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original article

Cross-cultural adaptation and psychometric properties of the Brazilian coach-athlete relationship questionnaire (CART-Q) - Athlete Version

Adaptação transcultural e propriedades psicométricas do questionário de relacionamento treinador-atleta brasileiro (CART-Q) – Versão atleta

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Abstract – The aim of this study was to test the psychometric properties of the Brazilian version of the Coach-Athlete Relationship Questionnaire (CART-Q) - Athlete Version. For this, three studies were performed. In the first, four translators and five experts in Sport Psychology adapted the CART-Q contents to the Brazilian context. In the second, 364 athletes of individual and collective sports answered the adapted version of CART-Q. In the third, an independent sample of 185 athletes answered the CART-Q and the Task and Ego Orientation in Sport Questionnaire (TEOSQ) to analyze the external validity of the instrument; and 50 athletes answered the CART-Q in two distinct moments for the analysis of the temporal stability. Study 1 showed that the Portuguese version contains clear and relevant questions (CVC> 0.80). Study 2 showed that the CART-Q presents satisfactory internal consistency (α> 0.70 / CC> 0.70). The confirmatory factor analysis showed that the model with 11 items showed good fit [X^2/gl = 3.03; CFI = 0.96, GFI = 0.94; TLI = 0.94; RMSEA = 0.08] and also the existence of the second-order model. Study 3 showed the external (r> 0.40 with variable task orientation) and internal validity (CFA with an independent sample) and temporal stability (ICC> 0.70). It was concluded that the Brazilian version for of CART-Q proved to be valid to evaluate the perception of athletes about their relationship with the coach in the Brazilian sports context.

Key words: Psychometrics; Relationship; Sport psychology.

Resumo – *O objetivo deste estudo foi testar as propriedades psicométricas da versão brasileira do Coach-Athlete Relationship Questionnaire (CART-Q)-Versão Atleta. Para isso, foram realizados três estudos. No primeiro, quatro tradutores e cinco especialistas em Psicologia do Esporte adaptaram o conteúdo do CART-Q para o contexto brasileiro. No segundo, 364 atletas de modalidades esportivas individuais e coletivas responderam a versão adaptada do CART-Q. No terceiro, uma amostra independente de 185 atletas respondeu o CART-Q e o Task and Ego Orientation in Sport Questionnaire (TEOSQ) para a análise da validade externa do instrumento; e 50 atletas responderam o CART-Q em dois momentos para a análise da estabilidade temporal. O Estudo 1 evidenciou que a versão em português contém questões claras e relevantes (CVC > 0,80). O Estudo 2 revelou que o CART-Q apresenta consistência interna satisfatória (α > 0,70/CC > 0,70). A análise fatorial confirmatória revelou que o modelo com 11 itens apresentou ajuste adequado [X^2/gl = 3,03; CFI = 0,96, GFI = 0,94; TLI = 0,94; RMSEA = 0,08] e também a existência do modelo de segunda ordem. O Estudo 3 evidenciou a validade externa (r>0,40 com as variáveis de orientação à tarefa) e interna (AFC com uma amostra independente), além da estabilidade temporal (ICC > 0,70). Concluiu-se que a versão para a língua portuguesa do CART-Q se mostrou válida para avaliar a percepção do atleta sobre sua relação com o treinador no contexto esportivo brasileiro.*

Palavras-chave: *Psicologia do Esporte; Psicometria; Relacionamento.*

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INTRODUCTION

Recent studies have shown that the coach-athlete relationship plays a central role in the physical, motor and psychosocial development of athletes[1-3], improving their abilities, making them successful individuals[4]. This relationship usually has characteristics of cooperation, proximity and commitment, while it is not free from interpersonal conflicts[5-7]. A relationship like this has proved to be essential for the development of the athlete's career[8,9] assisting at critical moments (lesions or drop in performance), transitions or emotional crises[3,10,11].

In this context, the dynamics of the relationship between coaches and athletes has been widely analyzed from the perspective of the multidimensional model of leadership in sports[12,13]. However, the literature suggests that studies on social behavior such as those observed in research on leadership should not be a substitute for studies on social relations[9,14,15] and in order to fully understand these relationships, it is necessary to incorporate in addition to the behavioral aspect, other aspects such as affective and cognitive existing in interpersonal relations[16,17]. However, this approach of the coach-athlete relationship is still new in the sports literature, especially in research with Brazilian athletes. In fact, this study seeks to provide advances in literature by filling the gap that there are still no validated instruments in the Brazilian context addressing the coach-athlete relationship in the context of social relations, allowing the advance for the validation of a theoretical model for the Brazilian context.

In the international and Brazilian scientific community, there are assessment tools that deal with the coach's behavior such as the Coach Behavior Scale[18], the Leadership Scale in Sports / ELD[19] and the Athlete Satisfaction Questionnaire[13]. However, such instruments have as theoretical support the Multidimensional Model of Leadership[19] or the Model of Mediation of the Coach-Athlete Relationship[20], showing once again the analysis of the coach-athlete relationship from the perspective of leadership. This context highlights the lack of instruments that specifically assess feelings, thoughts and behaviors existing in the coach-athlete relationship, emphasizing the relevance of this study[16].

