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RESEARCH PAPER

Persian translation and validation of the Kujala Patellofemoral Scale in patients with patellofemoral pain syndrome

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***Purpose*: To culturally translate and validate the Persian version of Kujala Patellofemoral Scale (KPS) and evaluate the test-retest reliability, internal consistency, construct validity and ceiling or floor effects of this instrument in patients with patellofemoral pain syndrome (PFPS). *Method*: After standard forward and backward translations, 100 patients with PFPS completed the Persian versions of the KPS and Short-Form 36 Health Survey (SF-36) in the first visit. With time interval of 2–3 days after the first visit, 47 patients filled out the KPS in the second visit. Test-retest reliability and internal consistency were assessed using intraclass correlation coefficient ($ICC_{2,1}$) with 95% confidence interval (95% CI) and Cronbach's α coefficient, respectively. The Spearman's rank correlation (r_s) was used to assess the correlations between the Persian KPS and SF-36 subscales. *Results*: The acceptable level of ICC >0.70 (ICC = 0.96, 95% CI = 0.93–0.98) and Cronbach's α coefficient >0.70 (α = 0.81) was obtained for the Persian KPS. There were low to moderate correlations (r_s = 0.25–0.60, $p < .01$) between the Persian KPS and Persian SF-36 subscales of mental and physical health components. However, correlations between the Persian KPS and SF-36 physical components were higher than correlations between the Persian KPS and SF-36 mental components. No ceiling and floor effects were seen for the Persian KPS. *Conclusions*: The Persian version of KPS is a reliable and valid outcome measure of disability and seems to be a suitable instrument for use in clinical practice of Iranian patients with chronic PFPS.**

Keywords: Kujala Patellofemoral Scale, patellofemoral pain syndrome, Persian version, outcome measure

Implications for Rehabilitation

- The results on psychometric properties of the Persian Kujala Patellofemoral Scale are comparable with three validated versions obtained for the Finnish, Turkish and Chinese populations.
- Persian version of the Kujala Patellofemoral Scale has acceptable reliability/validity and now can be used in "clinical" and "research" settings of Iranian patients with chronic patellofemoral pain syndrome.

Introduction

Patellofemoral pain syndrome (PFPS) is a common musculoskeletal condition [1] that is characterized by anterior knee pain in activities that load the patellofemoral joint especially prolonged sitting, squatting, jumping and ascending/descending stairs [1–3]. It has been estimated that approximately 6–30% of general population suffers from patellofemoral pain at some times in their lives [4] and this incidence is even higher in active, athletic population [5,6].

From clinical viewpoint and in order to monitor the influence of therapeutic intervention and reaching an appropriate clinical decision, it is necessary to have a reliable, valid and responsive outcome measure [2]. Furthermore, without a valid outcome measure, it is difficult to compare the results between studies [7].

In spite of various outcome measures that have been developed for specific conditions of the knee, only a few have concentrated on PFPS [3,8,9]. Kujala Patellofemoral Scale

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[10] (KPS) – also called the Anterior Knee Pain Scale – is a popular, condition specific, self administrated instrument that fulfills most of the prerequisites for appropriate instrument selection in patients with PFPS. This instrument is easy to understand [1], time-efficient (i.e. taking no longer than 20 min to complete [9]) and comprehensive as to encompass most of the functional activities related to PFPS [7]. In addition, several studies showed that the KPS is a reliable, valid and sensitive outcome measure in the assessment of this specific patient population [1–4,7,9,10].

Reliability and validity are population specific properties, and if an instrument shows satisfactory psychometric properties in one population, there is no guarantee that it is appropriate for use in other culturally different populations [8,11]. To date, three validated versions of the KPS have been reported in Finnish [10], Turkish [3] and Chinese [2] populations. However, to the authors' knowledge, there is no validation study of this instrument in Iran. Therefore, the purposes of this study were to culturally translate and the Persian version of KPS and evaluate the test-retest reliability, internal consistency, construct validity and ceiling or floor effects of this instrument in patients with PFPS.

Materials and methods

Translation process

After obtaining permission from the developer, Prof. Kujala, the KPS was translated from original source in English to Persian based on the recommendations provided by the International Quality Of Life Assessment (IQOLA) project [12].

