

PSYCHOMETRIC PROPERTIES OF THE GROUP ENVIRONMENT QUESTIONNAIRE (GEQ) FOR THE HIGH PERFORMANCE SOCCER AND FUTSAL CONTEXT

PROPRIEDADES PSICOMÉTRICAS DO QUESTIONÁRIO DE AMBIENTE DE GRUPO (GEQ) PARA O CONTEXTO DO FUTEBOL E FUTSAL DE ALTO RENDIMENTO

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RESUMO

O objetivo deste estudo foi analisar as propriedades psicométricas da versão brasileira do *Questionário de Ambiente de Grupo* (GEQ) para o contexto do futsal e futebol de alto rendimento. Participaram do estudo 441 atletas do sexo masculino, sendo 140 de futebol e 301 de futsal. A análise dos dados foi conduzida utilizando os testes alfa de Cronbach(α), confiabilidade composta (CC), análise fatorial confirmatória (AFC), variância extraída média e correlação de Spearman. Os resultados evidenciaram que o GEQ apresentou consistência interna satisfatória ($\alpha > 0,70/CC > 0,70$). A AFC revelou que o modelo (M2) com 16 itens apresentou ajuste adequado para atletas de futebol e futsal e a análise multigrupos apontou invariância parcial (métrica e configuracional) entre jogadores de futebol e futsal. O GEQ apresentou validade externa satisfatória ($r > 0,50/p < 0,05$) com as dimensões do CART-Q (Questionário do Relacionamento Treinador-A atleta – versão atleta). Concluiu-se que a versão do GEQ apresentou propriedades psicométricas satisfatórias para o contexto do futebol e futsal brasileiro de alto rendimento.

Palavras-chave: Psicometria. Coesão de grupo. Esporte.

ABSTRACT

This study aimed at analyzing the psychometric properties of the Brazilian version of the Group Environment Questionnaire (GEQ) in futsal and soccer high performance contexts. The sample consisted of 441 male athletes, 140 soccer players and 301 futsal players. The data analysis was carried out by using the following tests: Cronbach's alpha (α), Composite Reliability (CR), Confirmatory Factor Analysis (CFA), Average Variance Extracted (AVE) and Spearman's correlation. The results showed that the GEQ has a good internal consistency ($\alpha > 0,70/CC > 0,70$). The CFA revealed that the model (M2) with 16 items showed an adequate fit for soccer and futsal athletes, and that the multigroup analysis supported a partial invariance (metric and configurational ones) among soccer and futsal players. The GEQ had a good external validity ($r > 0,50/p < 0,05$) with all the CART-Q dimensions (*Coach-Athlete Relationship Questionnaire – athlete version*). It was concluded that the GEQ version showed good psychometric properties in Brazilian high performance soccer and futsal contexts.

Keywords: Psychometrics. Group cohesion. Sport.

Introduction

The study of psychological variables has received great emphasis in high performance soccer and futsal contexts¹, since the psychological preparation has been considered a difference by athletes and coaches of champion teams, in addition to reflect directly on the players' welfare^{2,3}. In this sense, besides the individual psychological evaluation of the athletes, assessing behavior and established relationships within groups/teams has been emerging, since the creation of good environments is critical to the achievement of the aims and fulfillment of the emotional needs of the group members^{4,5}.

In this perspective, group cohesion is a variable sport psychology researchers are concerned about, especially in the international scope, where most of the research on cohesion occur by analyzing the factors involved in the relations of the teams, such as anxiety,

collective efficacy, optimism, motivational climate, performance, the coach leadership style and athletic satisfaction^{2,6,8,9,10}. However, there is the need for further research on some factors that affect the team cohesion, which is still little explored in the literature, that is, the coach-athlete relationship⁶ and the prototypical attributes of the teams⁷. Therefore, it is seen that the investigations have been intense in some sports, such as soccer⁸, futsal⁹, hockey, American football, rugby, and basketball^{10,11}.

However, considering the national sport context there is little research aimed at evaluating the group cohesion, and the existing ones are on futsal¹² and volleyball¹³ modalities, with few investigations on soccer¹². In addition, the evaluation of issues related to group cohesion are extremely important for soccer, given its relevant collective work characteristics and preparation based on the group, in addition to issues related to such a sport popularity in our country¹⁴ and in different cultures, increasingly seen in Brazilian teams.

