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European Portuguese Version of the Multidimensional Fatigue Symptom Inventory-Short Form: Validation Study

Validação da Versão Portuguesa do Inventário Multidimensional de Sintomas de Fadiga-Forma Reduzida

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ABSTRACT

Introduction: Appropriate management of fatigue relies upon comprehensive assessment instruments and timely delivery of targeted interventions. The aims of this study were to translate a commonly used English-language measure of fatigue in cancer patients (the Multidimensional Fatigue Symptom Inventory–Short-Form, or MFSI-SF) into European Portuguese and to evaluate the psychometric properties (internal consistency reliability, factorial structure, and discriminant, convergent and criterion concurrent validity) of the translated measure for use with Portuguese patients.

Methods: After translation and adaptation of the MFSI-SF to European Portuguese, 389 participants (68.38% women), with a mean age of 59.14 years, completed the study protocol. This sample included 148 patients in active cancer treatment from a cancer center and a community sample composed of 55 cancer survivors, 75 patients with other chronic diseases, and 111 healthy controls.

Results: The European Portuguese version of the Multidimensional Fatigue Symptom Inventory-Short Form (IMSF-FR) showed strong internal consistency (Cronbach's alpha = 0.97, McDonald's omega = 0.95). An exploratory factor analysis indicated that the items loaded in a 5-factor model in subscales were similar to the original version. Strong correlations between the IMSF-FR and other measures of fatigue and vitality confirmed convergent validity. Discriminant validity was supported by weak-to-moderate correlations between the IMSF-FR and measures of sleepiness, propensity to sleep, and lapses of attention and memory. The IMSF-FR accurately distinguished cancer patients from healthy controls and was able to differentiate clinician rated levels of performance among cancer patients.

Conclusion: The IMFS-FR is a reliable and valid tool to assess cancer-related fatigue. By providing integrated comprehensive characterization of fatigue, this instrument may assist clinicians implementing targeted interventions.

Keywords: Chronic Disease; Fatigue; Neoplasms; Portugal; Psychometrics

RESUMO

Introdução: A gestão apropriada da fadiga depende do desenvolvimento de instrumentos de avaliação compreensivos que permitam identificar os sintomas que devem ser alvo de intervenção. Os objetivos deste estudo foram traduzir uma medida internacional sobejamente usada na avaliação da fadiga (o *Multidimensional Fatigue Symptom Inventory–Short-Form*, ou MFSI-SF) para português-europeu e avaliar as propriedades psicométricas (consistência interna, estrutura fatorial, e validade discriminante, convergente e de critério, concorrente) daquele instrumento para pacientes portugueses.

Métodos: Após a tradução e adaptação do MFSI-SF para português-europeu, 389 participantes (68,38% mulheres), com uma média de idades de 59,14 anos, completaram o protocolo de estudo. Esta amostra incluiu 148 pacientes oncológicos em tratamento ativo de um hospital de oncologia e uma amostra comunitária composta por 55 sobreviventes oncológicos, 75 pacientes com outras doenças crónicas e 111 controlos saudáveis.

Resultados: A versão portuguesa do *Multidimensional Fatigue Symptom Inventory-Short Form* (IMSF-FR) revelou uma forte consistência interna (alfa de Cronbach = 0.97, ómega de McDonald = 0.95). A análise fatorial exploratória indicou que os itens seguem um modelo de cinco fatores em subescalas idênticas à versão original. A validade convergente foi confirmada por relações fortes entre o IMSF-FR e outras medidas de fadiga e vitalidade. A validade discriminante foi sustentada por correlações fracas-a-moderadas entre o IMSF-FR e outras medidas de sonolência, propensão para a sonolência, e lapsos de atenção e memória. O IMSF-FR conseguiu distinguir corretamente doentes oncológicos e participantes saudáveis e predizer a capacidade funcional dos doentes oncológicos.

Conclusão: Os resultados sugerem que o IMFS-FR é um instrumento válido e fiável para avaliar a fadiga em doentes oncológicos e outros doentes crónicos. Ao permitir uma caraterização integrada e compreensiva da fadiga, este instrumento pode assistir os profissionais de saúde a implementar intervenções específicas para a constelação de sintomas exibida.

