French validation of the Foot Function Index (FFI)*

C. Poutier-Piotte a, B. Pereira b, M. Soubrier c, E. Thomas d, L. Gerbaud e, E. Coudeyre a,*

a Unité de nutrition humaine, INRA, UMR 1019, CRNN, service de médecine physique et réadaptation, université d’Auvergne, CHU Clermont-Ferrand, 63000 Clermont-Ferrand, France
b Unité de biostatistique, délégation recherche clinique et innovation, CHU Clermont-Ferrand, France
c Service de rhumatologie, université d’Auvergne, CHU Clermont-Ferrand, France
d Boucherec podo-arthésiste, Saint Chély d’Apecher, France
e Service d’épidémiologie, économie de la santé et prévention, CHU Clermont-Ferrand, France

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ABSTRACT

Objective: French validation of the Foot Function Index (FFI), self-questionnaire designed to evaluate rheumatoid foot according to 3 domains: pain, disability and activity restriction.

Methods: The first step consisted of translation/back translation and cultural adaptation according to the validated methodology. The second stage was a prospective validation on 53 patients with rheumatoid arthritis who filled the FFI. The following data were collected: pain (Visual Analog Scale), disability (Health Assessment Questionnaire) and activity restrictions (McMaster Toronto Arthritis questionnaire). A test/retest procedure was performed 15 days later. The statistical analyses focused on acceptability, internal consistency (Cronbach’s alpha and Principal Component Analysis), test-retest reproducibility (concordance coefficients), external validity (correlation coefficients) and responsiveness to change.

Results: The FFI-F is a culturally acceptable version for French patients with rheumatoid arthritis. The Cronbach’s alpha ranged from 0.85 to 0.97. Reproducibility was correct (correlation coefficients > 0.56). External validity and responsiveness to change were good.

Conclusion: The use of a rigorous methodology allowed the validation of the FFI in the French language (FFI-F). This tool can be used in routine practice and clinical research for evaluating the rheumatoid foot. The FFI-F could be used in other pathologies with foot-related functional impairments.

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1. Introduction

According to a 2010 epidemiological study [1] focusing on the prevalence of foot pain in rheumatoid arthritis (RA) and its care management, 35.4% of patients indicated that their feet was the first symptomatic site of RA. In all, 90.3% of responders reported foot pain for more than one day since the beginning of their pathology and 69.2% of them experienced foot pain during one day in the past month. In responders, 64% of patients had previously seen a podiatrist and only 54.2% of patients had plantar orthosis.

The French High Health Authority (HAS) [2] published recommendations regarding the non-pharmacologic care management of patients with RA. Podiatric follow-up and the prescription of adapted footwear and plantar orthosis are recommended. In order to be able to evaluate the impact of the various therapeutic modalities, it is necessary to have a validated assessment tool.

Several tools have been described in the literature to evaluate the rheumatoid foot. We focused mainly on the Foot Function Index (FFI) published by Budiman-Mak et al. in 1991 [3,4]. This questionnaire includes 23 items, scored from 1 to 10 using the Visual Analog Scale (VAS) and divided into three subscales: “pain” (score up to 90), “function” (score up to 90) and “activity limitation” (score up to 50). The total maximum score is 230. The FFI is designed to measure both current state, defined as the past week before taking the test, and change in status.

The FFI psychometric properties confirmed the relevance of validating it in the French language. In the original article [5], internal consistency evaluated by Cronbach’s alpha was reported at 0.9556 for the total score. Test-retest reliability evaluated by an Intraclass Correlation Coefficient (ICC) was also good at 0.87 (0.79–0.92) for the total score. A literature review dating from 2008 [3] allowed the confrontation of several tools to assess the rheumatoid foot and compare their psychometric properties. Among the different questionnaires evaluated, the FFI emerged as...
one of the best questionnaires and the only one where responsiveness to change was correct. A revised version of the FFI was also validated [6].

The use of FFI [7–12] in clinical practice makes it a reference tool. It is most often used as an evaluation tool for the rheumatoid foot and it is the questionnaire most used by AOFAS members [13]. Helliwell [14] used the FFI as a reference to develop a new evaluation scale to assess foot function in RA.

