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ORIGINAL RESEARCH

The Brazilian hip and groin outcome score (HAGOS-Br): cross-cultural adaptation and measurement properties

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Abstract
Background: Hip and groin pain or symptoms is a recurrent musculoskeletal complaint among young and active individuals. It is important to objectively measure functional limitations using patient-related outcomes that have been validated in the language of the target population.
Objectives: To perform a cross-cultural adaptation and to evaluate the measurement properties of the Hip and Groin Outcome Score (HAGOS) for the Brazilian population.
Methods: We adapted the HAGOS to Brazilian Portuguese and evaluated the following measurement properties: internal consistency, test–retest reliability, measurement error, and structural and construct validity. The sample recruited consisted of active individuals between 18 and 55 years of age with long standing hip and groin pain and individuals who participated in sports with high physical demand of the hip and groin region.
Results: A total of 103 athletes and physically active individuals of both sexes participated in this study. The HAGOS was successfully translated and culturally adapted to the Brazilian population. Factor analysis confirmed that the HAGOS consists of six subscales. The HAGOS-Br showed good internal consistency. The CFA revealed a Cronbach's alpha for the HAGOS subscales ranging

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from 0.86 to 0.96, test-retest reliability was substantial, with intraclass correlation coefficients ranging from 0.81 to 0.94 for the six subscales and an acceptable measurement error (standard error of measurement [SEM]=5.43–11.15 points; and smallest detectable chance [SDC]= 16.71–30.9 points). Good construct validity existed with more than 75% of the pre-defined hypotheses being confirmed. No ceiling or floor effects were observed.
Conclusion: The HAGOS-Br showed to be equivalent to the original version with adequate validity and reliability properties.

Introduction

Hip and/or groin pain are among the most common injuries in male athletes and physically active individuals.[1–6] These injuries have been investigated because of their negative impact on function and health-related quality of life.[7–9] Due to the high incidence rate, the assessment and treatment of hip and/or groin pain is essential to avoid physical limitations and improve the functional capacity of athletes and physically active individuals.[10–13]

The Copenhagen Hip and Groin Outcome Score (HAGOS) questionnaire was developed and validated[9] according to the recommendations of the Consensus-based Standards for Health Measurement Instruments (COSMIN) to assess young and physically active individuals with long standing hip and groin complaints.[14] The HAGOS consisting of 6 subscales: symptoms, pain, activities of daily living (ADL), sports/recreation (sports/rec), physical activity (PA), and quality of life (QOL). This instrument is now widely used as a measure of outcomes in clinical trials and clinical settings by physical therapists and physicians and it has been cross-culturally adapted in several countries, including Denmark,[9] Holland,[15,16] China,[17] and Sweden.[18] However, a Brazilian version of HAGOS has not yet been created and validated.

Brazilian soccer athletes have a high prevalence of hip/groin injuries and a clinical tool such as HAGOS could help guide interventions planning.[19,20] Therefore, the present study aimed to translate and cross-culturally adapt the HAGOS into Brazilian Portuguese, and to evaluate key measurement properties (e.g., test-retest reliability, internal consistency, standard error of measurement (SEM), smallest detectable chance (SDC), construct validity, and ceiling and floor effects).

Methods

Study design

This cross-sectional study complied with the requirements of the Declaration of Helsinki,[21] and the Ethics Committee of Federal University of Vales do Jequitinhonha and Mucuri approved the study protocol (73359517.3.0000.5108). We defined the measurement properties of HAGOS-Br according to the recommendations of the COSMIM checklist and previous studies.[14,22–25]

Translation and cross-cultural adaptation

The translation and cross-cultural adaptation of the HAGOS-Br was conducted following the guidelines for cross-cultural adaptation of self-administered questionnaires[26] after obtaining the consent of the authors of the original questionnaire.[9]

Initially, 2 bilingual translators worked independently to translate the HAGOS from Danish into Brazilian Portuguese. The separate translations were later compared and consolidated into a consensus preliminary initial version of the HAGOS-Br. Two native Danish translators performed the back-translation, independently, then, compared their work and reached consensus on the back-translated Danish version of the HAGOS. A specialist committee audited all of the translations, compared them, and discussed with the translators to resolve any discrepancies and to develop a pre-final version of the HAGOS to be tested in Brazil, titled HAGOS-Br (http://www.koos.nu/).