To fill this gap, Jowett and Ntoumanis[16] developed the model known as the three "Cs" (closeness, commitment and complementarity), based on the definition of the relationship between two people[21], which argues that factors such as feelings, thoughts and behaviors of members of a group are mutually and causally linked. The three "Cs" model is formed by three constructs, proximity, commitment and complementarity. Construct proximity describes the emotional tone of the relationship and assesses the emotional ties between coaches and athletes such as respect, trust, admiration and appreciation for each other. Construct compromise measures the cognitive attachment and long-term orientation between each other. Construct complementarity evaluates the behavioral transaction of cooperation, responsiveness and affiliation between coaches and athletes. This

theoretical support has been used to explain a large number of sporting experiences such as motivation, passion and group cohesion[3].

The Coach-Athlete Relationship Questionnaire (CART-Q) was developed with British athletes with the aim of assessing the quality of the coach-athlete relationship in the three "Cs" model's perspective[16]. This instrument has been adapted and validated for different cultures (the United States, Belgium, China, Greece, Great Britain, Spain and Sweden)[3,11,22,23], revealing adequate psychometric properties in the factorial validity and reliability, confirming the instrument as a universal tool to measure the coach-athlete relationship. A number of qualitative studies based on the conceptual model of the coach-athlete relationship of the three "Cs" have also shown good results of these factors and highlighted the quality of the coach-athlete relationship in different cultures[5,11,24,25].

Given the importance of this measure to the sporting context, this study aimed to perform the cross-cultural adaptation and test the psychometric properties of the Brazilian version of the Coach - Athlete Relationship Questionnaire (CART-Q). Specifically, the study aimed to translate, adapt and validate the CART-Q content for the Portuguese language (Study 1) and to verify the construct validity and internal reliability of the instrument to the Brazilian sports context (Study 2), and to check the construct validity in an independent population, the external validity and temporal stability of CART-Q (Study 3).

METHODOLOGICAL PROCEDURES

Study 1 – Cross-cultural Adaptation and Content Validation of CART-Q

- Participants

The translation and cultural adaptation committee was composed of nine professionals (four certified translators and five PhD in Sport Psychology), which accepted to develop the processes of translation, adaptation and validation of the CART-Q content. After completion of the content validation process, a pilot study was conducted with a group of 20 swimmers, judo, volleyball and indoor soccer athletes selected by convenience and stratified by gender (13 men and 7 women) in order to assess the questions of the instrument regarding language and form of content presented[26]. These athletes were from six collective and seven individual sports (with different levels of performance) and with different characteristics (gender, experience and geographic location) and different stages of development.

- Validation tool

The original questionnaire used was the athlete version of the Coach - Athlete Relationship Questionnaire (CART-Q) developed by Jowett and Ntoumanis[16]. This instrument evaluates the perceptions of athletes about their relationship with the coach. The scale consists of 11 items distributed in three dimensions: Proximity (items 3, 5, 8 and 9), Commitment (Items

1, 2 and 6) and Complementarity (Items 4, 7, 10 and 11). Answers are given on a 7-point Likert scale on a continuum from "strongly disagree" (1) to "totally agree" (7). The score of each subscale is calculated from the average of the sum of items that comprise it. Higher values in dimensions described mean greater proximity, commitment and complementarity in relation to the coach.

For content validity purposes, a scale evaluating the language clarity and practical relevance of items was used. It is a 5-point Likert scale, which was answered by evaluators, allowing investigating the consistency of the opinions of judges in matters related to the instrument's questions.

- Procedures

The research is integrated into the institutional project and was approved by the Ethics Committee for Research involving Human Beings under No. 339/2011. Certified translators (n = 4) and PhD in Sport Psychology (n = 5) were contacted to translate and evaluate the clarity and relevance of the CART-Q items. The work of this group of experts was initially individualized and later performed together. All participants (translators, PhDs and athletes) agreed to participate in the study by signing the Informed Consent Form.

As for the reverse and independent back-translation, two translators of Portuguese mother tongue independently contacted translated the CART-Q into Portuguese; then, two other translators of English mother language were contacted to translate back into English the versions translated into Portuguese. Versions were unified, resulting in the final version of the instrument [27]. The instrument translated into Portuguese was entitled Coach-Athlete Relationship Questionnaire - Athlete Version (CART-Q).

The analysis of content validity was done using qualitative and quantitative approach. Quantitative approach was conducted through content validity coefficient for each item (CVCi) and for the questionnaire as a whole (CVCt). The three criteria for analysis were language clarity, practical relevance of the item and classification of the theoretical dimension to which the item belongs[27]. This technique also checks the agreement among judges with respect to the classification of items in the dimensions.

Qualitative approach was conducted through group interviews with experts and participants (athletes, coaches and experts). A pilot study with the final version of the instrument was conducted with 20 male and female athletes of different sports to qualitatively verify the understanding of items and dimensions evaluated.