Furthermore, several validated translated versions of the FFI are now available in the Netherlands [15], Germany [13] and China [16].

Overall, we choose the FFI because of its validated use in assessing the rheumatoid foot, its solid psychometric properties and its simple administration, with the objective to provide physicians with a reference tool for French patients.

The objective of this work is the validation of the FFI in the French language.

2. Methods

2.1. Translation of the FFI and cultural adaptation

The translation of the FFI in French abided by the literature guidelines [17–20]. Step 1: translations of the FFI into French performed by two independent French native translators. Step 2: synthesis by both translators and an observer based on the two previous translations. Step 3: double translation/back translation in English of the French version of the FFI by two native English speakers, without any medical background and blinded from the original English version. Step 4: elaboration by a committee of three experts of a pre-final version. Step 5: validation test of the pre-final version on 10 patients.

2.2. French version of the Foot Function Index (FFI-F)

The validated FFI-F is a self-questionnaire made of 23 items scored from 0 to 10 on a numeric scale and spread out in three subscales: pain (out of 90), function (out of 90) and activity limitation (out of 50).

Looking at all the various published translations of the FFI [13,15,16], we noticed that most of these questionnaires included 18 items and not 23 as in the original questionnaire. This is due to the fact that the third domain related to activity limitations was taken off in several versions, because its reproducibility was deemed too low. We chose not to change the initial questionnaire by keeping the 23 items in order to be consistent in comparing our statistical results with those of the original questionnaire.

2.3. Patient cohort and validation procedure

The prospective validation was conducted on patients with RA who filled out the FFI-F questionnaire. These patients came from the Physical Medicine and Rehabilitation (PM&R) and rheumatology consultations as well as rheumatology hospitalization. Patients had validated RA according to the American College of Rheumatology (ACR) criteria [21] with or without foot affections and were able to understand and read French. The number of patients to be included was set to a minimum of 50, following the recommendations published by Terwee et al. [22] and in accordance with our recruitment abilities. Furthermore, the following data were collected: foot-related history and recent disease activity score (DAS) 28-C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). For each patient, the maximum walking perimeter was collected. During the consultation, the time needed to walk 10 m and 200 m was recorded. Each foot was examined: collecting deformations, painful joints, range of motion, and testing of ankle and foot muscles.

In order to evaluate the external validity of the questionnaire for each of the successive domains, each patient, aside from the FFI-F, also filled out a VAS for the pain on the day of the consultation and the previous week, the Health Assessment Questionnaire (HAQ) [23] and the main foot disability using the McMaster Toronto Arthritis (MACTAR) questionnaire [24].

The latter is also used to compensate for the limited evaluation of activity limitation in the third subscale of the FFI-F. This tool was initially validated and used to assess RA-related activity limitations. In our case, the question asked was: which is the main disability related to your rheumatoid feet?

The retest was performed at D15.

2.4. Statistical considerations

In addition to the usual descriptive statistical analyses, the following psychometric properties of the scale were explored:

