The Journal of Foot & Ankle Surgery 56 (2017) 1213–1217

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

# Validity and Reliability of Visual Analog Scale Foot and Ankle: The Turkish Version

Gozde Gur, PT, PhD [1], Elif Turgut, PT, PhD [1], Burcu Dilek, PT, PhD [2], Gul Baltaci, PT, PhD [3], Nilgun Bek, PT, PhD [4], Yavuz Yakut, PT, PhD [5]

[1] *Research Assistant, School of Physical Therapy and Rehabilitation Sciences, Faculty of Health Sciences, Hacettepe University, Ankara, Turkey*
[2] *Assistant Professor, Department of Physical Therapy And Rehabilitation, Medipol University, Istanbul, Turkey*
[3] *Professor, Guven Hospital, Ankara, Turkey*
[4] *Professor, School of Physical Therapy and Rehabilitation Sciences, Faculty of Health Sciences, Hacettepe University, Ankara, Turkey*
[5] *Professor, Physiotherapy and Rehabilitation Department, Hasan Kalyoncu University, Gaziantep, Turkey*

ARTICLE INFO

*Level of Clinical Evidence:* 2

*Keywords:*
foot problems
internal consistency
outcomes assessment
questionnaire
test–retest reliability
Turkish
validation
VAS-FA

ABSTRACT

The present study tested the reliability and validity of the Turkish version of the visual analog scale foot and ankle (VAS-FA) among healthy subjects and patients with foot problems. A total of 128 participants, 65 healthy subjects and 63 patients with foot problems, were evaluated. The VAS-FA was translated into Turkish and administered to the 128 subjects on 2 separate occasions with a 5-day interval. The test–retest reliability and internal consistency were assessed with the intraclass correlation coefficient and Cronbach's $\alpha$. The validity was assessed using the correlations with Turkish versions of the Foot Function Index, the Foot and Ankle Outcome Score, and the Short-Form 36-item Health Survey. A statistically significant difference was found between the healthy group and the patient group in the overall score and subscale scores of the VAS-FA ($p < .001$). The internal consistency of the VAS-FA was very good, and the test–retest reliability was excellent. Adequate to good correlations were found between the overall VAS-FA score and the Foot Function Index, Foot and Ankle Outcome Score, and Short-Form 36-item Health Survey scores in the healthy and patient groups both. The Turkish version of the VAS-FA is sensitive enough to distinguish foot and ankle-specific pathologic conditions from asymptomatic conditions. The Turkish version of the VAS-FA is a reliable and valid method and can be used for foot-related problems.



Foot problems are very common owing to the use of unsuitable shoes, repetitive strain and injuries, unsuitable environmental conditions, and lifestyle choices (1). Population-based studies have shown that the prevalence of foot pain and stiffness ranges from 18% to 63% in the general population (2,3) with an increase associated with age and female gender (3). It has been demonstrated that foot pain is associated with a decreased ability to perform daily activities, problems with balance and gait, a decrease in quality of life, and loss of employment in working populations (2,4).

Foot pain can easily occur owing to altered foot and ankle biomechanics (5), minor disorders (eg, ankle sprains, plantar fasciitis, tendinitis, foot deformities), and more serious conditions (eg, Charcot arthropathy, diabetic foot, arthritis, and tendon ruptures) (6). Although most foot problems are not life-threatening, they can cause morbidity, and their effects should not be underestimated (6).

Conservative treatment, including physiotherapy and rehabilitation techniques, orthotics, medical treatment, and surgery are therapeutic options for foot pain and foot-related problems. In addition, outcome assessments are clinically important for evaluating the efficacy of the intervention (7,8). Physical examination, plain radiography, and magnetic resonance imaging are common methods for evaluating foot and ankle disorders (9). However, disease-specific and self-reported assessment tools, such as questionnaires, are appropriate instruments to determine the presence of possible symptoms, functional disabilities, and changes in health-related quality of life caused by foot problems from the patient's perspective (10). A wide range of patient-reported clinical outcome measurement tools have been used to evaluate foot and ankle procedures, disorders, and outcomes, including the American Orthopaedic Foot and Ankle Society (AOFAS) scales, visual analog scale (VAS) for pain, Short-Form 36-item Health Survey (SF-36), Foot Function Index (FFI), Foot and Ankle Outcome Score (FAOS), and the American Academy of Orthopaedic Surgeons outcomes instruments.