At the first step, two native Persian translators independently translated the original English version into Persian and then agreed on a common forward translation in a meeting with the researchers. Then, another native Persian translator evaluated the quality of the forward translation with respect to clarity, common language use and conceptual equivalence and modified the forward translation if needed. Finally, a native American-English translator translated the forward version back into English producing backward version [13]. Backward version of KPS was sent to the developer to evaluate the conceptual equivalence of backward version with the original one. In the final step, 20 patients with PFPS were asked to complete the Persian version of KPS to find any difficult, upsetting or confusing items.

Patients

The data were collected from October 2010 through October 2011. A convenient sample of 100 native Persian speakers with PFPS was recruited from the Sports Physical Therapy clinic of Esteghlal, Tehran and multiple private physical therapy clinics in Ahvaz located in Iran. All patients were diagnosed either by an orthopedic specialist or a physiotherapist based on clinical and radiological findings. As a screening test, patients were included if they reported anterior knee pain or retropatellar pain on at least two of six activities [4]: prolonged sitting with bent knees, squatting, kneeling, running, hopping/jumping and ascending or descending stairs.

All patients completed a general questionnaire for details of demographic and clinical characteristics (Table I). Patients were excluded if they were not able to read the questionnaire. Also, patients with diagnosis other than PFPS such as knee ligament, meniscus and tendon injuries [2,7], involvement of other joints affecting lower extremity or back, systematic inflammatory rheumatic disease, neurological conditions and psychiatric disorders were excluded from the study. In addition, patients over the age of 40 were excluded [4] to prevent the possible effects of degenerative joint disease on the patient's response.

In the first session, all patients completed one condition-specific questionnaire, KPS and one generic survey, Short-Form 36 Health Survey (SF-36). In the case of bilateral involvement, patients were asked to fill out the questionnaire for the most symptomatic leg only [4,7]. The KPS was readministered to a sample of 47 patients 2–3 days [7] after the first session to evaluate test-retest reliability. It was thought this time interval is sufficient for not changing the health status of participants and also not memorizing previous responses of the first session [4]. To evaluate stability in the health status of patients, they were asked to answer whether they believed their symptoms were better, same or worse in the retest session [4]. Only patients with the answer "same" were included in the reliability study. Their demographics which consisted of 19 men (40.43%) and 28 women (59.57%) were similar to all completers (Table I). The means (standard deviation) of

Table I. Demographic and clinical characteristics of patients completing the Kujala Patellofemoral Scale (n = 100).

	n (%) unless stated
Demographic data	
Age (year), mean (SD)	25.28 (7.00)
Height (m), mean (SD)	1.67 (0.8)
Weight (kg), mean (SD)	64.23 (11.86)
Sex	
Men	29 (29.0)
Women	71 (71.0)
Years of education	
6–8	2 (2.0)
9–12	15 (15.0)
>12	83 (83.0)
Marital status	
Single	73 (73.0)
Couple	27 (27.0)
Clinical data	
Side of involved knee	
Right	35 (35.0)
Left	33 (33.0)
Both	32 (32.0)
Dominant leg	
Right	89 (89.0)
Left	11 (11.0)
Score in the Persian Kujala, mean (SD)	67.6 (13.5)
Duration of symptoms (month), median (interquartile range)	12 (6, 24)

the age, height and weight were 27.7 (8.69) years, 1.69 (0.9) meters and 67.51 (12.93) kilograms, respectively.

All patients signed an informed consent form approved by the Ethics Committee at Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Instruments

The KPS [10] is a 13-item, self completed instrument with different categories consisted of limping, weight bearing, walking, stairs, squatting, running, jumping, prolonged sitting, pain, swelling, painful patellar movements, muscle atrophy and flexion deficiency [5,10]. The total score ranges from 0 to 100, with higher scores indicating lower levels of pain/ disability [2,3,10].

SF-36 is a 36-item generic, self completed measure which quantifies general health and wellness. It consists of 8 subscales: Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-Emotional (RE) and Mental Health (MH). Scores for each subscale range from 0 (poor health status) to 100 (good health status) [13]. From these 8 subscales, two summary measures namely Physical Health Summary Measure (PHSM) (including PF, RP, BP and GH) and Mental Health Summary Measure (MHSM) (including VT, SF, RE and MH) can be computed (Table III). The Persian version of SF-36 has been validated for use in Iran [14].

