

**RESEARCH ARTICLE**

# Reliability and Validity of the Persian Version of the Foot Function Index in Patients with Foot Disorders

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**Abstract**

**Background:** Foot function index (FFI) is a worthy subjective patient reported outcome measures (PROM) tool for evaluation of the outcomes of medical interventions on foot and ankle. This study was conducted to assess the validity of the Persian version of the foot function index (FFI).

**Methods:** After translating the original FFI into Persian, back-translation was performed on the agreed Persian version and the final version was established. A total of 113 Persian-speaking patients with foot and ankle problems were enrolled in this study and were asked to fill in the FFI.

**Results:** The Cronbach's alpha for subsections of FFI and MOXFQ was above 0.8 and 0.7, respectively, while it was 0.95 and 0.93 for total FFI and MOXFQ, respectively. The ICC for all subsections of MOXFQ and FFI was above 0.7. The Pearson's correlation coefficient for all subsections of FFI and MOXFQ was significant ( $P < 0.01$ ).

**Conclusion:** The Persian version of FFI is valid and reproducible in Persian speaking population.

**Level of evidence:** IV

**Keywords:** FFI, Foot function index, Persian version, Reliability, Validity

**Introduction**

It is estimated that almost 20% of population worldwide suffer from podalgia (1, 2). Foot problems are more common in patients with diabetic neuropathy as well as hyperuricemic or rheumatoid arthritis. Pain in the foot can be associated with swelling, stiffness, shoe discomfort, and impaired function; yet, the symptoms are rather subjective and difficult to be quantified. Although several tools had been developed to assess the pain and impaired function in different joints, none had specifically pertained to foot problems.

Originally introduced in 2006, the Manchester-Oxford Foot Questionnaire (MOXFQ) was developed as a patient-reported outcome (PRO) measure for patients undergoing corrective surgery on hallux valgus.

However, it was slightly modified and validated later for use in patients with a variety of foot or ankle problems. The questionnaire consists of three domains (16 items): "Walking/standing" (seven items), "Pain" (five items), and "Social interaction" (four items) (3). The suitability of MOXFQ in the evaluation of all foot and ankle surgeries have already been clarified (4).

The foot function index has been frequently used since 1991 as a self-administered questionnaire to evaluate the impact of foot pathologies on foot function in three subscales including pain (9 questions), difficulty (9 questions), and activity limitation (5 questions). The revised version was later developed by adding a psychological subscale (5).

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The FFI has already been translated and validated in Polish, Danish, German, Italian, Spanish, Portuguese, French, Chinese, Korean, and Turkish languages. The prevalence of foot problems among Iranian school students has been reported to be over 50% (6-20). Considering the high prevalence of foot problems in Iranian population, this study was conducted to assess the validity of the Persian version of the foot function index (FFI).

### Materials and Methods

The clearance to conduct this study was provided by Mashhad University of Medical Sciences (961302).

The original version of FFI was translated to Persian by two independent professional translators after obtaining the permission from the authors of the original FFI. Back-translation was performed on an agreed version of the Persian translate by two different independent professional translators who were blinded to the original version of the FFI. The final version was established after verification of the two Persian-to-English translations and subjected to analysis for the amenability of medical terminology by three independent clinician specialists. The whole process of translation was supervised by the corresponding author.

The study was performed at Ghaem Hospital outpatient orthopedic clinic. A total of 113 Persian-speaking patients with a diverse range of foot and ankle problems (i.e. Polydactyly, Brachymetatarsia, Sinus Tarsi, Hallux Valgus, Hallux Rigidus, ankle sprain, Plantar Fasciitis, Metatarsal Giant Tumor, Talar Deformity, Freiburg Deformity, Haglund Deformity, Talar OCD, Charcot Foot, Calcaneal Cyst, Os Naviculare, ...) were enrolled in this study. Patients with fractures were excluded from the study. The FFI consists of 23 visual analogue scale (VAS) questions (9 for pain in the foot; 9 for the level of disability; and 5 for the activity limitations). Each question is scored from 0 (as the lowest score) to 10 (as the highest score). All participants were asked to fill in the FFI and MOXFQ after signing the informed consent forms. The patients were asked to leave the question blank if it could not describe the patient's condition. A week later, 20 patients (~20%) were randomly called and asked to refill both questionnaires.

Data analysis was performed using SPSS 22.0 (IL, USA). Cronbach's alpha was used to assess the internal consistency of the questionnaire. The intraclass correlation coefficient (ICC) and Pearson's correlation coefficient were used to evaluate the subsections of the questionnaires. A  $P$  value < 0.05 was defined as statistically significant.

### Results

A total of 113 patients participated in this study whose demographic data are summarized in table 1.