Subsequently, this pre-final version was submitted for assessment to 25 Specialist Musculoskeletal and Sports Physical Therapist from all regions of Brazil. This committee analyzed the clarity and clinical applicability of the pre-final version of the questionnaire, as well as its adequacy to the socio-cultural and educational reality of the region. Therefore, through a Delphi study, with questions answered on a Likert scale, a level of agreement of at least 80%, defined as the cutoff point, was reached.

After obtaining consensus among the professionals, we tested the pre-final version in a self-administered manner on 25 university students who, in addition to answering the questionnaire, were asked to indicate possible difficulties in understanding some term and/or answer options. A level of understanding of 85% was defined as the cut-off point. After we obtained a proper level of comprehension of all items of the questionnaire in the pre-testing stage, the HAGOS-Br questionnaire was finalized (Supplemental Online Material).

Sample

Participants were divided into two groups: asymptomatic group (AG) and symptomatic group (SG). Participants were considered eligible for the study if they were 18–55 years of age, were physically active (at least 2.5 h per week), and agreed to sign the informed consent form. In addition, the AG was composed of asymptomatic individuals who participated in sports with high-demand for the hip and groin region; and the SG was composed of individuals who reported hip and/or groin pain with an intensity equal or greater that 1 point on a 0–10 Numeric Pain Rating Scale (NPRS) at rest or during/after sports participation/physical activity that persisted more than 6 weeks.[8,9,15,27] By including both symptomatic and asymptomatic individuals, the chances of achieving a data spread across the entire HAGOS

0–100 points range was optimized. As HAGOS is used in sporting populations for both screening, prevention, and treatment it is important that usage of the whole scales(s) is considered and included.[28–30] Potential participants with self-reported limiting comorbidities[31] or not able to complete the questionnaires were excluded. The flow chart of the inclusion procedure of participants is presented in the Supplemental Online Material.

Procedures

Data collection was performed on two different occasions with an interval period of 4–7 days. First, the participants were classified regarding hip and/or groin pain.[8,9] Next, the HAGOS-Br was self-administered after a brief explanation about the structure of the questionnaire. Finally, the Brazilian version of the Short Form-36 items (SF-36)[32] and Lower Extremity Functional Scale (LEFS)[33] were also completed by the participants.

The HAGOS includes 37 items, evaluated in 6 subscales: Symptoms (7 items); Pain (10 items); ADL (5 items); Sport/Rec (8 items); PA (2 items) and QOL (5 items). Standardized answer options are given (5 Likert boxes) and each question gets a score from 0 to 4, where 0 indicates no problem. The six scores are calculated as the sum of the items included, ex. $(100 - \frac{(total\ score\ subscale) \times 100}{maximum\ subscale\ score})$. Raw scores are then transformed to a 0–100 scale, with zero representing extreme hip/groin problems and 100 representing no hip/groin problems. Scores between 0 and 100 represent the percentage of total possible score achieved. An aggregate score is not calculated because it is regarded desirable to analyze and interpret the different dimensions separately.[9]

SF-36 is a generic instrument of easy comprehension and application that aims to evaluate QOL. It is presented as a multidimensional questionnaire consisting of 36 items in eight subscales: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, and mental health. Each subscale is scored separately, with values ranging from 0 to 100, with 0 indicates the worst condition and 100 the best condition.[32]

The LEFS aims to assess the functional level of individuals with lower limb injuries. This scale categorically evaluates 20 items about functions related to routine activities. The score of each item is given through a 5-point Likert scale, ranging from 0 to 4. The final score of the scale is given by the sum of the score of each item, generating a result ranging from 0 to 80, which should be transformed in a percentage value from 0% to 100%, with 0 indicating severe impairment and 100% no functional impairment. For the Brazilian version of the LEFS, differences above 11 points are considered clinically important.[33,34]

To measure average pain intensity experienced at rest and during/after sports participation/physical activity, an 11-point NPRS was also used.[15,35]

