.1 Participants

The group of the participants was 100 adolescent athletes (M = 14.49, SD = 1.40) who were recruited in Tunisia. All the participants were actively engaged in organised sports either as members of competitive professional sporting clubs or competitive amateur teams. Participants must meet eligibility criteria in terms of possessing at least two years of uninterrupted training in their specific sport discipline and being without any physical injury or diagnosed psychiatric

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disorder. Informed consent was given by both participants and their guardians. Institutional review board approval of the protocol for the study was obtained from the host university. The sample size was chosen according to established psychometric standards, to ensure sufficiency for exploratory and confirmatory factor analysis, with a participant-to-item ratio of more than 5:1.

2.2 Instrument Adaptation and Data Collection Procedure

The three tools used in the research are validated. These three included Sport Competition Anxiety Test (SCAT), 15-item measure which was meant to measure trait-based competitive anxiety. The second was the Trait Self-Confidence Inventory (TSCI) by Vealey (1986) an inventory of 13 sources which was utilized to verify on dispositional sport confidence. The third and intermediate tool was the Arabic version of Competitive State Anxiety Inventory-2 Revised (CSAI-2R) that is a 17 item tool to determine cognitive anxiety, somatic anxiety and self confidence. The cross-cultural adaptation of the French version of the instrument, which was cross-culturally adapted by Martinet et al. (2010), was cross-culturally validated and is called the CSAI-2R. Two bilingual sport psychologists translated the Arabic version then translated it back to French, which was also translated on its part. The versions were then subjected to review by a panel of experts in order to ascertain that they had semantic and conceptual equivalents. Pilot test was conducted on 15 adolescent athletes in order to make sure that all the items were clear and culturally relevant.

2.3 Procedure

Data collection was done at two time points within the span of two weeks. Under the same standardised testing conditions, all participants filled out the SCAT and TSCI questionnaires in the first session to determine their levels of trait anxiety and trait self-confidence. The second time point, which was a week later, had participants fill out the Arabic CSAI-2R roughly 15 minutes before engaging in a 2,000-meter middle-distance race. This was done to facilitate ecological validity and the measurement of pre-competition psychological states. No experimental manipulation or psychological priming was used in this iteration of the study; the earlier performance-grouping strategies were omitted to preserve the emphasis on psychometric assessment. All the questionnaires were given in Arabic, and research assistants could be called upon for purposes of clarifying doubts while administering the questionnaires.

2.4 Psychometric Evaluation Strategy

The research utilized the latent structure of the Arabic CSAI-2R by employing both the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) in the study. EFA was used to test the dimensionality of the scale using principal axis factoring, promax rotation. After that, CFA tested the proposed three-factor model and indices of model fit were the Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and the ratio of chi-square to degrees of freedom ( ). Internal reliability of CSAI-2R subscales was estimated by the use of Cronbach alpha (0) and omega (0

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) with estimates of more than 0.70 considered to be sufficiently high (Nunnally and Bernstein, 1994).Moreover, convergent validity was determined using average variance extracted (AVE) and composite reliability (CR) estimates, and discriminant validity was determined using Fornell-Larcker criterion. The inter-factor correlations were also examined in order to demonstrate separateness of the three constructs being measured. The criterion validity was investigated by comparing scores of CSAI-2R with those of SCAT and TSCI scores and actual performance of athletes (race time), as a predictor but not as an outcome measure in itself.

2.5 Statistical Analysis

All the statistical analyses were conducted with the help of IBM SPSS (Version 26) to conduct the exploratory factor analysis and descriptive statistics, and AMOS (Version 24) to credit structural equation modelling. It was then followed by the testing of the normality, linearity as well as the multicollinearity assumptions. The suitability of sample in the factor analysis was checked by the Kaiser-Meyer-Olkin (KMO) test and the Bartlett test of Sphericity. Means, standard deviation, skewness and kurtosis have been computed on all items and subscales. To test the relationships between the CSAI-2R sub scales with psychological constructs, Pearson correlation coefficients were used to test them. The inferential statistics employed the level of significance of $p < .05$.

3. Results

3.1 Factor Structure and Model Fit

The latent structure of the Arabic translation of the CSAI-2R was examined using an initial exploratory factor analysis (EFA). Sampling adequacy was confirmed by the Kaiser–Meyer–Olkin (KMO) measure (KMO = 0.87) and by a significant Bartlett's Test of Sphericity (χ^2 = 1324.56, df = 136, p = .001), indicating that the data were suitable for factor analysis.

Consistent with the theoretical framework of the CSAI-2R, the analysis revealed three distinct factors corresponding to somatic anxiety, self-confidence, and cognitive anxiety. All items loaded strongly on their respective factors, with factor loadings ranging from 0.62 to 0.83. Together, the three factors accounted for 68.4% of the total variance.