The alpha value for subsections of FFI and MOXFQ was above 0.8 and 0.7, respectively. However, the Cronbach's alpha for FFI and MOXFQ was above 0.9 [Table 2]. The difference between Cronbach's alpha of the domains and

**Table 1. Demographic characteristics of the study group total (N = 111)**

<b>Age(year)</b>	
Mean±SD	40.4±13.1
Range	7-69
<b>Sex, N (%)</b>	
Male	51 (45.9%)
Female	60 (54.1%)

**Table 2. Internal consistency using Cronbach's alpha coefficient**

FFI domains	Cronbach's $\alpha$ coefficient
Pain	0.90
Disability	0.93
Activity limitation	0.88
Total	0.95
<b>MOXFQ domains</b>	
Pain	0.87
Walking standing	0.89
Social interaction	0.76
Total	0.93

the total shows that the inter-item consistency is better between domains than within each domain.

The intraclass correlation coefficient (ICC) for all three subsections of MOXFQ questionnaire (pain, walking standing, and social interaction) as well as all three subsections of FFI (pain, disability, and activity limitation) was above 0.7, indicating the reliability of both questionnaires [Tables 3; 4].

MOXFQ questionnaire was used to evaluate the validity of FFI. The Pearson's correlation coefficient for all subsections was significant at  $P < 0.01$  level, indicating the validity of FFI [Table 5].

### Discussion

Orthopedic surgeons are used to judge the diseases based on clinical or para-clinical findings.

Patient reported outcome measurements are reliable means to measure validated subjective outcomes in orthopedic disorders. "Foot and ankle" is a very specific area where small bones together with rigorous networks of ligaments offer very smooth transitions. The biomechanics of foot and ankle components are very sophisticated and the outcomes of medical interventions cannot be easily measured with simple anatomic figures; hence, subjective patient reported outcome measures (PROM) are worthy tools.

Foot function index (FFI) is one of these PROMs,

MOXFQ domains	MOXFQ score		ICC(95%)CI	P
	1st assessment	2nd assessment		
Pain	3.21±1.06	3.12±0.93	0.84(0.58-0.94)	<0.001
Walking standing	3.32±1.02	3.18±1.03	0.94(0.84-0.98)	<0.001
Social interaction	3.40±0.93	3.33±1.12	0.78(0.42-0.92)	0.002
Total	3.31±0.95	3.21±0.93	0.88(0.68-0.95)	<0.001

FFI domains	FFI score		ICC(95%)CI	P
	First assessment	Second assessment		
pain	4.74±2.14	5.04±1.94	0.91(0.76-0.96)	<0.001
disability	5.54±2.37	5.73±2.40	0.87(0.67-0.95)	<0.001
Activity limitation	2.96±1.61	3.44±1.59	0.73(0.28-0.9)	0.005
Total	4.42±1.65	4.73±1.71	0.84(0.58-0.94)	<0.001

FFI domains	MOXFQ domains			Total
	Pain	Walking standing	Social interaction	
Pain	0.65**	0.46**	0.35**	0.50**
Disability	0.54**	0.40**	0.60**	0.49**
Activity limitation	0.33**	0.51**	0.82**	0.48**
Total	0.58**	0.49**	0.62**	0.58**

which has been developed in rheumatoid patients and validated, in orthopedic setting by the 2001–2002 Outcomes Committee of the American Orthopedic Foot and Ankle Society (AOFAS). The committee was concerned with the huge difference between elective foot and ankle disorders and rheumatoid patients, regarding the level of function. Without careful attention to this difference, we may encounter floor or ceiling effects in our assessment. They changed the VAS scoring system to a Likert scale due to the ease of measurement. In their study, 12 out of 23 questions dropped in the ceiling effect group. Considering a 15% threshold for the floor or ceiling effect, we found 10/23 in ceiling response and 5/23 in floor effect. It seems that FFI is effective in function measurement in the moderately active patients and it is not able to measure function changes in very active or low function people.

Likewise the French validation, the only cultural

adaptation during the translation stage was necessary on “four blocks” that was translated as “400 meters” in the Persian version (15).

In the FFI, not applicable questions are managed by deleting them in final assessment and they don't affect the final score. The final result is standardized in a scale between zero and 100. The larger score shows more severe involvement (21-24).

Table 5 shows moderate correlation between most of MOXFQ and FFI domains, considering a coefficient of 0.60-0.79 as strong and 0.40-0.59 as moderate correlations. There was a strong correlation between the corresponding pain domains, activity limitation and disability of FFI and social interaction of MOXFQ.

Interclass correlation coefficient (ICC) showed strong correlation in test retest reliability assessment (more than 0.73 in all three domains). This correlation was more than 0.69 in the original study in rheumatoid patients. Cronbach's alpha coefficient results with any