- acceptability: data quality was deemed acceptable if less than 5% of data were missing. The range (minimum and maximum), mean (and associated standard deviation SD) and median, floor and ceiling thresholds (for both, the maximum accepted as 15%), and asymmetry in scores’ distribution (skewness and kurtosis measures, limits: from -1 to +1) were analyzed;
- internal consistency was evaluated with the Cronbach α coefficient (accepted minimal value: 0.70), the inter-item correlation coefficient (≥ 0.30) and the overlap (correlation between an item and its dimension, > 0.30) (data not shown here). Internal consistency was also determined by the correlation between the domains making up the scale (standard, 0.30 to 0.70) [25]. Construct validity of the FFI-F was explored using a principal component analysis (PCA). A factorial analysis (principal component analysis and varimax rotation) was conducted in order to determine the multi-dimension structure of the scale. PCA consists in replacing a family of variables by new variables with maximum variation, not correlated two by two and which are linear combinations of the original variables. These new variables, called principal. These new variables, called principal components, define factorial planes serving as a base for a graph representation of the initial variables. Thus, it is an approach designed to synthesize the data to study and visualize the correlations between variables (in this case FFI items) in order to explore the links between items and study their potential redundancy. The final number of factors selected, the part of data to be kept and the screen plot of eigenvalues were determined according to the eigenvalue-one criterion (Kaiser criterion);
- reproducibility: the intraclass correlation coefficient (random-effects model ICC) and the Lin’s Concordance Correlation Coefficient (CCC) were computed to determine the test-retest reliability. ICC and CCC values ≥ 0.70 were deemed satisfactory;
- regarding external consistency, relationships between the questionnaire score and the other measures (HAQ, MACTAR and VAS) were evaluated via the correlation coefficient (Pearson’s or Spearman’s according to the distribution of the parameters studied, P > 0.50);
- accuracy: for each domain, the standard error of the mean (SEM) was computed as such SEM = SD × √ (1-ICCrest-test). It is admitted that good accuracy is equivalent to SEM ≤ 1/2 (SD). Furthermore, the valued associated to the SDD (smallest detectable difference) for each domain was calculated from the reproducibility study allowing to evidence, for the 3 subscales of the FFI, an estimation of the variability of the measure and thus of the error;
following the exhaustive analysis of the published studies [26–29], it seems that no method, related to the sensitivity of a measure, has been validated in the scientific world. In this study, the responsiveness to change was evaluated by paired samples’ tests (Student’s t-test or Wilcoxon signed-rank test, if the conditions of the t-test were not respected) in order to study the evolution of the parameters associated to the HAG, and VAS (day and week) and the FFI domains on the study population.

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2.5. Ethics

The protocol, the information sheet as well as the case report form were submitted to the Ethics Committee of the Clinical Investigation Centers of the Inner region Rhône Alpes Auvergne. The Ethics Committee gave its approval on 12/15/2011. A signed written consent form was collected from patients before study inclusion. The study was conducted according to good clinical practices and the declaration of Helsinki.

3. Results

3.1. Translation and cultural adaptation

Cultural adaptations were necessary. The main one concerned the evaluation of the gait perimeter. The notion of “blocks” was not used in France to evaluate distance. After research, 200 m was equivalent to one block thus we adapted the translation “four blocks” by using 800m. FFI-F was read by 10 patients who did not find it necessary to change that version.

3.2. Descriptive analysis

Prospective validation was conducted on 53 patients with RA who filled out the FFI-F. The cohort included 39 women and 14 men aged 17 to 78 years. Median disease progression time was 14 years (interquartile range IQR 5–23). Thirty-four patients were unemployed. Only 14 patients had seen a podiatrist before the beginning of the disease. Thirty-four had foot orthosis and 7 had custom-made therapeutic footwear. Two patients had previous foot surgery. The total of the scores obtained for each questionnaire is listed in Table 1.

Table 1

| Age (years); m (±SD) | 60 (±12) |
| Pathology duration years; median [interquartile interval] | 39 (73.6) |
| Working patients; n (%) | 19 (35.8) |
| Podiatric care; n (%) | 13 (24.5) |
| Foot orthosis; n (%) | 34 (64.1) |
| Custom-made therapeutic shoes; n (%) | 7 (13.2) |
| Foot surgery; n | 2 |
| DAS28 ESR; m (±SD) | 2.65 (±1.5) |
| DAS28 CRP; m (±SD) | 2.75 (±1.6) |
| 200 m walking test (seconds); m (±SD) | 141 (±27.3) |
| 10 m walking test (meters/seconds); m (±SD) | 1.36 (±0.46) |
| Maximal walking distance (meters); m (±SD) | 2873 (±3323) |
| VAS pain on the day of inclusion; m (±SD) | 34.4 (±26.8) |
| VAS pain in the past last week; m (±SD) | 35.3 (±25.6) |
| HAQ; m (±SD) | 1.22 (±0.93) |
| MACTAR; m (±SD) | 5.28 (±3.04) |

m: mean; SD: standard deviation; n: number.

