
Multidimensional Fatigue Inventory: Spanish adaptation and psychometric properties for fibromyalgia patients.

The Al-Andalus study

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ABSTRACT

Objectives. *The aim of this study was to assess the psychometric properties and transcultural adaptation into Spanish of the Multidimensional Fatigue Inventory in fibromyalgia patients.*

Methods. *The Spanish version of the Multidimensional Fatigue Inventory (MFI-S) was translated and cognitively pretested following cross-cultural adaptation guidelines. Test-retest reliability, convergent validity, and operational qualities were evaluated in a total of 116 fibromyalgia patients. Convergent validity was assessed comparing MFI-S with a visual analogue scale for global fatigue.*

Results. *The intra-class correlation coefficients varied from moderate to excellent (from 0.64 to 0.91) and the standard errors of the mean ranged from 0.5 to 1.1 points for the five MFI-S domains. The coefficient of repeatability was less than 2 standard deviations and the limits of agreement ranged from 2 to 4 points for the MFI-S domains. A weak to fair significant relationship was found between each MFI-S domain and the visual analogue scale (from 0.21 to 0.32). The mean time required to complete the MFI-S was 3.2±2.0 minutes. None of the patients needed external help to complete the MFI-S, and there were very few missing values.*

Conclusion. *The MFI-S developed in this study presents a good reliability and reasonable construct validity for Spanish fibromyalgia patients unaffected by cognitive dysfunction and severe depression. This questionnaire is quick, easy to administer and interpret.*

Introduction

Fibromyalgia syndrome is a systemic chronic musculoskeletal pain disorder characterised by multiple tender points

(1, 2) that can lead to significant patient disability and high economic burden on society (3). Fibromyalgia is found primarily in woman (4) and is also typically accompanied with a wide variety of symptoms, such as sleep disturbances, reduced physical work capacity, fatigue (5), stiffness, mood disorders (4, 6), and cognitive disturbances (7).

Fatigue greatly impacts quality of life and has been identified as one of the most characteristic symptoms in fibromyalgia patients (8, 9). Fatigue is also common in all rheumatic diseases (8), in other chronic patients (10) and in general population (11). It is difficult to measure fatigue because of its fluctuating and subjective nature and the many factors that influence the way fatigue is experienced (12, 13). The subjectivity of the symptom reinforces the importance of self-report measures in capturing the patients' point of view, rather than the professional's (14). However, different instruments might generate different results, even when fatigue is assessed in the same person at the same moment (15). Consequently, valid and reliable methods to assess fatigue are fundamental for its treatment.

Several fatigue assessment instruments have been developed, both for the general population and for various patient populations (16, 17). Instruments available to assess fatigue in patients can be divided into one-dimensional and multidimensional instruments. The Brief Fatigue Inventory (18) and Fatigue Severity Scale (19) measure fatigue severity and have been widely used as one-dimensional methods. The use of a multidimensional instrument offered however the opportunity to obtain a profile of fatigue that would provide information on the nature of the experience, and its intensity.

The Multidimensional Fatigue Inventory (MFI) is probably the most commonly used fatigue questionnaire in Europe (20). The MFI was originally developed in Dutch, and then adapted and validated into different languages (21-24). It has been used to elucidate the different dimensions of fatigue in Swedish fibromyalgia patients (25, 26) as well as other clinical (27-29) and healthy populations (21). Therefore, its characteristics and psychometric properties have been investigated in different populations and languages. The results showed that the instrument has high usability and clinical/research utility, and moderate psychometric properties (17).

There are no multidimensional fatigue questionnaires for Spanish-speaking fibromyalgic patients and the MFI is one of the few multidimensional fatigue questionnaires currently available. Because of cultural differences, it is necessary to analyse any new adaptation of the questionnaire and verify its psychometric properties. Consequently, the objective of this study was to assess the psychometric properties and transcultural adaptation of the MFI in Spanish fibromyalgia patients.

