



Transcultural adaptation and validation of the Spanish version of the Identification of Functional Ankle Instability (IdFAI-Sp)

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Clinical implications

1. The Spanish-language version of the Identification of Functional Ankle Instability questionnaire (IdFAI-Sp) is a valid and reliable tool.
2. The IdFAI-Sp enables researchers and healthcare professionals to identify and classify chronic ankle instability among Spanish-speaking patients.
3. Accordingly, it can be considered a useful clinical instrument.
4. Application of the questionnaire before and after treatment can reveal the patient's degree of recovery over time.

For Peer Review

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3 **Transcultural adaptation and validation of the Spanish version of the**
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5 **Identification of Functional Ankle Instability (IdFAI-Sp)**
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Abstract

Objective. The study aim was to cross-culturally adapt the Identification of Functional Ankle Instability (IdFAI) into a Spanish-language version (IdFAI-Sp), which would then be validated and its psychometric properties evaluated for use in possible cases of ankle instability.

Methods. The cross-cultural adaptation was performed following the guidelines of the International Society for Pharmacoeconomics and Outcomes Research. Pearson correlations were calculated to assess the convergent validity between IdFAI and the Cumberland Ankle Instability Tool. Cronbach's alpha and test re-test reliability values were calculated and floor/ceiling effects analysed. Construct validity was assessed by confirmatory factor analysis (CFA).

Results. The study population was composed of 110 participants, with a mean age of 40.49 years (10.43) and of whom 62 (56.36%) were female. Good test-retest results were obtained, with an intraclass correlation coefficient of 0.85 (ICC_{2,1}: 95% CI: 0.82 - 0.88). The structure matrix was examined by CFA, which revealed a three-factor solution that accounted for 79.89% of the variance. The IdFAI-Sp obtained an excellent fit (RMSEA 0.068, GFI 0.94, CFI 0.98 and NFI 0.97).

Conclusions: This study validates the IdFAI-Sp questionnaire, corroborating its value to researchers and medical professionals as a self-reported outcomes measure for use with a Spanish-speaking population.

Key words: Ankle instability, Reliability, Self-reported, Validity.

Introduction

Lateral ankle sprain is one of the most common pathologies of the foot, affecting [1], approximately half of whom report mobility problems, recurrent sprains, pain and residual swelling for 6-8 months after injury, while over 40% develop chronic ankle instability (CAI) [2,3]. The most characteristic symptom reported by patients with CAI is the sensation of the ankle “giving way” [4].

Diagnostic support can be obtained by means of self-administered questionnaires [5] such as the Cumberland Ankle Instability Tool (CAIT) [6], the Chronic Ankle Instability Scale (CAIS) [7], the Ankle Instability Instrument (AII) [8] and the Identification of Functional Ankle Instability (IdFAI) [4]. In particular, the CAIT is the questionnaire with the most cross-cultural adaptations to different languages [7], obtaining good psychometric properties in them, in the case of the Spanish version of the CAIT with a Cronbach's alpha of 0.84, an ICC of 0.95 and a solution of 3 factors [9,10].

The IdFAI questionnaire was developed specifically to detect the presence of CAI and to classify patients in this respect [11]. This instrument combines elements of the CAIT and the AII, providing better characterisation, greater simplicity and more efficient administration [4].

The IdFAI is a patient-reported outcome measure that was originally developed by Donahue et al. [11] for English-speaking patients. It provides good reliability and validity and, with just ten items, is very easy to use. The IdFAI has been translated into Persian [12], Chinese [13], Japanese [14], Korean [15] Brazilian-Portuguese [16] and Turkish [17] but not into Spanish or validated for use with a Spanish-speaking population.