**Financial Disclosure:** None reported.
**Conflict of Interest:** None reported.
Address correspondence to: Gozde Gur, PT, PhD, Faculty of Health Sciences, Hacettepe University, Ankara 06100, Turkey.
*E-mail address:* gosdegr@hotmail.com (G. Gur).

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http://dx.doi.org/10.1053/j.jfas.2017.06.001

However, no broadly accepted consensus has been reached regarding which tools are preferred. Therefore, research is needed regarding valid and reliable outcome measures for the foot and ankle (11). Recently, a validated new score for the foot and ankle was established at the Hannover Medical School's Trauma Department in Germany, known as the VAS foot and ankle (VAS-FA) (12). The VAS-FA is a subjective form to measure symptoms, such as limitations in function and deteriorating health-related quality of life, caused by foot- and ankle-related problems (12,13). The validity and reliability of VAS-FA was reported, and the process of validating it against the SF-36 was completed (12). The VAS-FA is widely used to evaluate foot and ankle problems from the patient's perspective (12,13). The purpose of the present study was to translate the original English version of the VAS-FA into a Turkish version and evaluate the validity and reliability of the Turkish version of the VAS-FA for patients with foot and ankle problems.

## Patients and Methods

### *Subjects*

The study included 128 participants—65 (50.8%) healthy subjects and 63 (49.2%) patients with various foot problems. The patients were sequentially enrolled from the foot clinic department of our university. The healthy subjects were recruited through public announcements, meetings, and telephone interviews. Subjects were excluded if they were unable to follow instructions and/or had a recent history of immobilization due to lower extremity fracture or surgery. The local ethics committee of the university approved the research, and the participants provided written informed consent before inclusion in the study.

### *Procedure*

Beaton's intercultural adaptation principles were used for the translation process of the questionnaire (14). First, proper written permission was received from the authors of the original VAS-FA. It was translated into Turkish by 2 different translators whose native language was Turkish. They met to review the translations and inconsistencies in the translations, which were resolved by discussion. After agreeing on a Turkish version, it was translated back into English by a linguist whose native language was English; the linguist was unaware of the original version. Finally, a review group consisting of both translators and physiotherapists discussed and finalized the translations. The first version of the Turkish VAS-FA was completed by an asymptomatic group of subjects (n = 10) for cultural adaptation. The final version was compared with the original English version, and feedback was obtained from the preliminary testing results. Eventually, a Turkish version of the VAS-FA was completed.

After the VAS-FA had been translated into Turkish and the cultural adaptation performed, the new version was administered to 128 individuals with and without foot problems. To evaluate the reliability of the Turkish version of the VAS-FA (inner consistency and test–retest reliability), 65 healthy subjects and 63 patients with foot problems completed the VAS-FA twice, at an interval of 5 days. No treatment was given to the patients during the 5-day interval. The Turkish versions of the FFI, FAOS, and Medical Outcomes Study SF-36 were used to determine the validity of the Turkish version of the VAS-FA in the present study.

### *VAS-FA Questionnaire*

The VAS-FA subjective form consists of 20 questions requiring entirely subjective answers (12). The questions encompass 3 different groups (pain, n = 4; function, n = 11; and other complaints, n = 5). For each question, a VAS value from 0 to 100 is allowed. Thus, the total value for the entire score (all 20 questions answered) ranges from 0 to 2000 points. This total value is then divided by 20, resulting in a possible total score ranging from 0 to 100 points. Higher scores indicate less impairment. To obtain the results from the individual categories, the total values from the category questions are divided by the number of questions (function, n = 11; pain, n = 4; other complaints, n = 5) in that category.

### *Foot Function Index*

The FFI was developed to measure the effect of foot abnormalities on function in terms of pain, disability, and activity restrictions (15). The FFI includes 23 items divided into 3 subscales: activity limitation (5 items), disability (9 items), and pain (9 items). Every question is answered on a VAS, with conversion to scores ranging from 0 to 10. To eliminate the decimal point, the score is multiplied by 100. Therefore, each subscale score ranges from 0 to 100, with higher scores indicating greater degrees of impairment. The Turkish version of the FFI has been previously reported (16).