Methods

Study population

We contacted several local associations of fibromyalgia patients in Granada and Seville (Southern Spain), and an invitation to participate in the study was sent to all women aged 18 to 65 years ($n=850$). One hundred seventy-seven potentially eligible patients responded and received more information. All patients gave their written informed consent after receiving detailed information in a meeting about the study aims and procedures. The exclusion criteria included the inability to read and write in Spanish, history of drug taking affecting the central nervous system during the last month, history of taking opioids or nonsteroidal antiinflammatory drugs during the last week (30), history of morbid obesity, known cardiopulmonary diseases, uncontrolled endocrine or allergic disturbances, severe trauma within the last six months, inflammatory rheumatic disease (31),

severe depression according to the Beck Depression Inventory II (BDI-II) categories (a score ≥ 29 was considered as severe depression) (32), and history of major psychiatric disease according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (33). In addition, patients who were pregnant and who were unable to pass the Mini-Mental State Examination (*i.e.*, those with a score ≤ 26 (out of 30) points) (34) were also excluded. According to the exclusion criteria, 61 patients were identified as with severe depression and/or cognitive impairment. A total of 116 patients were finally included in the reliability and validity analysis. The research protocol was reviewed and approved by the Ethics Committee of the *Hospital Virgen de las Nieves* (Granada, Spain). Two measurement conditions, separated by one-week interval, were performed to obtain the values used in the test-retest reliability and convergent construct validity of the Spanish version of the Multidimensional Fatigue Inventory (MFI-S) in a sample of fibromyalgia patients. The participants were asked not to change their medications, habitual lifestyles, or undergo any treatments during the week of the study. During the first appointment, the sociodemographic, anthropometric, and personal medical records of the fibromyalgia patients were examined, and the fibromyalgia diagnosis was confirmed following the American College of Rheumatology classification criteria (5) in order to avoid misdiagnosis (35). In addition, the Spanish version of the BDI-II (32), Mini-Mental State Examination (34), visual analogue scale (VAS) for global fatigue of the Spanish version of the Fibromyalgia Impact Questionnaire (FIQ) (36), and MFI-S were administered and completed by each patient, and the time consumed to filling the MFI-S was computed. During the second appointment, the patients were carefully interviewed to ensure that their medicaments, treatments, and routine lifestyles had not changed during the study period. In addition, the MFI-S was administered and completed by each patient, and also the time consumed was computed.

Instruments

– Fatigue measures

Fatigue level was measured using two different instruments: a single-item VAS and the MFI-S. Both instruments assess fatigue symptoms during the previous week.

The MFI-S. This questionnaire, like the English version, is a 20-item assessment tool with five domains: General Fatigue, Physical Fatigue, Mental Fatigue, Reduced Activity, and Reduced Motivation. Each fatigue domain consists of four items and has a potential score range from 4 to 20, where higher MFI scores indicate a high degree of fatigue. The VAS for global fatigue. This instrument is a 100 mm scale included in the FIQ (36, 37). Patients were shown the scale and asked to place a mark on the line that described how tired they have been during the previous week, where 0 mm is “No tiredness” and 100 mm is “Very tired” (36, 37). The intensity of the patient’s fatigue was scored by measuring in millimeters from the low end of the scale to patient’s mark.

– Anthropometrical measures

All anthropometric measurements were performed according to the Anthropometric Standardisation Reference Manual (38). Height was measured to the nearest 0.1 cm using an electronic balance with an incorporated stadiometer (Seca 22, Hamburg, Germany) with the patients in their underwear. Weight was measured to the nearest 100 g using a portable bioimpedance meter (Inbody R20, Seoul, Korea). BMI was calculated as the body mass (in kilograms) divided by the height (in meters) squared.

– Cognitive measures

The validated Spanish version of the Mini-Mental State Examination (34) was used for screening cognitive dysfunction in all patients. In non-geriatric populations (younger than 65 years), such as the sample in our study, a score ≤ 26 was considered as any degree of cognitive impairment (34).

– Psychological measures

The Spanish version of the BDI-II (32) was used for screening severe depres-

sion in all patients. There is substantial evidence for the reliability and validity of this instrument in various populations, including fibromyalgia patients (39). The BDI-II generates a total ranging from 0-63. Higher scores represent more severe depression. The BDI-II then assesses the severity of depression: minimal (0 to 13), mild (14 to 19), moderate (20 to 28), and severe (29 to 63).

Study design

– Transcultural translation process

The adaptation process for the MFI followed the steps recommended in specialised literature (40) using direct and reverse translation. The translators were asked to score the degree of difficulty of the translation (1=minimum; 10=maximum) and the degree of conceptual equivalence that they believed it bore to the original version (1=different; 10=equivalent). Translators systematically reviewed both translations to determine the differences and to establish a first consensus version of the questionnaire.