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3 Accordingly, the main aim of our study is to conduct a cross-cultural adaptation into
4 Spanish of the IdFAI questionnaire and to validate and analyse its psychometric
5 properties for use by Spanish-speaking patients with a history of acute or chronic ankle
6 sprain and instability.
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15 **Material and Methods**

16 *Ethical approval*

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18 This study was performed in accordance with the Declaration of Helsinki and all
19 applicable legislation on ethical standards for human experimentation. It was approved
20 by the Ethics Committee of the University of Malaga (CEUMA 88-2019-H). All
21 participants provided signed informed consent.
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30 *Translation and cross-cultural adaptation*

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32 Permission was obtained from the authors of the original version to translate the IdFAI
33 questionnaire. The cross-cultural translation into Spanish was performed in accordance
34 with the guidelines of the International Society for Pharmacoeconomics and Outcomes
35 Research (ISPOR) [18] and was composed of the following stages.
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- 43 (1) A forward translation was performed by two bilingual Spanish translators working
44 independently.
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- 46 (2) The resulting translations were then reconciled by consensus between the two
47 translators.
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- 49 (3) The reconciled Spanish version was back-translated into English by two bilingual
50 English translators, who were blinded to the original version.
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- 52 (4) The back-translations were reviewed by the project leader to remove any
53 discrepancies in meaning or terminology.
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3 (5) Three translators and a group of Spanish podiatrists then conducted the
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5 'harmonisation' stage of the process, to check that the Spanish-language translations
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7 were comprehensive and cross-culturally equivalent to the original version, after
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9 which a final Spanish version was developed for field testing.
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12 (6) This final version was pre-tested for comprehensibility. Ten native speakers of
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14 Spanish were asked to confirm that they understood the questionnaire items and to
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16 identify any problems with the language used.
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19 (7) The project leader independently corrected the final translation to ensure it
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21 contained no errors.
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24 (8) Finally, a test reading was performed, and the Flesch Kincaid Grade Level and the
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26 Flesch Reading Ease tests were performed to assess the readability of the
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28 questionnaire [19,20]. These are two tools that measure the level of readability of
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30 the text, assessing whether the questionnaire is an effective tool at the
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32 communication level.
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36 The above process is illustrated in the flowchart presented in Image 1. The final
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38 Spanish-language translation of the IdFAI was then cross-culturally adapted and
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40 validated.
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43 *Participants*

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45 All participants were recruited at a private podiatry clinic in Malaga (Spain), from
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47 November 2019 to January 2020. All participants met the following inclusion criteria:
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49 aged at least 18 years, able to walk normally, history of ankle instability with or without
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51 a history of ankle sprain, native speaker of Spanish. Any patients who had undergone
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53 foot or ankle surgery in the last six months, or were unable to read proficiently, were
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55 excluded from the study.
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3 A total of 110 patients were included in the final analysis, and 220 questionnaires were
4 completed (110 for each ankle). The participants' average age was 40.49 (18-70) years;
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6 43.6% were female and 56.4% were male. Their mean body mass index (BMI) was
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8 24.99 kg/cm² (Table 1).
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10 11 12 *Data collection*

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15 Data collection was performed by 2 researchers and scores were blinded. All
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17 participants were informed about the procedure and aims of the study and gave signed
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19 informed consent to take part. The data collected for each participant were age, gender,
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21 height and weight. All participants completed the Spanish-language versions of the
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23 CAIT and the IdFAI, with respect to both ankles in every case.
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27 The CAIT is a questionnaire that assesses the patient's level of CAI. It is composed of
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29 nine items, each with various answer options. The total score obtained is scored on a
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31 scale ranging from 0 to 30, where 30 represents 'normal' stability and 0, severe
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33 instability with a cut-off score ≤ 24 . The original English version [6] has been cross-
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35 culturally adapted into Brazilian-Portuguese [21], Spanish [9], Korean [22], Persian
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37 [23], Japanese [24], Dutch [25] and Arabic [26].
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41 The IdFAI is used to assess whether a patient has CAI. The questionnaire is composed
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43 of ten items, each with various response options. The total score obtained is scored on a
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45 scale ranging from 0 to 37, where a score of 0 corresponds to 'correct' ankle stability
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47 and 37, to severe instability. A total score of ≤ 10 is interpreted as meaning CAI is
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49 unlikely, and one of ≥ 11 indicates its probable presence. The IdFAI instrument has been
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51 cross-culturally adapted into Brazilian-Portuguese [16], Korean [15], Japanese [14],
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53 Chinese [13], Persian [12] and Turkish [17].
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58 *Statistical analysis*

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3 All statistical analyses were performed with SPSS v.25.0. Statistics and SPSS Amos 26
4 statistical software (IBM, International Business Machines Corporation, EE.UU.). The
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6 Kolmogorov-Smormov test was used to determine the normality of distributions. Mean
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8 values, standard deviations and relative and absolute frequencies were obtained for all
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12 descriptive statistics.

