Original Article

Reliability and validity of Persian version of Western Ontario and McMaster Universities Osteoarthritis index in knee osteoarthritis

Eftekharsadat Bina[1], Arash Babaei-Ghazani[2], Seyyed Hassan Niknejad-Hosseyni[1], Vahideh Toopchizadeh*[1], Homayoun Sadeghi[3]

[1] *Associate Professor, Physical Medicine and Rehabilitation Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*

[2] *Assistant Professor, Department of Physical Medicine and Rehabilitation, School of Medicine, Iran University of Medical Sciences, Tehran, Iran*

[3] *Assistant Professor, Physical Medicine and Rehabilitation Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*

Abstract

Introduction: This study aimed to test the reliability and validity of translated and adapted version of Western Ontario and McMaster (WOMAC) questionnaire in Persian language speaking patients with symptomatic osteoarthritis (OA) of the knee.

Methods: 100 consecutive patients, attended 3 major referral rehabilitation centers at the northwest of Iran, were asked to answer two disease-specific questionnaires WOMAC and knee injury and osteoarthritis outcome score (KOOS). The same patients were readmitted for refilling the same questionnaire 24-48 hours after the first visit. Internal consistency, reliability, and validity were assessed.

Results: There were statistically significant correlations between WOMAC and KOOS in case of the pain (P < 0.001) and stiffness (P = 0.004) scores subclass, the sum of difficulty with performing daily activity (DPDA) score (P = 0.001) and also the total score (P < 0.001). Internal consistency with Cronbach's alpha for the pain, stiffness, and physical function subscales were 0.96, 0.98, and 0.99, respectively. Internal consistency with Cronbach's alpha for the total score of WOMAC was 0.99.

Conclusion: We found that this Persian version of WOMAC questionnaire is a reliable and valid version for evaluating the knee OA.

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Introduction

Osteoarthritis (OA) is the most common degenerative joint disorder and a major public health problem throughout both developed and developing countries.[1] The joint most frequently associated with clinical symptoms and disability during this disease is the knee.[2] Studies in various times have reported that symptomatic knee OA is more common in women that its prevalence is directly associated with age decade ranges 7 to ≥ 11.2%.[3,4] The distribution of OA in urban and rural regions of Iran follows the same pattern by prevalence of 16.6-20.5% and presentation mostly in women at both urban and rural regions.[5]

Physical disability arising from pain and loss of functional capacity reduces the quality of life and increases the risks of morbidity and mortality in patients with symptomatic knee OA.[6,7] Various treatment strategies are recommended, which are aimed to reduce symptoms and prevent further functional deterioration.[8,9] Thus, appropriate monitoring tools are needed to assess the course of the disease and responses to treatment in patients with OA, afterward the indexes and questionnaires are

become an important part of management in patients with OA.

During the past few decades, a number of clinical tools were developed to measure the outcomes in patients with OA.[10-15] The Western Ontario and McMaster (WOMAC) index is one of the most widely used outcome measures for this purpose. It is a disease-specific questionnaire developed initially for outcome evaluation in OA clinical trials and at mean time is used in clinical practice as well.[16,17] The WOMAC scale was designed to measure dysfunction and pain associated with OA of the lower extremities by assessing 17 functional activities, 5 pain-related activities, and 2 stiffness categories.[18]

The psychometric properties of the WOMAC index have been thoroughly studied[10,17] and the index has been translated into many different languages worldwide.[18] However, the applicability of this questionnaire for the population speaking Persian language including Iran, Afghanistan, Tajikistan and parts of Uzbekistan, and Pakistan is questionable, because there are certain differences in culture and linguistic expressions between these populations and people in the Western countries, where the questionnaire was originally developed.

The aim of the present study is to develop a Persian version of the WOMAC index and evaluate its validity and reliability in Persian language speaking Iranian population with symptomatic knee OA.

Methods

The present prospective descriptive-analytic study was carried out at the Rehabilitation Centers of Imam Reza, Sina and Shohada Hospitals in Tabriz, Iran, from June 2010 to September 2011.

All participants have signed written consent, and the study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences, which was in compliance with Helsinki Declaration.