Assessment of psychometric properties

Reliability

The reliability of repeated measures was evaluated by the two-way random effects model of intraclass correlation coefficient ($ICC_{2,1}$) proposed by Shrout and Fleiss [15]. An ICC equal to or greater than 0.70 was considered acceptable for test-retest reliability [16].

Internal consistency examines the homogeneity of items in a scale [8,9]. Cronbach's α coefficient was used on the first administration of the KPS to evaluate internal consistency. A Cronbach's α level equal to or greater than 0.70 was considered acceptable [16].

The standard error of measurement (SEM) was calculated from the root mean square error term of the analysis of variance table. The SEM aimed to estimate measurement precision associated with repeated measurements [17]. Therefore, it is useful for computing the smallest detectable change (SDC) which is the smallest change in an individual's performance which can be considered as a real change or the change beyond the measurement error [1]. The SDC was defined as the 95% CI of SEM (±1.96 SEM) [18].

Validity

Construct validity assesses the instrument's behavior in relation to other validated instruments. In the present study, the Spearman's rank correlation [16] (r_s) was used to assess the association between the Persian KPS and SF-36 subscales. Correlation coefficients less than 0.30, 0.30–0.60 and greater than 0.60 were considered as low, moderate and strong correlation, respectively [19]. It was hypothesized a priori that the correlations between the Persian KPS and the SF-36 subscales of physical health (PF, RP, BP and GH) should be higher than the correlations between the Persian KPS and the SF-36 subscales of mental health (VT, SF, RE and MH).

Ceiling and floor effects

Ceiling and floor effects are concerned with the limits of response ranges where no further improvement or deterioration can be detected [9]. Achievement of highest (ceiling effect) or lowest (floor effect) scores by more than 33% of the patients is considered as a cut-off point for poor content validity [20].

Results

With regard to the translation process, the results showed that no major modifications were made by forward and backward translators. The results of our pilot study on 20 patients with PFPS showed that questions on "muscle atrophy" and "knee flexion deficiency" need additional explanation for the respondents. Therefore, the phrases *Laghar shodan va kaheshe hajme azolate raan* and *dard va mahdoudeiiat hengame kham kardane zanou* were added to the "muscle atrophy" and "knee flexion deficiency" questions, respectively. The English format of these phrases is "decrease in thigh muscles mass" and "pain and limitation during knee flexion," respectively.

Table II shows that the acceptable level of ICC >0.70 and Cronbach's α coefficient >0.70 was obtained for the Persian KPS.

The results of construct validity are shown in Table III. As expected, higher correlations were found between the Persian KPS and SF-36 subscales of physical health than between the Persian KPS and SF-36 subscales of mental health.

Furthermore, Table IV shows no ceiling and floor effects for the Persian KPS.

Table II. Test-retest reliability and internal consistency of the Persian Kujala Patellofemoral Scale.

Questionnaire	Test (n = 47)	Retest (n = 47)	ICC (95% CI)	Cronbach's α (n = 100)	SDC
Persian Kujala	64.4 (16.2)	64.6 (15.4)	0.96 (0.93–0.98)	**0.81**	6.44

CI, confidence interval; ICC, intraclass correlation coefficient; SDC, smallest detectable change.

Values for test and retest are mean (standard deviation). ICC and Cronbach's α grater than 0.70 are in bold. Cronbach's α is for the first assessment day.

Table III. Correlation analyses between the Persian Kujala Patellofemoral Scale and the SF-36 subscales for construct validity (n = 100).

SF-36	SF-36 physical health summary measure	SF-36 mental health summary measure	Kujala Patellofemoral Scale
Physical Functioning	0.72	0.38	0.51
Role-Physical	0.81	0.47	0.44
Bodily Pain	0.70	0.43	0.47
General Health	0.55	0.52	0.34
Vitality	0.59	0.78	0.33
Social Functioning	0.53	0.71	0.37
Role-Emotional	0.45	0.83	0.25
Mental Health	0.52	0.74	0.35

All correlations are significant at the $p < .01$ level with the exception of correlation between Role-Emotional and Kujala patellofemoral scale ($p < .05$).

Table IV. Ceiling and floor effects of the Persian versions of Kujala Patellofemoral Scale and SF-36 subscales (n = 100).

