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Structural validity of the Japanese Orthopedic Association back pain evaluation questionnaire in individuals with chronic low back pain

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SUMMARY

OBJECTIVE: The main aim of this study was to evaluate the structural validity of the Brazilian version of the Japanese Orthopedic Association Back Pain Evaluation Questionnaire (JOABPEQ).

METHODS: Individuals with chronic low back pain were included. The data collection of the study occurred by means of online platform. Confirmatory factor analysis was performed. The theoretical version proposed for the JOABPEQ with five domains was tested. The following indices were considered to verify the fit of the model: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and chi-square/degrees of freedom (DF).

RESULTS: The final sample consisted of 175 volunteers, mostly women (68%), adults (mean age of 28.98 years), lean (mean body mass index of 25 kg/m^2), with incomplete higher education, single, with mean of pain chronicity of 61.50 months and mean of pain intensity of 6.78 points on the Numeric Pain Scale. Regarding the structure of the JOABPEQ, the original version with five domains was adequate: chi-square/DF=1.52, CFI=0.954, TLI=0.948, and RMSEA=0.055. The factorial load ranges from 0.41 to 0.90.

CONCLUSIONS: This study confirms the structure of JOABPEQ with 5 domains (low back pain, lumbar function, walking ability, social life function, and mental health) and 25 items in individuals with chronic low back pain.

KEYWORDS: Chronic low back pain. Questionnaire. Reproducibility of results.

INTRODUCTION

Chronic low back pain is one of the main causes of musculoskeletal disability presented by the world population, affecting mainly the adult population, with clinical diagnosis centered on patient reports, and the majority being nonspecific and with a multifactorial etiology[1]. According to the study by Carregaro et al.,[2] in the Brazilian population, health cost and loss of productivity due to low back pain are substantial, with men having higher levels of disability compared to women.

Therefore, it is extremely important to have accessible and low-cost instruments to measure the disability of these individuals, such as questionnaires, which must have adequate psychometric properties and precise statistical values to be used[3-5]. Usually, the most evaluated psychometric properties are reliability, content

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validity, responsiveness, and cross-cultural adaptation[3]. For the Brazilian population, previous studies support the clinical use of the Roland–Morris Disability Questionnaire (RMDQ)[6], Bournemouth Questionnaire[7], STarT Back Screening Tool[8], and Oswestry Disability Index[9]. Another interesting tool is the Japanese Orthopedic Association Back Pain Evaluation Questionnaire (JOABPEQ), developed by Fukui et al.[10]. It is a questionnaire centered on the patient's self-report and encompasses five domains: low back pain, lumbar function, walking ability, social life function, and mental health.

The original version of the JOABPEQ has adequate reliability (kappa ≥0.48)[11,12]. In addition, this questionnaire has already been adapted and validated for Chinese[13], Turkish[14], Korean[15], Thai[16], Iranian[17], and Arabic[18] languages. In Brazil, the questionnaire was translated and cross-culturally adapted for the Brazilian population by Poletto et at.,[19] with good reliability (Cronbach's alpha ≥0.90) and construct validity (magnitude of the significant correlations with domains of the Medical Outcomes Study 36-Item Short Form Survey and Oswestry Disability Index, r=0.22–0.79).

However, there is no study in the literature that proposed to evaluate the structural validity of the JOABPEQ. This psychometric property is a specific statistical procedure with the objective of verifying whether the domains and items originally proposed in the creation of the questionnaire are supported statistically[3].

The objective of this study was to evaluate the structural validity of the Brazilian version of the JOABPEQ in individuals with chronic low back pain. The hypothesis of this study is that the originally proposed structure of JOABPEQ with five domains is supported by factor analysis, according to the previous study[12]. In the scientific literature, only the study conducted by Fukui et al.[12] analyzed the internal structure of JOABPEQ. The clinical relevance of the present study is to ensure that the JOABPEQ measures what it proposes to measure, giving a clinimetric basis for the use of this questionnaire by clinical professionals and researchers.