- Data analysis

To calculate the content validity coefficient, the guiding principles used were accepted in specialized literature [27], with cutoff point of 0.80. To analyze the level of agreement among judges for the theoretical dimension of items, the Kappa coefficient was used.

Study 2 - Internal Consistency and Construct Validity of CART-Q

- Participants

After the cross-cultural adaptation and content validation (Study 1) Study 2 was conducted with the internal consistency and construct validity of CART-Q. The sample was composed of 364 adult athletes of collective and individual sports (151 female and 213 male) of the final stage of the 2013 Open Games of Paraná (JAPS), from different regions of Brazil with average age of 22.11 ± 4.86 years and average practice time of 8.22 ± 5.31 years. The sample size was determined based on recommendations of Maroco[26], who proposes a minimum of 10 participants per instrument item. Subjects practiced the following sports: athletics (50), cycling (15), karate (20), swimming (30), tennis (5), chess (05), basketball (29), soccer (32), indoor soccer (38), handball (35), rugby (58), beach volleyball (23) and volleyball (24).

The inclusion criteria were: 1) having participated in some national competition during the 2012 season; 2) have participated in the State Championship during the 2012/2013 season; and 3) be qualified for the final phase of 2013 JAPS, thus representing high performance athletes and teams. All athletes signed an informed consent form.

- Validation tool

The questionnaire used was the Coach - Athlete Relationship Questionnaire / (CART-Q) [16], translated and adapted to Portuguese (Coach-Athlete Relationship Questionnaire - Athlete Version / CART-Q) in Study 1.

- Procedures

The Sport Secretary of the State of Paraná (organizer of JAPS) was contacted in order to obtain authorization to collect the survey data with athletes and teams participating in the competition. The CART-Q was applied in the accommodation of athletes in the city where the competition took place in the second half of 2013 with authorization of the respective teams.

- Data analysis

Data were evaluated with the aid of the SPSS version 19.0 and Amos version 17.0 software. Data on the sample characteristics were descriptively analyzed (mean and standard deviation) for continuous data and frequency distribution (percentage) for categorical data. With CART-Q adapted into Portuguese, the following were calculated: a) the Cronbach alpha reliability coefficient and composite reliability (internal consistency) and b) parallel analysis to indicate the amount of items to retain and confirmatory factor analysis to verify the construct validity of the instrument through absolute fit indexes, thrifty and incremental, in addition to the average variance extracted to analyze the convergent validity[26,28].

The verification of the existence of outliers was evaluated by the square of the Mahalanobis distance (D^2). Normality was also verified by studying the univariate data distribution by asymmetry (Sk) and kurtosis (Ku), the

multivariate distribution (Mardia coefficient for multivariate kurtosis) (ISKI <3.0 and IKuI <10)[28]. To check the stability and significance of the factor loadings of each item with its respective factor, the Bootstrapping technique was used[26]. Although the CART-Q latent model has been extensively tested, including in cross-cultural studies, we chose to conduct an analysis for dimensionality indicators prior to confirmatory factor analysis (CFA). The Kaiser-Mentler-Olkin indicator, the Bartlett test and the parallel analysis were also calculated.

As our data were not normally distributed, the Bollen-Stine Bootstrap technique was conducted to correct the chi-square value and coefficients estimated by Maximum Likelihood[26,29]. The final CART-Q model has been tested by means of fit indexes: Chi-square (X^2 and p-value), Goodness of Fit Index (GFI> 0.90), Root Mean Square Error of Approximation (RMSEA < 0.08, CI 90%), Normalized Fit Index (NFI> 0.90), Tucker-Lewis Index (TLI> 0.90), Adjusted Goodness of Fit Index (AGFI> 0.90), normalized chi-square (X^2 / gl, recommended between 1.0 and 3.0) and Comparative Fit Index (CFI> 0.90)[28,29]. Analysis of Average Variance Extracted (AVE) verified convergent validity, with values higher than 0.50 being considered appropriate[26]. The Composite Reliability (CR) was also calculated, for which values greater than 0.70 were considered satisfactory[28].

Study 3 - Internal and External Validity and temporal stability of CART-Q

- Participants

In this part of the study, two samples of athletes were assessed in a non-probabilistic for convenience way: a) to assess the internal and external validity of CART-Q in a sample independent of study 2 with 185 high-performance male and female athletes and b) to verify the temporal stability (test and retest reliability) of the instrument with 50 athletes from four sports (indoor soccer, swimming, athletics and judo) with interval of 7-14 days after initial testing.

- Tools

The Coach-Athlete Relationship Questionnaire - Athlete Version / CART-Q (CART-Q) with 11 items, validated for the Portuguese language in Study 2 and the Task and Ego Orientation in Sport Questionnaire (TEOSQ), composed of 16 items that assesses subscales task and ego orientation were used.

- Procedures

The board and coaching staff of teams was contacted in order to obtain authorization to carry out data collection. Then, the informed consent form was sent to athletes of teams who agreed to participate. The application of the instruments was held in the training site of athletes according to schedule predetermined by the coaching staff in the first half of 2014. In the case of CART-Q, there was a re-collection with an interval of seven days between test and retest.

