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RESEARCH

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Knee osteoarthritis pre-screening questionnaire (KOPS): cross-cultural adaptation and measurement properties of the brazilian version—KOPS Brazilian version

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Abstract

Background: Despite the criteria already established for the classification of knee osteoarthritis (OA), a radiographic and/or clinical knee OA diagnosis usually occurs in cases of fully manifest or more advanced disease, which can make health promotion, prevention, and functional rehabilitation in more advanced stages of the disease less effective. In addition, radiographic knee OA can generate more financial costs for health services. Therefore, developing and validating screening instruments to assess the probability of development and progression of knee OA would be of great value for both clinical practice and science.

Objective: To cross-culturally adapt and investigate the measurement properties of the Knee OA Pre-screening Questionnaire Brazilian version.

Methods: A total of 250 individuals of both sexes aged between 35 and 92 years [(mean (standard deviation): 63 (11) years old; 74.1 (15.1) kg; 1.59 (0.09) m; 29.38 (5.44) kg/m^2] participated in this study. The cross-cultural adaptation and analyses of the measurement properties of the KOPS Brazilian version included: (1) assessment of conceptual and item equivalence; (2) assessment of semantic equivalence; (3) assessment of operational equivalence; and (4) assessment of measurement equivalence, reliability, and validity.

Results: Cronbach's alpha for the internal consistency among the six components of the KOPS Brazilian version was 0.71. The test-retest 72 h apart for each component resulted in a coefficient correlation intraclass ranging from 0.74 to 1.00. The probability of an individual randomly chosen from the population having KL $\geq$ 1 and KOPS Brazilian version $\geq$ 21 points was 0.74 (area under the curve of the Receiver Operating Characteristic – AUC of ROC); furthermore, the AUC for KL $\geq$ 2 and the KOPS Brazilian version $\geq$ 23 points was 0.77.

Conclusion: The KOPS Brazilian version is a reliable and valid instrument for early screening of knee OA in individuals aged 35 years and over in the Brazilian context.

Keywords: Osteoarthritis, Knee, Validation, Cross-cultural adaptation, Measurement properties

Introduction

Knee osteoarthritis (OA) is the most prevalent condition in the lower limbs, especially in older adults whose progressive functional impairment is a concerning problem to be addressed [1]. Although OA is more prevalent

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after 60 years old [2], persons aged 40 or 50 years old are also affected [3]. According to the American College of Rheumatology (ACR), the classification criteria for knee OA include knee pain plus at least three of the following aspects: age over 50, short morning stiffness, crepitus, tenderness, bone enlargement, and evident joint heat [4]. The European League Against Rheumatism (EULAR) establishes that a knee OA classification should be based on three symptoms and three clinical signs such as crepitus, limited movement, and bone enlargement [5].

Despite these guidelines, a radiographic and/or clinical knee OA diagnosis usually occurs later, which can make health promotion, prevention, and functional rehabilitation in more advanced stages of the disease less effective. In addition, radiographic knee OA can generate more financial costs for health services. Therefore, developing and validating screening instruments to assess the probability of development and progression of knee OA would be of great value for both clinical practice and science.

Thus, the Knee OA Pre-Screening Questionnaire (KOPS) for knee OA screening without imaging exams was developed by Yázigi et al. [6]. KOPS is a self-reported and self-filled questionnaire structured based on an extensive literature review, especially on the ACR and EULAR criteria for knee OA diagnosis [5, 7]. The KOPS followed the validation process of the screening questionnaires [8, 9], as well as the Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC) scores [10] and the Knee and Osteoarthritis Outcome Score (KOOS) [11]. The KOPS items were critically discussed by experts consisting of rheumatologists, physiotherapists, epidemiologists, and specialists in physical exercise and health [6]. The validity and accuracy of this instrument have been demonstrated for the Portugal population [6]. However, a cross-culturally adapted and validated KOPS version for the Brazilian population is not yet available. Thus, the present study aimed at conducting a cross-cultural adaptation and validation of the KOPS for Brazilian Portuguese.

