Original Article

Content validation and inter-rater reliability of a protocol for the precision assessment of boccia players

JOSÉ IGOR V. OLIVEIRA[1], JOSÉ IRINEU GORLA[1], SAMARA M. NASCIMENTO[2], JOSÉ MARCOS M. OLIVEIRA[2], PEDRO P. PAES[2], SAULO F. M. OLIVEIRA[2]

[1]*Department of Studies of Adapted Physical Activity. School of Physical Education. University of Campinas. Campinas, Brazil.*
[2]*Department of Physical Education and Sports Science. Federal University of Pernambuco. Recife, Brazil.*

ABSTRACT

Purpose: To verify a protocol's content validation and reliability for assessing the precision in the throw of Paralympic boccia in two different steps. Methods: The study was divided into two steps: In step 1, the perception of 15 boccia coaches was evaluated using a questionnaire containing 6 questions about the pertinence of the protocol on a Likert scale (1 to 5). In step 2, reliability was evaluated by two researchers, applying the protocol with two targets (0.5 and 1.0, targets) to verify the short precision (SP), average precision (AP), long precision (LP), and total precision (TP) of 23 boccia athletes (BC1 = 5; BC2 = 7; BC3 = 1; BC4 = 10) in tournaments of the modality. The Content Validity Index (CVI) calculation was applied for the electronic questionnaire, the Intraclass Correlation Coefficient (ICC) for the agreement between evaluators, and the T-Test for the difference between means. $p < .05$ was adopted. Results: In the result of the CVI, reliability was noticed through the experts' evaluation (Question1 = 1.0; Q2 = 0.93; Q3 = 0.80; Q4 = 0.80; Q5 = 0.93; Q6 = 0.93). There was an agreement between the evaluators by the ICC in the 0.5 targets for SP ($p < .01$), AP ($p < .01$), LP ($p < .01$), and TP ($p < .01$), and in the 1.0 target for SP ($p < .01$), AP ($p < .01$), LP ($p < .01$), and TP ($p < .01$). No differences were found between the means in the t-test. Conclusion: It was demonstrated that the protocol meets the established reliability and content validity criteria, allowing its practical use to evaluate the precision in the boccia.

Keywords: Performance analysis of sports, Paralympic sport, Cerebral palsy, Instrument.

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Corresponding author. *Department of Studies of Adapted Physical Activity. School of Physical Education. University of Campinas. Campinas, Brazil.* https://orcid.org/0000-0002-0034-9638
E-mail: igorvasconcelos200@hotmail.com
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INTRODUCTION

The Paralympic sport emerged with a proposal for the rehabilitation and insertion of people with disabilities into society (Guttmann, 1967; Silver, 2012). With success, the first major recreational events for people with disabilities began to spread around the world (Bailey, 2008). With systematic practice, some sports modalities were created, and over the years the sporting events have gained strength, repercussion, and many fans (i.e., reaching 22 sports, 162 countries, and 4,400 athletes participating in the Tokyo 2020 Paralympics) (International Paralympic Committee, 2021). Within Paralympic sports, the boccia is a modality that over the years has been gaining many practitioners.

The Paralympic boccia stands out for being a modality covering different functional classes for people athletes/people with high support needs (WorldBoccia, 2021a). The throwing precision emerges as the primary determinant of performance (Reina et al., 2018). However, to adequately evaluate this variable in boccia athletes, validated instruments and protocols are needed. They exist few studies that sought to create tools and assessment protocols for boccia, some did not go through validation (Doewes et al., 2020; Ramírez et al., 2018) others are specific to a functional class (Lapresa et al., 2017).

Given this scenario, the validation of instruments and protocols in other modalities seems to be something not far from reality. For example, an instrument that verifies ball possession in Rugby has been designed and validated in six steps, including an evaluation (Villarejo et al., 2014). More specifically in Paralympic sports, content validation studies have grown more and more in the scientific scenario. In the scientific literature, studies are found that delimit steps for the creation of new instruments (Bertoldi et al., 2021) such as in wheelchair tennis (Dwi Yulianto et al., 2021). Nonetheless, studies with these characteristics are specific to certain objectives and modalities.

Given the specificity of the modality, it should be noted that a specific protocol was recently created to improve precision in boccia athletes, however, it does not yet have content validity (Oliveira et al., 2021). To this end, it is a perceived need for coaches and researchers for a reliable and practical instrument for the evaluation of precision in boccia athletes. For this reason, the main objective of this study is to validate the content of an individual precision assessment protocol in boccia in two steps 1) a content validation of the throwing precision test and 2) the assessment of the inter-evaluator reliability of the same test in boccia.

