

# Knee Injury and Osteoarthritis Outcome Score: Reliability and Validation of the Turkish Version

## DİZ İNCİNME VE OSTEOARTRİT SONUÇ SKORU: TÜRKÇE SÜRÜMÜNÜN GÜVENİLİRLİK VE GEÇERLİLİK ÇALIŞMASI

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### Abstract

**Objective:** Knee injury and osteoarthritis outcome score (KOOS) is a useful scale in evaluating symptoms and functional status related to knee injury and knee osteoarthritis. This tool has five subscales, namely pain, symptoms, daily living, sports and recreational activities, and quality of life related to the knee. The purpose of this study was to evaluate the reliability and validity of the KOOS Turkish version in patients with knee osteoarthritis.

**Material and Methods:** Fifty patients with osteoarthritis were included in the study. All patients completed the KOOS and SF-36 health questionnaire. The procedure was repeated within a week only for KOOS. Reliability, validity and internal consistency of the KOOS Turkish version were evaluated.

**Results:** KOOS subscales interclass correlations were calculated to assess reliability. Reliability coefficients were between 0.85-0.89. Internal consistency was calculated using Cronbach's alpha. Cronbach's alpha range was 0.66-0.95. All relationships above 0.26 were significant ( $p < 0.05$ ).

**Conclusion:** A positive correlation was observed between the KOOS subscales and also between the similar subscales of SF-36 and KOOS. The results of our study suggest moderate reliability and validity of the KOOS Turkish version.

**Key Words:** Osteoarthritis, knee; validation studies

Türkiye Klinikleri J Med Sci 2007, 27:350-356

### Özet

**Amaç:** Diz incinme ve osteoartrit sonuç skoru (KOOS), diz yaralanmaları ve diz osteoartritine bağlı semptomları ve fonksiyonel durumu değerlendirmeye yarayan bir ölçektir. Ağrı, günlük yaşam aktiviteleri (GYA), spor ve boş zaman değerlendirme aktivitelerinde fonksiyonel durum ve dize bağlı yaşam kalitesi olmak üzere 5 alt grubu vardır. Bu çalışmanın amacı diz osteoartriti olan hastalarda KOOS'un Türkçe sürümünün güvenilirlik ve geçerliliğinin araştırılması idi.

**Gereç ve Yöntemler:** Çalışmaya diz osteoartriti olan 50 hasta dahil edildi. Başlangıçta tüm hastalar KOOS ve SF-36 sağlık sorgulamasını doldurdu. Sadece KOOS hastalara 1 hafta içinde yeniden verildi. KOOS'un Türkçe sürümünün güvenilirlik, geçerlilik ve içsel tutarlılığı incelendi.

**Bulgular:** Güvenilirlik için KOOS alt gruplarının sınıf içi korelasyon katsayıları hesaplandı. Güvenilirlik katsayıları 0.85-0.89 arasında idi. İçsel tutarlılık değerlendirilmesi için hesaplanan Cronbach alfa değerleri 0.66-0.95 arasında bulundu. Yapısal geçerlilik çalışmasında KOOS alt grupları ile SF-36 fiziksel sağlık alanı arasında anlamlı pozitif ilişki saptandı ( $p < 0.05$ ).

**Sonuç:** Çalışmamızın sonuçları KOOS'un Türkçe sürümünün diz osteoartritinde güvenilirlik ve geçerliliğini göstermiştir.

**Anahtar Kelimeler:** Osteoartrit, diz; geçerlilik çalışması

**K**nee osteoarthritis (OA) is a common disease of old age and it frequently affects women as a cause of functional disability of the lower extremities.<sup>1</sup> The aim of

treatment is to relieve pain and improve function. Recently, in addition to monitoring medical treatment, patients' perception of the disease using specific and generic scales has become the focus of interest. In a study including two groups with total knee arthroplasty and rheumatic disease, while SF-36 reflected the general health status of the patient, the Western Ontario and McMaster Universities (WOMAC) OA index was more valuable for disease specific information.<sup>2</sup> WOMAC OA index is a disease specific tool, widely used in knee OA.<sup>3</sup>

Geliş Tarihi/Received: 20.06.2006

Kabul Tarihi/Accepted: 11.01.2007

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KOOS is a new instrument developed for assessing post traumatic or primary OA.<sup>4</sup> KOOS actually is a more detailed version of WOMAC, developed after literature surveys, expert panels, and pilot studies.<sup>5</sup>

In our study, we assessed the reliability and validity of the Turkish version of KOOS in knee OA.