It is necessary to highlight that the shortage of research in the national scope might result from the lack of instruments for evaluating the group cohesion. However, the recent validation of the Group Environment Questionnaire (GEQ) for Brazilian sport context¹⁵ has contributed to the advancement of this gap. This instrument was originally developed by Carron et al.¹⁶ and reviewed by Eys et al.¹⁷, whose items have been changed into positive statements. The scale has multidimensional characteristics, and it aims at evaluating the group environment of sport teams. It is divided into four dimensions related to the involvement of the athletes, considering the interaction and attraction of such athletes with the tasks and the social group (team).

Regarding Brazilian sport context, Nascimento Junior et al.¹⁵ found that the questionnaire has adequate and reliable psychometric properties, however they suggest the need to replicate the study to confirm the factor solution found, because the instrument has been reduced from 18 to 16 items. The same authors also suggest the evaluation of its generalization in independent samples and specific modalities, which is the gap to be filled by this study. Furthermore, this research advances methodologically since it evaluates the factor structure, invariance and the external validity of the instrument with high performance athletes, in two of the most popular sports in the country, soccer and futsal. Since such modalities have peculiar characteristics, it is relevant to evaluate the factor structure of psychometric instruments specifically with the players of both sports.

The analysis of the psychometric properties adequacy of the original instruments from other cultures is an orientation of the literature specialized in instruments for psychological evaluation^{18,19}, considering the changes and influences that the socio-cultural and economic characteristics have in different populations^{18,19}. Therefore, there is a concern in the sense of identifying and adapting the GEQ validity indicators in the international sport context;. Thus, the questionnaire has been used as a validated focus in different countries such as the USA, New Zealand, Canada, Portugal and Spain^{11,17,20,21}, and appropriate indicators of such an instrument validity and stability have been found.

Given these considerations, the present study aims at analyzing the GEQ psychometric properties in high performance soccer and futsal contexts, specifically the internal consistency, as well as the construct, convergent and external validities of the GEQ.

Methodological Procedures

Population and sample

The population of this study consisted of high performance male soccer and futsal players. Considering the futsal context, the athletes from the 19 teams who had participated in the National Futsal League, 2013, were invited to participate. All teams agreed, and, thus, the

sample embraced the entire Brazilian high performance futsal players with a total of 301 athletes. The athletes had a mean age of 25.49 ± 4.91 years and had begun to practice the sport at the age of 9.12 ± 3.59 years. Concerning the soccer context, all the professional teams from the north and northwest regions of Paraná state who had participated in the Soccer Cup of the state in 2015 were invited to take part in the survey. However, only five teams agreed to participate, with a sample of 140 athletes. Athletes came from different regions of Brazil with an average age of 20.01 ± 2.29 years. Therefore, the total survey sample consisted of 441 athletes. The sample size was determined based on the recommendations of Hair et al.²², who suggests at least ten subjects per instrument item for carrying out the factor analysis.

The sample inclusion criteria were to have participated in any competition at the national and/or state sport level in the last three years (2010-2012). Only the athletes who have been part of the team for at least 3 months were evaluated, and this period was considered the minimum so that the athlete could have a better relationship in the group, and a perception of team cohesion as well. All the athletes above 18 years of age signed the Free and Clarified Consent Term, and in the case of the underage athletes the terms were signed by the coaches.

For the GEQ external validity analysis, 50 subjects out of the 140 soccer players were selected based on a non-probabilistic convenience. They also answered the Coach-Athlete Relationship Questionnaire (CART-Q) – Athlete Version.

Data collecting instruments

The Group Environment Questionnaire (GEQ)¹⁶ was the instrument used to identify the cohesion level of futsal and soccer players, which was reviewed and modified by Eys et al.,¹⁷ adapted and validated for the Brazilian sport context by Nascimento Junior et al.¹⁵. This instrument evaluates the group cohesion perception in sport teams, and it embraces 16 items distributed among four dimensions: 1) Task-Group Integration (GI-T: 8, 10, 12, 14 and 16); 2) Social- Group Integration (GI-S: 9, 11, 13 and 15); 3) Task-Group Individual Attraction (AI-T: 3, 4 and 6); and 4) Social-Group Individual Attraction (AI-S: 1, 2, 5 and 7). The answers are given on a Likert scale of nine points, ranging from 'I strongly disagree' (1) to 'I strongly agree' (9), in which the value of each dimension is given from the average of the responses of their respective items.