MATERIALS AND METHODS

Research and participants

This research is divided into two steps:

This research is divided into two steps: a) *step 1* refers to the evaluation of the individual protocol of throwing precision in boccia (Oliveira et al., 2021) by 15 coaches (46.7 % - ≥ 10 years of experience; 33.3% - ≤ 5 years of experience; 20% - 6-9 years of experience) evaluated through an electronic form (via *google forms*). The entire investigation was approved by the University's Human Research Ethics Committee; b) *step 2* involved 23 boccia athletes (BC1 = 5; BC2 = 7; BC3 = 1; BC4 = 10) in three official championships of the modality with the application protocol of throwing precision assessment (Oliveira et al., 2021) being evaluated by two independent evaluators. The entire investigation was approved by the University's Human Research Ethics Committee.

Measures

Coaches evaluation form

The electronic form was created by the authors of the study. The form was divided into three parts: (1) presentation of the research objectives and the Informed Consent Form; (2) personal data of coaches (e.g., time of experience); and (3) six questions about the protocol, considering its clarity, relevance and practical applicability in boccia (e.g., "*would you use the proposed protocol to assess the precision of Paralympic boccia athletes?*"), plus, an open question for suggestions for improvements and criticisms. For all questions of the form was used an adaptation of a Likert scale from 0, 1, 2, 3 (needs change), 4, and 5 (clear enough), for each of the dimensions that need evaluation.

Precision assessment protocol

The precision assessment protocol followed the recommendations of the study by Oliveira et al. (2021). This protocol is considered the best results for short precision (SP), average precision (AP), and long precision (LP) for specific zones beyond the total precision (TP) as a general parameter (figure 2, panel A). As a collection instrument, two targets with a maximum length of 110.5 cm each were created, graduating from 1 to 7 points. What differs between both circular targets is the thickness of the scoring zones and also the sensitivity of the graduation. Both can be used in the same way within the proposed protocol and with a maximum permissible score total of 42.0 points (Figure 1).

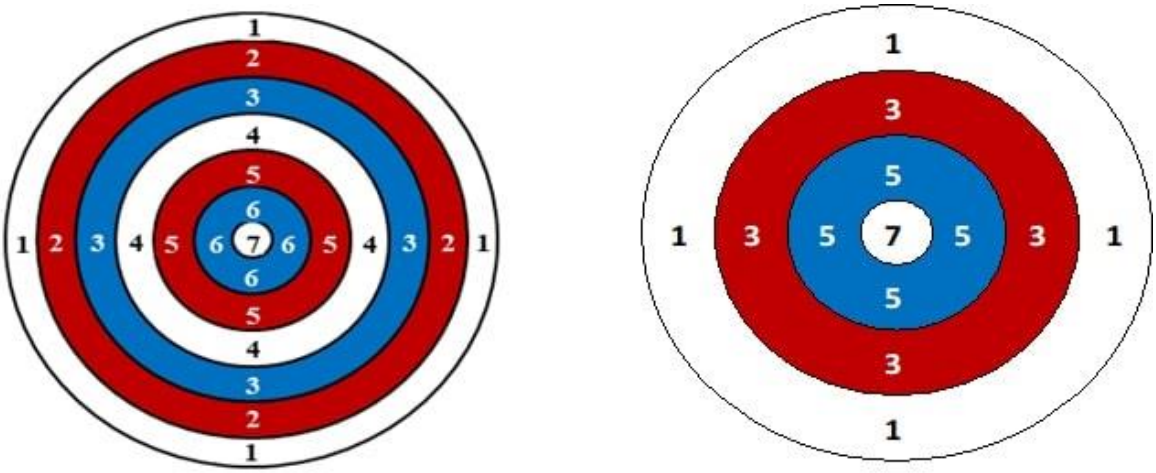

Figure 1. The two targets were used for data collection.

Procedures

For step 1, online material was presented (via e-mail or as the guest finds best (i.e., WhatsApp®)) for each coach containing: a document with a detailed description of how the proposed evaluation protocol is organized and applied; b) explanatory videos of the protocol (containing athletes performing gestures and application logistics); and c) photographs of the instruments (targets and evaluation form). In step 2, the evaluators determined three distances from the limit line of boxes 2 and 5 (3, 6, and 9 meters). Each player positioned himself in boxes 3 and 4 (in that order), and direct his throws sideways to the right, if he was in boxing 4, and left if he were in boxing 3 (figure 2, panel A). Each player throws two balls from both positions (right and left), and the best throw (highest score) is counted by the evaluators. Targets 1.0 and 0.5 share the same collection protocol. First, collections were performed with a target of 0.5 and then with a target of 1.0. For collection control, two independent evaluators (previously trained and adapted to the entire process) collected each throwing (Figure 2, panel B).