Methods

Ethical aspects

The study followed the recommendations of the World Medical Association Helsinki declaration, and Resolution 466 of December 12, 2012, of the National Health Council. It was approved by the Research Ethics Committee of the University of Pernambuco (study# 2.196 0.979; CAAE: 67049717.8.1001.5207).

All participants signed an informed consent form after learning and agreeing with the study objectives, methodological procedures, possible risks, related discomforts, and benefits before starting the assessments.

Study design

This is an observational analytical study focused on observing reality to suggest associations between demographic measures, functional signs, and symptoms, and the radiographic diagnosis of knee OA in the participants for cross-cultural adaptation and validation of the original KOPS version for Brazilian Portuguese.

Participants

A total of 250 participants of both sexes aged between 35 and 92 years was included in this study. The inclusion criteria were: (1) participants 35 years old or older; (2) with X-ray in the anteroposterior (front to back) view of both knees during full weight-bearing in bipedal stance and (3) those with sufficient ability for reading and understanding spoken and written the Portuguese language. Participants who did not answer all the mandatory questions in the questionnaire were excluded from the study.

The participants were recruited from: (1) Rheumatology Outpatient Clinic of the School of Medicine of the University of São Paulo (São Paulo—SP); (2) University Hospital of the Federal University of Vale do São Francisco (Petrolina – PE); (3) extension projects at the University of Pernambuco (Petrolina—PE); (4) health centers; (5) parks; (6) squares; and (7) churches. Radio ads, local news, and social media (Facebook and Instagram) were used to publicize the study. All participants signed an informed consent form after learning and agreeing with the study objectives before starting the assessments and were then effectively allocated to one of the two study groups.

Sample size

The sample size calculation was performed to meet the criteria for carrying out the factor analysis, considering a proportion of at least ten participants for each question of the proposed questionnaire [12]. Thus, at least 200 participants were needed considering the 20 items of the KOPS.

The instrument

The KOPS is a self-reported and self-filled questionnaire, which contains 20 items with nominal or ordinal responses, divided into four domains. The first part of the instrument contains sociodemographic information; the second part contains information about risk factors for knee OA; the third part is about signs and symptoms of knee OA; the last part contains additional information related to mobility, exercise, and clinical supervision [6].

Pain intensity during functional activities was scored from 0 to 10, in which 0 is the absence of pain and 10 is the most pain ever felt by the participant. The signs and

symptoms were classified as 0 or 1, in which 1 is a positive response. Age was categorized into seven intervals ($\leq 39 = 0$; 40–49 = 1; 50–59 = 2; 60–69 = 3; 70–79 = 4; 80–89 = 5; $\geq$ 90 = 6) for the biological risk component. Menopause was considered a dichotomous response, for which the number 1 states the woman was in menopause. Body mass index (BMI) was categorized into six intervals (underweight = 1; healthy = 2; overweight = 3; grade 1 obesity = 4; grade 2 obesity = 5, and grade 3 obesity = 6). The component related to external risk factors, lower limb injuries, and working postures were scored in a dichotomous way, in which 1 is the criterion statement. The sports volume ("years" times "the weekly frequency of sports activity") was categorized into seven intervals (no sports = 0; 1–15 = 1; 16–29 = 2; 30–44 = 3; 45–59 = 4; 60–74 = 5; 75–89 = 6; $\geq$ 90 = 7).

The maximum value achieved on the KOPS is 54 points; the higher the value, the greater the probability of the participant having knee OA.

Knee OA radiographic diagnosis

After self-completing the KOPS Brazilian version, the participants underwent an X-ray in the anteroposterior (front to back) view of both knees during full weight-bearing in bipedal stance for subsequent knee OA radiographic diagnosis according to the criteria of Kellgren and Lawrence (KL) [13]. The knee with the higher (worst) radiographic KL grade was adopted for the analysis in this study.

Cross-cultural adaptation and measurement properties of the KOPS brazilian version

Formal authorization to cross-culturally adapt and validate the original KOPS to Brazilian Portuguese was obtained by email obtained from the main author (FY) of the original instrument.