Subscale	Ceiling effects (%)	Floor effects (%)
Kujala Patellofemoral Scale	0	0
SF-36 subscales		
Physical Functioning	4	2
Role-Physical	24	22
Bodily Pain	4	0
General Health	0	0
Vitality	0	0
Social Functioning	0	8
Role-Emotional	**43**	**36**
Mental Health	0	0
SF-36 summary measures		
Physical Health Summary Measure	0	0
Mental Health Summary Measure	0	0

Ceiling and floor effects by more than 33% of the patients are in bold.

Discussion

In spite of multiple advantages of self completed instruments [1], there is one disadvantage; perception restriction of some items by some respondents. This disadvantage can be minimized by adding some explanations to the problematic items that is not easily understood by patients. In the current study, we encountered this problem for 2 of 13 items of the Persian KPS. They were "muscle atrophy" and "knee flexion deficiency." Similarly, Watson et al. [7] reported that questions related to "atrophy of thigh muscles," "knee flexion deficiency" and "abnormal kneecap movements" were the problematic items of the KPS in their study.

Reliability is considered as a critical factor for appropriate selection of an outcome measurement [7]. Excellent test-retest reliability of the Persian KPS (ICC = 0.96, 95% CI = 0.93–0.98) obtained in this study is well fit with the results of Chinese (ICC = 0.96) [2] and Turkish (Spearman's correlation = 0.94) [3] versions of the KPS and also other studies conducted by Bennell et al. (ICC = 0.96) [4], Watson et al. (ICC = 0.95) [7] and Crossley et al. (ICC = 0.81) [1] on patients with PFPS. In addition, high internal consistency of the Persian KPS ($\alpha = 0.81$) is in agreement with the Chinese ($\alpha = 0.81$) [2] and Turkish ($\alpha = 0.84$) [3] versions of this instrument. Since reliability results have not been reported in the original version of KPS [10], we have not chance to compare the results with the Finnish version.

The SDC score of 6.44 for the Persian KPS is comparable with the various scores reported in other studies i.e. SDC score of 7, 10 and 13 in studies by Crossley et al. [1], Bennell et al. [4] and Watson et al. [7], respectively. Several factors such as time interval between test and retest sessions, demographic (e.g. age) and clinical characteristics of participants such as duration of symptoms, and type of statistics can all affect the SDC scores [4,7] and this make the comparison difficult between studies.

With respect to construct validity, the results demonstrated low to moderate correlations between the Persian KPS and Persian SF-36 subscales of physical and mental health components. However, correlations between the Persian KPS and SF-36 physical components including PF ($r_s = 0.51$), RP ($r_s = 0.44$), BP ($r_s = 0.47$) and GH ($r_s = 0.34$) were higher than the correlations between the Persian KPS and SF-36 mental components including VT ($r_s = 0.33$), SF ($r_s = 0.37$), RE ($r_s = 0.25$) and MH ($r_s = 0.35$). Similar findings were reported for the Chinese version of KPS [2] in which correlations between the Chinese KPS and SF-36 physical components were higher than the correlations between the Chinese KPS and SF-36 mental components. SF-36 is a generic health questionnaire, so it was predictable that there were low to moderate correlations between SF-36 subscales and KPS which is a condition-specific questionnaire. These two questionnaires measure two different aspects of health status.

Instruments with good content validity should have low ceiling and floor effects [8]. In the current study, no ceiling and floor effects were seen for the Persian KPS. This feature of validation has not been reported in other studies conduced on KPS.

Some study limitations must be considered. First, due to the study design, the responsiveness of the Persian KPS was not assessed in the present study and we recommend sensitivity measurement of this instrument for future projects. Second, the results of this study are primarily applicable to patients with "chronic" PFPS, as the mean duration of symptoms was 18.12 months. Third, the results are not generalized to patients with other patellofemoral disorders such as patellar dislocation/subluxation, patellar tendonitis and patellofemoral osteoarthritis. Patients with these conditions were excluded from this study and importantly, these conditions are accompanied by symptoms such as locking and giving way [7] that were not included in the contents of original KPS questionnaire [10].

In conclusion, the results on psychometric properties of the Persian KPS showed that this instrument is a reliable and valid outcome measure of disability and seems suitable for use in clinical practice of Iranian patients with chronic PFPS.

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