Statistical analysis

The sample size was based on previous studies,[9,16,36,37] and consistent with the literature, which recommended to include at least 50 participants.[14,24] Only symptomatic participants were used for test-retest reliability, measurement error, internal consistency, structural validity, and interpretability analysis (n = 51, while both groups were used for construct validity(n = 103). Descriptive statistics were used for demographic variables and scores on the questionnaires. Data are presented as mean ± standard deviation (SD). Statistical analysis was performed with IBM SPSS Statistics Version 22 (IBM Inc., Armonk, NY, USA), using a significance level of 5%. The statistical software AMOS version 22.0 (IBM Inc., Armonk, NY, USA) was used to carry out the confirmatory factor analysis.

Test-retest reliability

Test-retest reliability is the extent to which scores for the same patients are unchanged for repeated measurements over time. To evaluate this property, we use only stable individuals of the symptomatic group. Participants who did not present clinical changes in LEFS were considered stable and included in the test–retest reliability analysis.[14,22] Test-retest reliability was assessed using the intraclass correlation coefficient ($ICC_{2,1}$), and were calculated for each subscale using a two-way random effects model, type absolute agreement. ICC values of 0.70 or higher indicate high test-retest reliability.[22,38]

Measurement error

The measurement error (systematic and random error of a patient's score that is not attributed to true changes in the construct to be measured) was calculated using the SEM ($SEM = SD \times \sqrt{1\text{-}ICC}$), which was converted to the SDC at an individual level with the 95% confidence interval ($SDC_{95} = 1.96 \times \sqrt{2} \times SEM$).[14,24,39,40]

Internal consistency

The internal consistency is the extent of interrelatedness among the items of the questionnaire, thus measuring the same construct, to verify the homogeneity of the questionnaire.[22,24]

For internal consistency analysis, we calculated Cronbach's α values for each subscale of the HAGOS-Br. Values between 0.70 and 0.95 are considered to indicate good internal consistency.[24,38]

Structural validity

The structural validity is the extent to which the scores of an instrument are an adequate reflection of the dimensionality of the construct to be measured.[22] To assess the structural validity the confirmatory factor analysis (CFA) was performed by applying the maximum likelihood estimation method, available in AMOS software. The method was conducted to test the six-factor structures identified in the exploratory factor analysis of the original HAGOS.[9] The goodness of fit for the competing models was evaluated through the following fit indices[41]: the chi-square test, the goodness of fit index (GFI), the root mean square error of approximation (RMSEA), the normed fit index (NFI), the Tucker–Lewis index (TLI), and the comparative fit index (CFI). The criteria used to determine a good model fit were a nonsignificant chi-square. For the GFI, NFI, TLI, and CFI, values above 0.90 indicate an adequate fit, and values above

0.95 indicate a good to very good fit and RMSEA < 0.08.[42,43] The magnitudes of factor loadings > 0.3 were considered acceptable and statistically significant ($p < 0.05$).

Construct validity

Because there is no gold standard, validity was expressed in terms of construct validity, which is related to the score on a patient-reported outcome (PRO) instrument consistent with a priori hypotheses, based on the assumption that the PRO instrument measures the target construct.[14,22]

Construct validity of the HAGOS-Br subscales, SF-36 subscales, LEFS, and NPRS were investigated by Spearman's correlation coefficient. We defined strong correlations as $r \geq 0.7$ (or -0.7 in case of an inverse relationship), moderate correlations as $0.5 < r < 0.7$ (or $-0.5 < r < -0.7$), and weak correlations as $r \leq 0.5$ (or -0.5).[24]

Because the HAGOS is better designed to measure physical health than mental and/or social function, we expected the highest correlations between HAGOS-Br subscales and the SF-36 subscales of physical function, physical role due to physical health problems, and bodily pain (convergent validity) and lower correlations between the HAGOS-Br subscales and the SF-36 subscales of general health, vitality, social functioning, emotional role due to emotional problems, and mental health (divergent validity). Furthermore, we expected higher correlations between the HAGOS-Br subscales and LEFS (convergent validity); and between HAGOS-Br subscale of pain and NPRS at rest or during/after sports participation/physical activity (convergent validity). A priori hypotheses were formulated (Table 1), and good construct validity was based on meeting the criteria in at least 75% (42/56) of the indicated hypotheses.[24]

Table 1 Expected correlations (Strong, Moderate, or Weak) between HAGOS BR scores and other questionnaire variables at baseline as a priori set (Numbered) hypotheses.