3.3. Acceptability

The quality and acceptability of the FFI-F data are detailed in Table 2.

The time needed to complete the FFI-F was under 10 minutes for the entire population. The only recurring difficulty seems to be to fill-out the questionnaires pertaining to the VAS, the use of this tool remains complicated for older patients.

3.3.1. Principal component analysis

The FFI-F construct validity was assessed with the principal component analysis (PCA) allowing the identification of 4 factors (Fig. 1) explaining 85% of the initial variance. The first component was associated with the intensity of the responses (all contributions were positive and in the same order of magnitude) regardless of the dimension studied and thus could not help differentiate the 3 domains studied by the scale. Component 2 characterized items 1 to 9 corresponding to pain assessment (strong negative contributions) items 19 to 23 were used to evaluate activity limitation (strong positive contributions). Items 22 and 23 were the only ones well represented in the third component. Component 4 differentiated items 10 to 18 related to disability (strong negative contributions) from other items. The first dimension of the PCA was related to 66% of the initial information, the second dimension was related to 9% of the information, meaning 75% for the first factorial axis.

3.4. Internal consistency

Cronbach’s alpha was at 0.97 for FFI-F Pain, 0.97 for FFI-F function and 0.85 for FFI-F activity limitation. The ITCC ranged from 0.71 to 0.95 according to the items. These results are listed in Table 4.

The internal consistency analysis was completed by the calculation of the correlation between the domains making up the scale. The inter-item correlation and the item-dimension correlation were excellent except for the last domain (from 0.57 to 0.96 for the 1st domain; from 0.69 to 0.99 for the 2nd domain and from 0.28 to 0.89 for the 3rd domain) and mainly pertaining to the last question. Regarding correlations between domains we found a Pearson’s r of 0.94 for the correlation between total FFI-F and FFI-F pain; 0.97 for the correlation FFI-F total and FFI-F function; 0.84 for the correlation between FFI-F total and activity limitation; 0.86 for the correlation between FFI-F pain and FFI-F function; 0.67 for the correlation between FFI-F pain and FFI-F function and 0.78 for the correlation between FFI-F function and activity limitation.

3.5. Reproducibility

Lin concordance coefficient was: 0.90 for total FFI-F, 0.87 for FFI-F pain, 0.89 for FFI-F function and finally 0.56 for FFI-F activity limitation. The numbers obtained for ICC were similar. Exhaustive results for each item are listed in Table 3.

3.6. External validity

External validity was evaluated by calculating a correlation coefficient between FFI-F and other questionnaires (Table 4). Total FFI-F was well correlated to VAS, HAQ and MACTAR (correlation coefficient > 0.5). It is important to note that FFI-F activity limitation was not as well correlated to VAS and HAQ and was poorly correlated to MACTAR (correlation coefficient of 0.39). Walking speed (10 m and 200 m tests) was not correlated to FFI-F. There was a reverse correlation between gait perimeter and FFI-F. Regarding the inflammatory status of the RA, its correlation to FFI-F varied.
Table 2
Quality and acceptability of FFI-F data.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>Floor effect %</th>
<th>Ceiling effect %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>49</td>
<td>99.36</td>
<td>61.49</td>
<td>-0.23</td>
<td>1.77</td>
<td>115</td>
<td>0</td>
<td>208</td>
<td>8.26</td>
<td>2.04</td>
</tr>
<tr>
<td>Pain</td>
<td>53</td>
<td>43.45</td>
<td>25.45</td>
<td>-0.28</td>
<td>1.50</td>
<td>46.29</td>
<td>0</td>
<td>90</td>
<td>9.43</td>
<td>1.89</td>
</tr>
<tr>
<td>Function</td>
<td>51</td>
<td>43.22</td>
<td>27.24</td>
<td>-0.33</td>
<td>1.72</td>
<td>50</td>
<td>0</td>
<td>88</td>
<td>9.80</td>
<td>1.96</td>
</tr>
<tr>
<td>Activity limitation</td>
<td>51</td>
<td>12.87</td>
<td>12.35</td>
<td>0.69</td>
<td>2.22</td>
<td>9</td>
<td>0</td>
<td>41</td>
<td>17.65</td>
<td>1.96</td>
</tr>
</tbody>
</table>

SD: standard deviation; Min: minimum value; Max: maximum value.