13 14 15 *Construct validity*

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18 In every case, construct validity was evaluated by exploratory factorial analysis, and a
19
20 confirmatory factorial analysis (CFA) was performed to assess factor structure [27]. The
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22 model was fitted using the following parameters: the chi square/df function, for which a
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24 value of <3 was considered indicative of good fit; the root mean square error of
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26 approximation (RMSEA) and 90% confidence intervals, for which a value of 0.05-0.07
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28 was considered acceptable; the Comparative Fit Index (CFI); the Goodness of Fit Index
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30 (GFI); and the Normed Fit Index (NFI). For each of these indices, a value of 0.90 was
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32 considered indicative of good fit.
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36 37 *Discriminatory power*

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39 Discriminant validity (i.e., the cutoff score for IdFAI-Spain) was assessed according to
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41 the receiver operating characteristic (ROC) curve and the area under the curve (AUC)
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43 [28]. The cutoff point, representing the strongest discrimination between patients with
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45 and without ankle instability, is located in the top left of the graph, this point is
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47 confirmed/supported calculating the Youden Index to select the optimal cut-off value.
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51 52 *Test-retest validity*

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54 Test-retest reliability was evaluated using **intraclass correlation coefficients (ICC_{2,1})**.
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56 The Spanish version of the IdFAI was administered twice by the same observer, at an
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58 interval of seven days. **An ICC_{2,1}** value >0.7 was classed as “excellent”, 0.60-0.74 as
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3 , “good”, 0.40-0.59 as “fair” and <0.40 as “poor” [27]. The absolute reliability of IdFAI-
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5 Sp was evaluated according to the standard error of measurement (SEM) and the
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7 minimal detectable change (MDC) [29,30].
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9 10 *Internal consistency*

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13 Internal consistency was assessed using Cronbach’s alpha. Values >0.7 were considered
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15 to indicate ‘fair’ internal consistency, with <0.8 rated ‘good and >0.9 ‘excellent’ [30].
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18 *Convergent validity*

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21 The convergent validity between the Spanish version of the IdFAI questionnaire and the
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23 CAIT was measured by reference to the corresponding Pearson’s correlations.
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25 Coefficients <0.30, <0.60 and ≥ 0.60 were considered to indicate poor, moderate and
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27 strong correlations, respectively [31].
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30 *Floor and ceiling effects*

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33 The IdFAI-Sp was considered to present floor and ceiling effects if >15% of the
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35 participants obtained the minimum and maximum possible score, respectively, in their
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37 responses to the questionnaire [30].
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44 **Results**

45 46 *Cross-cultural adaptation*

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49 The IdFAI questionnaire was translated and cross-culturally adapted into Spanish. In the
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51 pilot study phase, all participants understood each of the questionnaire items; no
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53 discrepancies were reported and no assistance was required from the observer for their
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55 interpretation.
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58 59 *Readability*

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3 The IdFAI-Sp produced a maximum response range, without help from the
4 administrator, and the time required for complete implementation was 4-5 minutes. The
5
6 Flesch Reading Ease test and Flesch Kincaid Grade Level results were 18.3 and 12.9,
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8 respectively.
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10 11 12 *Construct validity*

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15 In our exploratory factor analysis, the results obtained by the Kaiser-Meyer-Olkin test
16 (0.842) and Bartlett's test of sphericity (765.69) ($p < 0.001$) showed that the correlation
17 matrix for validity IdFAI-Sp was correct. This analysis produced a three-factor solution,
18 as shown in the scree plot graph (Image 2), which explained 79.89% of total variance.
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20 The questionnaire items were grouped into three factors: Factor 1, information about the
21 ankle sprain and its degree of instability (items 1, 2, 5, 7, 8); Factor 2, information on
22 the impact of instability on activities of daily life and sports (items 6, 9, 10); Factor 3,
23 information on the severity of the sprain (items 3, 4).
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34 **CFA** produced the following results: relative chi-square (χ^2/df ; 52.72/26, $p < 0.001$),
35 RMSEA 0.068, CFI 0.98, GFI 0.94 and NFI 0.97. These findings show that the model
36 presents excellent goodness of fit and complies with multinormality criteria (Image 3).
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41 42 *Discriminatory power*