### *Foot and Ankle Outcome Score*

The FAOS is an adaptation of the knee injury and osteoarthritis outcome score intended to evaluate symptoms and functional limitations related to the foot and ankle (17). The FAOS consists of 42 items assessing 5 separate patient-relevant dimensions: pain (9 items); other symptoms such as stiffness, swelling, and range of motion (7 items); activities of daily living (17 items); sports and recreational activities (5 items); and lower limb-related quality of life (4 items) (17). To answer each question, 5 Likert boxes are used (no, mild, moderate, severe, extreme), and all items are scored from 0 to 4. Each of the 5 subscale scores is calculated as the sum of the items included. The raw scores are then transformed to a scale from 0 to 100. Higher total scores indicate fewer problems and/or functional limitations. The Turkish version of the FAOS has been previously reported (18).

### *Medical Outcomes Study SF-36*

The SF-36 is a generic measure of quality of life addressing 8 health concepts: physical functioning, physical role, bodily pain, vitality, emotional role, social functioning, mental health, and general health (19). The scores for each domain range from 0 (poor health) to 100 (good health). The Turkish version of the SF-36 has been previously reported (20).

### *Statistical Analysis*

Descriptive statistics were used to compare the baseline characteristics of the patients. The data are presented as the mean ± standard deviation or frequency. Reliability was assessed using test–retest reliability and internal consistency. Test–retest reliability was determined using the intraclass correlation coefficient (ICC). Although the ICC can vary from 0.00 to 1.00, an ICC of 0.60 to 0.80 indicates good reliability, and scores >0.80 indicate excellent reliability (21). Internal consistency was assessed by calculating Cronbach's $\alpha$ coefficient for the baseline administration of the VAS-FA. A Cronbach's $\alpha$ of $\geq$0.70 was considered to indicate satisfactory internal consistency. Very good internal consistency was characterized by a Cronbach's $\alpha$ coefficient >0.80 (22). Validation was assessed by construct validity, which refers to the scale's behavior in relation to other assessment tools. Construct validity was determined by comparing the scores of similar subscales and the total of the Turkish VAS-FA with the FFI, FAOS, and SF-36. Pearson's correlation coefficient was also calculated to assess the validity. The validity coefficient was considered excellent at 0.81 to 1.0, very good at 0.61 to 0.80, good at 0.41 to 0.60, adequate at 0.21 to 0.40, and weak at 0 to 0.21 (23). SPSS, version 15.0 (IBM Corp., Armonk, NY), was used for data management and statistical analysis. Statistical significance was defined as $p < .05$.

## Results

The Turkish translation of the VAS-FA and the English back-translation did not require any explanations for the test population (n = 10); thus, no modifications were deemed necessary.

A total of 164 subjects were initially included. However, 17 subjects (10.3%) answered <20 of the VAS-FA questions and 19 (11.5%) did not complete >1 "other symptoms" scale. These patients were excluded from further evaluation, leaving 128 participants. All the scales were completely answered by these 128 subjects (78.0%). Thus, 65 healthy subjects (mean age 28.4, range 17 to 57 years) and 63 patients with foot problems (mean age 28.7, range 20 to 54 years) were enrolled in the present study. The main foot problems were categorized into 3 major groups: bone, soft tissue, and joint. Bone included fractures, corns, and calluses; soft tissue included plantar fasciitis, tarsal tunnel syndrome, tenosynovitis, bursitis, ankle sprains, and pain syndromes, and joint included arthritis. The baseline characteristics of the subjects are listed in Table 1.

The mean scores of scales and their subscales are presented in Table 2. A statistically significant difference was found in the overall score and subscale scores of the VAS-FA between the healthy and patient groups ($p < .001$).

The results from the reliability analyses are presented in Table 3. The ICCs for the VAS-FA subscales ranged from 0.88 to 0.93 for the healthy subjects and 0.92 to 0.95 for the patients, showing excellent test–retest reliability. The internal consistency measured using Cronbach's $\alpha$ coefficient ranged from 0.93 to 0.96 for the healthy subjects and 0.75 to 0.92 for the patients. These results showed very good internal consistency for the VAS-FA.

