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Psychological Evaluation

Psychometric Evidence of the Coping Inventory for Brazilian Paralympic Athletes in Competition Situations

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Abstract: Paralympic athletes face stressful situations in sports competitions daily, and assessing how they cope with these situations is important. This study aimed to evaluate the psychometric properties of the Coping Inventory for Brazilian Paralympic Athletes in Competition Situations. This study included 531 Brazilian Paralympic athletes aged 18 years or older, of both sexes, living in different Brazilian regions. They competed nationally or internationally and had physical or visual disabilities. Athletes with cerebral palsy were excluded. The participants answered a data questionnaire and the coping inventory. A confirmatory factor analysis confirmed a 12-theoretical dimension structure: six adaptive (Self-Reliance, Support-Seeking, Problem-Solving, Information-Seeking, Accommodation, Negotiation) and six maladaptive dimensions (Delegation, Social Isolation, Helplessness, Escape, Submission, and Opposition). Reliability indexes ranged between 0.60 and 0.94. The conclusion is that the instrument is reliable for assessing coping strategies among Brazilian Paralympic athletes.

Keywords: athletes, physically disabled, visually disabled, coping, psychometrics

Evidências Psicométricas do Inventário de *Coping* para Atletas Paralímpicos Brasileiros em Situação de Competição

Resumo: Atletas paralímpicos lidam diariamente com situações estressantes na competição, sendo importante avaliar como as enfrentam. Este estudo teve como objetivo avaliar as propriedades psicométricas do Inventário de *Coping* para Atletas Paralímpicos Brasileiros em Situação de Competição. Participaram 531 atletas paralímpicos brasileiros, a partir de 18 anos de idade, de ambos os sexos, residentes em diferentes regiões do Brasil. Competiam em nível nacional e internacional e apresentavam deficiência física e visual. Foram excluídos atletas com paralisia cerebral. Participantes responderam a um questionário de dados e ao inventário de *coping*. A análise fatorial confirmou a estrutura de 12 dimensões teóricas, sendo seis adaptativas (Autoconfiança, Busca de Suporte, Resolução de Problemas, Busca de Informações, Acomodação, Negociação) e seis mal-adaptativas (Delegação, Isolamento, Desamparo, Fuga, Submissão e Oposição). Os índices de fidedignidade para as dimensões variaram entre 0,60 e 0,94. Conclui-se que o instrumento é confiável para avaliar as estratégias de *coping* de atletas paralímpicos brasileiros.

Palavras-chave: atletas, deficiente físico, deficiente visual, coping, psicometria

Evidencias Psicométricas del Inventario de Afrontamiento para Atletas Paralímpicos Brasileños en Situación de Competición

Resumen: Los deportistas paralímpicos se enfrentan a diario a situaciones estresantes en competición, y es importante evaluar cómo las afrontan. El objetivo de este estudio fue evaluar las propiedades psicométricas del Inventario de Afrontamiento para Atletas Paralímpicos Brasileños en Situación de Competición. El estudio incluyó a 531 atletas paralímpicos brasileños, mayores de 18 años, de ambos os sexos, residentes en diferentes regiones de Brasil. Competían a nivel nacional e internacional y presentaban deficiencias físicas y visuales. Respondieron un cuestionario de datos y el inventario de afrontamiento. Se excluyeron los deportistas con parálisis cerebral. El análisis factorial confirmó la estructura de 12 dimensiones teóricas, siendo seis adaptativas (Autosuficiencia, Búsqueda de apoyo, Resolución de problemas, Búsqueda de información, Acomodación, Negociación) y seis desadaptativas (Delegación, Aislamiento social, Desamparo, Escape, Sumisión y Oposición). La confiabilidad varió entre 0,60 y 0,94. Se concluye que el instrumento es confiable para evaluar estrategias de afrontamiento en atletas paralímpicos brasileños.