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45 The discrimination score in the ROC curve (≥ 10.5 points) shows that the model can be
46 used to identify patients with ankle instability (AUC=0.84, $p < 0.001$) (Image 4). The
47 maximum Youden's Index related was 0.85 and the cut-off was 10.5, which indicates
48 that patients who obtain a score greater or equal to 10.5 have a diagnosis of ankle
49 instability.
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55 56 57 *Test-retest validity*

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3 The IdFAI-Sp version showed good test-retest reliability, with a global ICC_{2,1} of 0.85
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5 (95% CI; 0.82 to 0.88). The SEM and MDC were 2.31 and 6.4, respectively.
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8 *Internal consistency*

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11 The IdFAI-Sp version showed good internal consistency, with a Cronbach's alpha result
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13 of 0.86.
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15 *Convergent validity*

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19 The Pearson's correlation coefficient between the IdFAI-Sp and the Spanish version of
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21 the CAIT was -0.715 (p<0.001). The mean score was 6.37 (SD: 8.16) and the item-total
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23 correlation was >0.70 for every item.
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25 *Floor and ceiling effects*

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29 No ceiling effect (5.5%) or floor effect (3.4%) was found in the IdFAI-Sp total score.
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31 The threshold of 15% was not exceeded in any case.
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34 **Discussion**