- Data analysis

Data were analyzed using the SPSS and AMOS version 19.0 software. To evaluate the internal validity, CFA (described in Study 2) was replicated with an independent sample to check the construct validity. External validity was measured by Spearman correlation among the CART-Q dimensions and a related construct that is the Goals Orientation. Since the CART-Q is a model of the coach-athlete relationship, the hypothesis tested for external validity was that the CART-Q dimensions would present moderate to high correlations (r> 0.40) Task Orientation, which is the dimension most related to collective, and weak correlations (r <0.20) with Ego Orientation, as suggested in literature[17,30]. For the CART-Q temporal validity, the intraclass correlation coefficient was performed, thus verifying the test-retest reliability of the instrument. The minimum index (r> 0.70) was adopted for this study, as recommended in literature[29].

RESULTS

It was found that all CART-Q dimensions obtained content validity coefficients in relation to language clarity and practical relevance above 0.80, showing that CART-Q translated and adapted to the Portuguese language presents clear language and is pertinent and relevant to the Brazilian sports context. In relation to the classification of the CART-Q items in dimensions Proximity, Commitment and Complementarity, Kappa coefficient of 0.85 was observed, showing that the evaluators obtained high correlation when CART-Q items were measured.

Descriptive statistics and internal consistency of CART-Q

The descriptive analysis of results revealed that the average value of answers ranged from 5.01 ± 1.65 to 6.52 ± 0.90, respectively, in items 1 ("I'm close to my coach") and 8 ("I respect my coach"). The overall internal consistency index of CART-Q was 0.91. The Cronbach's alpha of dimensions was satisfactory, ranging from $\alpha = 0.70$ to $\alpha = 0.83$. The item-dimension correlations ranged from $0.50 \leq r \leq 0.74$, indicating moderate to strong correlation (PF ≥ 0.50) between dimensions and their respective items.

Confirmatory factor analysis of CART-Q

Initially, the absence of outliers was verified, allowing the use of the confirmatory factor analysis. Analyses revealed the existence of three latent dimensions, with acceptable KMO (0.85) and significant Bartlett's test (P <0.05), corroborating the proposal of the original version of the model.

The model (M1) showed acceptable adjustment (Table 1), with adjustment indexes close to the threshold recommended in literature. However, the modification indexes recommended correlation among errors of item 5 ("I trust my coach") and 9 ("I appreciate the sacrifices of my coach to improve my performance"). Such correlation among errors was weak (r <0.30) and among items of the same factor. It was observed that the items

of the modified model (M2) showed satisfactory adjustment (Table 1). All factorial saturations (λ) presented moderate and strong values between 0.54 and 0.85 and bootstrap replications ($p < 0.001$) and confidence interval (95%) indicated stability of factorial estimates and model adjustment for the data. Then, the second-order model with the existence of a second-order factor for the Coach-Athlete Relationship (RTA) was tested. The second-order model adjustment indexes (M3) are identical or higher than the first-order model adjustment indexes (M2) (Table 1), demonstrating support to the hierarchical model.

Table 1. CART-Q models fitness indicators for the validation sample.

Model Comparison	1. 11 items model	2. Modified 11 items model	3. Second order model
X^2	189.78	118.99	122.30
DF	41	36	37
p-value	0.001	0.001	0.001
X^2 adjusted (X^2/df)	4.62	3.03	3.30
GFI	0.90	0.94	0.96
RMSEA [I.C. 90%]	0.10[0.09-0.11]	0.08[0.07-0.09]	0.08[0.06-0.09]
TLI	0.90	0.94	0.94
AGFI	0.84	0.90	0.90
NFI	0.91	0.94	0.94
CFI	0.93	0.96	0.96
AIC	239.78	178.99	180.30
BIC	337.21	295.91	293.32
MECVI	0.66	0.50	0.50

Note. X^2 = Chi-square; df = degree of freedom; X^2/gl = Adjusted chi-square; GFI = Goodness of Fit Index; RMSEA = Root Mean Square of Erro of Approximation; TLI = Tucker-Lewis Index; NFI = Normed Fit Index; AGFI = Adjusted Goodness of Fit Index e CFI = Comparative Fitness Index; AIC = *Akaike* Inforation Criteria; BIC = *Bayes* Information Criteria; MECVI = Modified Expected Cross-Validation Index.

The factorial loadings of first-order to second-order factors (Coach-Athlete Relationship) were also substantially high (Proximity = 0.98; Commitment = 0.98; Complementarity = 0.92) and significant ($p < 0.001$) (Figure 1).

After analyzing the factorial structure of the first- and second-order model, the Brazilian version of the CART-Q was distributed as follows: 1) Proximity (Items 3, 5, 8, 9); Impairment (Items 1, 2, 6); and 3) Complementarity (Items 4, 7, 10, 11).