METHODS

Study design

This study of structural validity of a questionnaire was carried out according to the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN)[3]. The data collection of the study occurred by means of online platform.

The study procedures were approved by the Research Ethics Committee of the Universidade Federal do Maranhão (opinion number 14783219.2.0000.5087). The volunteer recruitment took place in the university community, by means of dissemination, with physiotherapists and physical education professionals working in the rehabilitation of patients with chronic low back pain, and dissemination on social media. All volunteers included in the study validated their participation by signing informed consent forms.

Participants

The sample size calculation was based on COSMIN: seven times the number of items of the questionnaire[3]. In these terms, considering the JOABPEQ with 25 items, the present study was composed of 175 individuals with chronic low back pain.

We included participants of both sexes between the ages of 18 and 60 years, with pain report at least 3 months and with minimum pain intensity of 3 points on the Numeric Pain Scale (NPS)[20]. The following exclusion criteria were adopted: unlettered; history of trauma, fractures, or acute spinal injuries; spine surgery; use of painkillers in the past 7 days; physiotherapeutic treatment for low back pain in the previous months; or the presence of other chronic pain.

Assessments

The online form featured an anamnesis with questions related to personal, sociodemographic, and anthropometric aspects to characterize the sample. In addition, the NPS, RMDQ, and JOABPEQ were answered.

The NPS is a simple and easy-to-measure scale that consists of a sequence of numbers, ranging from 0 to 10, in which a value of 0 represents "no pain" and a value of 10 represents "worst pain imaginable." The volunteers graduated their pain based on these parameters. Pain intensity was assessed with the individual at rest and after active movements (flexion, extension, inclinations, and rotations) of the lumbar spine. This scale was adapted and validated for Portuguese by Ferreira-Valente et al.[21]

The RMDQ is a questionnaire that has been validated and adapted by Nusbaum et al.[6] for the Brazilian population. This is an instrument that assesses disability related to low back pain and consists of 24 items that describe daily activities, in which each response is quantified from 0 to 1 (total score varying 0–24 points). The higher the total score, the greater the level of disability.

The JOABPEQ has been translated, adapted to Brazilian Portuguese, and validated by Poletto et al.[19] The questionnaire consists of 25 items covering issues related to low back pain, lumbar function, walking ability, social life function, and mental health. The subscale scores range from 0 to 100, and the higher the score, the better the individual's condition. Based on the study by Fukui et al.,[12] formulas were defined to calculate the score for each domain, as described in Table 1.

Table 1. Formulas for calculating the score for each Japanese Orthopedic Association Back Pain Evaluation Questionnaire domain.

Domain	Formula
Low back pain	('Q1–1'×20+'Q1–2'×20+'Q1–3'×20+'Q1–4'×10–70)×100÷70
Lumbar function	('Q2–1'×10+'Q2–2'×10+'Q2–3'×20+'Q2–4'×10+'Q2–5'×30+'Q2–6'×20–100)×100÷120
Walking ability	('Q3–1'×30+'Q3–2'×20+'Q3–3'×10+'Q3–4'×10+'Q3–5'×30–100)×100÷140
Social life function	('Q4–1'×2+'Q4–2'×4+'Q4–3'×6–22)×100÷74
Mental health	('Q5–1'×3+'Q–2'×4+'Q5–3'×6+'Q5–4'×6+'Q5–5'×3+'Q5–6'×3+'Q5–7'×3–28)×100÷103

Q1: Questions (1–4) related to the low back pain domain; Q2: Questions (1–6) related to the lumbar function domain; Q3: Questions (1–5) related to the walking ability domain; Q4: Questions (1–3) related to the social life function domain; Q5: Questions (1–7) related to the mental health domain.