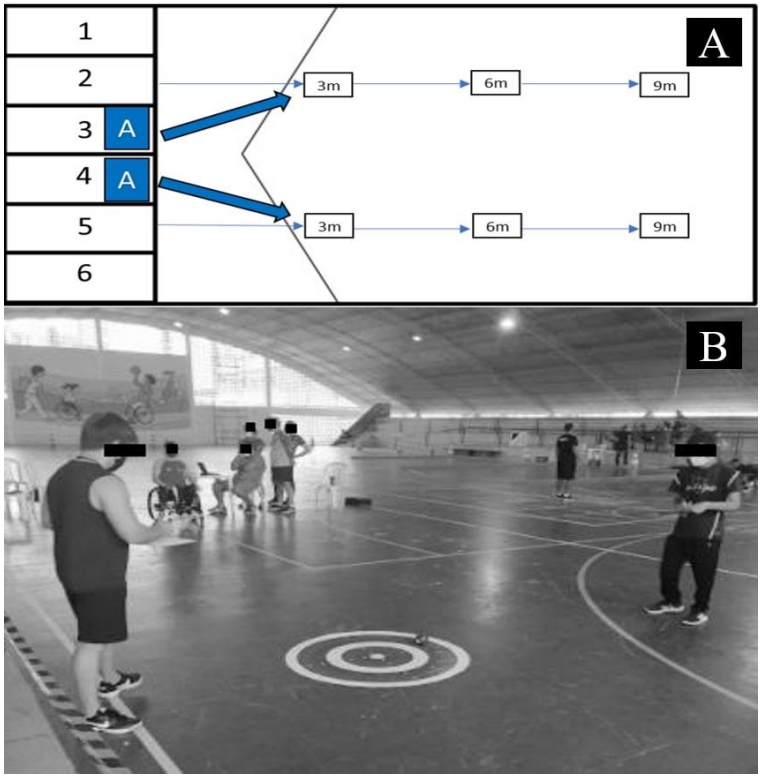

Figure 2. (A) Organization of the protocol for assessing the throwing precision of boccia athletes (Letter A in boxes 3 and 4 = athlete); (B) Collection of the protocol performed by two independent evaluators.

Statistical analysis

The descriptive data were determined by mean and standard deviation. For step 1, the calculation of the Content Validity Index (CVI) was applied and observed the proportion/percentage of experts who agreed with each item was presented (Holanda et al., 2019). It is understood that the rate found in each question should not be less than 0.78 (Polit et al., 2007). For each item evaluated, the calculation formula was applied:

$$CVI = \frac{nº\ of\ answers\ 4 \text{ and } 5}{total\ number\ of\ responses} \quad [1]$$

For *step 2*, the mean and standard deviation of the precision levels (right and left) were checked. The data collected by the two independent evaluators were analysed using the Intraclass Correlation Coefficient (ICC), the values were interpreted as "*poor*" (ICC < 0.4), "*reasonable*" (ICC = 0.4 to 0.6), "*good*" (ICC = 0.6 to 0.75), and "*excellent*" (ICC > 0.75) (Cicchetti, 1994). As a complement, the mean among the evaluators was evaluated by the T-Test in order to verify the discrepancy between the precision indicators. The data were analysed by IBM SPSS (version 22.0; SPSS Inc, Armonk, NY). Statistical significance was set at 5% (p < .05).

RESULTS

The coaches' answers, the time of experience, and the CVI result are in Table 1. It is perceived that Q1 = 1.0; Q2 = 0.93; Q3 = 0.80; Q4 = 0.80; Q5 = 0.93, and Q6 = 0.93 demonstrated significant results, indicating the relevance of the protocol in relation to the evaluation of the individual precision of boccia.

Table 1. Results of the Content Validity Index (CVI) and descriptive data of the coaches.

	Questions						Experience
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	
C1	4	3	3	5	4	3	More than 10 years
C2	5	5	4	4	4	4	Less than 5 years
C3	5	5	4	5	5	5	More than 10 years
C4	4	4	3	3	4	5	More than 10 years
C5	5	5	3	5	5	4	Less than 5 years
C6	4	4	4	4	3	4	More than 10 years
C7	5	5	4	5	5	5	More than 10 years
C8	5	4	4	3	4	5	Less than 5 years
C9	5	5	5	5	5	5	Less than 5 years
C10	5	4	5	3	4	5	More than 10 years
C11	5	5	5	5	5	5	Between 6 and 9 years
C12	5	5	5	5	5	5	Between 6 and 9 years
C13	5	5	5	5	5	5	Less than 5 years
C14	5	4	4	5	5	5	Between 6 and 9 years
C15	5	4	5	4	4	5	More than 10 years
CVI	1.0	0.93	0.80	0.80	0.93	0.93	-

Note: CVI = Content Validity Index; C = coach; Q = question.