Palabras clave: atletas, deficiente físico, discapacidad visual, coping, psicometría

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Paralympic sports have developed significantly in recent decades, leading to increased competitiveness in sports among Paralympic athletes and the search for improved results (Rodrigues et al., 2017; Santos, Furtado, Poffo, Velasco, & Souza, 2019). However, the emergence of stressful situations in competitions often causes changes in psychological functioning, such as decreased concentration, loss of focus of attention, and increased state of anxiety. Furthermore, because a lack of an adequate stress response often leads to decreased ability to perform, athletes participating in competitive sports need to adopt adaptive coping strategies to manage the stressful demands of competitions and maximize performance (Christensen & Smith, 2018; R.V. Silva, Gonçalves, Cotian, & Nobre, 2018).

There are no valid measures to assess coping strategies among Paralympic athletes in Brazil. The Athletic Coping Skills Inventory (ACSI-28BR) was adapted in the context of sports in general, and its validity was also investigated (Miranda, Coimbra, Bara Filho, Miranda Júnior, & Andrade, 2018). However, this instrument is not based on a specific theory of Coping (Murphy & Tammen, 1998), and it measures the effectiveness of coping strategies rather than their use (Gaudreau & Blondin, 2002). The instrument measuring the use of coping strategies more directly captures behaviors athletes present in a competition. On the other hand, the assessment of the strategy's effectiveness is more focused on the athletes' subjective judgment about whether a given strategy is useful without necessarily using it (Skinner & Welborn, 1994). Therefore, measures assessing adopted strategies can be more useful in the practice and planning of interventions. Additionally, the specifics and characteristics of Paralympic athletes are not considered in general instruments assessing coping in sports.

Given this scenario, Bertoldi, Silva, Bandeira, Bandeira, and Mazo (2021) built the Coping Inventory for Brazilian Paralympic Athletes in Competition Situations (*Inventário de Coping para Atletas Paralímipicos em Situação de Competição* - ICAP) and verified its content validity. The instrument's items were based on the Motivational Theory of Coping (TMC), a systematic review of instruments assessing coping strategies among athletes, and on Universal Testing (TU).

As recommended in the literature, this study aimed to identify this instrument's further validity evidence (American Educational Research Association [AERA], American Psychological Association [APA], and National Council for Measurement in Education [NCME], 2014; Pasquali, 2017). Hence, it assessed the psychometric properties of the Coping Inventory for Brazilian Paralympic Athletes in Competition Situations. The specific objectives were: (1) To assess evidence related to ICAP's internal structure; and (2) To estimate the reliability of the inventory dimensions using Composite Reliability (CR).

Method

This study has a quantitative methodological and cross-sectional design and used statistical procedures to assess the validity and reliability of the ICAP (Breakwell, Hammond, Fife-Schaw, & Smith, 2010).

Participants

Table 1 presents the participants' main characteristics: 531 Brazilian Paralympic athletes of both sexes, aged between 18 and 40 ($M = 30.01$; $SD = 9.01$). The inclusion criteria were being a Paralympic athlete of both sexes, competing in collective or individual modalities, and at the national or international level, with physical or visual impairment according to the functional classification of the International Paralympic Committee. Athletes with cerebral palsy were excluded due to this condition's high comorbidity with intellectual disability (Reid, Meehan, Arnup, & Reddihough, 2018). Intellectual disability can prevent a participant from understanding the instrument's questions. Regarding sociodemographic characteristics, the population was mainly composed of men (66.3%) who were not in a stable relationship (67.6%). Most participants had completed high school and lived in the Southeast (60.4%). Regarding the characteristics of the athletes' disabilities, most had an acquired physical disability. As for occupational and professional variables, most practiced athletics in international competitions and received scholarships (see Table 1 for further details).