The 4 bilingual translators established a consensus version of the final questionnaire. The investigation team in collaboration with all of the translators compared the reverse translation with the original version of the questionnaire in English. The consensus resulted in the second version of the questionnaire.

Subsequently, individual interviews were conducted for the fibromyalgia patients to evaluate their understanding of the questionnaire (cognitive debriefing), as described by previous studies (41). The purpose of this strategy was to evaluate the comprehensibility and feasibility of the instrument. The ratings of the results of the comprehension test by the research team resulted in the final version of the questionnaire (appendix 1).

– Evaluation of test-retest reliability

Test-retest reliability was evaluated for the five MFI-S domains. All of the patients were asked to complete the MFI-S twice (separated by 1-week interval).

– Evaluation of construct validity

The item of VAS for global fatigue from the Spanish version of the FIQ has been

Appendix 1: Spanish version of Multidimensional Fatigue Inventory (MFI-S).

Instrucciones:

Por medio de las siguientes afirmaciones, nos gustaría obtener una idea de cómo se ha sentido últimamente. Por ejemplo, ante la afirmación:

“ME SIENTO RELAJADO”

Sí piensa que esto es completamente cierto, que verdaderamente se ha sentido relajado últimamente, por favor, coloque una “X” en el extremo izquierdo del recuadro; como en el siguiente ejemplo:

- | | | | |
|---|----------------|---|-------------------|
| 1. Me siento en forma. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 2. Físicamente me siento capaz de hacer poco. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 3. Me siento muy activo. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 4. Tengo ganas de hacer todo tipo de cosas agradables. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 5. Me siento cansado. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 6. Creo que hago muchas cosas al día. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 7. Cuando estoy haciendo algo, me cuesta estar pensando en lo que estoy haciendo. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 8. Puedo exigirme físicamente. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 9. Me da miedo hacer ciertas cosas. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 10. Creo que hago pocas cosas al día. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 11. Puedo concentrarme bien. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 12. Estoy descansado. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 13. Me supone mucho esfuerzo concentrarme en ciertas cosas. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 14. Físicamente siento que estoy en baja forma. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 15. Tengo muchos planes. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 16. Me canso fácilmente. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 17. Hago pocas cosas. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 18. No me siento con ganas de hacer nada. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 19. Mis pensamientos vagan fácilmente. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |
| 20. Físicamente me encuentro en una excelente condición. | Sí, es cierto. | ☐ ☐ ☐ ☐ ☐ ☐ | No, no es cierto. |

analysed and was demonstrated to possess satisfactory psychometric properties in fibromyalgia (36). The VAS for global fatigue has been used to analyse the convergent construct validity of the MFI in fibromyalgia (25) and other clinical populations (21, 23) in different languages. All of the patients were asked to complete the VAS for global fatigue once. This administration coincided with the first completion of the MFI-S. In order to investigate the convergent construct validity of the MFI-S, it was correlated with the VAS.

– Statistical analyses

Demographic and clinical variables were analysed by comparing the results from the homogeneous sample (n=116) and the full sample of patients (n=177) with the Mann-Whitney U-test.

The test-retest reliability of the MFI-S domains was assessed using the intraclass correlation coefficients (ICCs) with 95% CIs (42), differences observed between the readings (tests 1 and 2), standard deviations (SDs) of the differences, intra-patient SDs, standard errors of the measurement (SEMs) (43), minimal detectable changes (MDCs) (44), and limits of agreement (45). A 95% confidence level for the MDCs that corresponded to a z -value of 1.96 was established. Bland-Altman plots, including the 95% limits of agreement, were used to determine the agreement between the recorded values at the individual level. They provide a range within which 95% of all the differences are found (45). The association between the difference and the magnitude of each MFI-S domain (*i.e.* heteroscedasticity) was examined by regression analysis. The following classification was used to interpret the ICC values: ICCs of <0.50, 0.50-0.75, and >0.75 represented poor, moderate, and good reliability, respectively (46). Due to the variables were not normally distributed, non-parametric tests were used. The Wilcoxon signed-rank test was selected to analyse the systematic differences in the variables between the two appointments.