100 consecutive knee OA patients were referred to the Physical Medicine and Rehabilitation Centers at Imam Reza, Sina and Shohada Hospitals of Tabriz University of Medical Sciences, were asked to be studied. The patients diagnosed as primary OA according to the criteria of the American College of Rheumatology[19] were asked to complete the Persian WOMAC index and their demographic data.

Exclusion criteria included history or active presence of other rheumatic diseases potentially responsible for a secondary OA, myopathies, traumatic knee lesions, intra-articular or systemic use of corticosteroids within the previous 3 months, and use of analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs) during the previous 2 months. Patients who had cognitive and psychological impairment for completing questionnaire, or advanced cardiac, respiratory, or peripheral vascular diseases were also excluded from the study.

The WOMAC index is a disease-specific and self-administered questionnaire, developed to study patients with hip or knee OA. It consists of 24 questions, grouped into three subscales including pain, stiffness, and physical function.[20] The questions are rated either on a Likert scale or a visual analog scale (VAS) ranging from "none" to "extreme". In our study, we used a five-point Likert scale version with five response levels for each item, representing different degrees of intensity: None (0), mild (1), moderate (2), severe (3), and extreme (4). The maximum score is 20 points for pain, 8 points for stiffness, and 68 points for physical function. Higher scores indicate more or worse symptoms, maximal limitations, and poor health.

In this study, we used a normalization procedure to correct for differences in scale length. In order to normalize the LK scale on a scale of 0-10, the following correction factors were used where S = sum of raw scores of items in dimension: Pain normalization = S × 0.50; stiffness normalization = S × 1.25; and physical function normalization = S × 0.147.[21] After subscale values were normalized, they were summated to provide a single value in which the three component subscales were

equally weighted (WOMAC total score).[21]

Two independent bilingual translators, whose mother tongue is Persian, translated the original English version of the WOMAC into the Persian version in base of Guilleni's strategies. Both of these professional translators have been informed about the concept of the questionnaire, and finally at a meeting with a Physical Medicine and Rehabilitation Specialist, they agreed to move on a single improved version of translation. Afterward, the translation was translated back to the English version by another two professional bilingual English and Persian-translators, who were blinded to the aim of questionnaire and study, and also unaware of the original English version. The original English, Persian , and back translated English versions were then compared by a review committee comprising the English-to-Persian and Persian-to-English translators, and two Physical Medicine and Rehabilitation Specialists. This committee worked for detecting possible misinterpretations and exercised an effort to locate nuances that might have been missed. For this issue, pain was evaluated in right and left knee, separately and was assessed using VAS, also. The final version was then approved with slight changes that were proposed by consensus.

The questionnaire was administered twice during a 24-48 hours interval by two investigators. This interval was chosen to avoid variations in clinical status, and the patients remember previous answers. Only the patients with clinically stable condition were tested twice.

The validity of the questionnaire was assessed by knee injury and osteoarthritis outcome score (KOOS).[22] This questionnaire was given to the patients at the same time with WOMAC, and finally results of both questionnaires were compared. Data were analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA). Test results were reported as significant for P < 0.05. Quantitative variables were described using mean ± standard deviation (SD) and ranges.

Test-retest reliability was tested using interclass correlation coefficients (ICC).[23] The ICC reflects both systematic and random differences in test scores. Values of ICC thus vary from 0 (totally unreliable) to 1 (perfectly reliable).[24]

Internal consistency was measured by Cronbach's alpha.[25] Internal consistency measures the extent to which items within a scale are correlated with each other. If the WOMAC is internally consistent in the OA population, we would expect items within the individual scales (or dimension) to be highly correlated with each other. The Cronbach's alpha statistic[25] is used to estimate the average of the correlations between items within a dimension. A value of 0.8 is usually regarded as acceptable.[26,27]

The validity of WOMAC was assessed by determining convergent and discriminant validity. To evaluate the questionnaire convergent validity, correlation of the scores of the WOMAC index subscales was compared with the scores of the KOOS applied in the study. Divergent validity was assessed by correlating the WOMAC subscale scores with variables such as age, gender, marriage status, mean duration disease, education, and body mass index (BMI). For each dimension, the Pearson correlation or Spearman's correlation coefficient was calculated.

