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Translation, Cross-Cultural Adaptation, Reliability, and Validity of Turkish Version of the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale

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ABSTRACT

We sought to translate and culturally adapt the American Orthopaedic Foot and Ankle Society ankle-hindfoot scale (AOFAS-AHFS) into Turkish and determine the selected psychometric properties of the translated version. The AOFAS-AHFS is widely used to evaluate disability associated with foot and ankle injuries but has not yet been translated or culturally adapted for Turkish-speaking individuals. The AOFAS-AHFS was translated into Turkish using the Beaton guidelines. The measurement properties of the Turkish AOFAS-AHFS (internal consistency, construct validity, and floor and ceiling effects) were tested in 72 patients (94 feet, 50 [69.4%] females; average ± SD age 44.88 ± 16.30 years) with a variety of foot and ankle pathologic features. Construct validity was analyzed using the Turkish version of the Foot and Ankle Ability Measure (FAAM) and the Medical Outcomes Study short-form 12-item survey (SF-12). The Turkish version of the AOFAS-AHFS showed excellent test–retest reliability (intraclass correlation coefficient 0.91). The correlation coefficients between the AOFAS-AHFS and the FAAM activities of daily living and FAAM sport were r = 0.41, $p = .01$ and r = 0.37, $p = .03$, respectively. The correlation coefficients between the AOFAS-AHFS and the SF-12 physical component scale was r = 0.27, $p = .08$. The weakest correlation was found between the AOFAS-AHFS and the SF-12 mental component scale (r = −0.03, $p = .73$). The Turkish version of the AOFAS-AHFS has sufficient reliability and validity to measure patient-reported outcomes for Turkish-speaking individuals with a variety of foot and ankle disorders.

The ankle is the most commonly injured part (25.9%) of the body. Foot and ankle problems range from minor disorders such as ankle sprains, plantar fasciitis, and bunions to more serious conditions such as Charcot arthropathy and Achilles tendon rupture. Patients' symptoms frequently include foot pain, various levels of activity limitations, chronic ankle instability, a reduced range of movement, decreased quality of life, and participation restrictions (1,2).

Patient-reported outcomes (PROs) have been used by clinicians and researchers to assess the effect of treatment interventions directed at individuals with foot- and ankle-related pathologic features. PRO measures have been developed for the assessment of foot and ankle injuries and include the Foot and Ankle Outcome Scale, Foot and Ankle Ability Measure (FAAM), Foot and Ankle Disability Index, and Foot Function Index (3–6). These outcomes can be categorized as generic, disease specific, or joint specific. Before PROs can be used in a society other than the one in which it was developed, it must be translated and adapted culturally. In addition, the psychometric properties of the translated version of the self-reported outcomes instruments must be assessed and compared with those of the original version. The foot and ankle self-reported outcomes instruments that have been translated into Turkish and psychometrically tested include the Foot and Ankle Outcome Scale, Foot Function Index, and FAAM (7–9). The American Orthopaedic Foot and Ankle Society (AOFAS) committee also developed PRO measures. They developed an evaluation system for different anatomic regions of the foot, resulting in 4 different scales: the ankle-hindfoot scale (AHFS) for the ankle and foot, a scale for the midfoot, a scale for the metatarsophalangeal and interphalangeal joints of the hallux, and a scale for the metatarsophalangeal and interphalangeal joints of the other foot toes, allowing them to be applied to different types of injuries and treatments (10). The AOFAS-AHFS, which was developed in English, has been widely used by researchers for many foot and ankle pathologic

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entities. The only cross-cultural adaptation of the AOFAS-AHFS was conducted for the Portuguese and German languages (11,12). However, data obtained from the cross-culturally adapted versions have contributed to a better understanding of the instrument's measurement properties. The purpose of the present study was to translate and cross-culturally adapt the English version of AOFAS-AHFS into Turkish and then investigate the reliability and validity of the translated version. We also hypothesized that the AOFAS-AHFS Turkish version would provide adequate results compared with the FAAM and Medical Outcomes Study short-form 12-item survey (SF-12). The purpose of the present study was to translate and culturally adapt the AOFAS-AHFS into Turkish and determine its reliability and validity.