For the analysis of the questionnaire external validity, the 50 soccer players answered the GEQ with the CART-Q Athlete Version²³ validated for the Brazilian context by Vieira et al.²³. This instrument evaluates the perceptions of the athletes about their relationship with the coach in the sport context. The scale consists of 11 items divided into three dimensions: Proximity, Commitment and Complimentarily. The answers are given on a Likert scale of seven points, ranging on a continuum from 'I strongly disagree' (1) to 'I strongly agree' (7). The use of this scale to assess the external validity is supported by international research that points the coach-athlete relationship as a potential interpersonal mediator correlative to the group cohesion, since high group cohesion levels are achieved from positive relationships of the athletes with their coaches⁶.

Procedures

The study was endorsed by the Standing Committee on Ethical Research with Humans of the State University of Maringá (Opinion n°248,363/2013). Initially the researchers contacted the directors of the Brazilian Futsal Confederation (CBFS) and the directors and coaches of futsal and soccer teams, in order to clarify the aims and procedures of the research.

After the allowance of the CBFS, that is, the directors and coaches of the teams, dates were set for signing the consent Free and Clarified Consent Term and data collecting. The data collecting was carried out the days and periods the players and coaches had available.

Data analysis

The data were evaluated with the help of the software SPSS version 19.0 and Amos version 17.0. Data on the characteristics of the sample were analyzed descriptively (mean and standard deviation) for continuous data; and frequency distribution (percentage) for the categorical data. In order to analyze the GEQ psychometric properties in high performance soccer and futsal contexts, Cronbach's alpha reliability coefficient and composite reliability scores (internal consistency) were used, as well as the confirmatory factor analysis (CFA) to verify the construct validity of the instrument, by means of: a) individual reliability of the items, absolute fit indices, parsimonious and incremental; and b) average variance extracted (AVE) to analyze the convergent validity²⁵. For the external validity analysis, Spearman's correlation coefficient was used.

Considering the CFA, the finding of outlier cases was carried out by using the Mahalanobis square distance (D^2), since the lack of such cases is a precondition for this analysis²⁶. Normality was also evaluated, which is one of the other conditions for performing the confirmatory factor analysis, having studied the univariate data distribution through both, asymmetry (Sk) and kurtosis (Ku), in addition to the multivariate distribution (Mardia's coefficient for multivariate kurtosis) ($ISkI < 3.0$ and $IKuI < 10$)²⁵.

Once the data violated the normality assumption, the Bollen-Stine Bootstrap procedure was carried out in order to get a Chi-square corrected value of the estimated coefficients for the Maximum verisimilitude estimator¹⁸. Although some authors recommend a cutoff of 0.70 as suitable for factorial loads²², it was decided to set charges above 0.50 as acceptable, since this value ensures an explained variance item of at least 25%, as suggested by several psychometrics researchers²⁵⁻²⁷. In addition, the bootstrapping technique was used to verify the factor loading significance for each item and its respective factor²⁸.

Therefore, the GEQ was tested by means of fit indexes usually recommended in the literature (reference values expected for each index): Chi-square (X^2 and p-value), Goodness-of-Fit Index ($GFI > 0.90$), the Root Mean Square Error of Approximation ($RMSEA < 0.08$, I.C. 90%), Normalized Fit Index ($NFI > 0.90$), Tucker-Lewis Index ($TLI > 0.90$), Adjusted Goodness-of-fit Index ($AGFI > 0.90$), Comparative Fit Index ($CFI > 0.90$) and Normalized Chi-square ($X^2/\text{degree of freedom}$, recommended between 1.0 and 3.0). These indices are intended to assess whether the model has a good fit to the data, as suggested in the literature^{22,25,26,29}.

The AVE analysis was used in order to evaluate the convergent validity, and values close to or higher than 0.50 were considered indicators of the model adequate convergent validity²¹. The Composite Reliability (CR) was calculated through the CFA results (factor loading and residual errors), since this measure provides the internal consistency index of the instrument dimensions through the factor loadings of its respective items, and values higher than 0.70 were considered indicators of suitable CR³⁰.