Results

100 patients completed the index. The majority of patients were women 67 (67%). Table 1 shows patients' demographic and clinical characteristics. 54 patients (54%) were obese (BMI > 30 kg/m²). 83 of the patients were married, and the rest were single. In case of education level, 56 have graduated primary level, 23 secondary level, 13 high school level, and 8 university. 29 patients were free of morbidity condition, 59 had 1 comorbid condition, and 12 patients had 2 or more comorbid conditions.

Table 1. Demographic and clinical characteristics of patients

Variable	Mean ± SD
Age (years)	51.4 ± 7.1
BMI (kg/m²)	32.3 ± 7.5
Duration of disease (years)	7.2 ± 5.1

BMI: Body mass index; SD: Standard deviation

The administration of the translated version of WOMAC did not present any difficulty, and no objections were raised during answering the questions. OA affected 35 patients right knee, 34 left knee, and 31 patients was affected bilaterally.

Table 2 shows the results of reliability of WOMAC. The ICC of the three dimensions: pain, stiffness, and physical function were 0.965 [95% confidence interval (CI): 0.948-0.976], 0.980 (95% CI: 0.971-0.987) and 0.937 (95% CI: 0.931-0.999), respectively. The ICC for the total WOMAC score was 0.968 (95% CI: 0.960-1.000). Internal consistency with Cronbach's alpha for the pain subscale was 0.96 and for the stiffness and physical function subscales were 0.98 and 0.99, respectively. Internal consistency with Cronbach's alpha for the total score of WOMAC was 0.99.

Table 2. Comparison of test and retest results of WOMAC (Western Ontario and McMaster) subscales

WOMAC subscales	Mean ± SD
Pain on right side	
Right	
Test	1.63 ± 0.75
Retest	1.56 ± 0.70
Left	
Test	2.16 ± 1.15
Retest	2.37 ± 1.24
VAS for pain	
Right	
Test	2.29 ± 2.25
Retest	2.17 ± 2.20
Left	
Test	3.14 ± 3.15
Retest	3.24 ± 3.14
Stiffness	
Test	1.90 ± 0.91
Retest	1.95 ± 0.83
DPDA	
Test	2.25 ± 1.01
Retest	2.37 ± 1.00
Total	
Test	7.02 ± 2.18
Retest	7.02 ± 2.23

SD: Standard deviation; WOMAC: Western Ontario and McMaster; DPDA: Difficulty with performing daily activity; VAS: Visual analog scale

Table 3 shows the mean and SD of subscales scores for Persian version of WOMAC and KOOS, while table 4 demonstrates the correlation of subscales scores for Persian version of WOMAC and KOOS. There was a statistically significant correlation between the pain score of WOMAC and KOOS (P < 0.001). The total score of stiffness subclass in WOMAC was significantly correlated to the KOOS (P = 0.004). Also, there was a statistically significant correlation between the sum of difficulty with performing daily activity (DPDA) score of WOMAC and KOOS (P = 0.001). Finally, the total score of WOMAC was significantly correlated to the total score of KOOS (P < 0.001).

Table 3. The subscales' scores for Persian version of WOMAC (Western Ontario and McMaster) and KOOS (Knee injury and osteoarthritis outcome score)

WOMAC and KOOS subscales	Mean ± SD
WOMAC	
Pain	
Right	2.29 ± 2.25
Left	3.14 ± 3.15
VAS	
Right	1.63 ± 0.75
Left	2.16 ± 1.15
Stiffness	1.90 ± 0.91
DPDA	2.25 ± 1.01
Total	7.02 ± 2.18
KOOS	
Symptom	2.78 ± 1.37
Pain	2.49 ± 1.11
Stiffness	1.92 ± 0.92
DPDA	2.30 ± 1.04
Function	3.23 ± 1.08
QOL	3.28 ± 1.07
Total	10.86 ± 2.51

SD: Standard deviation; WOMAC: Western Ontario and McMaster; DPDA: Difficulty with performing daily activity; KOOS: Knee injury and osteoarthritis outcome score; QOL: Quality of life; VAS: Visual analog scale

Discussion

The final results of the present study demonstrated excellent reliability and validity for the pain, stiffness, and physical functioning items of the Likert type of the Persian version of WOMAC in Iranian population with the knee OA.