The translation and back-translation were not carried out in this study since Lusitanian and Brazilian Portuguese are the same language. In 1996, an international treaty called the "Community of Portuguese Language Countries (CPLP)" was signed between Portuguese-speaking countries, with one of its objectives being to unify Portuguese spelling. Thus, only the cross-cultural adaptation to the Brazilian Portuguese language and validation stages were necessary. The following study stages were performed: (1) Assessment of conceptual and item equivalence; (2) assessment of semantic equivalence; (3) assessment of operational equivalence; and (4) assessment of measurement equivalence [14].

Next, the relevance of the concepts, dimensions, and adequacy of each item of the original instrument to Brazilian Portuguese was verified to assess the conceptual and item equivalence of the KOPS Brazilian version. This stage sought the best representation of these items for the Brazilian context. Then, maintaining the meanings of the main concepts of the original and adapted version to Brazilian Portuguese by a formal consideration of the semantic equivalence, review, and pre-test were conducted in the semantic equivalence assessment stage [14].

The semantic adaptation from Lusitanian Portuguese to Brazilian Portuguese was independently performed by three health professionals (two rheumatologists and a physiotherapist), who are fluent in Brazilian Portuguese. The consensual version among these three professionals was compared with the original version and can be seen in the Additional file 1 of this paper. These professionals have more than 10 years of experience in knee OA. They verified the literal correspondence between the items in the Lusitanian and Brazilian Portuguese KOPS versions. The professionals also verified the adequacy of the items in the Brazilian version according to the age group and cultural context of the target population. The formal assessment of semantic equivalence was performed by a professional (physiotherapist), who compared the general meanings of the terms between the original version and the three adaptation proposals made for the Brazilian version to assess the relevance and acceptability of the style used in a given word in the version adapted to the target culture [15]. The synthesis of the KOPS Brazilian version had an agreement greater than 80% between the specialists and was posteriorly judged by a professional with a Bachelor of Arts degree and more than 20 years of experience in the area.

The initial KOPS Brazilian version was applied in the "paper and pen" format to 16 individuals (judges-evaluators) in the pre-test stage. The sociodemographic and clinical characteristics of the judges-evaluators were similar to those of the target participants. This stage aimed to verify the acceptability and understanding of the first KOPS Brazilian version by the target participants. The judges-evaluators were participants of both sexes, aged 35 years or over, able to read, understand and answer all the KOPS Brazilian version questions on their own.

The operational equivalence was carried out by the same judges-evaluators and aimed at the feasibility and adequacy of the administration format and mode of the instrument with the new target population. The feasibility of applying the KOPS Brazilian version was confirmed at this stage. A Likert-type satisfaction scale was applied to the participants after they completed the KOPS Brazilian version. This scale aimed to assess the participants' satisfaction with the administration and formatting model of the KOPS Brazilian version. The participants should fill in one of the following alternatives for each item of the KOPS Brazilian version questions: "I disagree", "I partially disagree", "I neither agree nor disagree", "I partially agree"

or "I agree". A minimum agreement of 80% was considered among the participants, who also had the opportunity to make suggestions about the formatting and administration of the KOPS Brazilian version.

The final version of the KOPS Brazilian version (Additional file 2) was applied to 200 participants to assess its internal consistency and validity and compare these measures with those found in the original KOPS version.

The repeatability of the KOPS Brazilian version was verified by a test-retest design, in which 50 individuals with demographic and anthropometric characteristics similar to the target population answered the questionnaire in a 72-hour interval.

Statistical analyses

The reliability of KOPS was tested for internal consistency and repeatability. The internal consistency of the KOPS Brazilian version was verified by Cronbach's alpha using the following classification: low (0.00 to 0.20), reasonable (0.21 to 0.40), moderate (0.41 to 0 0.60), substantial (0.61 to 0.80) or almost perfect (0.81 to 1.00) [16].

The repeatability of each of the six KOPS Brazilian version components was calculated using the Intraclass Correlation Coefficient ($ICC_{3,1}$) [17]. The repeatability was considered high when the ICC was > 0.75, moderate with ICC between 0.40 and 0.75, and low when the ICC was < 0.40 [18].