**Table 1**
Baseline characteristics of the participants (N = 128)

| Characteristic | Healthy Subjects (n = 65) | Patients (n = 63) |
|---|---|---|
| Age (y) | 28.45 ± 8.90 | 28.71 ± 8.66 |
| Body weight (kg) | 66.22 ± 13.79 | 64.57 ± 12.97 |
| Height (cm) | 169.18 ± 9.29 | 166.52 ± 8.25 |
| Body mass index (kg/m$^2$) | 22.98 ± 3.35 | 23.12 ± 3.19 |
| Gender (n[%]) | | |
| Male | 29 (44.62) | 15 (23.81) |
| Female | 36 (55.39) | 48 (76.19) |
| Main foot problem (%) | | |
| Bone | NA | 6.34 |
| Soft tissue | NA | 88.88 |
| Joint | NA | 3.17 |

Abbreviation: NA, not applicable.

The results of the validity analysis for the VAS-FA are listed in Table 4. Adequate to good and statistically significant correlations were found between the overall score of the Turkish VAS-FA scale and the FFI, FAOS, and SF-36 scales for the healthy subjects and patients both. For the pain and function subscales, adequate to good statistically significant correlations were obtained for the patient group. However, in the healthy group, statistically significant correlations were observed between the VAS-FA and FFI for pain and the VAS-FA and FAOS for pain and function only. For the subscale of other complaints, an adequately significant correlation was found when comparing the VAS-FA and FAOS in the healthy subjects only. A comparison of the VAS-FA with the FFI and SF-36 in terms of the "other complaints" subscales was impossible because of a lack of "other complaints" information in these questionnaires.

## Discussion

Considering the Turkish sociocultural conditions, the present study has demonstrated that a Turkish adaptation of the VAS-FA is a valid and reliable self-reported outcome measure for healthy subjects and patients with foot problems. Our results are comparable with previous studies using the original German version (12) and a Thai cultural adaptation of the VAS-FA (13).

Self-reported questionnaires are widely used to measure patients' symptoms related to foot and ankle pain and functional alterations and their effect on quality of life (24). VAS-based self-reported questioning techniques have been demonstrated to provide the most appropriate and sufficient discriminative data for patients with pain to describe their pain and related problems regarding objectivity and reliability, as a recent review showed (25). In addition, VASs were reported to be advantageous in terms of the time required to complete them (25). The VAS-FA is a VAS-based outcome score for the foot and ankle. Richter et al (12) also reported faster evaluations with the VAS-FA than with the Hannover questionnaire and SF-36. Similarly, the time needed to complete the questionnaire was shorter for the VAS-FA than for the other questionnaires used in our study. Angthong et al (13) reported the mean time required to complete the VAS-FA was 6.3 minutes. We also found that the time required to complete the VAS-FA was 6 minutes on average. The VAS-FA has been adapted into 3 languages: English (12), German (12), and Thai (13). Stüber et al

**Table 2**
Score results of visual analog scale foot and ankle, Foot Function Index, Foot and Ankle Outcome Score, and Short-Form 36-item Health Survey (N = 165)