The descriptive data of the athletes who participated in *step 2* are found in Table 2.

Table 2. Descriptive data of the players participating in the study.

ID	FC	Age (years)	Gender	Experience time (years)
01	BC1	25	Male	2
02	BC1	39	Male	9
03	BC1	22	Male	1
04	BC1	38	Female	4
05	BC1	31	Male	14
06	BC2	32	Male	5
07	BC2	28	Male	8
08	BC2	24	Male	5
09	BC2	17	Male	8
10	BC2	39	Male	7
11	BC2	21	Male	6
12	BC2	20	Male	6
13	BC3	21	Female	4
14	BC4	35	Male	8
15	BC4	37	Male	9
16	BC4	47	Male	10
17	BC4	18	Male	4
18	BC4	25	Male	1
19	BC4	32	Male	6
20	BC4	23	Male	1
21	BC4	46	Male	9
22	BC4	34	Male	1
23	BC4	47	Male	6
M	-	31	-	6
SD	-	9.37	-	3.36

Note: ID = number of players; FC = functional class; M = mean; SD = standard deviation.

Table 3 shows that the correlation between the evaluators for target 0.5 in SP (ICC = 0.911; $p < .01$), AP (ICC = 0.910; $p < .01$), LP (ICC = 0.831; $p < .01$), and TP (ICC = 0.865; $p < .01$) and for target 1.0 in SP (ICC = 0.918; $p < .01$), AP (ICC = 0.893; $p < .01$), LP (ICC = 0.839; $p < .01$), and TP (ICC = 0.842; $p < .01$) were excellent, showing the reliability of the results in practice. For the evaluation by the T-Test, it was noticed that there was no difference between the means of the evaluators for target 0.5 and SP ($p = .996$), AP ($p = .984$), LP ($p = .978$), and TP ($p = 1.000$) and target 1.0 for SP ($p = .953$), AP ($p = .908$), LP ($p = 1.000$), and TP ($p = .931$).

Table 3. Descriptive results of the levels of precision, ICC, and T-test among the evaluators for targets 0.5 and 1.0.

	Short precision (SP)		**Average precision (AP)**		**Long precision (LP)**		**Total precision (TP)**	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**
Target 0.5 (n = 23)								
Evl 1	2.93±2.06	3.78±1.94	2.47±2.01	2.63±2.06	2.04±2.21	1.17±0.94	7.56±4.65	7.65±3.88
Evl 2	2.93±2.06	3.82±1.98	2.47±2.01	2.67±2.10	2.04±2.21	1.21±1.05	7.52±4.70	7.73±3.95
ICC[p]	0.911[0.01]*		0.910[0.01]*		0.831[0.01]*		0.865[0.01]*	
T test[p]	0.004[0.996]		0.020[0.984]		-0.028[0.978]		0.000[1.000]	
Target 1.0 (n = 23)								
Evl 1	4.39±2.26	4.50±2.34	1.97±1.76	3.39±1.93	1.41±1.76	1.43±1.53	7.60±3.85	9.13±4.04
Evl 2	4.39±2.26	4.45±2.30	1.95±1.78	3.30±1.96	1.41±1.76	1.43±1.53	7.60±3.85	9.08±4.01
ICC[p]	0.918[0.01]*		0.893[0.01]*		0.839[0.01]*		0.842[0.01]*	
T test[p]	0.058[0.953]		0.116[0.908]		0.000[1.000]		0.087[0.931]	

Note: Evl = Evaluator; ICC[p] = Coefficient Intraclass correlation[p-value]; Test-T[p] = Test value t[p value]; p < .05.*

DISCUSSION

The main objective of this study is to validate the content of an individual precision assessment protocol in boccia in two steps (1) a content validation of the throwing precision test and (2) the assessment of the inter-evaluator reliability of the same test in boccia. It should be noted that this is one of the first reliability studies of a protocol in boccia. Our main findings reported here are (1) validation of the reliability of the throwing precision assessment protocol through coaches with expertise in the modality and (2) reliability of the application of the precision assessment protocol through two independent evaluators.