Table 1
Sample's characteristics

Variables	*N*	*%*
Education		
Middle School	49	9.2
High School	231	43.5
Incomplete Higher Education	140	26.4
Bachelor's degree	91	17.1
Graduate Studies	20	3.8
Country's region		
Mid-West	35	6.6
Northeast	84	15.8
North	21	4.0
Southeast	321	60.4
South	70	13.2
Disability		
Physical	426	80.2
Visual	105	19.8
Type of disability		
Acquired	282	53.1
Congenital	249	46.9
Modality		
Athletics	171	32.2
Weightlifting	77	14.5
Swimming	69	13.0
Wheelchair basketball	52	9.8
Badminton	33	6.2
Wheelchair fencing	28	5.3
Judo	24	4.5
Goalball	17	3.2
Sitting volleyball	15	2.8
Five-a-side football	9	1.7
Wheelchair rugby	7	1.3
Table tennis	6	1.1
Shooting sports	5	0.9
Triathlon	5	0.9
Rowing	4	0.8
Wheelchair tennis	2	0.4
Bocce ball	2	0.4
Cycling	2	0.4
Archery	1	0.2
Sailing	1	0.2
Taekwondo	1	0.2
Competition Level		
International	281	52.9
National	250	47.1
Years of Competition		
Up to 5 years	267	50.2
5 to 10 years	133	25.0
11 to 15 year	70	13.1
16 to 20 years	42	7.9
More than 20 years	18	3.8
Athlete Scholarship		
Yes	329	62.0
No	202	38.0

Note: N = frequency.

Instruments

Personal data questionnaire. A questionnaire was developed to address the participants' personal information such as age, sex, marital status, education, religion, state of residence, modality, disability, type of disability, competition level, years in sports competition, and whether the participant had a scholarship, category of the athlete's scholarship, and training location.

Coping Inventory for Brazilian Paralympic Athletes in Competition Situations (Inventário de Coping para Atletas Paralímipicos em Situação de Competição - ICAP). ICAP is a self-report instrument designed to assess coping strategies among Brazilian Paralympic athletes in competition situations. It consists of 91 items, rated on a five-point Likert scale (ranging from never, rarely, sometimes, almost always to always). The items are distributed into 12 theoretical dimensions: Self-Confidence, Seeking Support, Problem Solving, Seeking Information, Accommodation, Negotiation, Delegation, Isolation, Helplessness, Escape, Submission, and Opposition [citation omitted to prevent the identification of the manuscript's authors].

Procedures

Data collection. Data were collected online (N = 89; 16.8%) and in-person (N = 442; 83.2%). The online collection was conducted using the Survey Monkey® platform to enable reaching individuals in different Brazilian regions. The Southeast (60.5%) and Northeast (15.9%) were the regions most represented. In order to collect data face-to-face, the research project was submitted to the Brazilian Paralympic Academy (APB) referees, who granted a favorable opinion, authorizing the first author to collect data at the Paralympic Training Center (TC) in São Paulo, Brazil. Therefore, Paralympic athletes were approached when they were presented at the TC to train or compete and invited to participate in the study. Note that the author also asked the coaches to authorize the application of the personal data form and ICAP. The instruments were applied individually to athletes with total visual impairment. The researcher read the questionnaires and asked the participants to rate the items verbally so they could take notes on the forms. The questionnaires' font size was enlarged for Paralympic athletes with low vision so that they could read and complete the forms themselves. The athletes with physical disabilities answered the instruments individually and collectively, read the instructions of the inventory and questionnaire, and answered the items without assistance.

Data analysis. Data were analyzed using *Mplus* 8.0 and Jasp version 0.9.0.1. Descriptive statistics were used to describe personal data: mean and standard deviation were used for the continuous variables, and frequency distribution for absolute and relative values was used for the categorical variables.

Confirmatory Factor Analysis was conducted to assess the ICAP's factor structure. The Weighted Least Squares Mean - and Variance-adjusted (WLSMV), considered the most appropriate for categorical data, was the estimation method used. This method provides weighted least squares estimates using weighted matrix, mean and robust standard deviations by adjusting the variance for the Chi-square test (Muthén & Muthén, 2012). The comparative fit index (CFI), the Tucker Lewis (TLI), and the Root Mean Square Error of Approximation (RMSEA) were used to evaluate the models' general fit. A parameter equal to 0.90 was considered the minimum to infer the model's fit for the CFI and TLI (Hair, Black, Babin, Anderson, & Tatham, 2009), while an RMSEA <0.08 was considered acceptable (Hair, Babin, & Krey, 2017); p-values <0.05 were considered significant. The Mplus 8.0 software (Muthén & Muthén, 2012) was used for this analysis.