For analyzing the GEQ factorial invariance among soccer and futsal players, a suitability model was initially defined for both modalities. After obtaining the factors, they were simultaneously subjected to a multi group analysis (with Emulisrel correction⁶) that aimed at analyzing a progressive set of constraints (factor loadings, variance and covariance) in order to verify the instrument equivalence in two subgroups (soccer vs. futsal). The chi-

square difference value ($\Delta\chi^2$) and its degrees of freedom (df) were used to analyze possible significant differences between the models tested, as well as the difference of CFI values¹⁸.

The external validation was measured by using Spearman's correlation (nonparametric data) between the GEQ dimensions and a related construction, that is, the CART-Q. As GEQ is a cohesive group model in the sport environment, the hypothesis tested for the external validation was mainly that the GEQ task dimensions would show mean and high correlations ($r > 0.40$) with the CART- Q dimensions (Proximity, Complimentarily and Commitment), as suggested by the literature⁶.

Results

Descriptive statistics and internal consistency

The descriptive analysis of the results showed that the athletes have used the nine existing possible answers for each of the 16 GEQ items. The means of the answers for the items ranged from 5.10 ± 2.14 to 7.87 ± 1.49 , illustrating the lower and higher means in items 5, respectively ('I like the parties my staff gives more than other kinds of parties') and 3 ('I'm happy with the desire to win of my team'). It was also found that the athletes had a relatively high perception of group cohesion, with the following scores: GI-T = 7.23 ± 1.30 ; GI-S = 5.47 ± 1.67 ; AI-T = 7.55 ± 1.26 ; and AI-S = 6.57 ± 1.41 . The GEQ overall internal consistency level was of 0.90. It was found, according to Table 1, that Cronbach's alpha was good for the four dimensions of the questionnaire.

Table 1. GEQ internal dimension consistency and item-dimension correlation

| GEQ Dimensions | Item n° | α | Item-dimension correlation |
|----------------|-------------------|----------|----------------------------|
| GI-T | 8, 10, 12, 14, 16 | 0,85 | 0,73/0,80/0,80/0,82/0,78 |
| GI-S | 9, 11, 13, 15 | 0,80 | 0,80/0,81/0,78/0,75 |
| AI-T | 3, 4, 6 | 0,76 | 0,82/0,77/0,80 |
| AI-S | 1, 2, 5, 7 | 0,75 | 0,73/0,75/0,71/0,79 |

Source: the authors

The existence of the item-correlation dimension ranging from $0.71 \leq R \leq 0.82$ was also seen, which indicates a high correlation between the dimensions and their respective items.

Confirmatory factor analysis

Initially, no outliers were found, allowing the use of the CFA. No variable showed value indicators of severe violations to the normal distribution (Sk and Ku). The GEQ model for futsal and soccer submitted to CFA was similar to the measurement model of the version initially validated for the Brazilian context in general. However, other fit models were also evaluated, since the first model did not have good indices. Furthermore, a factorial model of second order was tested.

Based on the evaluation of the individual reliability of GEQ items, through the factor loading weights, it was found that in the initial model (M1) all the 16 items saturated in their respective factors with a magnitude higher than 0.50 ($p < 0.001$). However, the model (M1) did not have an acceptable fit [χ^2 (98) = 360.07; χ^2/df = 3.67; CFI = 0.92; GFI = 0.90; AGFI = 0.86; TLI = 0.90; RMSEA = 0.08 (I.C.. 0.07-0.10); AIC = 436.07; BIC = 591.45; ECVI = 0.99] (Table 2). In addition, modification indices suggested a correlation among the measurement errors of some factor items. Thus, the final model (M2) showed a correlation among the errors of items 9 ('The members of our team would rather go out to parties

together than going out alone') and 11 ('The members of our staff often give parties together'), and among the errors of the items 14 ('If the members of our team have problems during training, everyone wants to help them so that we can be together again'), and 16 ('Our team openly communicate about the responsibilities of each athlete during competitions and tournaments'). Such correlations among the errors were weak ($r < 0.40$) and among the items of the same factor, thereby not compromising fit or theoretical acceptance of the model.