### Material and Methods

We included 50 patients with symptomatic knee OA in the study. Seven of the patients were males and 43 were females, age ranging from 41 to 85 years. The diagnosis of OA was based on American Rheumatology College (ACR) criteria.<sup>6</sup> All patients were literate. Patients who had hip or other articular disease and patients who were unable to cooperate were excluded from the study. Patients were filled the KOOS twice within a week and SF-36 once.

This study was approved by the hospital ethics committee.

#### Evaluation Scales

##### KOOS (Knee injury and osteoarthritis outcome scale)

KOOS is a questionnaire developed from the Likert 3.0 version of the WOMAC osteoarthritis index by Roos, et al, specifically designed to assess knee disease.<sup>5</sup> KOOS includes 42 items covering five subscales of knee function daily quality of life: pain, patient's view of other symptoms, daily living, sports and recreational activities, and knee related quality of life. Just like WOMAC osteoarthritis index, each item is given a score from 0 to 4 and the results are converted to a scale of 0 to 100 points where 0 point signifies severe knee problem, while 100 points stands for no knee problem. Transformation is performed by taking the percentage of scores in each subscale to maximum points that can be achieved and subtracting this sum from 100. For example, a patient receiving 10 points from the subscale will actually receive 72 points when converted to the 100 scale:

$$100 - \left[ \left( \frac{10}{36} \right) \times 100 \right] = 72.22$$

**Table 1.** KOOS subscales and calculation of maximum values that can be achieved.

KOOS subscale	Related sections	Achievable maximum value
Pain	P1-P9	9x4= 36
Symptoms	S1-S7	7x4= 28
Daily living	A1-A17	17x4= 68
Sports and recreational activities	Sp1-Sp5	5x4= 20
Knee related quality of life	Q1-Q4	4x4= 16

Maximum points that can be achieved in each subscale are given in Table 1.

#### Preparation of the Turkish Version

Original version of KOOS was translated into Turkish and the Turkish translation was retranslated into English. The two translated versions of KOOS were assessed by a group consisting of native Turkish speaking psychiatrists, 1 physiotherapist, 1 clinical psychologist and 1 non-medical person with good knowledge of English. The Turkish version was used for patients with knee osteoarthritis.

#### SF-36 Health Survey

SF-36 is a generic test that addresses 36 questions to evaluate patient's quality of life. It has 8 subscales that cover physical function, physical role, bodily pain, general health status, vitality, social function, emotional role, and mental health.<sup>7</sup> In our study we used the Turkish version of SF-36 health survey.<sup>8</sup>

Statistical analysis was performed using the SPSS package program, version 11.0. Interclass correlation coefficients and Cronbach's alpha correlation factors were calculated. Spearman test was used assessing construct validity.  $p < 0.05$  was considered statistically significant.

### Results

Mean age of the patients in our study group was  $62.57 \pm 9.45$  years. Calculated mean body mass index was  $32.4 \pm 0.27$  kg/cm<sup>2</sup>.

Distribution of KOOS and SF-36 subscales values are given in Table 2.

### Reliability

Calculated KOOS subscales interclass correlations were 0.86 for pain subscale, 0.85 for symptoms subscale, 0.89 for daily living subscale, 0.87 for sports and recreational activities subscale and 0.89 for quality of life subscale. Test-retest reliability of Turkish version of KOOS was moderate in this study.

### Internal Consistency

Internal consistency calculated using Cronbach's alpha was 0.89 for pain subscale, 0.66 for symptoms subscale, 0.95 for daily living subscale, 0.90 for sports and recreational activities subscale and 0.75 for quality of life subscale.

### Construct Validity

All relationships above 0.26 were significant ( $p < 0.05$ ) (Table 3). Higher correlation was observed between the KOOS subscales and physical health domains of SF-36, however, the correlation between KOOS subscales and mental health, emotional role and vitality domains of SF-36 was lower.

As we had expected, there was a stronger subscale relationship for similar or same subscales. The correlation value was  $r_s:0.57$  when the SF-36 physical function subscale was compared with the

KOOS daily living subscale; the correlation value was  $r_s:0.63$  when the SF-36 physical function subscale was compared with the KOOS sports and recreational activities subscale; and the correlation value was  $r_s:0.67$  when the SF-36 global bodily pain subscale was compared with the KOOS pain subscale.

Correlation values were lower in non-similar subscales.

### Discussion

In our study, interclass correlation coefficients were high for the five KOOS subscales. Test-retest reliability coefficients were between 0.85-0.89. In the reliability study of the Swedish version of KOOS prepared by Roos, et al, the correlation coefficient range was 0.78-0.91.<sup>9</sup> Reports suggest that a correlation range of 0.80-0.89 for physiological data signifies moderate relationship.