The ICAP reliability analysis was calculated using Composite Reliability (CR). The CR is a structural quality indicator of a psychometric instrument (Hair et al., 2009). The CR calculations are performed using the parameters estimated by structural equation modeling of the confirmatory factor analysis. CR has been used more frequently when compared to Cronbach's Alpha (Valentini & Damásio, 2016), considering that the factor loadings can vary in CR, whereas in Cronbach's Alpha, the loads are fixed to be equal (Zijlmans, van der Ark, Tijmstra, & Sijtsma, 2018). The CR values may change due to the number of items in a dimension and factor loadings homogeneity. Hence, the cut-off point for this indicator may be questionable in dimensions with few items (Valentini & Damásio, 2016). Hair, Risher, Sarstedt, and Ringle (2019) state that a CR of 0.60 is considered acceptable.

Ethical Considerations

The project was submitted to and approved by the Institutional Review Board at the *Universidade Federal do of Rio Grande do Sul* (CAAE 69372917.8.0000.5347; Opinion No. 2,199,899). The participants were ensured that their personal information would remain confidential. In addition, the athletes received clarification of the study's objectives and procedures. Participation was voluntary, and the participants signed free and informed consent forms.

Results

First, the model was tested with 91 items distributed into 12 dimensions: six Adaptive (Self-Confidence, Support-Seeking, Problem-Solving, Information-Seeking, Accommodation, and Negotiation) and six Maladaptive dimensions (Delegation, Social Isolation, Helplessness, Escape, Submission, and Opposition) was tested in the confirmatory factor analysis. The first model's goodness of fit indexes (Table 2) were below expected. In this first model, 24 items presented a factor loading <0.50 and, for this reason, were excluded to improve the model's factor fit. Thus, a new model with 67 items was developed.

The final model with 67 items showed satisfactory goodness of fit (Table 2). Most items presented factor loadings >0.50. Although six items presented factor loadings <0.50, the final model's overall fit was satisfactory. Therefore, these items were kept in the instrument's final version, considering their importance from a theoretical point of view. If they were excluded, important information for the Accommodation, Isolation, and Submission dimensions would be lost. Additionally, item loadings were equal to or greater than 0.30, which is considered satisfactory to meet the minimum level for structure interpretation (Hair et al., 2009).

The ICAP reliability was assessed using Composite Reliability (CR); the dimension values ranged from 0.60 to 0.94. These values indicate satisfactory reliability in all ICAP dimensions. The ICAP total composite reliability value was 0.98 (Table 3).

Table 2
Confirmatory Factor Analysis' General goodness of fit

Model	Items	χ^2	*DF*	*P-value*	*CFI*	*TLI*	*RMSEA*	*90%CI*
First	91	9307.657	3938	0.0001	0.81	0.80	0.05	0.05 – 0.05
Final	67	4887.999	1886	0.0001	0.91	0.90	0.05	0.04 – 0.05

Note: χ^2 = Chi-square; DF = degrees of freedom; p-value = statistical significance; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; 90%CI = 90% Confidence Interval.