The convergent construct validity was calculated using the Spearman correlation coefficient. We determined the correlation between results from the MFI-

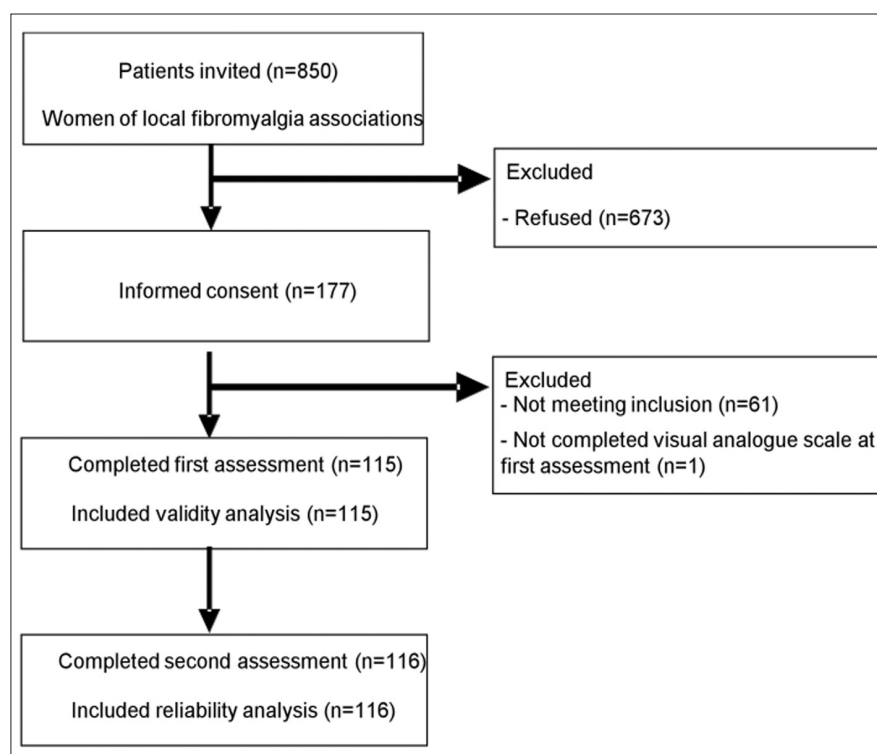


Fig. 1. Flowchart of study.

S and those from the VAS for global fatigue in order to identify the convergent validity of the former. The following classification was used to interpret the correlation values: correlations of <0.25, 0.25-0.50, 0.50-0.75, and >0.75 represented weak or no relationship, fair, moderate to good, and good to excellent relationship, respectively (25). The operational qualities of MFI-S were assessed by the percentage of patients who were able to complete the questionnaire by themselves and by the time employed in filling it out. Statistical analyses were performed using the SPSS package (version 18; SPSS Inc., Chicago, IL) and the significance level was set in 0.05.

Results

Sample characteristics

One hundred and seventy-seven women with fibromyalgia agreed to participate in this study and a total of 116 patients were finally included in the reliability and validity analysis. Figure 1 displays the flowchart of the study. No differences were observed between the final sample (n=116) and the original sample (n=177) in any demographic and clinical variable (p varies from

Table 1. Demographic and clinical characteristics of study population (n=116).

Variables	Median (25th–75th percentiles)
Tender point count, 1–18	18 (18-18)
Age, years	51 (46-55)
Body mass index, kg/m ²	27 (24-30)
Beck Depression Inventory II, 0–63	19 (13-22)
Mini-Mental State Examination, 0–30	29 (28-30)
	n (%)
Gender (Female/Male)	113/3 (97/3)
Ethnicity (White)	116 (100)
Time since diagnosis	
≤ 5 years	38 (33)
> 5 years	76 (67)
Highest education	
No schooling	6 (5)
Elementary school	59 (51)
High school	28 (25)
College/university	22 (19)
Marital status	
Single	14 (12)
Married	90 (77)
Widowed	2 (2)
Divorced or separated	10 (9)

NOTE. Values are the median (25th–75th percentiles) unless otherwise indicated.

Two missing data on diagnosis and body mass index, one missing data on highest education.

Table II. Examples of the complete process of transcultural adaptation.