Hypotheses	Expected correlation
1–6	Correlations moderate to strong between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity, and QoL and SF-36 physical function
7–12	Correlations moderate to strong between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity, and QoL and SF-36 physical role
13–18	Correlations moderate to strong between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 bodily pain
19–24	Correlations weak to moderate between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 general health
25–30	Correlations weak to moderate between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 Vitality
31–36	Correlations weak to moderate between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 Social Functioning
37–42	Correlations weak to moderate between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 Emotional Role
43–48	Correlations weak to moderate between the HAGOS-Br subscales, Pain, ADL, Sport and recreation, Physical activity and QoL and SF-36 Mental Health
49–54	Correlations moderate between the HAGOS-Br subscales Symptoms, Pain, ADL, Sport and recreation, Physical activity and QoL and LEFS
55	Correlations moderate to strong between the HAGOS-Br subscale Pain and NPRS at rest
56	Correlations moderate to strong between the HAGOS-Br subscale Pain and NPRS during/after SP/PA

Abbreviations: ADL, activities of daily living; NPRS, numerical pain-rating scale. QoL, quality of life; SP/PA= Sports Participation/Physical Activity.

Interpretability

Interpretability is the extent with which it is possible to assign qualitative meaning to an instrument's quantitative scores or change in scores.[22] This includes the distribution of total scores, change in scores, and floor and ceiling effects. Floor and ceiling effects were defined as being present if more than 15% of patients reported lowest (0) or highest (100) possible scores, and were assessed by calculating the relative frequency of the maximum and minimum values on the HAGOS-Br.[24]

Results

Translators and back-translators had no difficulty in translating the HAGOS. There was agreement between the translators. The Delphi study of the pre-final version of the HAGOS-Br showed a high level of comprehension among the members of the specialist committee.

A total of 103 athletes and physically active individuals of both sexes participated in this study. Recruitment occurred from March to May 2019. The demographics characteristics of all participants of this study are in Table 2.

Test-retest reliability

The HAGOS-Br subscale scores for both test occasions, as well as the corresponding ICCs for absolute agreement, for the 51 participants in the symptomatic group are presented in Table 3. For all comparisons analyzed, ICCs were consistent, and higher than 0.70.

Table 2 Participants' characteristics.

	Asymptomatic group (n = 52)	Symptomatic group (n = 51)
Age (years)	24.7 ± 5.8	28.9 ± 9.0
Sex		
Male	45 (87%)	34 (67%)
Female	7 (14%)	17 (33%)
BMI (kg/m^2)	23.5 ± 1.9	25.3 ± 3.5
Education level		
Elementary school	1 (2%)	0 (0%)
High school	25 (48%)	15 (29%)
College	14 (27%)	11 (22%)
Bachelor's degree or higher	12 (23%)	25 (49%)
Pain duration		
> 6 weeks	_	11 (22%)
> 12 weeks	_	10 (20%)
> 6 months	_	15 (29%)
> 12 months	_	15 (29%)
Pain (NPRS)		
At rest	_	3.0 ± 2.6
During/After SP/PA	_	6.2 ± 1.9
Hours of sport per week	9.5 ± 5.7	6.2 ± 3.7

Values are mean ± standard deviation or frequency (proportion).
Abbreviations: BMI, body mass index; NPRS, numeric pain-rating scale.
SP/PA, Sports Participation/Physical Activity.

Measurement error

The SEM and the SDC at an individual level with the 95% confidence interval of HAGOS-Br are presented in Table 3.

Internal consistency

The CFA revealed a Cronbach's Alpha for the HAGOS-Br subscales ranging from 0.86 to 0.96 (Table 4).