Patients and Methods

Translation and Cultural Adaptation

Translation and cross-cultural adaptation of the AOFAS-AHFS was performed in 5 stages, consistent with the stages recommended by Beaton et al (13). In the first stage, 2 Turkish individuals with a good command of English were responsible for the literal and conceptual translation of the AOFAS-AHFS. The informed translator was a physical therapist, and the uninformed translator was an architect. Both translators were fluent in English and spoke Turkish as their mother tongue. The translations were completed independently. In the second stage, both translations were compared and reviewed by a bilingual individual, who highlighted any conceptual errors or inconsistencies in the translations to establish the first Turkish translation. In the third stage, after the first Turkish translation had been agreed on, 2 native English speakers with a good command of Turkish separately translated the finalized Turkish translation back into English. Both translators were unaware of the purpose of the present study and had no access to the original English version. In the fourth stage, the back-translated version of the AOFAS-AHFS was compared against the original English version of the AOFAS-AHFS by a committee consisting of a methodologist, a language professional, and the 4 translators. The committee evaluated the 4 translations and compared the discrepancies. After discussing the discrepancies, the committee finalized and approved the Turkish version of the AOFAS-AHFS. In the final stage, preliminary testing was performed to determine comprehension of the Turkish version.

Preliminary Testing

Preliminary testing was conducted using 15 patients (13 [86.7%] females; mean ± SD age 38.2 ± 18.3 years, range 16-75 years; body mass index 29.7 ± 2.8 kg/m^2) who had fulfilled the eligibility criteria of the study to determine comprehension of the Turkish version. After completion of the questionnaire by each patient, physical therapists interviewed the patients to determine whether they had had any difficulties understanding the questions. The questions that were difficult to understand were noted, and the patients were asked for their recommendations for revisions. The patients recruited for the preliminary test were not included the patient population in the remainder of the study. Therefore, they were not retested.

PRO Questionnaires

AOFAS Ankle-Hindfoot Scale

The AOFAS-AHFS is specific to the region of the ankle and hindfoot. The questionnaire includes 9 items, distributed over 3 categories: pain (40 points), functional aspects (50 points), and alignment (10 points), for a total of 100 points. A score of 100 points is possible for a patient with no pain, a full range of sagittal and hindfoot motion, no ankle or hindfoot instability, good alignment, the ability to walk >6 blocks, the ability to ambulate on any walking surface, no discernible limp, no limitation of daily or recreational activities, and no assistive devices needed for ambulation (8). The systems incorporate both subjective and objective subscales into numeric scales to describe function, alignment, and pain. The subjective subscales, which are completed by the patients, include pain, activity limitations, and walking distance. The objective subscales, which are assessed by clinicians include gait abnormality, sagittal plane motion (flexion plus extension), hindfoot motion (inversion plus eversion), and alignment defect scales of the foot. It is not possible to determine isolated ankle joint range of motion clinically; therefore, dorsiflexion and plantarflexion are measured using a goniometer and described as sagittal motion (10).

Foot and Ankle Ability Measure

The FAAM consists of the 21-item activities of daily living and 8-item sports subscales. Together, these provide information across the spectrum of ability. The FAAM was validated in individuals with a wide range of musculoskeletal disorders of the lower leg, ankle, and foot and, therefore, has broad application (9).

Short-Form 12-Item Survey

The shortened questionnaire, known as the SF-12, require only one third of the usual time for completion of the Medical Outcomes Study 36-item questionnaire, with a trade-off of the loss of information from 8 domain scales (i.e., general health, vitality, physical functioning, role-physical, bodily pain, social functioning, role-emotional, and mental health). The SF-12 uses only 12 questions to reproduce the physical component scale (PCS) and mental component scale (MCS) (14).

Participants

Before inclusion in the study, potential participants were asked to read and sign an informed consent form, which had been approved by the ethics committee of the Cerrahpaşa Medical Faculty of Istanbul University (institutional review board approval no. 02-279984). The present study was conducted according to the Declaration of Helsinki. All participants were informed about the study before providing written informed consent.