OA of the knee has been identified as one of the most prevalent chronic disorders affecting adults and a major cause of the discomfort (pain and stiffness) and physical disability that results in extensive use of health-care resources.[28,29]

Table 4. Correlation between the Persian version of WOMAC (Western Ontario and McMaster) and KOOS (Knee injury and osteoarthritis outcome score) subscales scores using P value and Spearman's correlation coefficient

WOMAC subscales	KOOS			
	Pain	**Stiffness**	**DPDA**	**Total**
WOMAC				
Pain	P < 0.001, *+0.466			
Stiffness		P = 0.004, **+0.284		
DPDA			P < 0.001, *+0.596	
Total				P = 0.001, **+0.320

SD: Standard deviation; WOMAC: Western Ontario and McMaster; KOOS: Knee injury and osteoarthritis outcome score; DPDA: Difficulty with performing daily activity; *Pearson correlation, **Spearman's correlation coefficient

In spite of the high prevalence of OA, only a few of validated health status measures exist for evaluation of patients with OA, either in clinical practice or in clinical trials. The WOMAC is a widely used and validated three-dimensional disease-specific, self-administered, health status measure assessing pain, stiffness, and function in patients with OA of the knee or hip.[30] To enable comparison between assessments made in different countries, these measures need not only be translated but also adapted for use in different cultures.

As a part of the present study, the majority of the participants were female who were enrolled into the study by consecutive way. The high female prevalence can be explained by multiple reasons: most of the Iranian women with knee OA are usually unemployed, have low education, spend most of the time at home, have many children, earn extra income, if any, and are generally considered by the society to be responsible for the household activities. In addition, their weight was often high (60.6% of patients were obese) and it is among them that obesity is often noted to originate from lifestyle, cultural and/or esthetical reasons. Although this condition is steadily and increasingly changing and today, many women are working outside of their homes, women continue to be considered, like in many parts of the world, as the primary responsible for household activities.

Reliability was assessed in terms of internal consistency (Cronbach's alpha coefficient) and test-retest reliability (ICC analysis). Cronbach's alpha coefficients were fully acceptable for all three subclasses of the Persian WOMAC, in base of Cronbach's alpha coefficient ≥ 0.80.[26,27] This indicates that the internal consistency of the Persian version of WOMAC demonstrated by Cronbach's alpha was excellent, which is similar and even better than results were reported for other languages.[31-37] The ICC for pain, stiffness, and physical function subscales were more than 0.96, which could be considered near to totally reliable. Similar results were reported for the German,[38] Swedish,[39] and the Italian[40] languages versions.

The repeatability of the scale was excellent. It is unlikely that these results could be due to the short interval between the test and retest. Patients had to answer the questions at the beginning of the first visit. When they answered for the second time, at a 24-48 hours interval, they might have remembered some questions but would be unlikely to remember their previous answers. For all subscales, the ICC values observed during the validation of the original questionnaire were strong (≥ 0.96), which could be explained by interviewing at an interval of 24-48 hours.

There are various ways of determining the validity of a questionnaire, one of which is convergent and divergent validity. This is generally done by comparing the instrument under study with other instruments that have already been validated. The KOOS is a widely used instrument[41] and has been validated in Iran.[42] So, we compared the WOMAC and KOOS questioners. Our data on validity present excellent correlations when the dimensions of both questionnaires were compared, with correlation coefficients ranging from 0.93 to 0.96, which is consistent with other studies.[43-45]

As expected, the WOMAC dysfunctional

score scale obtained the best correlation with the KOOS DPDA scale compared with the rest of the scales. For the stiffness scale, the highest coefficient values were found in the by spearman's correlation coefficient. This could be a result of the fact that the data do not have a normal distribution and are similar to those described. The divergent validity was studied according to levels of severity. Regarding the patients who underwent hip replacement surgery, no statistically significant differences were found between slight and moderate severity, which could be the result of the small number of patients in both groups. Altogether, in case of validity, which was tested by correlating the WOMAC subscales with KOOS questionnaire, all correlations were significant (P < 0.010). Another investigation conducted with Ebrahimzadeh et al. seemed to be done after or at the same time with our research showed similar

findings with Cronbach's alpha of 0.91.[46]

Conclusion

The results of the present study demonstrated that the Persian version of WOMAC questionnaire could be used as proper tool for assessing the knee OA severity and life quality in Persian-speaking population.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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