Structural validity

The CFA showed that the six constructs detected in the original HAGOS were confirmed, with the constructs presenting correlations from 0.68 to 0.96 (Supplemental Online Material). We tested for the six-factor structure with correlations between factors, however, we obtained poor indexes of model adjustment (chi-square= 1746.57, $p < 0.001$, GFI= 0.549, RMSE= 0.134, NFI= 0.654, TLI= 0.791, CFI= 0.741). We therefore checked the structure of each scale separately. For all HAGOS-Br scales, acceptable fit indexes were shown (Table 4). For RMSEA, four scales showed acceptable goodness-of-fit (<0.08). All questions showed acceptable factor loadings (>0.3) (Table 4).

Construct validity

Table 5 shows the Spearman correlations between the HAGOS-Br subscales, SF-36 subscales, LEFS questionnaire, and between the HAGOS-Br subscale of pain and NPRS at rest or during/after sports. A correlation between the

Table 3 Descriptive and reliability data for HAGOS-Br subscales in the symptomatic group (n = 51).

	Mean ± SD test	Mean ± SD retest	Mean ± SD Test-Retest difference	ICC (95% CI)	SEM	SDC 95%	Ceiling effect (%)	Floor effect (%)
Symptoms	74.9 ± 20.1	76.0 ± 19.9	1.1 ± 0.2	.91 (.85, .93)	6.03	16.71	0 (0%)	0 (0%)
Pain	82.0 ± 19.2	83.7 ± 18.3	1.7 ± 0.9	.92 (.89, .95)	5.43	15.32	0 (0%)	0 (0%)
ADL	85.0 ± 19.6	87.0 ± 16.9	2.0 ± 2.7	.89 (.84, .92)	6.50	18.01	1 (2%)	0 (0%)
Sport/Rec	74.3 ± 26.6	77.5 ± 24.1	3.2 ± 2.5	.92 (.88, .95)	7.52	20.84	2 (4%)	0 (0%)
PA	77.5 ± 25.6	76.8 ± 24.7	0.7 ± 0.9	.81 (.73, .86)	11.15	30.90	7 (14%)	2 (4%)
QoL	76.2 ± 25.7	77.4 ± 25.1	1.2 ± 0.6	.94 (.91, .96)	6.29	17.43	0 (0%)	0 (0%)

Abbreviations: ADL, activities of daily living; ICC, intraclass correlation; PA, Participation in physical activity; QoL, quality of life; SD, standard deviation; SDC, small detectable change; SEM, standard error of the measurement.

Table 4 Confirmatory factor analysis and internal consistency of the HAGOS-Br Subscales.

DIMENSION/ITEM	Standardized Factor loading	SE	CR	*p*
Symptoms (*7 items, Cronbach's* α = *.86*)				
S1	0.923	0.233	5.742	<0.001
S2	0.396	0.090	2.578	<0.001
S3	0.603	0.144	6.999	<0.001
S4	0.685	0.117	6.646	<0.001
S5	0.791	0.072	6.376	<0.001
S6	0.614	0.081	5.553	<0.001
S7	0.665	0.097	6.633	<0.001
CMIN/DF = 1.11, *p* = 0.34, RMSEA 0.033 (90%CI = 0.01, 0.109), CFI = 0.99, GFI 0.96, NFI = 0.96, TLI = 0.94				
Pain (10 *items, Cronbach's* α = *.92*)				
P1	0.793	0.047	4.441	<0.001
P2	0.578	0.063	4.345	<0.001
P3	0.695	0.048	-3.554	<0.001
P4	0.666	0.042	-3.320	<0.001
P5	0.794	0.038	3.447	<0.001
P6	0.749	0.035	2.727	0.006
P7	0.762	0.056	2.787	0.005
P8	0.777	0.025	2.315	0.021
P9	0.753	0.025	2.666	0.008
P10	0.802	0.033	2.348	0.019
CMIN/DF = 1,44, *p* = 0.07, RMSEA 0.06 (90%CI = 0.0, 0.30), CFI = 0.98, GFI 0.93, NFI = 0.95, TLI = 0.97				
Activities of daily living (5 *items, Cronbach's* α = *.91*)				
A1	0.811	0.107	4.880	<0.001
A2	0.902	0.045	6.068	<0.001
A3	0.808	0.033	4.648	<0.001
A4	0.747	0.042	6.096	<0.001
A5	0.889	0.056	6.445	<0.001
CMIN/DF = 1.95, *p* = 0.08, RMSEA 0.09 (90%CI = 0.00, 0.187), CFI = 0.98, GFI 0.96, NFI = 0.97, TLI = 0.97				
Sports/Recreation (8 *items, Cronbach's* α = *.96*)				
SP1	0.721	0.164	4.180	<0.001
SP2	0.861	0.091	6.908	<0.001
SP3	0.892	0.053	6.496	<0.001
SP4	0.817	0.046	6.099	<0.001
SP5	0.894	0.044	6.538	<0.001
SP6	0.956	0.055	6.251	<0.001
SP7	0.905	0.032	4.210	<0.001
SP8	0.859	0.051	5.889	<0.001
CMIN/DF = 1.16, *p* = 0.29, RMSEA 0.04 (90%CI = 0.10, 0.53), CFI = 0.99, GFI 0.96, NFI = 0.98, TLI = 0.99				
Participation in physical activity (2 *items, Cronbach's* α = *.96*)				
PA1	1.00	0.067	10.834	<0.001
PA2	—	—	—	—
CMIN/DF = 0.0, *p* = 0.001, RMSEA 0.936 (90%CI = 0.779, 1.10), CFI = 1.0, GFI 1.0, NFI = 1.0, TLI = 1.0				
Quality of life (5 *items, Cronbach's* α = *.90*)				
Q1	0.709	0.232	4.010	<0.001
Q2	0.703	0.141	6.519	<0.001
Q3	0.850	0.097	6.636	<0.001
Q4	0.815	0.064	5.517	<0.001
Q5	0.952	0.072	5.996	0.019
CMIN/DF = 0.99, *p* = 0.41, RMSEA 0.01 (90%CI = 0.0, 0.14), CFI = 0.99, GFI 0.98, NFI = 0.98, TLI = 1.0				