| Outcome Measure | Items (n) | Healthy Subjects (n = 65) | Patients (n = 63) | *p* Value |
|---|---|---|---|---|
| VAS-FA | | | | |
| Pain | 4 | 80.01 ± 19.48 | 65.73 ± 22.15 | <.001† |
| Function | 11 | 88.71 ± 13.53 | 75.50 ± 18.78 | <.001† |
| Other complaints | 5 | 87.60 ± 15.77 | 75.34 ± 19.25 | <.001† |
| Overall | 20 | 85.52 ± 14.33 | 72.19 ± 18.06 | <.001† |
| FFI | | | | |
| Pain | 9 | 11.30 ± 13.28 | 22.90 ± 16.98 | <.001† |
| Disability | 9 | 5.87 ± 7.69 | 13.58 ± 9.90 | <.001† |
| Activity limitation | 5 | 2.27 ± 4.30 | 6.00 ± 8.86 | .003* |
| Overall | 23 | 6.37 ± 7.40 | 14.16 ± 10.08 | <.001† |
| FAOS | | | | |
| Pain | 9 | 89.90 ± 11.69 | 74.76 ± 21.61 | <.001† |
| Other symptoms | 7 | 86.01 ± 15.79 | 75.14 ± 21.13 | .001* |
| Activities of daily life | 17 | 91.54 ± 12.54 | 85.38 ± 15.63 | .016* |
| Sports | 5 | 85.88 ± 16.72 | 70.97 ± 26.29 | <.001† |
| Quality of life | 4 | 83.21 ± 17.12 | 64.15 ± 23.22 | <.001† |
| Overall | 42 | 87.26 ± 11.58 | 74.07 ± 18.83 | <.001† |
| SF-36 | | | | |
| Physical functioning | 10 | 86.30 ± 17.60 | 74.04 ± 22.41 | .001* |
| Role limitations, physical health | 4 | 82.81 ± 32.99 | 61.90 ± 35.31 | .001* |
| Role limitations, emotional problems | 3 | 66.25 ± 23.05 | 56.76 ± 21.19 | .017* |
| Energy/fatigue | 4 | 69.16 ± 19.37 | 60.04 ± 15.04 | .004* |
| Emotional well-being | 5 | 58.20 ± 16.74 | 59.04 ± 15.36 | .768 |
| Social functioning | 2 | 77.34 ± 21.23 | 72.00 ± 24.87 | .195 |
| Pain | 2 | 75.00 ± 36.61 | 71.43 ± 39.19 | .597 |
| General health | 6 | 66.06 ± 16.80 | 69.14 ± 15.44 | .284 |
| Overall | 36 | 72.64 ± 16.71 | 65.54 ± 16.08 | .016* |

Abbreviations: FAOS, Foot and Ankle Outcome Score; FFI, Foot Function Index; SF-36, Short-Form 36-item Health Survey; VAS-FA, visual analog scale foot and ankle.
* $p < .05$.
† $p < .001$.

**Table 3**
Test–retest reliability results of the visual analog scale foot and ankle and its subscales (N = 165)

| Variable | Cronbach's α | ICC | 95% CI |
|---|---|---|---|
| Healthy subjects | | | |
| Overall | 0.96 | 0.93 | 0.895–0.960 |
| Pain | 0.93 | 0.88 | 0.819–0.928 |
| Function | 0.93 | 0.88 | 0.816–0.927 |
| Other | 0.96 | 0.93 | 0.902–0.962 |
| Patients | | | |
| Overall | 0.75 | 0.95 | 0.920–0.970 |
| Pain | 0.95 | 0.92 | 0.873–0.952 |
| Function | 0.97 | 0.94 | 0.915–0.968 |
| Other | 0.92 | 0.85 | 0.777–0.912 |

Abbreviations: CI, confidence interval; ICC, intraclass correlation coefficient.

(26) found that the average scores of the normative data for pathologic conditions in 121 patients with a mean age of 51.6 years were as follows: overall, 55.0 ± 21.6; pain, 45.5 ± 25.9; function, 56.9 ± 24.6; and other complaints, 58.9 ± 23.7. These scores were lower than those found for the patients with foot problems in our study. However, the scores reported by Angthong et al (13) for 42 Thai patients were similar to those found in our study. A healthy subject group with no history of foot-related complaints or problems was used to assess the sensitivity of the VAS-FA to changes in the pathologic conditions found in the present study. The comparisons in the present study between healthy subjects and patients revealed that the VAS-FA is a sensitive tool for distinguishing foot- and ankle-specific pathologic conditions from asymptomatic conditions.

The results obtained for the reliability of the VAS-FA in the present study are similar to those for the original version of the VAS-FA. We found very good internal consistency, with a Cronbach's α coefficient of 0.92 to 0.95 for the subscales in the patient group. In addition, satisfactory internal consistency, with a Cronbach's α coefficient of 0.75, was found for the overall VAS-FA. A Cronbach's α of 0.70 has been reported to indicate the homogeneity of the items in each subscale (22). Therefore, our results have shown that the items in the Turkish VAS-FA are homogeneous. For test–retest reliability, an ICC range from 0.85 to 0.95 for the overall score and subscales was observed for the patient group, indicating excellent test–retest reliability in the present study. Angthong et al (13) found an ICC as high as 0.99 for test–retest reliability and excellent internal consistency with a Cronbach α coefficient of 0.99.