Convergent Validity and Composite Reliability of the 3-factor CART-Q Model

All items loaded significantly and with acceptable magnitude in the CART-Q dimensions, indicating good convergent validity. In addition, the average extracted variance values (AVE) were Proximity = 0.57; Commitment = 0.45; Complementarity = 0.56. Only Commitment factor did not saturate with magnitude greater than 0.50; however, it obtained a very close value, which does not compromise the convergent validity of the model. Taken together, the results supported the convergent validity of the second-order

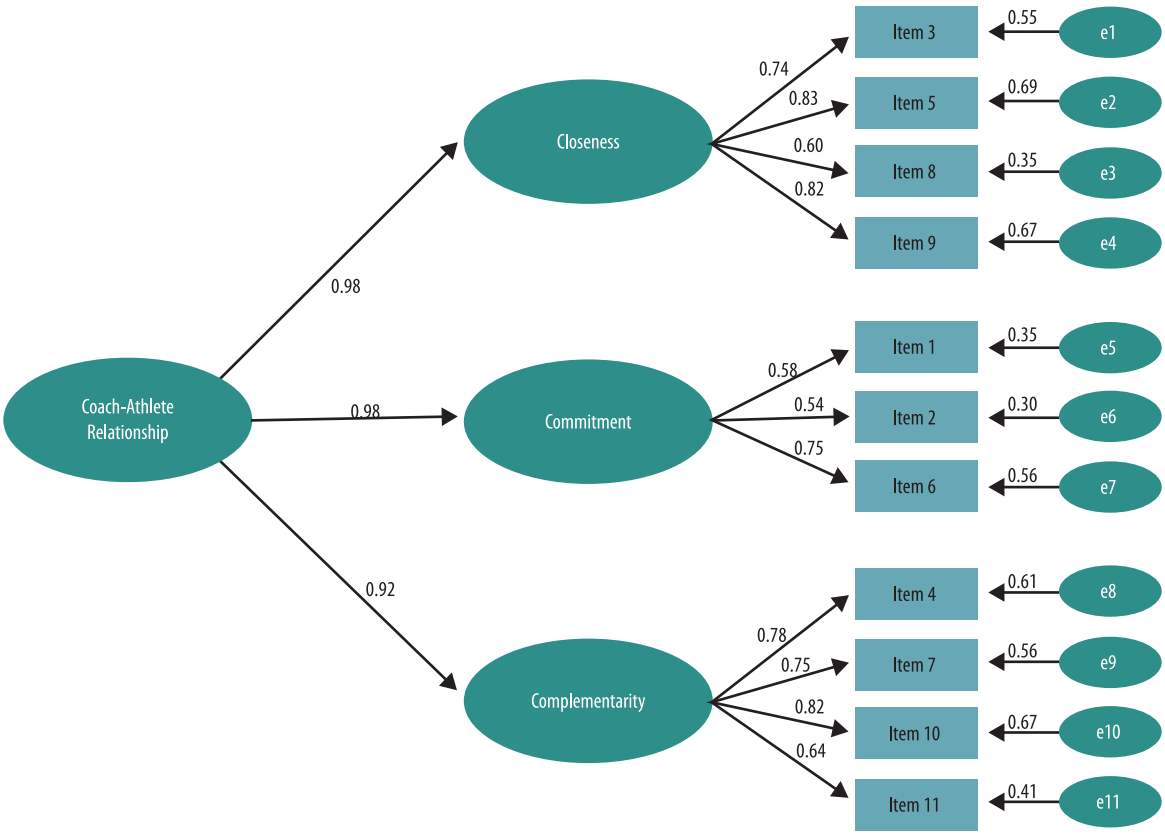

Figure 1. Factor loadings and item-factor intercorrelations in the second order CART-Q model (M3).

model with 11 items of the CART-Q (M2). The CC values were satisfactory for the evaluation of the internal consistency (Proximity = 0.84, Commitment = 0.69; Complementarity = 0.84), indicating satisfactory reliability of the model for the validation sample.

CFA has confirmed the construct validity shown in study 2, now with an independent sample [X^2 (36) = 69.93; X^2/gl = 2.18; CFI = 0.94; GFI = 0.93; TLI = 0.92; RMSEA = 0.08], without demonstrating the need to establish correlations among errors. External validity showed that the three dimensions of CART-Q (proximity, commitment and complementarity) were related as expected, with moderate and positive correlations with the Task Orientation (proximity r = 0.39, commitment r = 0.40 and complementarity r = 0.45). Commitment dimension showed correlation slightly higher than expected with Task Orientation (r = 0.24), but still a weak correlation. Proximity and complementarity showed weak and non-significant correlations (p> 0.05) with Ego Orientation (r = 0.07 and r = 0.15, respectively).

The intraclass correlation coefficients confirmed the reliability (temporal stability) of the scale. All items are above the minimum index recommended in literature (r> 0.70), with the exception of item 2 ("I am committed to my coach"), which showed intraclass correlation coefficient r = 0.60; however, this correlation is considered moderate and can be accepted, not affecting the temporal stability of the instrument. By grouping the 11 items, average intraclass correlation of 0.72 was found, showing

the temporal stability of the scale items. Since it is a multidimensional instrument, it was found that all CART-Q dimensions showed intraclass correlation coefficient of r = 0.72 and r = 0.81, indicating strong reliability of CART-Q dimensions between test and retest for the validation sample.