Abbreviations: CFI, Comparative Fit Index; CR, Critical Ratio; GFI, Goodness of Fit Index; NFI, Normed Fit Index; RMSEA, Root Mean Square Error of Approximation; SE, Standardized Error; TLI, Tucker—Lewis index.

Table 5 Spearman correlations Found at Validity Testing.

	HAGOS-Br					
Instrument/ subscale	Symptoms	Pain	ADL	Sport/Recreation	PA	QoL
LEFS	.77*	.81*	.79*	.81*	.69*	.80*
SF36						
Physical Function	.69*	.74*	.67*	.72*	.67*	.71*
Physical Role	.44*	.46*	.39*	.50*	.55*	.50*
Bodily Pain	.51*	.53*	.47*	.47*	.44*	.54*
General Health	.13	.17	.18	.17	.14	.10
Vitality	.35*	.31*	.28*	.34*	.34*	.34*
Social Functioning	.34*	.39*	.30*	.37*	.34*	.33*
Emotional Role	.31*	.29*	.23*	.30*	.26*	.31*
Mental Health	.20*	.19*	.19*	.24*	.24*	.18
NPRS at rest	–	- .75*	–	–	–	–
NPRS during/after SP/PA	–	- .81*	–	–	–	–

Abbreviations: ADL, activities of daily living; NPRS, numerical pain-rating scale; PA, Participation in physical activity; QoL, quality of life; SP/PA, sports participation/physical activity.
* $p < 0,05$.

HAGOS-Br and the SF-36 subscales was found, from the lowest to the highest, in mental health, emotional role, vitality, social functioning, physical role, bodily pain, and physical function. There was a strong correlation between the HAGOS-Br subscales and the LEFS questionnaire, as well as for the HAGOS-Br subscale of pain and NPRS both at rest or during/after sports. We confirmed 43 of the a priori hypotheses, formulated resulting in 76.7% agreement.

Interpretability

Overall, no ceiling or floor effects were observed for the HAGOS-Br subscales.

Discussion

Our study aimed to translate and cross-culturally adapt the HAGOS into Brazilian-Portuguese, and to evaluate the measurement properties. Based on the results, we can confirm that HAGOS-Br has an idiomatic and semantic equivalence to the original version, based on the guidelines for cross-cultural adaptation of self-administered questionnaires. In addition, the data suggest that the final version of HAGOS-Br is a reliable, internally consistent, and valid (structural and construct validity) measurement tool to assess physical functioning in active individuals between 18 and 55 years of age with long standing hip and groin pain.