The study was performed from February 2015 to December 2015. The inclusion criteria were age ≥16 years; surgical treatment of foot and ankle pathologic features that included plantar fasciitis, osteoarthritis, cartilage lesions, calcaneal spur, diabetic foot, and ankle sprain (Table 1); and the ability to read and write in Turkish. The diagnosis was established by a physician using the patient's history, physical examination findings, and diagnostic imaging results. The exclusion criteria were patients with nerve injury and peripheral neuropathy, sensory deficit, neuromuscular pathologic findings, infection, acute fractures in the lower extremities, and acute rheumatic disease.

A total of 72 consecutive patients were asked to complete the Turkish version of the AOFAS-AHFS (Supplemental Table S1) and the previously validated Turkish versions of the FAAM and SF-12. Physical therapists administered the subjective subscale of Turkish version of the AOFAS-AHFS to patients in waiting rooms after their appointment with an orthopedic surgeon. The objective part of the scale was completed by the physical therapists. The second assessment of the Turkish version of the AOFAS-AHFS was completed 7 days after the first assessment to determine the test–retest reliability. The objective part of the AOFAS-AHFS was assessed by a different physical therapist to test the interrater reliability. To minimize the risk of short-term clinical change, no treatment was provided during this period. After each patient had completed the subjective subscale of the Turkish version of the AOFAS-AHFS, the physical therapists checked for missing responses. Patients who skipped a question on the questionnaire were asked to give the reason. Any difficulties in understanding the question or incompatibility with their problem were noted. Only those individuals who reported that they had "stayed the same" were included in the reliability analysis.

Statistical Analysis

All statistical analyses were performed using SPSS for Windows, version 21.0 (IBM Corp, Armonk, NY). Descriptive statistics were calculated for all variables. These included frequency counts and percentages for nominal variables and measures of central tendency (mean and median) and dispersion (standard deviation and range) for continuous variables. The measurement properties analyzed in the present study for

Table 1
Patient demographics (N = 72 patients)

Demographic Data	n (%) or Mean ± SD (range)
Gender	
Female	50 (69.44)
Right foot	12 (12.76)
Bilateral	13 (13.82)
Male	22 (30.55)
Right foot	9 (9.57)
Bilateral	8 (8.51)
Age (y)	44.87 ± 15.86 (16 to 75)
Weight (kg)	74.10 ± 15.25 (150 to 189)
Height (cm)	163.58 ± 7.39 (150 to 189)
Education	
Primary school	21 (29.16)
High school	42 (58.33)
University degree	8 (11.11)
Master's degree	1 (1.38)
Doctorate	0 (0)
Diagnosis	
Calcaneal spur	16 (22.22)
Ankle injury	20 (27.77)
Diabetic foot	2 (2.77)
Fracture	8 (11.11)
Talus cartilage lesion	19 (26.38)
Surgery for ankle fracture	7 (9.72)

the studied instruments included internal consistency, test–retest reliability, construct validity, and ceiling and floor effects.

Test–Retest Reliability

Test–retest reliability represents a scale's ability to yield consistent results when administered on separate occasions during a period in which the individual's status has remained stable (15). The patients who reported no change in their condition between the first and second administration of the outcomes measure were included in the analysis of test–retest reliability. Intrarater reliability was calculated using the subjective subscale of the Turkish version of the AOFAS-AHFS, and interrater reliability was assessed using the objective subscale of the Turkish version of the AOFAS-AHFS. Intraclass correlation coefficients (ICCs) were calculated using a 2-way, mixed-model of variance under consistency. Values of $\geq$0.4 were considered satisfactory (r = 0.81 to 1.0 indicates excellent; r = 0.61 to 0.80, very good; r = 0.41-0.60, good; r = 0.21-0.40, fair; and r = 0.00-0.20, poor) (16,17).

Agreement

Agreement was assessed with the standard error of the mean (SEM) and minimal detectable change (MDC). The ICC was used to calculate the SEM, which is an index of measurement precision. The SEM was calculated as SD $\approx \sqrt{1 - \text{ICC}}$. The MDC refers to the minimal amount of change that is within measurement error. The SEM was used to determine the MDC at the 95% limits of confidence (MDC95), which was calculated using the formula $1.96 \times \sqrt{2} \times \text{SEM}$ (18).