The criterion validity was evaluated by comparing the component scores of the KOPS Brazilian version with the KOPS Lusitanian version. The construct validity was assessed by the sensitivity and specificity of the KOPS Brazilian version obtained by the ROC curve (Receiver Operating Characteristic). A ROC curve was also used to determine the cut-off value of the KOPS Brazilian version to discriminate individuals with a greater probability of presenting higher KOPS and radiographic femorotibial knee OA values, diagnosed in an anterior-posterior RX. The more accurate a test is, or the larger the area under the ROC curve, the greater the probability of finding higher values of the measure of interest in a person with the disease than in another without the disease [19]. The ROC curve was calculated considering the KL ≥ 1 and KL ≥ 2. In the first model (KL ≥ 1), a cut-off value even in people with questionable radiographic signs of osteophyte formation was intended. In the second model (KL ≥ 2), those individuals with well-defined osteophyte formation were targeted. Thus, the study provides the reader with the possibility of using two cut-off values from the KOPS Brazilian version. A 95% confidence interval for the area under the ROC curve was adopted [20].

Descriptive statistical analyzes and internal consistency and reliability of data inferences were performed using the Statistical Package for the Social Sciences program (v. 22, SPSS, IBM Co., Chicago, IL). The sensitivity, specificity, and ROC curve calculation analyses were performed in the MedCalc program (v. 20.006, Mariakerke, Belgium). An alpha of 0.05 was adopted as the statistically significant level for all analyses.

Results

The anthropometric, sociodemographic, and working conditions of the participants included in the cross-cultural validation process are presented in Table 1.

Table 1 Characteristics of samples in the phases of content validity and reliability

Variables	Content validity (*n* = 200)	Reliability (*n* = 50)
	Mean (SD)	Mean (SD)
Age (years)	63 (11)	52 (10)
Body mass (kg)	74.10 (15.13)	72.09 (12.5)
Height (m)	1.59 (0.09)	1.63 (0.09)
BMI (Kg/m^2)	29.38 (5.44)	27.11 (4.31)
	n (%)	n (%)
Gender		
Female	181 (90.5)	33 (66.0)
Male	19 (9.5)	17 (34.0)
Age group (years)		
≤ 39	9 (4.5)	8 (16.0)
40–49	21 (10.5)	12 (24.0)
50–59	39 (19.5)	20 (40.0)
60–69	65 (32.5)	7 (14.0)
70–79	53 (26.5)	2 (4.0)
80–89	11 (5.5)	1 (2.0)
90–99	2 (1.0)	0 (0.0)
KL grade		
0	15 (7.5)	n. a.
1	35 (17.5)	n. a.
2	54 (27.0)	n. a.
3	47 (23.5)	n. a.
4	33 (16.5)	n. a.
Job Posture		
Standing position	114 (57.0)	19 (38.0)
Sitting position	11 (5.5)	22 (44.0)
Squatting position	50 (25.0)	0 (0.0)
Education level		
No answer	47 (23.5)	0 (0.0)
Elementary school	47 (23.5)	4 (8.0)
High school graduate	54 (27.0)	8 (16.0)
Incomplete College	35 (17.5)	1 (2.0)
College	17 (8.5)	20 (40.0)

BMI: Body mass index; *SD*: Standard deviation; n. a.: not assessed.

The KOPS brazilian version

The KOPS Brazilian version component scores according to the study by Yázigi et al. [6] are shown in Table 2.

Participants normally take between 10 and 15 min to fill out the KOPS Brazilian version. The KOPS Brazilian version can be found in Additional file 2 of this paper or requested by emailing the corresponding author of this paper.

Descriptive statistics represented by the mean and standard deviation for each component of the KOPS Brazilian version were: Functional Pain (2.8; 1.9), pain intensity in the last month (5.0; 3.7), pain intensity in the last year (5.0; 3.8), signs/other symptoms (4.6; 2.2), biological risk (6.9; 1.9) and external risk (2.5; 1 0.4).

Reliability

The final mean KOPS Brazilian version score obtained in the present study was 26.8, ranging from 3 to 43 points ($n = 200$).