Table 2. GEQ measurement model fit indexes in high performance soccer and futsal contexts.

| Comparison between GEQ models | Model with 16 items (M1) | Model with 16 modified items (M2) | Model of 2 nd Order (M3) |
|----------------------------------|-----------------------------|--------------------------------------|--|
| X^2 | 360,07 | 291,32 | 341,90 |
| G1 | 98 | 96 | 98 |
| p-value | 0,001 | 0,001 | 0,001 |
| X^2 normalized ($X^2/g1$) | 3,67 | 3,03 | 3,48 |
| GFI | 0,90 | 0,92 | 0,91 |
| RMSEA [I.C. 90%] | 0,08[0,07-0,10] | 0,07[0,06-0,08] | 0,07 [0,06-0,08] |
| TLI | 0,90 | 0,92 | 0,91 |
| AGFI | 0,86 | 0,90 | 0,90 |
| NFI | 0,89 | 0,91 | 0,90 |
| CFI | 0,92 | 0,94 | 0,93 |
| AIC | 436,07 | 317,32 | 417,89 |
| BIC | 591,45 | 534,88 | 573,28 |
| ECVI | 0,99 | 0,85 | 0,95 |

P.S.: X^2 = Qui-square; df = degrees of freedom; $X^2/g1$ = normalized qui-square; GFI = Goodness-of-fit Index; RMSEA = Root Mean Square Error of Approximation; TLI = Tucker-Lewis Index; AGFI = Adjusted Goodness-of-fit Index; NFI = Normalized Fit Index; CFI = Comparative Fit Index; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; ECVI = Expected Cross-Validatin Index.

Source: the authors.

The factor structure of the GRQ modified model (M2) related to the global model fit had X^2 (96) = 291.32 and was significant for $p < 0.001$, indicating a weak fit (Table 2). However, the values of the other absolute fit measures were acceptable (GFI = 0.92; RMSEA = 0.07, I.C. 0.06-0.08). Regarding the incremental fit measures, TLI (0.92) and AGFI (0.90) achieved the recommended level of 0.90, which confirms with credibility the acceptance of the GEQ modified model. For parsimonious fit measures it was found that the chi-square standard ($X^2/df = 3.03$) was adequate and the CFI (0.94) has achieved the recommended level (> 0.90).

In addition, it was observed that the modified model (M2) had better values in the indices based on the Information Theory (AIC = 317.32; BIC = 534.88; ECVI = 0.85) compared to the initial model (M1). Therefore, it is emphasized that the M2 showed good fit for soccer and futsal athletes, showing good psychometric properties of the instrument in high performance soccer and futsal contexts (Figure 1).