3.7. Accuracy

Data regarding accuracy study are presented in Table 5 (including ICC and SEM). SEM (standard error of the mean) was lower than SD/2 for the total FFI score and the pain and function domains. For the activity limitation domain, SEM was at 8.2 and SD/2 at 6.2.

3.8. Sensibility to change

The evolution of parameters associated with HAQ, and VAS (day and week) and FFI dimension were then analyzed on the study population. Thus, HAQ varied from 1.22 (0.93) to 1.28 (0.88) (delta: −0.06 [−0.18–0.06], P = 0.30). VAS scales varied from 34.1 (26.9) to 35.8 (23.9) for VAS day (delta: −1.74 [−7.20–3.72], P = 0.53) and 34.39 (25.71) to 37.08 (26.54) for VAS week (delta: −2.69 [−7.39–2.01], P = 0.25). FFI domains did not vary in a statistically significant manner between the two different evaluation times: pain (−3.46 [−6.97–0.04], P = 0.06), function (−0.70 [−4.40–3.00], P = 0.70) and activity limitation (−2.40 [−5.91–1.11], P = 0.17).

4. Discussion

Originally, the FFI questionnaire was one of the first validated questionnaires to evaluate the rheumatoid foot through different dimensions. It is a self-questionnaire with a short administration time making it easy to use in daily practice. It is easy to fill-out. Its validity of use makes it a reference tool as validated by many studies that used FFI as well as its translation in several languages [13,15,16]. During the translation stage, only one cultural adaptation was necessary regarding distance evaluation represented in the English version by “four blocks”. We then chose to use a numeric scale from 0 to 10 with numbers to circle (to score each item) to improve patients’ comprehension and facilitate data analysis.

According to the statistical analysis performed, FFI-F is a validated tool. Its metrological properties are correct and its acceptability is satisfactory. Of note, there is a limited ceiling effect for the third domain activity limitation (ceiling effect at 17.65% > 15%) in accordance with the numerous negative answers from the patients interviewed.

The Principal Component Analysis (PCA) shows an excellent repartition of the domains. The PCA was considered in order to explore the internal structure of the FFI. The first dimension can characterize patients with a high global FFI score (domains positively correlated to one another, with a moderate to strong correlation). The second component can help differentiate the 3 domains of the FFI, the items from a same domain were more closely related together than with items from other domains.

FFI-F has an excellent internal consistency as validated by Cronbach’s alpha close to 1. It is not as good for the third domain,
### Table 3
Internal consistency and test-retest reproducibility.