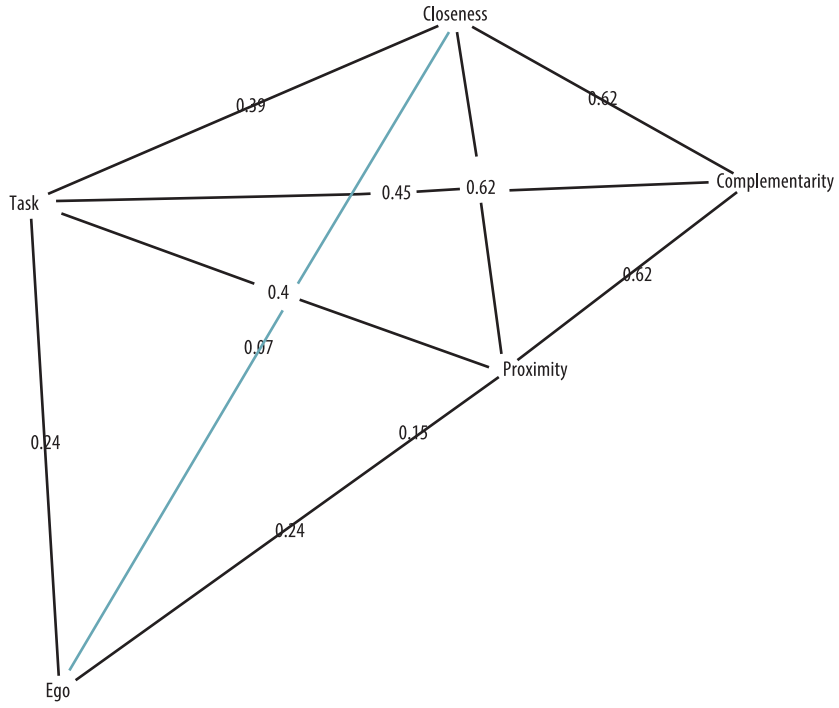

Figure 2. TEOSQ and CART-Q dimension correlations.

DISCUSSION

The adapted and translated version of the CART-Q presented satisfactory content validity values for pertinence and relevance[27]. The final structure of the instrument included three constructs (Proximity, Commitment and Complementarity), as the original questionnaire[16]. This consistency with the original questionnaire attests to the validity of the cross-cultural contents of this translation and adaptation process.

The variability (athletes of different characteristics and sports) in the characteristics of participants in the pilot study was intended to allow achieving conditions more similar to suggested criteria to test the model in relation to the original instrument and for allowing greater generalization [26]. It was found that adaptation obtained concordance and relevance for participants in the pilot study, corroborating the content analysis results. This result also adds evidence of content validity to the CART-Q three-dimensional construct with a sample of high-performance athletes in various sports, as well as the original validation that was performed with athletes from different sports[16] and validation studies for other cultures[23,25].

Overall, the Brazilian version of CART-Q showed good indicators of internal consistency and construct validity. Based on theoretical and empirical evidence of the conceptual model of the "3Cs"[9,16,25], two meas-

urement models were tested. The CFA conclusions indicated that both the three-factor model (3Cs) of first order (M2) as the hierarchical factor model, in which the three first-order factors (3CS) were grouped into a higher factor (Coach- athlete Relationship, M3) were acceptable. Similar results were found in studies that reported psychometric properties of the CART-Q in different cultures[3,5,11,22,23].

No item presented any inconsistencies in their factorial solutions, but to improve the model fit, the correlation among errors of two items of the Proximity dimension was fixed. No study has reported problems with the factorial structure of the CART-Q and some reports indicated using covariance among items in order to adjust the model[11]. These correlations were low (<0.30) which, according to literature, do not interfere with the model identification and does not suggest cross loading[26,29], and some form of covariance was expected since it deals with dimensions in which a correlation is expected[16]. In addition, the model adequacy indicators (M2 and M3) were considered acceptable according to literature[28]. If the correlations among errors do not affect the model identification, they may be admitted and the model accepted, as is the case in the present study[29].

It is noteworthy that changes in the model through the establishment of covariance among measurement errors almost always improves the model fit and therefore such a procedure should be treated with care. Thus, the model re-specifications should be theoretically justified [28]. In this study, the additional parameter is meaningful and interpretable and may be due to a cultural nuance. Both items deal with the coach figure, one focused on trust and another on the coach's appreciation, subjects that appear to be confused with recognition and linking with the coach. To confirm such cultural nuance, we recommend replicating the re-specification in a new sample.

It is also noteworthy that although the correlated measurement errors may be a failure of the model to explain all the covariance among variables, evidence of a series of validation studies[3,16,23] carried out to examine the factorial validity of CART- Q makes this possibility to be less likely to occur. However, the cross-validation of this finding is also essential with an independent sample of Brazilian athletes to find out whether this new specification is restricted to the present sample or for any Brazilian context.

The convergent validity of the model with 11 items was also tested, finding that all factorial loadings were high (0.54 to 0.83) and statistically significant (P = 0.001), and the average extracted variance presented values above or close to 0.50, as recommended by literature[26,29]. Similar results were found in the development of study of CART-Q[16] and other cross-cultural validations[3,11,25].