Process of Transcultural Adaptation	Item 7 of MFI	Item 14 of MFI	Item 17 of MFI
Original version	When I am doing something, I can keep my thoughts on it.	Physically I feel I am in a bad condition.	I get little done.
Direct translation A	Cuando estoy haciendo algo, puedo mantener la concentración en ello.	Físicamente me siento que estoy en mala condición.	He hecho poco
Equivalence Difficulty	9 1	9 1	6 3
Direct translation B	Cuando estoy haciendo algo, puedo mantener mi concentración en ello.	Físicamente siento que estoy en baja forma.	He conseguido poco.
Equivalence Difficulty	10 1	3 5	6 3
First consensus version	Cuando estoy haciendo algo, puedo mantener mi concentración en ello.	Físicamente siento que estoy en mala condición.	He conseguido poco.
Reverse translation	When I am doing something, I can keep my thoughts on it.	Physically I feel that I am in a bad condition.	I have got little.
Second consensus version	Cuando estoy haciendo algo, me cuesta estar pensando en lo que estoy haciendo.	Físicamente siento que estoy en mala condición.	Hago pocas cosas
Cognitive test	Most of the patients (7/12) preferred the option me cuesta estar pensando en lo que estoy haciendo to puedo mantener mi concentración en ello. They attributed pensar as a higher conceptual equivalence and lower comprehension difficulty than concentrar.	Most of the patients (10/12) preferred the option baja forma to mala condición. Mala condición was changed because this structure is not used in Spanish. Baja forma is most commonly used in Spanish.	Most of the patients (7/12) preferred the option hago pocas cosas to he conseguido poco. Hago pocas cosas makes reference to an impossibility of doing something while He conseguido poco was understood as underestimation of patients' life achievements.
Final version	Cuando estoy haciendo algo, me cuesta estar pensando en lo que estoy haciendo	Físicamente siento que estoy en baja forma.	Hago pocas cosas

MFI-S: Spanish version of the Multidimensional Fatigue Inventory.

Table III. Test-retest reliability of the five subscales of the MFI-S in fibromyalgia patients (n=116).

Subscales of the MFI-S	Median (25 th -75 th percentiles) Test 1	Median (25 th -75 th percentiles) Test 2	Difference mean (SD)	Intra-patient SD	Intra-class correlation coefficient	95% confidence interval	Coefficient of repeatability	Standard error of the measurement	Minimal detectable change
General fatigue	12.0 (12.0-14.0)	12.0 (11.3-14.0)	0.09 (0.94)	0.72	0.91	0.87-0.94	1.85	0.50	1.39
Physical fatigue	12.0 (12.0-14.0)	12.0 (12.0-14.0)	-0.13 (1.51)	0.99	0.79	0.69-0.85	2.96	0.82	2.28
Mental fatigue	10.0 (10.0-12.0)	10.5 (10.0-12.0)	0.09 (1.58)	0.72	0.75	0.64-0.83	3.10	0.90	2.50
Reduced activity	13.0 (12.0-15.0)	13.0 (12.0-15.0)	0.17 (1.82)	1.31	0.64	0.49-0.75	3.58	1.05	2.91
Reduced motivation	11.0 (11.0-13.0)	11.0 (10.3-13.0)	0.12 (1.84)	0.92	0.80	0.71-0.86	3.61	1.00	2.70

No significant differences between tests 1 and 2 ($p>0.05$).

MFI-S, Spanish version of the Multidimensional Fatigue Inventory.

0.322 to 0.757), except for the Mini-Mental State Examination and BDI-II ($p<0.001$ for both). Table I summarises the demographic and clinical characteristics of the patients.

Missing values

In the MFI-S, five missing values (95.7% completion rate) were found for the domain Physical Fatigue and one missing value (99.1% completion rate)

was found for the domains Reduced Activity and Reduced Motivation at test 1. At test 2, one missing value (99.1% completion rate) was found for the domain Physical Fatigue. As at least 50% of the items in a domain of the MFI-S were completed for all the protocols, the missing value were replaced by the average score of the completed items in the same domain (47).

In the validity study, one missing value

was found for the VAS for global fatigue, included in the FIQ (99.1% completion rate). The validity calculations were therefore based on 115 patients.