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39 This paper analyses a transcultural adaptation into Spanish of the IdFAI questionnaire,
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41 intended to provide healthcare professionals with a valid, reliable means of assessing
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43 ankle instability. Our results show that the version obtained is suitable for use by
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45 clinicians in Spain.
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50 The results obtained for the psychometric properties of the questionnaire corroborate its
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52 validity and reliability and are consistent with those obtained for the original version [4]
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54 and for the transcultural adaptations into Korean [15], Japanese [14], Chinese [13],
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56 Brazilian-Portuguese [16], Persian [12] and Turkish [17]. In the exploratory factor
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58 analysis of the Spanish version, a three-factor solution accounted for 79.89% of the total
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3 variance, a result similar to that obtained for the original version (77.4%). However, it
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5 differed from those obtained for the Japanese and Korean versions, which obtained a
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7 single-factor solution, and the Turkish version obtained a two-factor solution.
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10 Our factor analysis showed that the items comprising the three-factor solution of IdFAI-
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12 Sp vary from those within the factors of the original version [4] and of the Brazilian
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14 [16] and Persian [12] adaptations, and differ completely from the Japanese [14] and
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16 Korean [15] versions, which only identify one factor. The three-factor solution obtained
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18 by our exploratory factor analysis presents three dimensions: the “degree of instability”,
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20 reflected by items 1, 2, 5, 7 and 8; the “activities of daily life and sports”, reflected by
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22 items 6, 9 and 10; and the “severity of the sprain”, reflected by items 3 and 4.
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27 As suggested by Terwee et al. [30], a CFA was conducted to determine the structural
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29 validity of the model and to calculate the level of confidence. This approach contrasted
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31 with that adopted for previous adaptations of the IdFAI, among which only the Persian-
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33 language version [12] included the performance of a CFA, and in this case the factors
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35 were composed of different items. The CFA results obtained for the IdFAI-Sp confirm
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37 our original 10-item model, with an excellent fit between the data structure and the
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39 measurement model (RMSEA =0.68, 90% CI; CFI = 0.98; NFI = 0.97; GFI = 0.94).
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41 Moreover, the fit obtained for the three-factor model is better than that recorded for the
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43 Persian-language version [12], which uses the factor distribution given by the authors of
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45 the original version [4].
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50 Good internal consistency was observed in the IdFAI-Sp adaptation, with a Cronbach’s
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52 alpha of 0.86, which is a similar result to those obtained for the Korean, Japanese,
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54 Chinese, Brazilian-Portuguese, Persian and Turkish versions (0.89, 0.87, 0.89, 0.87,
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56 0.95 and 0.79, respectively). In the analysis of convergent validity, between the IdFAI-
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58 Sp and the CAIT, a good level of correlation was observed (-0.715), which is in line
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3 with the correlation obtained for the Persian, Korean and Brazilian-Portuguese
4 adaptations (0.92, -0.65 and -0.76, respectively). The Korean, Brazilian-Portuguese and
5 Persian versions of the IdFAI also incorporate other questionnaires, including the Short-
6 Form 36 Health Survey (SF-36), the Lower Extremity Functional Scale (LEFS), the
7 Foot and Ankle Ability Measure (FAAM) and the Foot and Ankle Outcome Score
8 (FAOS). These instruments were not used in our study, since they are designed to assess
9 the capacity and general functioning of the foot and ankle, and do not specifically focus
10 on chronic ankle instability.
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22 Simon et al. [4] took a cut-off score of ≥ 10.3 as indicative of chronic ankle instability, a
23 value similar to that employed in our study and in other versions of the IdFAI
24 questionnaire: IdFAI-Spanish 10.5, IdFAI-Korean 10, IdFAI Japanese 10.5 and the
25 others adaptations to the different languages did not specify a cut-off score.
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32 The Spanish-language version presented good reliability ($ICC_{2,1}=0.85$), which is in line
33 with other adaptations. The MDC of the IdFAI-Sp score was 6.4 points, which is
34 comparable to the values reported elsewhere in studies based on a similar methodology
35 (3.1-6.73). In our cross-cultural adaptation, no ceiling or floor effects were detected,
36 since the values obtained were well below the 15% threshold (5.5% and 3.4% of
37 participants, respectively). This finding, too, is in line with the results obtained for
38 previous adaptations.
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49 The main strength of this study is the solid methodology used in the cross-cultural
50 adaptation process, which ensures the reliability and validity of this version of IdFAI for
51 use with a Spanish-speaking population.
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56 Limitations
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Certain limitations to this study should be acknowledged. Firstly, the patient sample was relatively small. Furthermore, Rasch analysis might be needed to re-examine the internal structure of the IdFAI-Sp. In future studies of this question, it would be useful to consider a larger sample and to focus exclusively on patients diagnosed with chronic ankle instability and reliability should be measured in different age groups.

In conclusions, the results presented in this paper show that the cross-cultural adaptation of the IdFAI for use with Spanish-speaking patients is valid, reliable and sensitive. Therefore, it can be used by clinicians and researchers to measure ankle instability, to identify the severity of an acute or chronic ankle sprain and to evaluate the treatment of chronic ankle instability.

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26 Image 1. Cross-cultural adaptation

27 Image 2. Scree plot

28 Image 3. Confirmatory factor structure of IdFAI-Sp.

29 Image 4. ROC curve

30 Table 1. Characteristics of participants

31 Table 2. Factor matrix for the 10-item IdFAI-Spain questionnaire
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Image 1. Cross-cultural adaptation