Subsequently, confirmatory factor analysis (CFA) was conducted to validate the factor structure identified through EFA. The three-factor model demonstrated an adequate fit to the data (χ^2/df = 2.14, CFI = 0.94, TLI = 0.92, RMSEA = 0.051, 90% CI [0.045–0.060]). These indices indicate that the Arabic version of the CSAI-2R exhibits a satisfactory factorial structure and an overall good model fit.

3.2 Reliability and Internal Consistency

The internal consistency of each CSAI-2R subscale was assessed using Cronbach's alpha (α) and McDonald's omega (ω). The self-confidence subscale demonstrated excellent reliability (α =

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0.89; ω = 0.91). The cognitive anxiety subscale showed good internal consistency (α = 0.84; ω = 0.86), as did the somatic anxiety subscale (α = 0.81; ω = 0.83).

All reliability coefficients exceeded the commonly accepted threshold of 0.70, confirming the robustness and reliability of the CSAI-2R subscales for psychological assessment.

3.3 Convergent and Discriminant Validity

Each subscale had high item loadings and adequate average variance extracted (AVE > 0.50) that supported convergent validity. CR scores also were more than 0.70 in each of the three constructs. Discriminant validity was demonstrated with the FornellLarcker criterion as the square root of the AVE of the constructs was higher than the inter-construct correlations. The inter-factor correlations ranged between [?]0.24 and 0.46 showing conceptual uniqueness of the CSAI-2R elements.

3.4 Predictive Validity

In testing predictability validity, Pearson correlation analysis was done among the CSAI-2R subscales and attribute ratings (SCAT and TSCI) of the participants and their middle-distance performance time. More performance was positively correlated with the rating of self-confidence significantly and positively (r = 0.23, p <.05), which is the validation of the criterion-relationship of the subscale. There was moderate positive correlation of the trait anxiety with the cognitive anxiety (r = 0.41, p <.01) and somatic anxiety (r = 0.36, p <.01). Interestingly, the relationship between the cognitive and

performance was weak and negative (r = 0.15, p >.05) but no significant correlation between the somatic and the performance. It can be seen that the CSAI-2R subscales are measuring aspects of psychological functioning which can be used to predict meaningful outcomes in terms of athletic competition even though in this instance performance was used as a secondary measure of validation only.

4. Discussion

The primary objective of the present study was to examine the psychometric properties of the Arabic version of the Competitive State Anxiety Inventory–2 Revised (CSAI-2R) among Tunisian adolescent athletes. Overall, the findings provide strong evidence supporting the reliability and validity of the scale within this population, confirming its suitability for both research and applied practice in sport psychology in Arabic-speaking contexts.

The factorial structure of the CSAI-2R, comprising cognitive anxiety, somatic anxiety, and self-confidence, was supported through both exploratory and confirmatory factor analyses. The three-factor model demonstrated satisfactory fit indices (CFI = 0.94; TLI = 0.92; RMSEA = 0.051), comparable to those reported in previous validation studies conducted in different cultural and

linguistic contexts. These results reinforce the multidimensional conceptualization of competitive state anxiety and support the cross-cultural applicability of the CSAI-2R theoretical framework.
In terms of reliability, all subscales of the Arabic CSAI-2R exhibited strong internal consistency, with Cronbach's alpha and McDonald's omega coefficients exceeding 0.80. These findings are consistent with earlier validations of the CSAI-2R in French and Japanese samples and suggest that the Arabic translation maintains the psychometric robustness of the original instrument. Convergent and discriminant validity indices further supported the construct validity of the scale.
A key contribution of this study lies in the validation of the CSAI-2R within a North African, Arabic-speaking adolescent sample, a population that remains underrepresented in psychometric research. By employing standardized translation and adaptation procedures, this study provides evidence that the Arabic CSAI-2R is a reliable and valid assessment tool in this cultural and linguistic context.

Predictive validity was explored using middle-distance running performance as an external criterion. Although performance was not treated as a primary outcome, the observed associations between self-confidence, cognitive anxiety, and performance were consistent with existing theoretical and empirical literature, supporting the criterion-related validity of the instrument.
Despite its strengths, the study has limitations, including reliance on self-report measures and a cross-sectional design. Future research should adopt multi-method and longitudinal approaches, examine measurement invariance across subgroups, and include test–retest reliability to further strengthen the evidence base.

In conclusion, the Arabic version of the CSAI-2R demonstrates strong psychometric properties and represents a valuable tool for assessing competitive state anxiety and self-confidence among adolescent athletes in Arabic-speaking contexts.

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