Transcultural translation process

During the process of direct and reverse translation, the range of difficulty for the translators varied between 1 and 5, whereas the conceptual equivalence varied between 6 and 10. Items 7, 14

and 17 of the MFI presented the greatest difficulty and/or the least conceptual equivalence and were discussed during the consensus meetings. In these meetings, linguistic criteria were also unified, such as the use of the first form/person of singular of the present indicative as a preferred verbal tense. The most problematic items were analysed specifically in individual interviews to rate the patients' comprehension of the questionnaire (cognitive debriefing). The interviews were conducted for 12 fibromyalgia patients who ranged in age from 30 to 65 years and had different education levels (7 with an elementary school education, 1 with a high school education, and 4 with a university education). One item (item 14) required a minor modification to improve patient comprehension. Table II illustrates the complete process of transcultural adaptation for the 3 items. In item 7 of MFI, we observed that the sentence *I can keep my thoughts on it* obtained in the first consensus version was *puedo mantener mi concentración en ello*. After the patient interviews, the sentence *me cuesta estar pensando en lo que estoy haciendo* was selected because the sentence *puedo mantener mi concentración en ello* did not contribute to an increased conceptual equivalence and created greater comprehension difficulty. In item 14, there was a consensus for an equivalent term in the original version during the process of direct and reverse translation, *bad condition* was changed to *baja forma* because of difficulty comprehending this item on the cognitive test. The final example, item 17, shows the same process was carried out for Item 7, in this item, we observed that the sentence *I get little done* obtained in the first consensus version was *he conseguido poco*. After the patients interviews, the sentence *hago pocas cosas* was selected because the sentence *he conseguido poco* did not contribute to improve the comprehension. With respect to the degree of questionnaire acceptance and formality, the results showed that all patients found the format comfortable and considered their comprehension of the items sufficient to allow them to suggest changes in specific items on the questionnaire.

Table IV. Spearman correlation coefficients between measurements obtained with the subscales of MFI-S and the VAS for global fatigue in fibromyalgia patients (n=115).

Subscales of the MFI-S	Spearman correlation coefficients	95% confidence interval	p-value
General Fatigue	0.32	0.15, 0.47	0.001
Physical Fatigue	0.25	0.08, 0.41	0.006
Mental Fatigue	0.31	0.14, 0.46	0.001
Reduced Activity	0.25	0.08, 0.41	0.006
Reduced Motivation	0.21	0.03, 0.37	0.022

MFI-S: Spanish version of the Multidimensional Fatigue Inventory; VAS: visual analogue scale.

Test-retest reliability

The results of test-retest reliability for the five MFI-S domains are presented in Table III. The ICCs varied from moderate to excellent for the five MFI-S domains (from 0.64 to 0.91). The SEMs and MDCs were satisfactory for the five MFI-S domains; the SEMs ranged from 0.50 to 1.05 points, and the MDCs ranged from 1.39 to 2.91. Mean differences between test and retest were lower than the SEM for the five MFI-S domains, varying from -0.13 to 0.17 points. The coefficient of repeatability was less than 2 SDs for the five MFI-S domains. Figure 2 shows the Bland-Altman plots and the limits of agreement for the five MFI-S domains; General Fatigue (1.8, -2.0), Physical Fatigue (3.0, -2.9), Mental Fatigue (3.1, -3.5), Reduced Activity (3.5, -3.8), and Reduced Motivation (3.6, -3.8).

Convergent construct validity

The Spearman correlation coefficients revealed a weak to fair significant positive relationship between each of the five MFI-S domains and the VAS for global fatigue in the FIQ (r_s vary from 0.21 to 0.32; $p < 0.05$) (Table IV).

Operational qualities

The mean time required to complete the MFI-S was 3.18 ± 1.95 minutes per patient (range 1.0-6.0). None of the patients needed external help to complete the questionnaire.

Discussion

In the present study, we adapted the English version of the MFI into Spanish, and assessed the reliability and validity of the MFI-S by applying the questionnaire in fibromyalgia patients.

The present study showed a transcultural adaptation conceptually equivalent to their original version as well as a good reliability, weak to fair construct validity, and satisfactory operational qualities for the MFI-S in Spanish fibromyalgia patients.

During the adaptation of MFI-S, no significant problems were encountered during the translation into Spanish or during evaluation of the conceptual equivalence of the items on the questionnaire. In general, the ability of the fibromyalgia patients to comprehend the questionnaire was good, and the patients suggested various options when necessary to improve their comprehension.