For validity, the correlation of the overall VAS-FA score with the FFI, FAOS, and SF-36 scores was good for the patient group but adequate to moderately for the healthy subject group. For the patient group, the correlation with the other 3 scales for pain was good, although in terms of function, the correlation with the FAOS and SF-36 was adequate but with the FFI was good. In contrast, in the healthy subject group, no correlation with the FFI was found for function or with the SF-36 for pain and function. We believe this finding might have resulted from the general nature of the questions on the SF-36 scale for pain and function. The original FFI was developed for patients with rheumatoid arthritis, most of whom were male (15). Although the FFI has been adapted for several languages, some limitations exist in its usefulness and general application among populations of different ages and genders and those experiencing various foot problems (27). For the other complaints subscale, a real comparison could not be performed with the FFI and SF-36 because of the subscale differences. The comparison with the FAOS showed different results for healthy subjects and patients. This might have resulted from differences in the questions of the other complaints subscales of the VAS-FA and FAOS. For validation, Angthong et al (13) found a very good correlation ($r = 0.61$, $p < .001$) between the overall Thai VAS-FA score and the SF-36 score in patients with foot problems. Richter et al (12) reported a sufficient correlation ($r > 0.5$) in all score categories and total scores of the VAS-FA and SF-36 in a German population.

A key strength of the present study was that both healthy and symptomatic subjects were included. However, the present study had some limitations. We included subjects with a wide age range from 17 to 57 years; thus, the results should not be applied to a specific age group. The population was dominated by females, and soft tissue problems were the main diagnosis for the patients. Furthermore, future research should assess the responsiveness of the Turkish version of the VAS-FA to examine its ability to detect important changes in pain and function over time after conservative, medical, or surgical intervention.

In conclusion, the VAS-FA is a valid and reliable questionnaire that provides an outcome score for the foot and ankle in healthy individuals and patients with foot problems, and it can be used to investigate pain, function, and other complaints. We recommend the use of the Turkish version of the VAS-FA for Turkish-speaking patients with foot pain or complaints to evaluate foot-related pain, function, and relevant factors and the efficacy of treatment.

**Table 4**
Results of statistical correlation of visual analog scale foot and ankle, Foot Function Index, Foot and Ankle Outcome Score, and Short-Form 36-item Health Survey (N = 165)

| Variable | Category | | | Overall Score |
|---|---|---|---|---|
| | Pain | Function | Other Complaints | |
| Healthy subjects | | | | |
| VAS-FA versus FFI | $r = -0.48$, $p < .001$ | $r = -0.05$, $p = .69$ | NA | $r = -0.40$, $p = .001$ |
| VAS-FA versus FAOS | $r = -0.47$, $p < .001$ | $r = 0.37$, $p = .002$* | $r = 0.28$, $p = .02$* | $r = 0.55$, $p < .001$ |
| VAS-FA versus SF-36 | $r = 0.03$, $p = .77$ | $r = 0.32$, $p = .09$ | NA | $r = 0.34$, $p = .006$* |
| Patients | | | | |
| VAS-FA versus FFI | $r = -0.47$, $p < .001$ | $r = -0.53$, $p < .001$ | NA | $r = 0.51$, $p < .001$ |
| VAS-FA versus FAOS | $r = 0.54$, $p < .001$ | $r = 0.34$, $p = .006$* | $r = 0.19$, $p = .13$ | $r = 0.50$, $p < .001$ |
| VAS-FA versus SF-36 | $r = 0.52$, $p < .001$ | $r = 0.27$, $p = .02$* | NA | $r = 0.55$, $p < .001$ |

Abbreviations: FAOS, Foot and Ankle Outcome Score; FFI, Foot Function Index; NA, not available; SF-36, Short-Form 36-item Health Survey; VAS-FA, visual analog scale foot and ankle.

* $p < .05$.

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