As indicated by the authors of the instrument[16] and after the verification of high correlations among first-order factors, the existence of a second-order CART-Q model was tested. The weights of the second-order factors were substantially higher, showing that the second-order factor (Coach-Athlete Relationship) accounted for a large percentage of variance of first-order factors and confirming the factorial structure of the second-order model.

This finding is consistent with other validation studies of CART-Q[3,11,16,23].

Finally, the reliability scores for each factor met the internal consistency criteria (Cronbach's alpha and composite reliability) reported in literature, being less than 0.70[29]. The internal consistency coefficients of CART-Q were similar to the study of the original scale validation[16] and other validations for other cultures[3,11,23,25]. The item-dimension correlation values were satisfactory, providing evidence that the items actually measured what they intend to measure in each dimension. Item-dimension correlation coefficients greater than 0.50 are considered as indicators of a well-defined structure, considering that the factor explains at least 25% the individual variance of the item[29].

The internal validity of the Brazilian version of CART-Q remained stable when evaluated in an independent sample, with values similar to those found in Study 2 and also to those reported in literature[3,5,11,22]. It is noteworthy that for checking the CFA, an adequate fit was found, without fixing the correlation among errors, as occurred in Study 2. This reinforces the stability of the factorial structure, and also the correlation among errors previously verified was an isolated event characteristic of the target population. For external validity, CART-Q showed correlation patterns as expected and following the theoretical coherence of stronger relations with the Task Orientation with greater focus on community than on ego. These results were similar to those reported in previous study on the relationship between the two constructs[30]. However, new evidence of external validity, especially discriminant and predictive, need to be evaluated.

All dimensions of CART-Q were satisfactorily correlated with retest and no negative correlations between items and dimensions were observed[28]. By analyzing each individual item, it was found that item 2 ($r = 0.60$) did not obtained the recommended index ($r > 0.70$); however, literature indicates that values above 0.50 and close to 0.70 can be considered acceptable to confirm the test-retest reliability of a psychometric instrument[29]. The analysis of reliability through intraclass correlation coefficient showed that both the 11 items as the three dimensions of CART-Q showed no adherence to extremes, demonstrating reliability of intraclass correlation values observed. No studies verifying the temporal validity of scales were found in literature to date. This is a new finding that provides greater support to the psychometric evidence of CART-Q. However, further studies should be conducted to analyze the temporal stability of the Brazilian version of CART-Q to deepen knowledge about the psychometric properties of the instrument.

It is our understanding that the process of adaptation and analysis of the psychometric properties of psychological measures such as the coach-athlete relationship is an ongoing process that requires multiple methodological approaches[28,29]. In this sense, we chose to run three studies in a sequential order, with different methods and approaches and include alternatives with different samples. In our study, each study corroborated the previous results, thus verifying the adaptation and cultural validation of CART-Q. Moreover, this work also adds to literature information little or never reported such

as the content validity (Study 1) and temporal stability (Study 3).

One of our main results is the adequacy of the measurement model of CART-Q with 11 items (M2) and the verification of the second-order model (M3). The internal structure was the same as the original questionnaire and showed good adequacy for the confirmatory factor model, as previous studies have reported. This result allows using the instrument for cross-cultural comparison studies of coach-athlete relationship characteristics, using the same conceptual model of the "3Cs"[16].

The findings of this study include limitations that require to be interpreted with caution. The first limitation is related to the geographic distribution of the sample, since all athletes were from the state of Paraná. However, all athletes participate in state or national level competitions and came from different regions of Brazil. Future studies should also address issues related to cross-validation so that the results can be generalized to other independent samples. This study tested the Brazilian version with a sample of athletes from different sports, as suggested by Jowett and Ntoumanis[16]. The psychometric properties of CART-Q were similar to the original version and to other cross-cultural validation studies, showing the cross-validation of the scale between samples and cultures, strengthening its consistency and reliability. Another aspect, although the sample size of study 2 was suitable (n = 364), is that it is unclear whether the model re-specifications would be needed with a larger sample (n > 1000). Finally, variables predictors and criteria were measured at the same time, which can lead to measurement biases[29]. Although we have tried to eliminate biases by conducting an anonymous study and using instruments that are established in literature, future studies should use different research models such as the longitudinal approach in order to establish the predictive validity of CART-Q.

CONCLUSION

This is the first study of cross-cultural adaptation and evidence of psychometric properties of the coach-athlete relationship questionnaire - athlete version to the Brazilian sports context. The Brazilian version of CART-Q showed adequate psychometric properties (content validity, internal reliability, construct validity and temporal stability), demonstrating that the evaluation of the athlete's perception on the quality and content of his relationship with the coach via CART -Q is valid and reliable. Therefore, the results obtained with CART-Q can provide relevant information to help professionals in the Sport Psychology Area and coaches to develop experiences that promote a positive relationship between coaches and athletes.