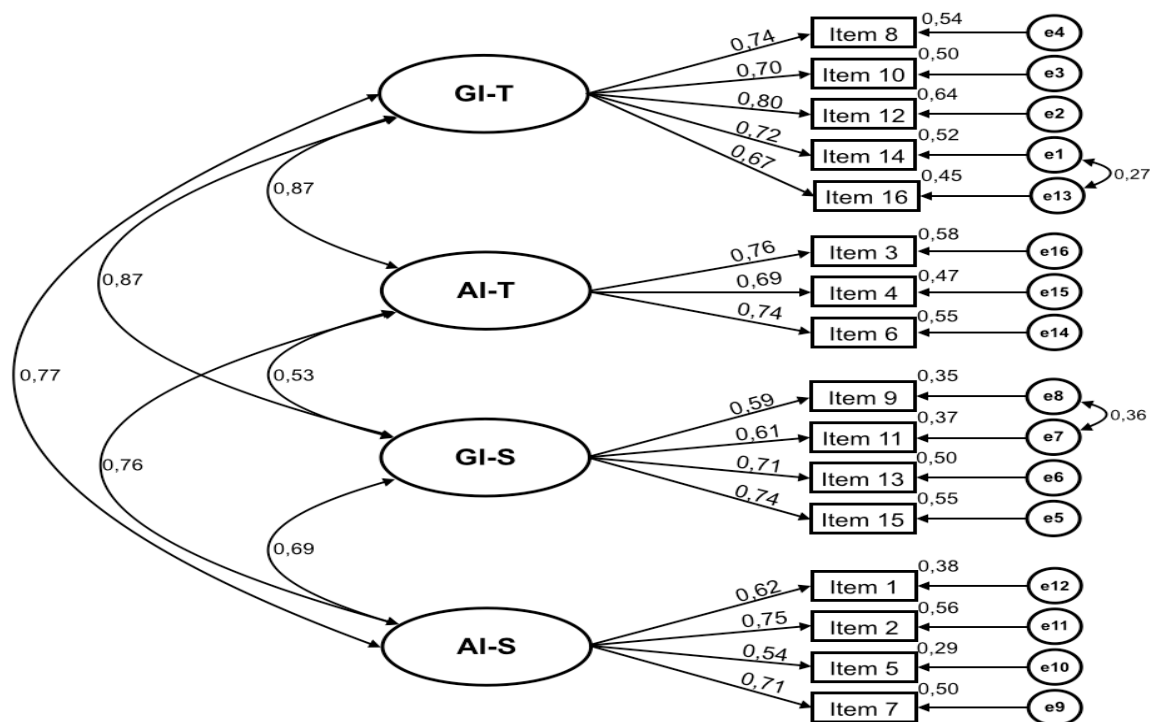


Figure 1. Standardized coefficients of Bootstrap replications, correlation among factors and errors associated to each item of the modified four-factor model of GEQ model in futsal and soccer contexts.

Source: The Authors

All factor loadings (λ) showed mean and strong values between 0.54 and 0.80, and the Bootstrap replication ($p < 0.001$) and the Confidence Interval (C.I. 95%) indicated the stability of factor estimates and consequent fit of the model for the data (Figure 1). Thus, it is clear that the GEQ factor structure analysis for futsal and soccer had psychometric properties similar to the model initially validated for Brazilian sport¹¹.

The average variance extracted values (AVE) were as it follows: GI-T = 0.53; GI-S = 0.44; AI-T = 0.54; and AI-S = 0.43. The two dimensions of social cohesion (GI-S and I-S) did not show convergent validity above what is recommended (0.50), however, they were values close to the cutoff point. CR values for evaluating the internal consistency were as it follows: GI-T = 0.85; GI-S = 0.76; AI-T = 0.77; and AI-S = 0.75. All the dimensions showed a good CR above the cutoff point (> 0.70), confirming the internal consistency of the scale items.

Considering the high correlations (Figure 1) found among the four first-order factors (M2), it was decided to test a second-order model with the existence of a factor called Group Cohesion, as also adopted by Nascimento Junior et al.¹⁵. The fit indices of the second-order model (M3) were identical or higher than the fit indices of the first-order model (M2) (Table 2), which shows a support to the hierarchical model. The factor loadings of the second-order factor for the first-order ones were also substantially higher (AI-T = 0.79; GI-T = 0.91; AI-S = 0.87; GI-S = 0.79) and significant ($p < 0.001$).

GEQ invariance among soccer and futsal athletes

When analyzing the configurational invariance of the GEQ first-order model with 16 items (M2) among soccer and futsal players [X^2 (192) = 452.47; X^2/df = 2.36; CFI = 0.92; GFI = 0.90; TLI = 0.90; RMSEA = 0.056; $p(\text{RMSEA} < 0.05)$ = 0.081], the model showed an

adequate fit among soccer and futsal athletes, indicating that the suggested structure is stable in both groups. It was found that the constrained model with factor weights in the athletes (soccer x futsal) did not have a fit significantly worse than the model with free parameters [$X^2_{diff}(12) = 29.38$; $p = 0.53$]. These findings show that the model with fixed factor weights has good fit for both groups, as well as the model with free parameters, showing the metric equivalence of the measuring weights among soccer and futsal athletes. However, the model structural invariance was not obtained [$X^2_{diff}(22) = 45.99$; $p = 0.02$], which means that the correlation levels among the factors are not the same for both groups. These results show the partial invariance (configurational and metric ones) of the GEQ model with 16 items in both groups.

GEQ external validity

It was found that almost all GEQ dimensions correlated positively and moderately ($p < 0.01$) with CART-Q dimensions (Proximity, Commitment and Complimentarity) (Table 3).