In this present study, we found excellent test-retest reliability for the HAGOS-Br with ICC values ranging from 0.81 to 0.94 which is similar to the reliability reported for the original HAGOS (ICC agreement range from 0.82 to 0.91).[9] Our reliability was higher than those described in the Dutch, Chinese, and Swedish versions.[15–18] The interval between the two measurements was considered adequate because it minimizes the chance of recall bias as well as a change in clinical conditions.[15,23] We used the ICC agreement with a 2-way random-effects model, indicated by Terwee et al.,[24] as used in previous studies.[9,15–18]

The SDC in our study was consistent with the original tool, ranging from 15 to 20 points for the subscales of symptoms, pain, ADL, sports/recr, and QOL. Meanwhile, for the subscale of PA, the SDC was 30.9 points. Changes above these values are considered real changes at the individual level.[9] Factor analysis confirmed that the HAGOS-Br consists of six subscales. The HAGOS-Br showed good internal consistency. The CFA revealed a Cronbach's alpha for the HAGOS-Br subscales ranging from 0.86 to 0.96, demonstrating that the items in the questionnaire are homogeneous and not redundant. Corroborating our findings, the internal consistency was similar on both the original HAGOS (Cronbach α 0.79–0.84)[9] and the Dutch version (Cronbach α ranging from 0.81 to 0.92),[15] with better results when compared to the Chinese (Cronbach α ranging from 0.78 to 0.88)[17] and Swedish (Cronbach α ranging from 0.77 to 0.89) versions.[18] The data for CFA fell short of providing a good fit, however there is evidence of partial fulfillment of the criteria, based on our sample size.[42]

Given that there is no gold standard available for comparison, the validation of PRO measures becomes a challenge. Thus, we chose to correlate the subscales of HAGOS-Br, with measures already validated for the Portuguese language with similar (convergent validity) and different (divergent validity) constructs.[14] The SF-36 subscales and the LEFS were used because they are tools validated in Portuguese, with adequate measurement qualities, which have been used in similar populations.[32–34] The construct validity was found to be appropriate, as greater than 75% (43/56; 76.7%) of the predefined hypotheses were confirmed. The highest correlations were observed between HAGOS-Br subscales and LEFS questionnaire, and similar to the original HAGOS, between the HAGOS-Br subscales and SF-36 subscales of physical function, physical role, and bodily pain (convergent validity). Weaker correlations were observed with the HAGOS-Br subscales and SF-36 subscales of vitality, social functioning, emotional role, and mental health (divergent validity). We also expected a moderate to strong correlation between the HAGOS-Br subscale of pain and the NPRS at rest and during/after sports participation/physical activity, which was confirmed in our study.

This study had some limitations that should be indicated. The sample size, based on the COSMIN checklist,[14] is

considered good, not excellent, because our sample size is lower than 100 participants.[23] We did not control the cognitive status of the sample, which may have influenced the results, thus, we cannot generalize to other populations. In our study, we also included asymptomatic participants to analyze the construct validity, which may have influenced our results, because the chances of achieving a data spread across the entire HAGOS 0–100 points range was optimized. However, as the HAGOS is used in sporting populations for both screening, prevention, and treatment it is important that scores across the whole scale range are considered and included.[28–30]

Future studies in others populations and contexts, investigating the predictive validity and responsiveness of the HAGOS-Br are still warranted. Despite the limitations, we achieved adequate cross-cultural adaptation and excellent measurement properties which allow the use of HAGOS-Br in clinical and scientific settings.

Conclusion

The HAGOS was successfully translated and cross-culturally adapted into Brazilian Portuguese. The HAGOS-Br is reliable, internally consistent, and a valid patient-related outcome measure, that is equivalent to the original version, as tested in a group of active individuals participating in sports with high-demand for the hip/groin region who were between 18 and 55 years and who had long standing hip and/or groin pain. HAGOS-Br can be used in clinical and scientific settings.

Conflicts of interest

The authors declare no conflicts of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjpt.2021.10.004.

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