The KOPS Brazilian version showed substantial internal consistency among its six components (Cronbach's alpha = 0.717). The test-retest ($ICC_{3,1}$) with an interval of 72 h for each component ranged from 0.748 to 1.000 (Table 3).

Sensitivity and specificity

The ROC curve analyses were performed from two perspectives; in the first one, the classification of the radiographic grade of KL ≥ 1 was used, and an area under the curve of 0.74 was obtained. In the second analysis considering the radiographic grade of KL ≥ 2, an area under the curve of 0.77 was obtained (Table 4) (Fig. 1).

The KOPS Brazilian version cut-off point which maximized sensitivity and specificity, considering the radiographic grade of KL ≥ 1, was ≥ 21 points with a sensitivity value of 78.38 and a specificity of 60.00. Considering the radiographic grade of KL ≥ 2, the cut-off point for the KOPS Brazilian version was ≥ 23 points, with a sensitivity value of 80.54 and a specificity of 60.78.

Table 2 Dimensions, components, items, and maximal scores of the KOPS Brazilian version questionnaire

Dimensions (2)	Components (6)	Items (20)	Score	Corresponding item in the questionnaire
Symptom	Functional pain (FP)			
		Walking	1	7.1
		Stepping	1	7.2
		Sitting down or getting up from a chair	1	7.3
		Standing posture	1	7.4
	Pain intensity in the last month (MP)	Last month	0–10	6.2 c
	Pain intensity in the last year (YP)	Last year	0–10	6.2 a
	Signs/other symptoms (SOS)			
		Morning stiffness	1	9
		Position stiffness	1	10
		Swelling	1	11
		Creaking	1	12
		Knee extension	1	13
		Deformity	1	14
Risk factors	Biological risk (BR)			
		Age interval	6	Age (years)
		Menopause	1	Menopause (yes/no)
		BMI classification	6	BMI classification**
	External risk (ER)			
		Lower limb injury	1	3
		Job posture:		
		Predominantly standing standing: stand position	1	4a
		Predominantly squatting position	1	4b
		Predominantly sitting	1	4c
		Sports volume	7	5 Years of practice multiplied by weekly frequency (average)]
KOPS Brazilian version total score			54	

*0 - Less than or equal to 39 years old; 1–40 to 49 years; 2–50 to 59 years; 3–60 to 69 years; 4–47 to 79 years; 5–80 to 89 years; 6 - Greater than or equal to 90 years old.
**1 - Underweight; 2 - Normal weight; 3 - Overweight; 4 - Grade 1 obesity; 5 - Grade 2 obesity; 6 - Grade 3 obesity

Table 3 Internal consistency and intra-rater repeatability analyses for each component

Components	$ICC_{3,1}$
Functional pain	0.754
Pain last month	0.822
Pain last year	0.886
Signs/other symptoms	0.748
Biological risk	1.000
External risk	0.974
KOPS Brazilian version total score	0.934

ICC: Intraclass Correlation Coefficient

Table 4 Area under the ROC curve based on the radiographic degrees of Kellgren and Lawrence ≥ 1 and ≥ 2

Variable	KL ≥ 1	KL ≥ 2
Area under the ROC curve	0.740	0.774
Standard error	0.065	0.037
95% Confidence interval	0.674 to 0.799	0.709 to 0.830
Z-statistic	3.645	7.393
Significance level	< 0.001	< 0.001
Sensitivity	78.38	80.54
Specificity	60.00	60.78

KL: Kellgren and Lawrence

Discussion

This study aimed at a cross-cultural adaptation and validation of the original version of the KOPS to Brazilian Portuguese. The main results of this study show satisfactory internal consistency and high repeatability reliability of the KOPS Brazilian version in individuals aged 35 years or older.

Considering the literature has shown signs and symptoms of knee OA in individuals over 40 years of age [3] and the radiographic knee OA diagnosis is commonly defined in a more advanced stage, the KOPS Brazilian version validation sought to early identify incipient risk factors in people aged over 35 years. Although OA is more prevalent after 60 years old [2], people aged 35 and over were included in this study since the risk of developing knee OA may be higher in young adults with a knee injury [21], in young persons with knee articular cartilage damage or active individuals [22], and or with obesity, and sarcopenic obesity [23].