Due to the study design, we chose to sum up the results according to each specificity. Understanding the difference between step 1 and step 2, the authors divided the discussion into two sessions: (1) evaluation of boccia coaches and (2) evaluation of inter-evaluator reliability.

Paralympic boccia coaches' assessment

Initially, it is essential to highlight the relevance of an expert assessment of a protocol and/or instrument (Dunn et al., 1999). Compliance with this step is essential for verifying the reliability of the protocol, besides being widely used when we observed similar studies (Hyrkäs et al., 2003; Miarka et al., 2011). To this end, it is necessary to highlight some suggestions offered by the coaches (a) add a distance of 5 meters in the centre of the court; (b) add one more distance near "*line V*", and (c) increase the number of attempts.

It is observed, therefore, that the addition of a distance of 5 meters in the centre of the court indicates the need to verify the precision of athletes in a specific situation of boccia. For example, both in the "*penalty*" and in the exit of the target ball (jack ball or white ball), the target ball will always be/will return to the match in the centre of the court (fixed point 5 meters from the athletes) (WorldBoccia, 2021b). In addition, adding some

distance close to "*line V*" (the line that limits the space for ball throws) suggests a very interesting strategy for athletes with impaired muscle strength (due to high support needs) (WorldBoccia, 2021b). The coaches too consider having different target points in different directions, as the target in 3, 6, and 9m were always in the same direction.

However, it is important to highlight the suggestion of the possibility of increased launch attempts. For the creation of the protocol, another protocol was used as a parameter (i.e., Protocol of the Projeto Esporte Brasil (PROESP-Br)) (Gaya et al., 2021). In the PROESP-Br evaluation protocol, some tests are performed with two attempts (e.g., medicine ball pitch). In association, a justification for the two attempts is the possibility of localized fatigue in boccia athletes. In this way, the upper trapezius muscle appears to fatigue in a prolonged game of boccia, limiting long-term assessments for these individuals (Fong et al., 2012).

Evaluation of reliability among evaluators

The process of developing instruments involves complex and systematic procedures that require theoretical and methodological rigor (Xie & DeVellis, 1992). According to Pasquali (2010), it can be performed in three basic procedures: theoretical, empirical (experimental), and analytical (statistical). Specifically in boccia, for the content validation of the protocol of Oliveira et al. (2021) the analytical approach was used. This approach includes statistical analyses to assess whether the instrument under construction accumulates evidence of validity and reliability (Xie & DeVellis, 1992).

As a complement to the evaluation of the reliability of the protocol, the agreement between evaluators (or evaluation) is also seen as an important parameter (Clark et al., 2010; Impellizzeri & Marcora, 2009; Longmuir et al., 2017). Therefore, by visualizing the good correlation between the evaluators in the collection, we can perceive the uniformity of the measure reproduced by the protocol and the instruments. Corroborating the suitable parameters, it is noteworthy that all athletes evaluated by the protocol were in a period of competition, in a better physical (Kataoka et al., 2020) and technical condition (Huang et al., 2014), emphasizing the reliability of the data.

Limitations

Some limitations should be emphasized. First, sample size measurements were not performed in both collections. Realizing this, guidelines for study with expert analysis indicate an approximate number between 6 and 20 subjects (Lynn M. R., 1986). The low sample number of boccia athletes in a study design is not uncommon, since most studies do not exceed the number of 20. However, when we observe the functional classes of the athletes, a very high sample heterogeneity is perceived among them, which may hinder the extrapolation of the reliability of the protocol. Another limitation is the non-standardization of the type of throw since each athlete was free to throw in their way.

Practical implications

It is observed that the protocol has high applicability in the context of throwing precision assessment, precision-based training prescription, and precision performance monitoring in athletes of different functional classes. In this way, boccia coaches will be able to standardize and systematize training for competitive periods through the protocol.

CONCLUSION

According to the results of the two steps, it is concluded that the protocol has favourable reliability for the evaluation of the individual precision of the boccia athlete. To be less specific, we noticed that the coaches

brought a more contextualized view with the practice, while the evaluators observed excellent levels of agreement in a collection. However, more specific updates are required for new scenarios at boccia. For this reason, future studies with changes in the protocol and instrument will be carried out to verify more possibilities in different applications and contexts that the protocol offers.

AUTHOR CONTRIBUTIONS

José Igor V. Oliveira and Saulo F. M. Oliveira contributed to the research design, data collection, and article writing. Samara M. Nascimento and José Marcos M. Oliveira contributed to the data collection and analysis. José Irineu Gorla and Pedro P. Paes provided critical revision and contributed to the critical article writing.

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DISCLOSURE STATEMENT

No potential conflict of interest were reported by the author.

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