<table>
<thead>
<tr>
<th></th>
<th>(Internal consistency α) ITCC</th>
<th>Lin concordance coefficient (95% IC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>NA</td>
<td>0.90 (0.85–0.95)</td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td>(0.97)</td>
<td>0.87 (0.80–0.93)</td>
</tr>
<tr>
<td>Q 1</td>
<td>0.86</td>
<td>0.89 (0.75–0.92)</td>
</tr>
<tr>
<td>Q 2</td>
<td>0.89</td>
<td>0.89 (0.70–0.90)</td>
</tr>
<tr>
<td>Q 3</td>
<td>0.93</td>
<td>0.88 (0.82–0.94)</td>
</tr>
<tr>
<td>Q 4</td>
<td>0.93</td>
<td>0.85 (0.78–0.93)</td>
</tr>
<tr>
<td>Q 5</td>
<td>0.95</td>
<td>0.86 (0.79–0.93)</td>
</tr>
<tr>
<td>Q 6</td>
<td>0.94</td>
<td>0.85 (0.78–0.93)</td>
</tr>
<tr>
<td>Q 7</td>
<td>0.86</td>
<td>0.81 (0.60–0.92)</td>
</tr>
<tr>
<td>Q 8</td>
<td>0.87</td>
<td>0.80 (0.68–0.92)</td>
</tr>
<tr>
<td>Q 9</td>
<td>0.95</td>
<td>0.80 (0.70–0.90)</td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td>(0.97)</td>
<td>0.89 (0.82–0.95)</td>
</tr>
<tr>
<td>Q 10</td>
<td>0.88</td>
<td>0.83 (0.75–0.92)</td>
</tr>
<tr>
<td>Q 11</td>
<td>0.93</td>
<td>0.82 (0.73–0.91)</td>
</tr>
<tr>
<td>Q 12</td>
<td>0.89</td>
<td>0.75 (0.63–0.87)</td>
</tr>
<tr>
<td>Q 13</td>
<td>0.94</td>
<td>0.84 (0.75–0.92)</td>
</tr>
<tr>
<td>Q 14</td>
<td>0.95</td>
<td>0.85 (0.77–0.93)</td>
</tr>
<tr>
<td>Q 15</td>
<td>0.85</td>
<td>0.83 (0.77–0.93)</td>
</tr>
<tr>
<td>Q 16</td>
<td>0.91</td>
<td>0.87 (0.81–0.94)</td>
</tr>
<tr>
<td>Q 17</td>
<td>0.92</td>
<td>0.87 (0.81–0.94)</td>
</tr>
<tr>
<td>Q 18</td>
<td>0.93</td>
<td>0.80 (0.70–0.90)</td>
</tr>
<tr>
<td><strong>Activity limitation</strong></td>
<td>(0.85)</td>
<td>0.56 (0.37–0.75)</td>
</tr>
<tr>
<td>Q 19</td>
<td>0.89</td>
<td>0.60 (0.42–0.77)</td>
</tr>
<tr>
<td>Q 20</td>
<td>0.77</td>
<td>0.56 (0.38–0.74)</td>
</tr>
<tr>
<td>Q 21</td>
<td>0.82</td>
<td>0.67 (0.52–0.83)</td>
</tr>
<tr>
<td>Q 22</td>
<td>0.78</td>
<td>0.44 (0.22–0.65)*</td>
</tr>
<tr>
<td>Q 23</td>
<td>0.71</td>
<td>0.52 (0.31–0.72)</td>
</tr>
</tbody>
</table>

ICC: Intraclass Correlation Coefficient.

* Positive answer = 0 or > 0: test-retest reproducibility kappa: 0.53 (P < 0.001).

* Positive answer = 0 or > 0: test-retest reproducibility kappa: 0.52 (P < 0.001).

Since the population studied used few gait-related technical aids and the negative results were often collected for these items. Correlation coefficient between these different domains are good, the weakest was the correlation coefficient FFI-F pain and FFI-F activity limitation. This element can be explained by the fact that disability in RA is not only related to pain. The test-retest reproducibility is good since the concordance correlation coefficient is excellent. Regarding external validity, the correlation VAS pain and total FFI is correct. However, we note a weaker correlation with the third domain, which can be explained by the fact that pain is not the sole etiology in activity limitations. We find also a good correlation between total FFI-F and HAQ. We note that patients with a low HAQ sometimes have a high FFI-F > 80/230. FFI-F could underline a foot-related disability not previously evidenced by the HAQ (questionnaire with no foot-specific item). Finally, FFI-F was well correlated to the MACTAR and this, regardless of the item positioned as the main disability on the 3 answers.

The study’s cohort sample was quite varied as shown by the descriptive analysis. The age range was wide and women were predominant. The results of the FFI, VAS foot pain and HAQ covered a wide range of individuals. Mean total FFI-F was 99.36/230 with a minimum at 0/230 and a maximum at 208/230. Those were patients with moderate pain since the mean VAS was 34.43 (±26.78). In the original article [5], the mean total FFI was only 28.09 with a maximum value at 77.67 reflect data from a population where patients were less bothered by their feet than our sample. This element reinforces the weight of our results since our sample was even larger than the one from the original validation study. The FFI-F enables to evaluate in a satisfactory manner the rheumatoid foot, regardless of the disease progression. We also find similar values for the internal consistency and test-retest (ICC), external validity is good in both cases, without being able to precisely compare the results since the reference tools used were different. Furthermore, the different statistical results obtained in our study are highly similar to the other validations of FFI translations [13,15,16].