Table 3
ICAP Factor Loading and Composite Reliability

	Item	Factor Loading	Error variance	R^2	Composite Reliability
Self-Reliance					
	Q01*	0.57	0.67	0.32	
	Q13*	0.66	0.52	0.43	
	Q25*	0.66	0.56	0.44	
	Q37*	0.69	0.52	0.47	
	Q49*	0.65	0.57	0.43	
	Q58*	0.58	0.65	0.34	
	Q61*	0.68	0.53	0.46	
	Q66*	0.70	0.51	0.50	
	Q68*	0.65	0.57	0.43	0.94
	Q75*	0.69	0.53	0.47	
	Q77*	0.73	0.46	0.53	
	Q81*	0.74	0.45	0.56	
	Q83*	0.70	0.51	0.48	
	Q85*	0.84	0.29	0.72	
	Q87*	0.80	0.36	0.64	
	Q89*	0.81	0.34	0.65	
	Q91*	0.64	0.59	0.41	
Support-Seeking					
	Q14*	0.50	0.75	0.24	
	Q38*	0.77	0.40	0.60	
	Q69*	0.62	0.61	0.39	
	Q78*	0.76	0.42	0.56	0.88
	Q84*	0.65	0.57	0.42	
	Q86*	0.82	0.32	0.67	
	Q88*	0.66	0.56	0.44	
	Q90*	0.81	0.34	0.66	
Problem Solving					
	Q15*	0.62	0.61	0.38	
	Q39*	0.63	0.60	0.40	0.79
	Q51*	0.79	0.37	0.62	
	Q62*	0.74	0.45	0.55	

(continued...)

Table 3
Continuation

	Item	Factor Loading	Error variance	R^2	Composite Reliability
Information-Seeking					
	Q04*	0.68	0.53	0.46	
	Q28*	0.70	0.51	0.49	
	Q40*	0.56	0.68	0.32	0.78
	Q52*	0.69	0.52	0.47	
	Q70*	0.60	0.64	0.36	
Accommodation					
	Q29*	0.30	0.92	0.10	
	Q63*	0.73	0.46	0.54	0.60
	Q71*	0.69	0.52	0.48	
Negotiation					
	Q18*	0.60	0.64	0.36	
	Q30*	0.74	0.45	0.54	0.67
	Q42*	0.58	0.66	0.33	
Delegation					
	Q19*	0.56	0.68	0.31	
	Q31*	0.65	0.55	0.44	0.67
	Q54*	0.67	0.50	0.46	
Isolation					
	Q08*	0.40	0.84	0.16	
	Q20*	0.33	0.89	0.10	0.67
	Q32*	0.88	0.22	0.77	
	Q64*	0.66	0.56	0.43	
Helplessness					
	Q21*	0.55	0.69	0.30	
	Q33*	0.65	0.58	0.42	
	Q45*	0.60	0.64	0.36	0.77
	Q56*	0.53	0.72	0.28	
	Q65*	0.55	0.69	0.30	
	Q80*	0.74	0.45	0.54	
Escape					
	Q22*	0.50	0.75	0.25	
	Q46*	0.57	0.67	0.32	0.66
	Q57*	0.58	0.66	0.33	
	Q73*	0.64	0.57	0.42	
Submission					
	Q23*	0.30	0.91	0.10	
	Q35*	0.40	0.84	0.16	
	Q47*	0.40	0.84	0.16	
	Q67*	0.56	0.68	0.31	0.60
	Q74*	0.72	0.48	0.51	
Opposition					
	Q24*	0.60	0.64	0.36	
	Q36*	0.71	0.49	0.50	
	Q60*	0.89	0.20	0.80	0.86
	Q76*	0.83	0.31	0.68	
	Q82*	0.72	0.48	0.51	

Note: *$p < 0.001$.

Discussion

This study aimed to assess the psychometric properties concerning the validity and reliability of the Coping Inventory for Brazilian Paralympic Athletes in Competition Situations (ICAP), intended to assess the coping strategies of Paralympic athletes.

Confirmatory Factor Analysis (CFA) tested the 12-dimension structure proposed by the Motivational Theory of Coping (Skinner, Edge, Altman, & Sherwood, 2003; Skinner & Welborn, 1994) with six adaptive dimensions (Self-confidence, Support Seeking, Problem Solving, Information Seeking, Accommodation, and Negotiation) and six maladaptive dimensions (Delegation, Isolation, Helplessness, Escape, Submission, and Opposition). The analyses confirmed the ICAP 12-dimension factorial structure, which presented satisfactory general and individual goodness of fit indexes. Hence, an instrument with 67 items is proposed.