The KOPS was originally developed for screening knee OA even before its clinical and/or radiological diagnosis [6]. Early screening for knee OA is a great advantage of KOPS over imaging tests, especially in developing countries such as Brazil, where the higher cost and waiting time for the public health service can be seen as economic barriers to requesting this type of exam. In the current Brazilian economic situation, professionals such as physiotherapists, physical education professionals, nurses, or even other allied health and researchers commonly face an often-bureaucratic process in requesting imaging tests for knee OA diagnosis. This process can prolong the prevention measures for the disease or even for establishing rehabilitation processes for knee OA. On the other hand, the KOPS Brazilian version can be used from now on as an inexpensive, easy-to-use instrument to screen individuals who are more likely to have radiographic knee OA.

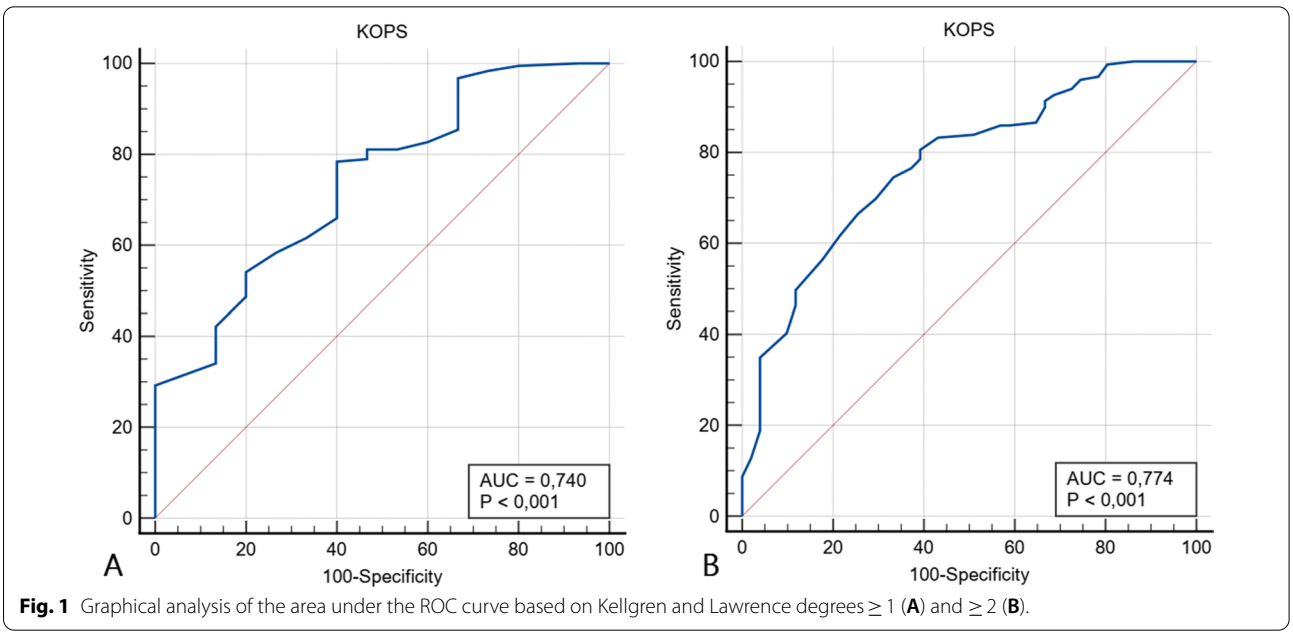

Fig. 1 Graphical analysis of the area under the ROC curve based on Kellgren and Lawrence degrees ≥ 1 (**A**) and ≥ 2 (**B**).

In addition, X-ray exams expose patients to radiation. It is important to note that in health systems, treatments are prescribed when there is a confirmed diagnosis. Thus, health professionals working in primary care, such as physiotherapists, nurses, general or family, and community physicians may use the KOPS for knee OA screening and depending on the results, prescribe or not X-ray for confirmation or referral to a rheumatologist.