No correlation between the FFI-F and walking tests was highlighted. The 10 m and 200 m tests, objective gait speed measures, evaluate gait more in terms of performance, which probably does not reflect the functional gait of patients with RA. The absence of correlation between FFI and the 10 m walking test was already validated [30], authors attributed it to patients’ progressive adaptation to their disease. However, the gait perimeter is conversely correlated to FFI-F. Gait perimeter, measured on a declaratory mode, is a relevant tool to assess the real gait capacities of patients with RA.

It is admitted that good accuracy is equivalent to SEM ≤ 1/2 (SD) thus total FFI, FFI pain, FFI function have a good accuracy which is not the case for the last domain of the questionnaire, since it is mixed and thus more influenced by other elements than foot pain.

If we focus on study limitations, one could wonder if the population studied included extreme clinical types (linked to recruitment), which could have been a source of bias. In fact, the wide range of answers can validate the diversity of this population, thus avoiding for the study to focus only on one category of patients followed at the hospital.

Furthermore, FFI was criticized because of its lack of analysis pertaining to activity limitations [31] This questionnaire, made of 3 subscales, explores thoroughly the impairments while focusing on pain evaluation, function – thanks to the evaluation of the consequences of gait impairments and going up and down the stairs for example – but it is less relevant for evaluating activity limitations. The third domain is a partial vision of activity limitations, which includes several dimensions: the impact on work, psychological status, social status, and activities of daily living. We could argue the choice of FFI versus the FFI-R [6] published at a later date. The latter is a revised version of the FFI designed to better account for the different domains of the International Classification of Functioning, Disability and Health (ICF); especially activity limitation while asking questions related to psychosocial consequences. Its use is limited by its length since it includes more than 50 items. There is a shorter version of the FFI-R but its statistical analysis is being debated. Nowadays, the FFI seems more adapted, even if the third domain explores, in a limited

### Table 4
Convergent validity: correlation (Pearson or Spearman if necessary).

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Pain</th>
<th>Function</th>
<th>Activity limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS Pain upon inclusion</td>
<td>0.73</td>
<td>0.73</td>
<td>0.68</td>
<td>0.57</td>
</tr>
<tr>
<td>VAS pain in the past week</td>
<td>0.69</td>
<td>0.71</td>
<td>0.62</td>
<td>0.55</td>
</tr>
<tr>
<td>HAQ</td>
<td>0.73</td>
<td>0.66</td>
<td>0.75</td>
<td>0.59</td>
</tr>
<tr>
<td>MACTAR</td>
<td>0.71</td>
<td>0.71</td>
<td>0.64</td>
<td>0.39</td>
</tr>
<tr>
<td>MACTAR (1st item)</td>
<td>0.70</td>
<td>0.73</td>
<td>0.64</td>
<td>0.37</td>
</tr>
<tr>
<td>DAS28 ESR</td>
<td>0.46</td>
<td>0.45</td>
<td>0.54</td>
<td>0.16</td>
</tr>
<tr>
<td>DAS28 CRP</td>
<td>0.54</td>
<td>0.54</td>
<td>0.59</td>
<td>0.21</td>
</tr>
<tr>
<td>200m test</td>
<td>0.39</td>
<td>0.34</td>
<td>0.42</td>
<td>0.23</td>
</tr>
<tr>
<td>10m test</td>
<td>–0.40</td>
<td>–0.29</td>
<td>–0.43</td>
<td>–0.40</td>
</tr>
<tr>
<td>Gait perimeter</td>
<td>–0.48</td>
<td>–0.45</td>
<td>–0.48</td>
<td>–0.38</td>
</tr>
</tbody>
</table>

* P > 0.05.
manner, activity limitations, the statistical analysis still underlines a correct correlation between FFI-F and MACTAR and the activity limitation domain of the FFI. This can be explained by the fact that FFI-F is a generic tool compared to the MACTAR which is a specific one. A specific foot-adapted MACTAR might be the right tool to use to evaluate activity limitation in addition to the FFI-F. Using both tools concomitantly, we could have an evaluation tool for the rheumatoid foot that would cover a larger range of concepts and quality of life.