The ICAP factorial structure presented differences when compared to that found by A.M.B. Silva et al. (2019). The authors built an instrument to assess the coping strategies used by dancers when facing pain. The instrument comprises 35 items grouped into two second-order factors (Adaptive Coping Strategies and Maladaptive Coping Strategies). The authors found difficulties classifying emotions, behaviors, and motivational orientations in the 12 coping dimensions proposed by the TMC because the coping construct analyzed by the TMC is complex; several aspects are relevant to be detailed by the functional analysis of coping. Additionally, to develop a specific instrument focused on adolescent dancers' coping with pain is necessary to consider the items' practical relevance (A.M.B. Silva et al., 2015) and their representativeness to assess the construct (A.M.B. Silva et al., 2019).

Six items presented factor loadings <0.50 in the final CFA model. Whether these items would be kept in the instrument was based on theoretical reasons and because they did not affect the model's general goodness of fit. In this sense, the decision to keep item 29 ("I try to listen to music to relax") in the Accommodation dimension is based on an active attempt to redirect attention away from the stressful experience; that is, listening to music can be a pleasant activity and help change one's perception of a stressful situation (Skinner et al., 2003; Skinner & Welborn, 1994). As for the decision to keep items 8 ("I move away from people"), 20 ("I try to be alone) in the Isolation dimension, and items 23 ("I think for months about the competition when I don't win"), 35 ("I have insomnia for months after the competition") and 47 ("I can't stop thinking about the situation") in the Submission dimension, was based on the fact that these items are related to social withdrawal, avoidance, loneliness, thought rumination, and rigidity. These characteristics are extremely harmful to athletes, and if they maintain this behavior for long periods, these may directly interfere with Paralympic athletes' sports performance and mental health.

Additionally, the decision to keep these items in the ICAP considered the items' theoretical relevance, practical relevance, and representativeness to measure the construct (A.M.B. Silva et al., 2015), as well as the specifics of Paralympic athletes. Furthermore, keeping these items did not influence the model's general fit.

The reliability of the ICAP dimensions was calculated using Composite Reliability (CR), considering the items' standardized factor loadings. All reliability indicators showed adequate parameters for the dimensions (ranging from 0.60 to 0.94). The CR for the ICAP total score was (0.98). Note that the cut-off point for CR should not be interpreted from a linear perspective. According to Valentini and Damásio (2016), "a single and fixed cut-off point, especially for the CR, does not seem justifiable due to its variability considering the instrument's number of items and factor loadings" (Valentini & Damásio, 2016, p. 3). The reason is that the items' factor loadings in the CR may change, while in the Alpha Coefficient, they are predetermined to be equal (Zijlmans et al., 2018). Thus, it is noteworthy that the CR generally presents more robust reliability indicators when compared to the Alpha Coefficient (Valentini & Damásio, 2016).

As for the instrument's psychometric analysis, the confirmatory factor analysis corroborated the model proposed by Skinner et al. (2003) and Skinner and Welborn (1994), indicating 12 dimensions with satisfactory goodness of fit indexes, showing the adequacy of empirical data to the theoretical model. Furthermore, the instrument's reliability calculated using the Composite Reliability (CR) showed good indexes for each dimension, indicating that the ICAP version is reliable for assessing coping strategies among Brazilian Paralympic athletes in competition situations. Thus, these results reinforce validity evidence of the instrument's internal structure and confirm that ICAP presents adequate psychometric properties for measuring coping strategies among Paralympic athletes. Finally, the study was conducted with theoretical and methodological rigor, following the specialized literature's main recommendations.

Future studies are suggested, using a larger and more diversified sample to investigate correlations with other instruments and perform analysis of invariance according to the type of disability. Other analyses may provide further evidence to support the use of ICAP to assess coping strategies among Paralympics athletes. Additionally, developing a short version of the ICAP, intended to assess coping strategies and use the most discriminating items, may be helpful in the context of Paralympic Sports in Brazil.

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