Table 3. Correlation among GEQ and CART-Q dimensions for soccer and futsal athletes.

| GEQ | CART-Q | | |
|------|---------------|---------------|-----------------|
| | Proximity | Commitment | Complimentarity |
| GI-T | 0,48** | 0,44** | 0,33* |
| GI-S | 0,18 | 0,12 | 0,06 |
| AI-T | 0,53** | 0,42** | 0,37** |
| AI-S | 0,52** | 0,32* | 0,24 |

* $p < 0.05$. ** $p < 0.01$.

Source: The authors.

It is noteworthy that the highest correlation coefficients were found among these dimensions: GEQ AI-T ($r = 0.53$), AI-S ($r = 0.52$) and GI-T ($r = 0.48$) with CART-Q and GI-T 'Proximity' dimension, and AI-T with 'Commitment' (Table 4). It is also noteworthy that GI-T and AI-T dimensions of GEQ correlated with all CART-Q dimensions, showing that the coach-athlete relationship has an increased interaction when the team athletes realize a higher cohesion level of the team focused on the task and aims. In addition, significant correlations among GI-S and CART-Q dimensions were not found. This might be due to the fact that the GI-S dimension aims at evaluating the group social interaction out off the courts, and the athletes may not realize the coach in such a situation.

Discussion

This is the first study that analyzes the psychometric properties of the GEQ Brazilian version in independent samples. Thus, the research methodological advancement is verified by analyzing reliability, the factor structure, invariance and the external validity of the instrument in a sample of high-performance soccer and futsal athletes. These modalities are considered the most popular ones in the country. In this perspective, data of high performance male athletes were used in both modalities.

Descriptive statistics and GEQ internal consistency

In the initial descriptive statistics, the athletes showed a relatively high perception of group cohesion, especially considering the means of AI-T (7.55) and AI-S (6.57) dimensions.

Similar results were found in a survey with Brazilian volleyball players, which showed good cohesion levels in relation to task and social groups¹³. These results are also supported by the study of Gomes et al.³¹ with futsal and soccer Portuguese athletes, who showed higher values of the above mentioned dimensions (AI-S = 7.16; AI-T = 6.97).

Concerning the reliability analysis (Cronbach's alpha), it was found that the general internal consistency level had a value considered acceptable (0.90), according to the reference criteria (above 0.70)^{29,30}. In addition, the reliability calculation of each GEQ dimension separately showed Cronbach's alpha ranging from 0.75 to 0.85, which indicates a strong internal consistency of the dimensions (Table 1). These results were similar to those obtained in the initial study of GEQ validation in Brazilian sport context¹⁵ and they may arise from the reduction of items in two dimensions of the instrument. The findings of the present research showed higher indices when compared to the international studies on instrument validation^{17,20,21} and to studies that analyzed group cohesion associated with other psychological variables, such as team conflicts and collective effectiveness³.

When the item-scale correlation values were verified, good values were observed concerning what is suggested in the literature ($0.71 \leq r \leq 0.82$), showing that the items actually assess what is expected for each dimension³⁰. It is noteworthy that the item-scale correlations above 0.70 are indicative of a very well-defined structure, since the factor explains at least 50% of the item variance²².

Confirmatory factor analysis

In general, the GEQ version for Brazilian high-performance soccer and futsal players had good construct validity indicators, evidenced by the confirmatory factor analysis, keeping the four-factors structure model suggested by Carron et al.¹⁶ in the original instrument (Integration in the task group; integration in the social group, individual attraction for the task group and individual attraction for the social group) (Table 2). Thus, the instrument final version consisted of 16 items divided into four dimensions, with a good model fit and weak correlations among the error indices of a few items of the same factor (Figure 1), which does not affect the factor structure because according to the literature correlation values lower to 0.40 are considered acceptable^{25,26}. These findings are in accordance with the criteria recommended by the literature³², indicating a good fit of the four-factor model of this study for the modalities investigated. The fit model indices were similar to the GEQ validation study for athletes in the Spanish context^{3,17,20}, as well as to the validation study of the original instrument in Brazilian context¹⁵. Other international research on GEQ validation also found the factor structure of the model suggested by Carron et al.¹⁶, in addition to support values for the four-factor model^{33,34}.