**Table 6. Scores for questions in FFI**

Question	Range of scores	Ceiling Score ( 10 )	Floor Score ( 1 )	No Response
FFI1	1-10	16 ( 18.60 % )	8 ( 9.30 % )	10 ( 11.63 % )
FFI2	1-10	14 ( 16.28 % )	22 ( 25.58 % )	7 ( 8.14 % )
FFI3	1-10	14 ( 16.28 % )	9 ( 10.47 % )	7 ( 8.14 % )
FFI4	1-10	15 ( 17.44 % )	11 ( 12.79 % )	4 ( 4.65 % )
FFI5	1-10	12 ( 13.95 % )	10 ( 11.63 % )	6 ( 6.98 % )
FFI6	1-10	12 ( 13.95 % )	12 ( 13.95 % )	4 ( 4.65 % )
FFI7	1-10	2 ( 2.33 % )	7 ( 8.14 % )	65 ( 75.58 % )
FFI8	1-10	1 ( 1.16 % )	7 ( 8.14 % )	66 ( 76.74 % )
FFI9	1-10	17 ( 19.77 % )	8 ( 8.14 % )	6 ( 6.98 % )
FFI10	1-10	12 ( 13.95 % )	9 ( 10.47 % )	4 ( 4.65 % )
FFI11	1-10	16 ( 18.60 % )	9 ( 10.47 % )	3 ( 3.49 % )
FFI12	1-10	25 ( 29.07 % )	6 ( 6.98 % )	6 ( 6.98 % )
FFI13	1-10	25 ( 29.07 % )	6 ( 6.98 % )	5 ( 5.81 % )
FFI14	1-10	20 ( 23.26 % )	8 ( 8.14 % )	6 ( 6.98 % )
FFI15	1-10	32 ( 37.21 % )	8 ( 8.14 % )	7 ( 8.14 % )
FFI16	1-10	9 ( 10.47 % )	19 ( 22.09 % )	4 ( 4.65 % )
FFI17	1-10	22 ( 25.58 % )	9 ( 10.47 % )	6 ( 6.98 % )
FFI18	1-10	33 ( 38.37 % )	6 ( 6.98 % )	4 ( 4.65 % )
FFI19	1-10	12 ( 13.95 % )	18 ( 20.93 % )	3 ( 3.49 % )
FFI20	1-10	6 ( 6.98 % )	25 ( 29.07 % )	4 ( 4.65 % )
FFI21	1-10	13 ( 15.12 % )	12 ( 13.95 % )	3 ( 3.49 % )
FFI22	1-10	8 ( 9.30 % )	47 ( 54.65 % )	4 ( 4.65 % )
FFI23	1-10	9 ( 10.47 % )	43 ( 50.00 % )	4 ( 4.65 % )

Total Number of patients=86 answers

Ceiling/Floor=Number of patients who answered question

(% of total) (1=no problem, 10=Worst problem). Act=activity, Limitation; Dis=disability

domain deletion, showed strong internal consistency of all three domains with activity limitation as the least (0.88).

The correlation levels in this study are comparable with those in other studies summarized in Table 7.

The French version showed exactly the same results with 85% coefficient for activity limitation (25). However, the ceiling effect for activity limitation subscale in the French version was 17.65% which is higher than the 15% threshold. Moreover, the population in the French FFI study used a few walking assistive devices (15).

The Taiwanese version was validated with 21 items as two items in the pain subscale were removed. Also, only patients with plantar fasciitis and foot/ankle fractures were included in their study (26).

The validation part in the German FFI evaluated only 53

patients undergoing foot/ankle surgery (27).

The Spanish version of FFI was validated with 80 subjects. Since people from different countries and ethnic groups speak Spanish, linguistic conflicts might weaken the generalizability of the Spanish version of FFI (12).

The 17-item Italian version of FFI was missing 6 items in the pain subscale and validated on only 30 patients with foot and ankle problems (10). Also, validation of the full version Italian FFI on 50 patients with plantar fasciitis showed almost similar correlation levels (9). However, validation of another 18-item Italian version of FFI (pain and disability subscales) with 89 patients with foot and ankle diseases resulted in similar correlations (11).

The FFI has also been translated into Chinese (most likely Mandarin), as the most widely spoken language

Table 7. Comparison of the correlation levels of various versions of FFI		
Study	Cronbach's $\alpha$	ICC
French	0.85-0.97	0.77-0.97
Taiwanese	0.94	0.82
German	0.98	0.97-0.99
Spanish	0.69-0.96	
Italian (17-IFFI)	0.95	0.90-0.92
Italian	0.98	0.86-0.98
Italian (18-IFFI)	0.95	0.91-0.94
Chinese	0.996-0.998	0.985-0.996
Korean	0.91-0.95	0.812-0.814
Korean	0.943	0.814
Turkish	0.821-0.938	0.960-0.985
Brazilian-Portuguese	0.61-0.80	0.97-0.99
Danish	0.97	0.95

worldwide, and validated in 306 patients with neuromusculoskeletal foot/ankle problems. Considering the Cronbach's  $\alpha$  and ICC, the Chinese FFI was proved to be a reliable version.

Both Korean versions of FFI with 121 and 36 patients with foot complaints have shown correlation levels consistent with other versions (17, 18).

The Turkish FFI was validated on 159 patients with foot disorders and was proved to be clinically applicable to foot and ankle disorders (19).

The FFI translation and transcultural adapted questionnaire has been validated and reproducible scale in our foot and ankle clinic in Persian speaking people of Iran in statistical assessment of psychometrical properties. Yet, we are cautious about its responsiveness in various surgical and non-surgical interventions because of high rate of ceiling and floor effect in certain

questions.

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