Statistical analysis

Confirmatory factor analysis (CFA) was performed using R Studio software (Boston, MA, USA), using the lavaan and semPlot packages. The analysis was performed based on a polychoric covariance matrix and a robust diagonally weighted least squares (RDWLS) extraction method, given that the JOABPEQ score has an ordinal categorical nature. The theoretical version proposed for JOABPEQ with five domains was tested[19]. The following indices were considered to verify the fit of the model: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and chi-square/degrees of freedom (DF). As an acceptability parameter of the model, CFI and TLI >0.90, RMSEA <0.08, and chi-square/DF <3 were considered[22].

RESULTS

In this study, 205 individuals with chronic low back pain participated. Of these, 22 were excluded for having a score below 3 on the NPS, 4 for having a traumatic injury to the spine, and 1 for having undergone a surgical procedure. Thus, the final sample consisted of 175 volunteers, mostly women (68%), adults (mean age of 28.98 years), lean (mean body mass index of 25 kg/m^2) with incomplete higher education, single, with mean chronicity of 61.50 months and mean of pain intensity of 6.78 points on the NPS. Table 2 presents the other personal characteristics of the study sample.

Regarding the structure of the JOABPEQ, the original version with five domains was adequate based on the analysis of the fit indices generated from the CFA, as provided in Table 3. In addition, Table 4 indicates the covariance between the domains of the JOABPEQ, ranging from 0.471 to 0.826, and Figure 1 shows the factorial loads of each item in their respective domains, ranging from 0.41 to 0.90.

Table 2. Characterization of the study sample with presentation of values in mean and standard deviation or number and percentage.

Variables	Participants (n=175)
Sex	
Female	119 (68%)
Male	56 (32%)
Marital status	
Single	111 (63.42%)
Married	57 (32.57%)
Widower	2 (1.14%)
Divorced	5 (2.85%)
Educational level	
Complete primary education	1 (0.57%)
Incomplete primary education	2 (1.14%)
Complete secondary education	27 (15.42%)
Incomplete secondary education	4 (2.28%)
Complete higher education	34 (19.42%)
Incomplete higher education	56 (32%)
Complete postgraduate	39 (22.28%)
Incomplete postgraduate	12 (6.85%)
Age (years)	28.98 (9.32)
Weight (kg)	69.89 (15.82)
Height (cm)	1.66 (0.09)
BMI (kg/m^2)	25 (4.55)
Chronicity (months)	61.50 (54.53)
NPS (score, 0–10)	6.78 (1.93)
RMDQ (score, 0–24)	4.80 (4.99)
JOABPEQ (score, 0–100)	
Low back pain	30.50 (24.20)
Lumbar function	69.30 (27.90)
Walking ability	75.90 (29.10)
Social life function	20.80 (13.07)
Mental health	54.40 (19.17)

BMI: Body Mass Index; NPS: Numerical Pain Scale; RMDQ: Roland-Morris Disability Questionnaire; JOABPEQ: Japanese Orthopedic Association Back Pain Evaluation Questionnaire.

Table 3. Fit indexes of the model of the Japanese Orthopedic Association Back Pain Evaluation Questionnaire with five domains in the studied sample (n=175).

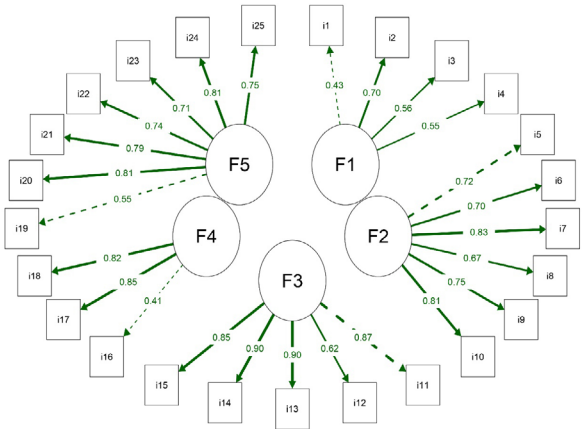
Chi-square	DF	Chi-square/DF	CFI	TLI	RMSEA (90%CI)
404.269	265	1.52	0.954	0.948	0.055 (0.044–0.066)

DF: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis Index; RMSEA: root mean square error of approximation.