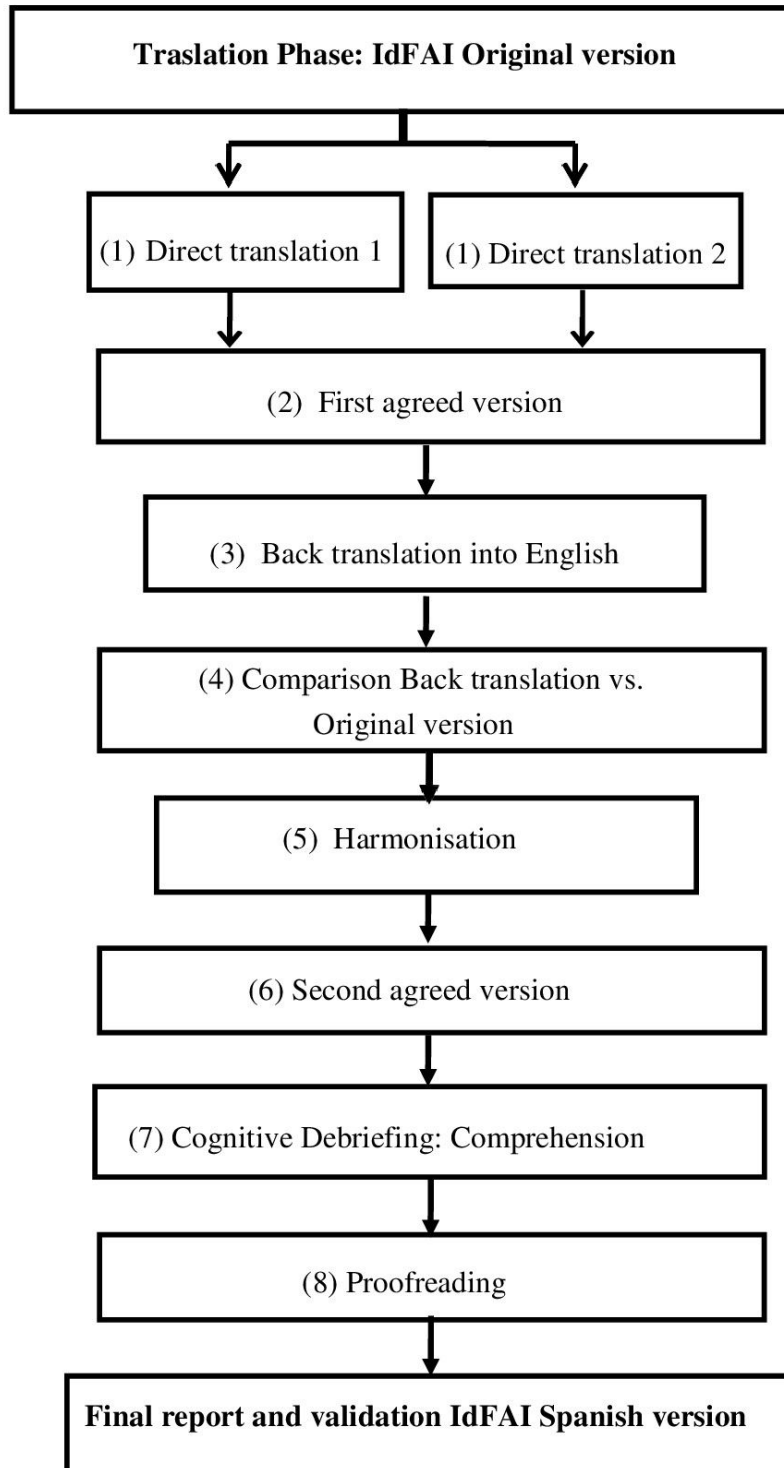


Image 2. Scree plot

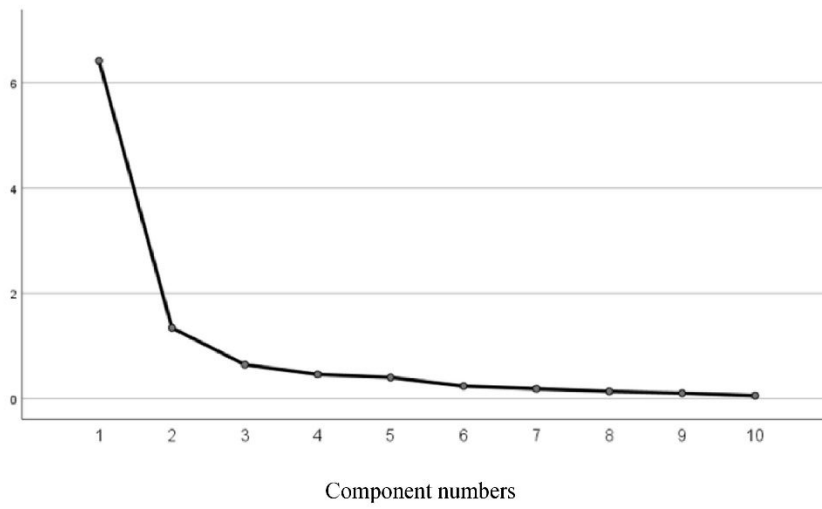
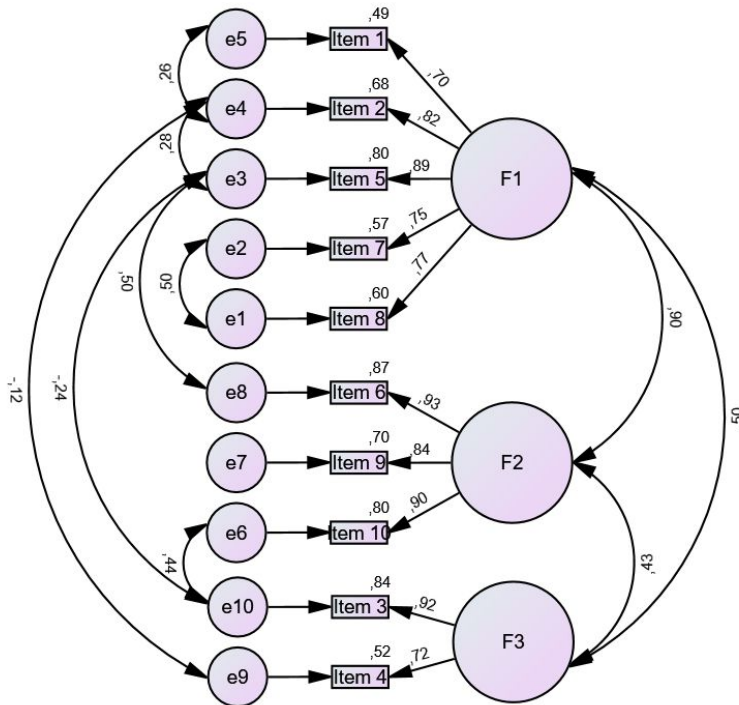


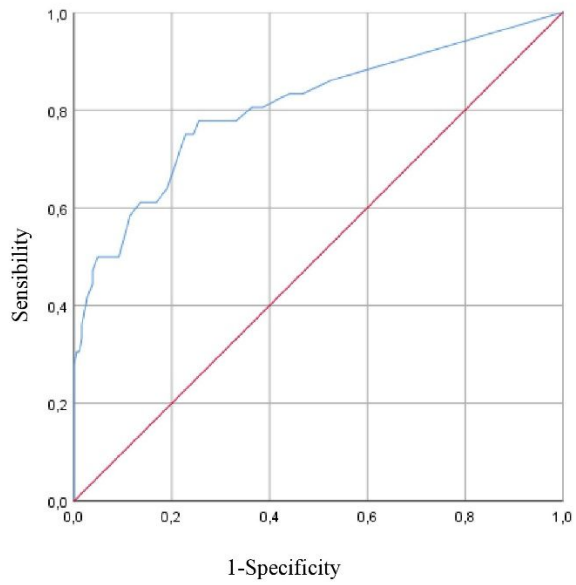
Image 3. Confirmatory factor structure of IdFAI-Sp.



F1: Factor 1; F2: Factor 2; F3: Factor 3

review

Image 4. ROC curve



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Table 1. Characteristics of participants

(n=110)		
Gender		
Male		48 (43.64%)
Female		62 (56.36%)
	Mean	SD
Age (years)	40.49	(10.43)
Height (cm)	171.08	(9.52)
Weight (Kg)	73.39	(13.50)
BMI	24.99	(3.66)
Shoe size (EU)	41.31	(2.98)
IdFAI	4.70	(7.4)
CAIT	25.45	(6.72)

Cm: centimeters; Kg: kilograms; BMI: body mass index; EU: European Union shoe size

Table 2. Factor matrix for the 10-item IdFAI-Spain questionnaire

	Factor 1	Factor 2	Factor 3
Item 1	.690		
Item 2	.768		
Item 5	.684		
Item 7	.829		
Item 8	.736		
Item 6		.812	
Item 9		.854	
Item 10		.815	
Item 3			.852
Item 4			.903