When analyzing the convergent validity, values for the Average Variance Extracted (AVE) were found, which showed good validity indicators in GI-T (0.53) and AI-T (0.54) dimensions. On the other hand, GI-S (0.44) and AI-S (0.43) dimensions had values below the limit suggested (0.50)²², however these values can be considered valid, since they are near the cutoff point. These results were also seen in the initial validation instrument¹⁵ in which only the AI-S dimension showed values below the limit. It is noteworthy that the discussion on AVE values with other international studies on the GEQ psychometric structure evidences is limited, since research using this validity criterion was not found in the literature, which explains the relevance of the convergent validity analysis carried out in this study.

Furthermore, by using the GEQ configurational invariance, and considering the futsal and soccer modalities, it was possible to see that the model had good fit for both modalities, showing that the suggested model remained stable for futsal and soccer players. It is

noteworthy that the values obtained were weak, however, this was not seen in national studies^{12,13,15}. Therefore, it can be said that the instrument structure has enough flexibility to be used in both modalities, in addition to strengthen the GEQ internal consistency in high-performance soccer and futsal players. These results corroborate with international studies in which the scale also showed invariance among samples from different countries³⁵ and between sex³.

External validity

When verifying the GEQ External Validity, the results showed a mean positive correlation ($r > 0.50$) with CART-Q dimensions (proximity, commitment, complementarity), especially in the dimensions related to the task (GI-T and AI-T), indicating that when the athletes realize a higher cohesion level of the team focused on the task and aims, there is a greater interaction in the relationship with the coach. These data are corroborated by Jowett and Chaundy's study⁶, which found high correlations of GEQ and CART-Q dimensions, considering the social and task dimensions in the view of the athletes. It is noteworthy that the results found for the external validation show some methodological advance of this study that is pioneer in evaluating the correlation structure between the athlete version GEQ and CART-Q scales in high-performance soccer and futsal athletes.

In addition, the external validity results are consistent with the factors that influence the cohesion of a sport team suggested by Carron et al.³⁶ (environmental, leadership, personal and team factors). In this sense, the coach's leadership style provides support to the athletes through strategies and resources for developing group cohesion, and for achieving the aims of the team as well¹². Thus, the several leadership manifestations and relationships established with the coach, and the other group processes are extremely valuable to the modalities evaluated in this study (soccer and futsal), mainly because they are modalities with relevant features of 'team spirit', which evidence the importance of collective work and social relationships (with peers and coaches).

The results of this research have some limitations that should be highlighted, as they demand to be interpreted cautiously. The first refers to the instrument used. Although it is a study on GEQ psychometric properties, the version validated for the Brazilian sport context with a reduction of two items was the option used instead of the complete version. This option was due to the fact that the aim of the research was to assess the scale behavior for soccer and futsal modalities from the version adapted and validated initially to the Brazilian context. In order to overcome this obstacle, more than one model in the CFA was verified to determine the best performance of the scale already validated. For further studies it is suggested to update the scale and check its operation in several modalities, since this range is to be used in the collective sport context in general, but not only for two sports in particular. The second limitation is related to AVE low values of GI-S and I-S dimensions, indicating a possible unstable relationship among items and their dimensions. However, these values were close to what was recommended and discussed, pointing out that this is a measure not seen in international studies, and needs to be analyzed. Further studies related to GEQ psychometric properties should, thus, verify the scale convergent validity so that there are further discussions and strengthening of the scale.

Conclusions

The GEQ analysis psychometric properties in high-performance soccer and futsal contexts was good for internal consistency, construct validity, convergent validity and

external validity. The instrument also identified a partial similarity of group cohesion among soccer and futsal athletes, verifying that cohesion focused on task is related to the relationship among athletes and coaches.

Considering further studies, analyzing the GEQ factor structure with other types of psychometric measures analysis would be interesting, especially by using the psychometric modern approaches, such as the Item Response Theory. Using studies that verify more specifically the ratio between group cohesion and athlete-coach relationship is also suggested, since a positive correlation was identified between these two constructs.

Therefore, the results obtained by carrying out the GEQ psychometric analysis for the modalities suggested in this study provide relevant information to the professionals who work involved in soccer and futsal teams (coaches and teachers), as an access to an instrument that evaluates group cohesion in the specific context of such modalities, so that they can assess the perceptions of the athletes on team cohesion and, thus, can create a positive environment for the development of group cohesion in sport. In addition, this study highlights the importance of the coach-athlete relationship quality, since this allows a greater union of the group to achieve the common aims of the team.

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