Cronbach's alpha is used for assessing internal consistency. Cronbach's alpha is useful in determining the homogeneity of a questionnaire. All items in a questionnaire should measure the same point and therefore should correlate with each other. Cronbach's alpha is a value between 1 and negative infinity and positive values indicate significance.<sup>10</sup> In our study, Cronbach's alpha ranged

**Table 2.** Distribution of KOOS and SF-36 scores among patients.

	Mean score	Standard deviation	Minimum and maximum values	Low effect (worst score) n (%)	High effect (best score) n (%)
KOOS symptom	51	19.4	11-100	0	1(2)
KOOS pain	39	20.2	3-89	0	0
KOOS daily living	41	21.9	1-98	0	0
KOOS sports and recreational activities	16	22.2	0-100	17(34)	1(2)
KOOS quality of life	26	18.7	0-62	5(10)	0
SF-36 physical function	26	25.3	0-100	10(20)	1(2)
SF-36 physical role	19	35.5	0-100	36(72)	6(12)
SF-36 bodily pain	29	21.9	0-84	8(16)	0
SF-36 general health	53	22.1	15-92	0	0
SF-36 vitality	37	23.2	0-85	3(6)	0
SF-36 social function	52	33.7	0-100	7(14)	8(16)
SF-36 emotional role	40	47.1	0-100	27(54)	18(36)
SF-36 mental health	54	17.6	12-88	0	0

**Table 3.** Assessment of construct validity, Spearman test results.

	<b>KOOS symptom</b>	<b>KOOS pain</b>	<b>KOOS daily living</b>	<b>KOOS sports and recreational activities</b>	<b>KOOS quality of life</b>
SF-36 physical function	0.44**	0.56**	0.57**	0.63*	0.44**
SF-36 physical role	0.31*	0.39**	0.47**	0.34*	0.58**
SF-36 bodily pain	0.53**	0.67**	0.75**	0.69**	0.62**
SF-36 general health	0.47**	0.44**	0.54**	0.34**	0.38**
SF-36 vitality	0.19	0.34*	0.30*	0.24	0.17
SF-36 social function	0.44**	0.53**	0.56**	0.52**	0.58**
SF-36 emotional role	0.13	0.33*	0.36**	0.44**	0.37**
SF-36 mental health	0.09	0.26	0.25	0.25	0.17

\* p value  $p < 0.05$ \*\*p value  $p < 0.01$ 

between 0.66-0.95. Cronbach's alpha value range of 0.80-1.00 signifies high reliability, whereas a value range of 0.60-0.80 is considered fairly reliable. Roos, et al reported a Cronbach's alpha value range of 0.71-0.95 in a study of 142 patients with menisectomies.<sup>11</sup> The low value of 0.66 in our study was obtained from the symptoms subscale. In this subscale, we saw that the question "Do you have joint swelling?" was not replied objectively by the patients. When we excluded this question, internal consistency rose from 0.66 to 0.73.

There is no standard method for patient outcome measure validity studies. To evaluate construct validity, results obtained by a newer measuring scale are compared with the results obtained by the older known measuring scale and a relationship is sought. In our study, we used correlation coefficient when determining SF-36 and KOOS similarities to obtain construct validity. The correlation coefficient gives a digital value for the relationship between two variables. As the  $r$  value approaches 1, the correlation increases. A positive correlation coefficient indicates a relationship between two variables in the same direction, while a negative correlation coefficient stands for a correlation in opposite directions. A  $r = 0$  value indicates no relationship and therefore no correlation between two variables.<sup>10</sup>

SF-36 is a validated, reliable scale. In our study, we generally found a high relationship between similar subscales of SF-36 and KOOS, while a low relationship between non-similar items. Be-

cause of the subscales of KOOS related only with physical symptoms, there was high correlation between the physical health domain of SF-36 and KOOS. There was a high relationship between bodily pain subscale of SF-36 and daily living, sports and recreational activities, and pain subscale of KOOS. However, there was a low relationship between the mental health, emotional role and vitality subscale of SF-36 and the five subscales of KOOS.

Our results indicate that the Turkish version of KOOS may be a useful test in knee osteoarthritis with demonstrated moderate reliability and validity.

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## Appendix 1. KOOS

Knee and Osteoarthritis Outcome Score (KOOS), English version LK1.0

# KOOS KNEE SURVEY

Today's date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Date of birth: \_\_\_\_/\_\_\_\_/\_\_\_\_

Name: \_\_\_\_\_

**INSTRUCTIONS:** This survey asks for your view about your knee. This information will help us keep track of how you feel about your knee and how well you are able to do your usual activities. Answer every question by ticking the appropriate box, only one box for each question. If you are unsure about how to answer a question, please give the best answer you can.