The KOPS Brazilian version is an instrument with dimensions related to risk factors for both onset and progression of knee OA, although we do not know whether people are diagnosed with OA. In contrast, instruments such as the WOMAC only assess the signs and symptoms related to the already in-progress disease. Therefore, KOPS can be seen as an innovative questionnaire, which can be used to consider risk factors for developing and progressing knee OA [6].

The internal consistency of the KOPS Brazilian version revealed good reliability (Cronbach's alpha = 0.717), corroborating the results of the original version of this instrument (Cronbach's alpha = 0.747) [6]. These results show that the KOPS Brazilian version items accurately measure what each of its six components is intended to measure. Hence, the six KOPS items are representative of the construct. This result ensures an effective screening to detect individuals with a higher probability of having knee OA, even in the earlier stages [24].

Considering the ROC curve analysis results, the present study shows that individuals with radiographic knee OA classified as KL ≥ 2 have a greater probability of having values of 23 points on the KOPS Brazilian version, with acceptable/reasonable accuracy [25]. Additionally, individuals with keen radiography classified as KL ≥ 1 (questionable osteophyte and/or doubtful joint space narrowing), have a greater probability of having values of 21 points on the KOPS Brazilian version. By using these two models, one can choose by screening potential patients in which the disease is already confirmed by the clear presence of osteophytes or in the stages in which there is doubtful osteophyte formation. Nevertheless, the cut-off value of KOPS ≥ 21 is suggested by the authors, as the main purpose of KOPS is to identify early individuals with higher risk factors for the development of knee OA to enable early therapeutic interventions.

The test-retest reliability for each component of the KOPS Brazilian version showed excellent repeatability of the same information with an interval of 72 h. These results are in line with the study by Yázigi et al. and show that the KOPS Brazilian version can be reapplied guaranteeing interpretation uniformity, understanding, and the response of the evaluated individual.

It is also important to highlight that the KOPS Brazilian version is a patient-reported outcome measure. These instruments have the advantage of only considering the patient's perception, and therefore they are not influenced by the evaluator's perception regarding the judgment and interpretation of the instrument's results [26].

Considering the CPLP treaty signed between Portuguese-speaking countries, and the little variation in the spelling of Portuguese in these countries, only the cross-cultural adaptation to the Brazilian Portuguese language and validation stages were necessary. We carried out the cross-cultural adaptation stage of some spoken and written specific Brazilian and Lusitanian terms referring to grammar and verbal and nominal agreement. Furthermore, the inclusion and exclusion of any question on the KOPS Brazilian version about its original Portuguese version was not needed, which reveals good semantics between both KOPS versions. Neither exploratory nor confirmatory factor analyses were performed in this study, as these measurement properties have already been tested in the original study.

The results of the study should be limited only to the "paper and pen" questionnaire version. This format might not be a good choice for population-based studies. The study results must be considered from the perspective of a convenience sample. This does not allow us to generalize these results to population-based studies. The respondents' cognitive performance was not used as a cut-off criterion for inclusion in the study. However, only participants with the apparent ability for reading and understanding spoken and written Portuguese were included in the study. The inclusion of a sample with a very wide age range (35 to 92 years old) can be seen as a limitation of the study, as aging is a risk factor for OA, especially by association with sarcopenia, and changes in cartilage metabolism.

Conclusion

The KOPS Brazilian version is a reliable and valid instrument for early screening of knee OA in individuals aged 35 years and over in the Brazilian population.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s42358-022-00274-z.

Additional file 1. Comparison between KOPS versions.

Additional file 2. Brazilian version of the Knee Osteoarthritis Pre-screening Questionnaire (KOPS Brazilian version).

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Author contributions
All the authors of the manuscript have made substantial contributions to the conception or design of the study, the acquisition, analysis, or interpretation of data, as well as the drafting of the manuscript or revising it critically concerning its intellectual content. All authors read and approved the final version of the manuscript before submission.