Finally, as it was underlined in the validation of the initial scale, the internal consistency study and PCA show a possible redundancy of questions since the results are so high, validated by the excellent correlations between the 3 domains, which are meant to explore different correlations. Along that line, our results are similar to those of the original validation of the initial study, with also the same drawbacks.

This study leads to several perspectives regarding this evaluation tool for the rheumatoid foot. This questionnaire could be used in clinical practice during consultations for foot-related RA and in clinical trials.

This type of cultural adaptation could help develop cross-sectional studies to evaluate targeted therapeutics for the rheumatoid foot.

5. Conclusion

This study led to a culturally acceptable version of the Foot Function Index-French (FFI-F) evaluation tool that can be used in daily practice or research, for French-speaking patients with rheumatoid arthritis affecting their feet. A rigorous methodology enabled to validate the translation of the FFI in terms of internal consistency and external validity. Results from the different statistical analyses are for the most part comparable with those of the original study and the other translations published.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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Audrey Pourtier (AP), Judith Barnoin (JB) and Justin McIntyre (JMI).

Appendix 1. French translation of the FFI

Traduction française de l’Indice fonctionnel du pied (FFI-F)
Ce questionnaire a été conçu afin de donner à votre médecin des informations sur la façon dont votre douleur aux pieds modifie votre vie quotidienne. Merci de bien vouloir répondre aux questions suivantes. Nous souhaitons que pour chacune des questions suivantes, vous évaluez sur une échelle de 0 à 10 ce qui décrit le mieux l’état de vos pieds durant la semaine dernière.
Lisez chaque question s’il vous plaît et entourez un chiffre correspondant de 0 à 10.

Échelle de la douleur : Quelle était l’intensité de votre douleur aux pieds ?
- De 0 (aucune douleur) à 10 (pire douleur imaginable)
- Q1 Lorsqu’elle était la pire ?
- Q2 Le matin au réveil ?
- Q3 Lorsque vous marchiez pieds nus ?
- Q4 Lorsque vous restiez debout pieds nus ?

Q5 Lorsque vous marchiez avec des chaussures ?
Q6 Lorsque vous restiez debout avec des chaussures ?
Q7 Lorsque vous marchiez avec des semelles orthopédiques ?
Q8 Lorsque vous restiez debout avec des semelles orthopédiques ?
Q9 À la fin de la journée ?

Échelle de fonction : Quel degré de difficulté aviez-vous pour ? :
- De 0 (aucune difficulté) à 10 (si difficile qu’impossible seul ou nécessaire de l’aide)
- Q10 Marcher lorsque vous étiez au domicile ?
- Q11 Marcher dehors ?
- Q12 Marcher 800 m ?
- Q13 Monter les escaliers ?
- Q14 Descendre les escaliers ?
- Q15 Rester sur la pointe des pieds ?
- Q16 Vous lever d’une chaise ?
- Q17 Monter sur un trottoir ?
- Q18 Marcher vite ?

Échelle des activités limitées: Dans quelle mesure étiez vous le contraire de ? :
- De 0 (pas de contrainte) à 10 (contrainte maximale ou telle que nécessaire de l’aide)
- Q19 Rester toute la journée chez vous à cause de vos pieds ?
- Q20 Rester allongé à cause de vos pieds ?
- Q21 Limiter vos activités à cause de vos pieds ?
- Q22 Utiliser une aide de marche (canne, déambulateur, béquilles…) à l’intérieur ?
- Q23 Utiliser une aide de marche (canne, déambulateur, béquilles…) à l’extérieur ?
A remplir par le médecin
Score : /230 à rapporter à 100

References


Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007;60:34–42.