Validity

Validity is represented by the extent to which a scale retains its intended meaning and interpretation (19). In the present study, we examined 3 aspects of validity: construct, convergence/divergence, and content validity. Evidence for construct validity of the Turkish AOFAS-AHFS was provided by determining its relationship to the FAAM and SF-12. The physical functioning, physical role functioning, and PCS domains of the SF-12 were used to assess convergence validity. Evidence for divergence validity was provided by determining the relationships with the mental health, emotional role functioning, and MCS domains of the SF-12. Pearson correlation coefficients and their 95% confidence intervals (CIs) were calculated to assess construct and convergence/divergence validity. Content validity was assessed by determining the distribution of the scales and the occurrence of ceiling and floor effects. The floor and ceiling effects of the AOFAS-AHFS at the first and second completion of the form were assessed by calculating the proportion of patients scoring the minimum or maximum values on the scale relative to the total number of patients. We considered scales between 0% and 10% to be minimum scales and scales between 90% and 100% to be maximum scales. Floor and ceiling effects were considered to be relevant if >30% of the patients had a score at the limits of the scale (19).

Results

Translation and Cross-Cultural Adaptation

During the translation process, the translators had difficulty translating the word *block*. *Block* is not a Turkish unit used to describe distance in Turkey. Therefore, *block* was replaced with the phrase *200 meters*. In addition, some patients were still unable to answer this question because they were unaccustomed to describing their walking distance. Instead, they preferred to describe their walking duration. Therefore, we included distance and duration in the scale. The scale required approximately 10 minutes to complete. The demographic and clinical characteristics of the patients are listed in Table 1. The descriptive statistics for the scales at baseline and the second administration of the AOFAS-AHFS and other outcome measures are provided in Table 2. The mean ± SD duration of symptoms was 6.4 ± 3.2 months. A total of 87 patients were evaluated initially in the present study. Of these patients, 3 declined to complete any of the questionnaires, 5 had received treatment between the 2 assessments, and 7 did not return to complete the questionnaires at the second assessment. Thus, 72 patients with different foot and ankle pathologic features completed the second assessment for determination of the test–retest reliability.

Table 2
Descriptive statistics for the patient-reported outcome measures (N = 72 patients)

Scale	Mean ± SD (95% CI)
AOFAS-AHFS assessment 1	60.78 ± 16.04 (58.5 ± 67.0 to 67.0 ± 17.8)
AOFAS-AHFS assessment 2	56.95 ± 14.25 (55.2 ± 12.2 to 62.4 ± 15.3)
SF-12 PCS	35.46 ± 9.37 (33.4 ± 8.0 to 37.9 ± 10.5)
SF-12 MCS	38.02 ± 9.4 (36.2 ± 7.8 to 4.1 ± 10.8)
FAAM ADL	46.95 ± 16.33 (45.2 ± 12.9 to 53.2 ± 18.0)
FAAM Sport	14.44 ± 6.62 (12.6 ± 5.6 to 16.2 ± 7.5)

Abbreviations: ADL, activities of daily living; AOFAS-AHFS, American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale; CI, confidence interval; FAAM, Foot and Ankle Ability Measure; MCS, mental component scale; PCS, physical component scale; SD, standard deviation; SF-12, Medical Outcomes Study Short-Form 12-item survey.

Test–Retest Reliability

The interval between the 2 assessments was 7 days. The intrarater and interrater reliability were 0.89 and 0.93, respectively (Table 3).

Agreement

The SEM and MDC were 4.8 and 13.3, respectively.

Construct Validity

The Turkish version of the AOFAS-AHFS demonstrated good correlation with the FAAM activities of daily living (r = 0.41, p = .01) and fair correlation with the FAAM sports (r = 0.37, p = .03). The SF-12 PCS showed fair correlation with the Turkish version of the AOFAS-AHFS (r = 0.27, p = .08). The weakest correlation was found with Turkish version of the AOFAS-AHFS and the SF-12 MCS (r = 0.03, p = .73).

Floor and Ceiling Effects

The floor and ceiling effects and the number of items answered were identical during the test and retest examinations. None of patients in the overall Turkish AOFAS-AHFS had a score that ranged between the minimum and maximum scales, implying that no ceiling and floor effects were present.