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Availability of data and materials
The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate
It was approved by the Research Ethics Committee of the University of Pernambuco (study# 2.196 0.979; CAAE: 67049717.8.1001.5207).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no professional, financial, or direct or indirect benefits that may influence the results and/or placement of this study.

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References

1. Glyn-Jones S, et al. Osteoarthr Lancet. 2015;386(9991):376–87.
2. Chen H, et al. The effects of a home-based exercise intervention on elderly patients with knee osteoarthritis: a quasi-experimental study. BMC Musculoskelet Disord. 2019;20(1):160.
3. Hana S, et al. Clinical and radiographic features of knee osteoarthritis of elderly patients. Curr Rheumatol Rev. 2018;14(2):181–7.
4. Altman R, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. Arthritis Rheum. 1986;29(8):1039–49.
5. Zhang W, et al. EULAR evidence-based recommendations for the diagnosis of knee osteoarthritis. Ann Rheum Dis. 2010;69(3):483–9.
6. Yazigi F, et al. Development of the knee OA pre-screening questionnaire. Int J Rheum Dis. 2016;19(6):567–76.
7. Altman RD. Criteria for the classification of osteoarthritis of the knee and hip. Scand J Rheumatol Suppl. 1987;65:31–9.
8. Quintana JM, et al. Validation of a screening questionnaire for hip and knee osteoarthritis in old people. BMC Musculoskelet Disord. 2007;8:84.
9. Satayavongthip B, et al. Development of the Thai Knee Osteoarthritis Screening Questionnaire (Thai-KOA-SQ) in Kanleurng Sub-District, Nakronpanom Province. J Med Assoc Thai. 2011;94(8):947–51.
10. Bellamy N, et al., *Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee*. Journal of rheumatology, 1988.
11. Roos EM, et al. Knee injury and osteoarthritis outcome score (KOOS)--development of a self-administered outcome measure. J Orthop Sports Phys Ther. 1998;28(2):88–96.
12. HAIR JF, et al. Análise multivariada de dados. São Paulo: Bookman; 2005.
13. Kellgren JH. Epidemiology of chronic rheumatism. Atlas of standard radiographs of arthritis; 1963.
14. Squassoni CE, Matsukura TS. Adaptação transcultural da versão portuguesa do social support appraisals para o Brasil. Psicologia: Reflexão e Crítica. 2014;27(1):71–80.
15. Herdman M, Fox-Rushby J, Badia X. A model of equivalence in the cultural adaptation of HRQoL instruments: the universalist approach. Qual Life Res. 1998;7(4):323–35.
16. Landis JR, Koch GG, *The measurement of observer agreement for categorical data* biometrics, 1977: p. 159–174.
17. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. Psychol Bull. 1979;86(2):420–8.
18. Fleiss JL. Reliability of measurement. The design and analysis of clinical experiments; 1986.
19. Altman DG, Bland JM. Diagnostic tests 3: receiver operating characteristic plots. BMJ: Br Med J. 1994;309(6948):188.
20. DeLong ER, DeLong DM, Clarke-Pearson DL, *Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach* Biometrics, 1988: p. 837–845.
21. Snoeker B, et al. Risk of knee osteoarthritis after different types of knee injuries in young adults: a population-based cohort study. Br J Sports Med. 2020;54(12):725–30.
22. Takeda H, et al. Prevention and management of knee osteoarthritis and knee cartilage injury in sports. Br J Sports Med. 2011;45(4):304–9.
23. Misra D, et al. Risk of knee osteoarthritis with obesity, sarcopenic obesity, and sarcopenia. Arthritis Rheumatol. 2019;71(2):232–7.
24. Souza, AC.d., NMC, Alexandre, Guirardello EdB. Psychometric properties in instruments evaluation of reliability and validity. 26: Epidemiologia e Serviços de Saúde; 2017. pp. 649–59.
25. Hosmer DW Jr, Lemeshow S, Sturdivant RX. Applied logistic regression. Vol. 398: Wiley; 2013.
26. Krogsgaard MR, et al. What is a PROM and why do we need it?: Article 1 in a series of 10. Scandinavian J Med Sci Sports; 2020.

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