Our results also showed that the patients readily accept the MFI-S, since there were very few missing values and all MFI-S domains were scored by the study population. This suggests that the face validity of the questionnaire was satisfactory for Spanish fibromyalgia patients. A similar result was shown for the Swedish version of MFI in fibromyalgia patients (25). The patients and therapists involved did not report significant problems understanding and interpreting the MFI-S. Several studies in different countries and clinical populations have also shown that the MFI is an easy-to-administer questionnaire for measuring fatigue (23, 48). In addition to satisfactory execution and easy administration, another advantage of the MFI-S is their short duration, which can promote a high response rate.

All MFI-S domains showed satisfactory test-retest reliability in the present study. The means of the differences were low, the ICCs were moderate to high, the SEMs provided a low index of error and the limits of agreement

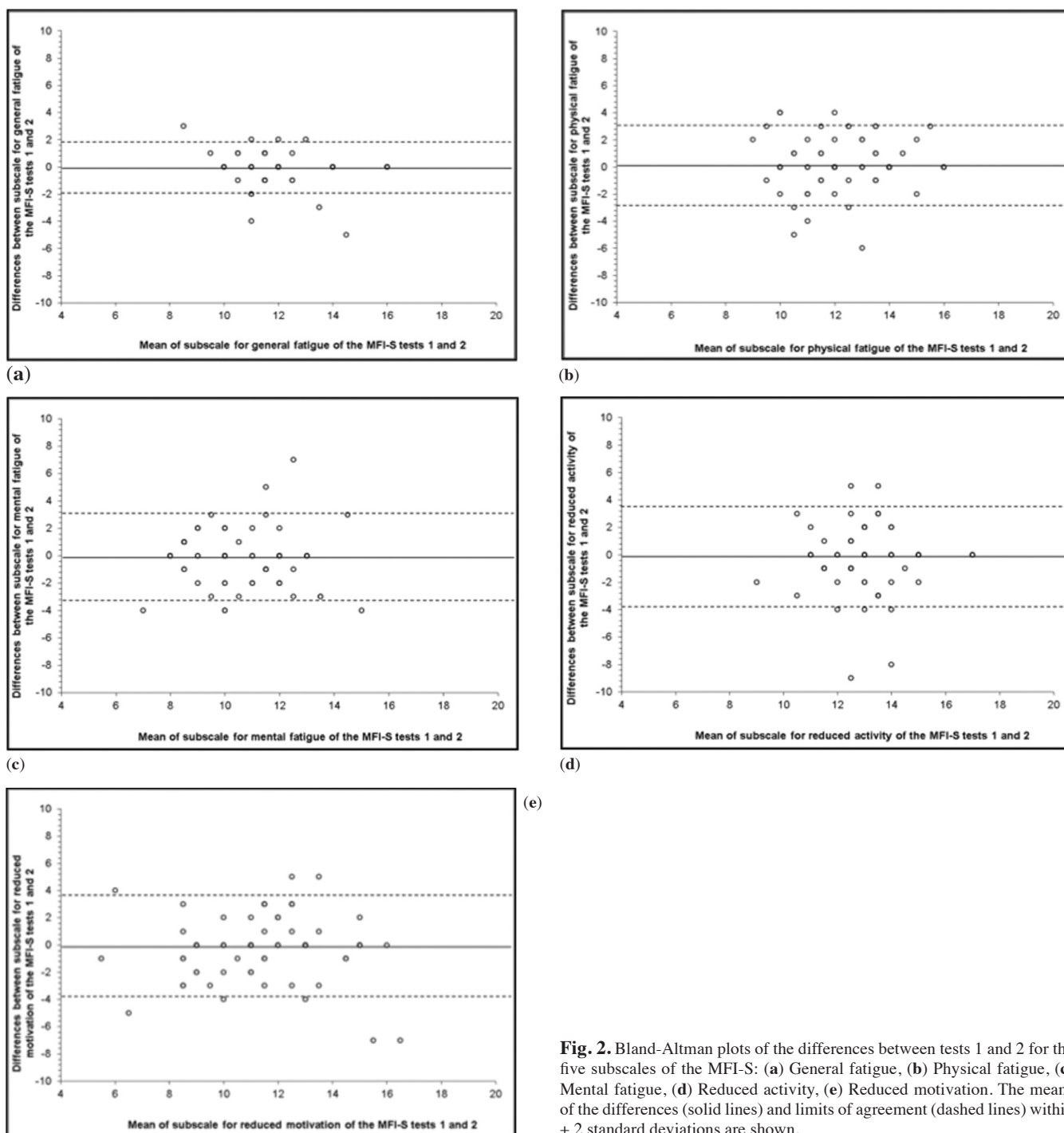


Fig. 2. Bland-Altman plots of the differences between tests 1 and 2 for the five subscales of the MFI-S: (a) General fatigue, (b) Physical fatigue, (c) Mental fatigue, (d) Reduced activity, (e) Reduced motivation. The means of the differences (solid lines) and limits of agreement (dashed lines) within + 2 standard deviations are shown.

ranged from 2 to 4 points for the MFI-S domains. Therefore, in our setting, an improved MFI-S domains score of at least 2 to 4 was required to be 95% certain of a true improvement in the patient. An examination of the Bland-Altman plots (see fig. 2), coefficients of repeatability, and heteroscedasticity suggested that the MFI-S domains were fairly repeatable, regardless of the score obtained.

Comparing all MFI-S domains, the domain General Fatigue had the highest degree of test-retest reliability. These results correspond to those in previous studies (16, 25). The ICC values in the present study were similar or slightly lower than those determined for the Swedish version of MFI in a fibromyalgia population (25). We suggest that these slightly low results for Mental Fatigue and Reduced Activity domains

might be due to the long interval between the measures (7 days), the patients may have been influenced by the fluctuating behaviour of symptoms in fibromyalgia (49).

The associations between the one-dimensional scale VAS for global fatigue and the five MFI-S domains provided some evidence of convergent construct validity for the MFI-S domains. The relationship with the one-dimensional

scale VAS for global fatigue was significant for all the five MFI-S domains, and this support the notions that fatigue is multidimensional and that different aspects of fatigue should be measured separately (25). Because fibromyalgia patients often report fatigue symptoms that are physical as well as mental in nature, using the MFI-S allowed us to examine the effect of different treatments across several dimensions of fatigue.