Discussion

The aim of the present study was to translate and culturally adapt the AOFAS-AHFS into Turkish and provide reliability and validity for the translated version using a sample of Turkish-speaking patients. From our sample, the Turkish version of the AOFAS-AHFS demonstrated acceptable levels of reliability and validity to be used as a PRO measure for Turkish-speaking individuals with a variety of foot and ankle pathologic features.

The original version of the AOFAS-AHFS was successfully translated and adapted to the Turkish language. The intra- and interreliability of the Turkish version of the AOFAS-AHFS was excellent with an ICC value of 0.89 and 0.93, respectively. The original version of the AOFAS-AHFS does not include any physicometric

Table 3
Reliability of the Turkish version of AOFAS-AHFS including the Portuguese version (N = 72 patients)

Scale	Intrarater Reliability		Interrater Reliability	
	ICC	p Value	ICC	p Value
Turkish version of AOFAS-AHFS	0.89	.001	0.93	.001
Portuguese version of AOFAS-AHFS	0.92	< .001	0.95	< .001

Abbreviations: AOFAS-AHFS, American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale; ICC, intraclass correlation coefficient.

properties of the scale. Only German and Portuguese versions are available in published studies with which to compare our results (11,12). However, the study of the German version was published in German and we could not read the report. The only available Portuguese version of the AOFAS-AHFS reported an ICC of 0.96 and 0.95 for the intra- and interreliability, respectively, similar to our results. The interval between repeat measurements is an important factor for determining the test–retest reliability (20). The subjective subscale of the AOFAS-AHFS contains only a few questions, which carries the risk of patients becoming familiar with or memorizing the questions. Therefore, we repeated the second assessment 7 days after the first assessment. The reported intervals for the estimation of the test–retest reliability of the AOFAS-AHFS range from 7 to 14 (mean 9) days for the Portuguese version of the AOFAS-AHFS (11). Agreement was assessed using the SEM and MDC. The MDC was 13.3. When a patient is evaluated $\geq$2 times with the Turkish version of the AOFAS-AHFS, a change of 13.3 from 1 measurement to the next should be considered a reflection of measurement error rather than a true change in the patient's condition. This is only study that has reported the MDC and SEM for the AOFAS-AHFS.

Evidence for construct validity was obtained by determining the relationship between the Turkish version of the AOFAS-AHFS and the Turkish version of the FAAM and SF-12. We found good to fair correlation with AOFAS-AHFS and FAAM activities of daily living and FAAM sports. The weakest correlation was found between the AOFAS-AHFS and SF-12 MCS. In a recent study, Rodrigues et al (11) investigated the validity of the AOFAS-AHFS by determining its relationship to the SF-36. They reported the highest correlations were between the Portuguese version of the AOFAS-AHFS and the SF-36 functional capacity and pain subscales ($r = 0.67$ to $r = 0.64$, $p < .001$). We used the SF-12 PCS and MCS for our validity estimation; therefore, we could not compare our results with the published data. However, we also found better reliability with the Turkish version of the AOFAS-AHFS and the SF-12 PCS ($r = 0.27$) compared with the SF-12 MCS.

The present study had several limitations. The only transculturally adapted version of the modified AOFAS-AHFS that we could examine was in Portuguese. Therefore, we could not highlight and compare our results with AOFAS-AHFS versions in other languages. The major limitation of the present study was that we cannot report the responsiveness data, which are critical measures for evaluating a patient's change in status. Assessing the responsiveness of instruments determines whether the assumption of constant variance is appropriate. Therefore, future studies are necessary to assess the responsiveness and determine the minimum clinically important differences for the Turkish version of the AOFAS-AHFS regarding foot and ankle pathologic features.

In conclusion, the Turkish translation and culturally adapted version of the AOFAS-AHFS is reliable and valid and can be used to assess the functional limitations of Turkish patients with various foot and ankle pathologic entities. Although the presented translation has been validated in the present preliminary study, the Turkish form should still be validated in larger and more diverse populations.

Supplementary Material

Supplementary material associated with this article can be found in the online version at www.jfas.org (http://dx.doi.org/10.1053/j.jfas.2016.06.001).

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