### Symptoms

These questions should be answered thinking of your knee symptoms during the last week.

S1. Do you have swelling in your knee?

Never  Rarely  Sometimes  Often  Always

S2. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never  Rarely  Sometimes  Often  Always

S3. Does your knee catch or hang up when moving?

Never  Rarely  Sometimes  Often  Always

S4. Can you straighten your knee fully?

Always  Often  Sometimes  Rarely  Never

S5. Can you bend your knee fully?

Always  Often  Sometimes  Rarely  Never

### Stiffness

The following questions concern the amount of joint stiffness you have experienced during the last week in your knee. Stiffness is a sensation of restriction or slowness in the ease with which you move your knee joint.

S6. How severe is your knee joint stiffness after first wakening in the morning?

None  Mild  Moderate  Severe  Extreme

S7. How severe is your knee stiffness after sitting, lying or resting later in the day?

None  Mild  Moderate  Severe  Extreme

Knee and Osteoarthritis Outcome Score (KOOS), English version LK1.0

### Pain

P1. How often do you experience knee pain?

Never  Monthly  Weekly  Daily  Always

What amount of knee pain have you experienced the last week during the following activities?

P2. Twisting/pivoting on your knee

None  Mild  Moderate  Severe  Extreme

P3. Straightening knee fully

None  Mild  Moderate  Severe  Extreme

P4. Bending knee fully

None  Mild  Moderate  Severe  Extreme

P5. Walking on flat surface

None  Mild  Moderate  Severe  Extreme

P6. Going up or down stairs

None  Mild  Moderate  Severe  Extreme

P7. At night while in bed

None  Mild  Moderate  Severe  Extreme

P8. Sitting or lying

None  Mild  Moderate  Severe  Extreme

P9. Standing upright

None  Mild  Moderate  Severe  Extreme

### Function, daily living

The following questions concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following activities please indicate the degree of difficulty you have experienced in the **last week due to your knee.**

A1. Descending stairs

None  Mild  Moderate  Severe  Extreme

A2. Ascending stairs

None  Mild  Moderate  Severe  Extreme

Knee and Osteoarthritis Outcome Score (KOOS), English version LK1.0

For each of the following activities please indicate the degree of difficulty you have experienced in the last week due to your knee.

A3. Rising from sitting

None  Mild  Moderate  Severe  Extreme

A4. Standing

None  Mild  Moderate  Severe  Extreme

A5. Bending to floor/pick up an object

None  Mild  Moderate  Severe  Extreme

A6. Walking on flat surface

None  Mild  Moderate  Severe  Extreme

A7. Getting in/out of car

None  Mild  Moderate  Severe  Extreme

A8. Going shopping

None  Mild  Moderate  Severe  Extreme

## A9. Putting on socks/stockings

None Mild Moderate Severe Extreme

## A10. Rising from bed

None Mild Moderate Severe Extreme

## A11. Taking off socks/stockings

None Mild Moderate Severe Extreme

## A12. Lying in bed (turning over, maintaining knee position)

None Mild Moderate Severe Extreme

## A13. Getting in/out of bath

None Mild Moderate Severe Extreme

## A14. Sitting

None Mild Moderate Severe Extreme

## A15. Getting on/off toilet

None Mild Moderate Severe Extreme

## Knee and Osteoarthritis Outcome Score (KOOS), English version LK1.0

For each of the following activities please indicate the degree of difficulty you have experienced in the last week due to your knee.

## A16. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc)

None Mild Moderate Severe Extreme

## A17. Light domestic duties (cooking, dusting, etc)

None Mild Moderate Severe Extreme

**Function, sports and recreational activities**

The following questions concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the last week due to your knee.

## SP1. Squatting

None Mild Moderate Severe Extreme

## SP2. Running

None Mild Moderate Severe Extreme

## SP3. Jumping

None Mild Moderate Severe Extreme

## SP4. Twisting/pivoting on your injured knee

None Mild Moderate Severe Extreme

## SP5. Kneeling

None Mild Moderate Severe Extreme

**Quality of Life**

## Q1. How often are you aware of your knee problem?

Never Monthly Weekly Daily Constantly

## Q2. Have you modified your life style to avoid potentially damaging activities to your knee?

Not at all Mildly Moderately Severely Totally

## Q3. How much are you troubled with lack of confidence in your knee?

Not at all Mildly Moderately Severely Extremely

## Q4. In general, how much difficulty do you have with your knee?

None Mild Moderate Severe Extreme

**Thank you very much for completing all the questions in this questionnaire.**