Domains for General Fatigue and Reduced Motivation had the highest and lowest associations to the VAS for global fatigue, respectively. These results are supported by Ericsson and Mannerkorpi (25) in the Swedish version of MFI in fibromyalgia patients in which the MFI was also correlated with a VAS. Higher correlation values were obtained in the Swedish version of MFI in fibromyalgia patients (25). The reasons for these comparatively low correlations between the VAS and the MFI-S domains in the Spanish patients are unclear and require further studies with additional indicators of validity.

The present study has several limitations, such as the absence of additional indicators of validity or the absence of a healthy group to examine the known group validity. Convergent validity of the MFI-S domains was analysed comparing with an one-dimensional instrument. It would be interesting to compare the MFI-S with another multidimensional instrument. A potential limitation is the long interval between the reliability measures (7 days), which do not ensure the clinical stability of the patients. Additional questionnaires could have been administered to ensure the clinical stability of the patients. Another limitation is that the currently used cross-sectional design does not provide any information on the sensitivity of the MFI-S domains. It would be interesting to examine whether the MFI-S domains are sensitive to change in future clinical trials, like other studies have shown with the VAS for global fatigue (50).

In addition, our patients do not represent the larger population of community-dwelling fibromyalgia patients. The relative restrictions of our sample

group limit the generalisability of the results and render the results mainly indicative. More research is needed in Spanish fibromyalgia patients and other populations before the MFI-S is ready for widespread use. The dimensional structure of the MFI-S should be analysed in future applications of fatigue assessments in a larger number of fibromyalgia patients. Normative data should be determined through using the MFI-S in relevant populations in cross-national studies.

In conclusion, the present study showed that the MFI-S developed during this study presents a good reliability and reasonable construct validity. This questionnaire is quick, easy to administer and interpret. Therefore, the MFI-S is an adequate instrument to assess fatigue with a minimal cost and burden to the Spanish fibromyalgia patients unaffected by cognitive dysfunction and severe depression. We recommend the use of this instrument for clinical application.

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