Table 4. Covariance between Japanese Orthopedic Association Back Pain Evaluation Questionnaire domains.

Domains	F1	F2	F3	F4	F5
F1	1	-	-	-	-
F2	0.665	1	-	-	-
F3	0.730	0.826	1	-	-
F4	0.764	0.823	0.756	1	-
F5	0.719	0.471	0.604	0.596	1

F1: Low back pain; F2: Lumbar function; F3: Walking ability; F4: Social life function; F5: Mental health.



F1: Low back pain; F2: Lumbar function; F3: Walking ability; F4: Social life function; F5: Mental health.

Figure 1. Path diagram with the factorial loads for each Japanese Orthopedic Association Back Pain Evaluation Questionnaire domain.

DISCUSSION

The results of the present study show that the JOABPEQ is a questionnaire that has a structure of five domains and 25 items. Only the study conducted by Fukui et al.[12] analyzed the internal structure of JOABPEQ by means of exploratory factor analysis using the maximum likelihood extraction method. The factor load varied from 0.26 to 0.81 and five domains were identified.

Despite the statistical differences between the studies (our study used CFA with the RDWLS extraction method because it is more suitable for ordinal categorical variables), the structure we found is the same as the structure with five domains proposed by Fukui et al.[12]. The factorial loads of our study were relatively higher, varying between 0.41 and 0.90.

When comparing the characteristics of the sample, our study was composed mostly women, with mean age of 28.98 years, mean chronicity of 61.50 months, and mean of pain intensity of 6.78 points on the NPS. The sample of the study conducted by Fukui et al.[12] was composed mostly men, with mean age of 50.7 years. This previous study did not assess the pain intensity, but classified the majority of patients with moderate severity of low back pain by means of qualitative analysis. Despite the differences between the studies, we considered our sample representative due to the eligibility criteria used here and the difference presented can be justified by the use of an online platform for data collection (the diffusion of technology is greater among younger people).

In the Brazilian Portuguese language, the study by Poletto et al.[19] performed translation and cross-cultural adaptation and evaluated the reliability and construct validity of the JOABPEQ. Despite this scientific initiative, it should be noted that no study has verified the structural validity of the JOABPEQ in the Brazilian population, an analysis that is a way of ensuring that the internal structure of the questionnaires (items and domains) is adequately based on rigorous statistical procedures, such as factor analysis[3,23].

In relation to other validations of the JOABPEQ, the Arabic version[18] assessed the instrument's internal consistency with a Cronbach's alpha value of 0.87, and, in addition, convergent validity was performed, which was confirmed with a correlation coefficient >0.4 for each item. Furthermore, an Iranian study[24] identified satisfactory results for internal consistency (Cronbach's alpha ≥0.71) and, as in the Arab study, convergent validity (r≥0.48) was also achieved, obtaining satisfactory results, suggesting that the items had a substantial correlation with the subscale it represents.

Our study differs from the methodology used in the validation of the JOABPEQ for the Arab and Iranian populations, given that our study used CFA, a more robust and refined method[25] than the simple correlation between the score of the items and the subscales.

In addition, cross-cultural adaptation of the JOABPEQ in other languages investigated the reliability and construct validity, as in the case of the versions in Thai[16], Korean[15], Chinese,[13] and Turkish[26]. We emphasized again that none of these studies

analyzed the internal structure of the questionnaire, as recommended by a robust international guideline[3,23].

The present study has some limitations. Data collection was carried out online due to the COVID-19 pandemic. In this way, we did not conduct a face-to-face clinical evaluation with the participants, and the eligibility criteria were applied based only on the participant's self-report.

CONCLUSION

This study confirms the structure of the JOABPEQ with five domains (low back pain, low back function, walking, social life function, and mental health) and 25 items in individuals with chronic low back pain.

AUTHORS' CONTRIBUTIONS

JSP: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **APS:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **GGCA:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **LPM:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **FOP:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing. **CAFPG:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing. **AVDF:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing.

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