REFERÊNCIAS

1. Jowett S, Cockerill IM. Incompatibility in the coach-athlete relationship. In: Cockerill IM, editor. Solutions in Sport Psychology. London: Thomson Learning; 2002. p. 16-31.

2. Côté J, Gilbert WD. An integrative definition of coaching effectiveness and expertise. Inter J Sports Sci Coach 2009;4(3):307-23.
3. Yang SX, Jowett S. Psychometric properties of the Coach- Athlete Relationships Questionnaire (CART-Q) in seven countries. Psychol Sport Exercise 2012;13(1):36-8.
4. Jowett S. The coach-athlete partnership. Psychologist 2005;18(1):412-5.
5. Philippe RA, Seiler R. Closeness, co-orientation and complementarity in coach-athlete relationships: What male swimmers say about their male coaches. Psychol Sport Exercise 2006;7(2):159-171.
6. Jowett S, Wylleman P. Interpersonal relationships in sport and exercise settings: Crossing the chasm. Psychol Sport Exercise 2006;7(2):119-23.
7. Lafrenière MAK, Jowett S, Vallerand RJ, Carbonneau N. Passion for coaching and the quality of the coach-athlete relationship: The mediating role of coaching behaviors. Psychol Sport Exercise 2011;12(2):144-52.
8. Mageau GA, Vallerand RJ. The coach-athlete relationship: a motivational model. J Sports Sci 2003;21(11):883-904.
9. Jowett S. Validating coach–athlete relationship measures with the nomological network. Meas Phys Educ Exercise Sci 2009;13(1):34-51.
10. Jowett S. Interdependence analysis and the 3+1Cs in the coach-athlete relationship. In: Jowett S, Lavalle D, editors. Social Psychology in Sport. Champaign: Human Kinetics; 2007. p. 15-28.
11. Balduck AL, Jowett S. Psychometric properties of the Belgian coach version of the coach-athlete relationship questionnaire (CART-Q). Scand J Med Sci Sports 2010;20(5):779-786.
12. Chelladurai P. Leadership in sports. In: Tenenbaum G, Eklund RC, editors. Handbook of Sport Psychology. 3rd ed. New York: John Wiley & Sons; 2007. p. 113-135.
13. Riemer HA, Chelladurai P. Development of the Athlete Satisfaction Questionnaire (ASQ). J Sport Exercise Psych 1998;20(2):127-56.
14. Hinde RA. Relationships: A dialectical perspective. London: Psychology Press; 1997.
15. Jowett S, Kanakoglou K, Passmore J. The application of the 3+1 Cs relationship model in executive coaching. Consult Psychol J: Pract Res 2012;64(3):183-97.
16. Jowett S, Ntoumanis N. The Coach–Athlete Relationship Questionnaire (CART-Q): Development and initial validation. Scan J Med Sci Sports 2004;14(4):245-57.
17. Rhind DJA, Jowett S. Initial evidence for the criterion-related and structural validity of the long versions of the direct and meta-perspectives of the Coach-Athlete Relationship Question. European J Sport Sci 2010;10(6):359-70
18. Pasquali, L. Instrumentos psicológicos: manual prático de elaboração. Brasília: IBAPP; 1999.
19. Chelladurai P, Saleh S. Preferred leadership in sports. Can J Appl Sport Sci 1978;3(1):85-92.
20. Smoll FL, Smith RE, Curtis B, Hunt E. Towards a Mediational model of coach-player relationships. Res Q 1978;49(4):528-41.
21. Kelley HH, Berscheid E, Christensen A, Harvey JH, Huston TL, Levinger G, McClintock E, Peplau LA, Peterson DR, editors. Close relationships. New York: Freeman; 1983.
22. Yang X, Jowett S. An examination of the psychometric properties of the Chinese Coach-Athlete Relationship Questionnaire (CART-Q). Inter J Coach Sci 2010;4(2):73-89.
23. Yang S, Jowett S. Conceptual and measurement issues of the complementarity dimension of the coach–athlete relationship across cultures. Psych Spor Exercise 2013;14(6):830-41.
24. Trzaskoma-Bicserdy GT, Bognar J, Revesz L, Geczi G. The coach-athlete relationship in successful Hungarian individual sports. Inter J Sport Sci Coach 2007;2(4):484-95.
25. Jowett S, Ntoumanis N. The Greek Coach - Athlete Relationship Questionnaire (GrCART-Q): Scale development and validation. Inter J Sport Psychol 2003;34(1):101-24.

26. Marôco J. Análise de Equações Estruturais: Fundamentos teóricos, Software e Aplicações. Pêro Pinheiro: Report Number; 2010.
27. Hernández-Nieto RA. Contributions to Statistical Analysis. Mérida: Universidad de Los Andes; 2002.
28. Kline RB. Principles and Practice of Structural Equation Modeling. New York: The Guilford Press; 2012.
29. Hair J, Black W, Babin B, Anderson R, Tatham, R. Multivariate Data Analysis. New Jersey: Pearson Educational; 2005.
30. Olympiou A, Jowett S, Duda, JL. The psychological interface between the coach-created motivational climate and the coach-athlete relationship in team sports. Sport Psychol 2008;22(4):423-38.

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