Palavras-chave: Doença Crónica; Fadiga; Neoplasias; Portugal; Psicometria

INTRODUCTION

Cancer-related fatigue (CRF) has been defined as a persistent and distressing sense of physical, emotional and/or cognitive tiredness or exhaustion that is not proportional to recent activity and interferes with normal functioning resulting from cancer or its treatment.[1] During the active treatment phase, fatigue affects up to 25% to 99% of patients, including patients undergoing chemotherapy, radiation, hormonal, surgical and/or biological therapies.[2-7] CRF usually increases during cancer treatments and decreases in the year that follows their completion. However, for about 25% to 33% of cancer survivors, CRF persists for months, years, or even decades after successful treatment completion.[8-10]

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Fatigue has been conceptualized as a multidimensional construct both in its etiology and expression. Encompassing a constellation of physical, cognitive and/or emotional manifestations that are not relieved by rest or sleep,[11,12] CRF may be influenced by demographic, medical and psychosocial factors, including depression[13] and sleep disturbances.[14] Cancer-related fatigue is associated with a myriad of negative consequences during and after cancer treatment, including emotional disorders, hampered quality of life, and disruptions in cognitive performance, interpersonal and self-care abilities.[15-18] Fatigue may lead to dose reduction or regimen discontinuation, compromising antineoplastic treatment.[19] Cancer-related fatigue may also predict shorter survival.[20] Notwithstanding such prevalence and harmful consequences, CRF is under-recognized, under-reported, under-assessed and under-treated.

Due to its subjective nature, patient self-report tools are the gold standard measures to assess fatigue.[1] However, there are no multidimensional measures to assess fatigue in Portuguese-speakers. Furthermore, measures of fatigue were never evaluated specifically for use with Portuguese-speaking cancer patients. With this paper we intend to provide a Portuguese version of a well-known, validated multidimensional tool to assess fatigue in nonclinical and clinical samples, including cancer patients. The Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF[20,21]) is a theoretically broad albeit brief instrument when compared to other multi-dimensional measures. By capturing the wide spectrum of symptomatic profiles associated with fatigue and minimizing the burden of patients who may find it challenging to complete a longer instrument, this tool might prove to be valuable for research and clinical use with Portuguese-speakers.

To address the issues raised above, we sought to translate the MFSI-SF to European Portuguese and evaluate its psychometric performance to establish its research and clinical utility. We first assessed the factorial structure of the European Portuguese version of the MFSI-SF to see if our results replicated the original factor analysis. Second, we assessed the reliability (via internal consistency) and validity (via convergent, discriminant, and criterion concurrent validity) of this translated measure for use with Portuguese patients.

METHODS

Ethics and legal compliance

All procedures were in accordance with the Helsinki Declaration and were approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of the University of Coimbra, and by the Ethics Committee, Legal Committee and Administration Board (number 93/DC/CA) of the Centro Hospitalar do Médio Tejo (CHMT). Informed consent was obtained from all participants involved in the study.

Procedures

Translation and adaptation to European Portuguese followed Hambleton's recommendations.[22] Two authors of the manuscript separately performed an initial translation, originating two translated versions which were then discussed, item by item, and harmonized to the European Portuguese cultural setting. The version arising from that discussion was presented to five experts in oncology and/or fatigue with vast clinical experience (one family physician, one psychiatrist, two psycho-oncologists, and one professor of Psycho-Oncology). After the expert review, a pre-final version was preliminarily tested with a non-probabilistic representative sample of the cancer population through the thinking aloud method.[23] The results of this pilot-test suggested that the final Portuguese version of the MFSI-SF was comprehensible. Lastly, a bilingual expert not involved in the study performed a back-translation to English to ensure that the Portuguese version correctly approximated the original meaning of the instrument's items.

Participants and data collection

For the current study, following a cross-sectional design, 389 participants were recruited (68.38% women) with 59.14 ± 11.60 (28 - 87) years, including patients undergoing cancer treatment (oncologic group) and a community sample. The oncologic sample (ONC) was collected from December 2021 to February 2022 at the Oncology daycare ward of the CHMT. All participants signed a written informed consent form before completing the survey. The community sample included three groups who completed an online survey (available November 2021-February 2022): healthy participants (H), participants diagnosed with a chronic disease other than cancer (CD), and cancer survivors (SUR). Criteria for inclusion in the study was 1) having at least 18 years of age, 2) being able to read Portuguese, and 3) providing written informed consent. The demographic, disease and treatment characteristics of the study participants are presented in Table 1. There were no statistically significant differences in age across the different groups F (326.09) = 2.45, p = 0.06.

Most cancer survivors (n = 21, 38.18%) had completed active cancer treatment more than five years before, 20 (36.36%) had completed treatment one to five years prior, seven (12.73%) had finished treatment six months to one year before, and seven had finished treatment less than six months before. Common diagnoses in the chronic disease group included respiratory disease (n = 13), hypertension (10), thyroid disease (9), chronic pain (8), heart disease (8), diabetes (6), and gastrointestinal disease (5).

Table 1 – Demographic and medical characteristics of patients undergoing active cancer treatment, cancer survivors, chronic disease patients, and healthy participants

	Active cancer treatment (ONC, n = 148)	Cancer survivors (SUR, n = 55)	Chronic disease (CD, n = 75)	Healthy group (H, n = 111)
Age	60.82 ± 10.19	59.24 ± 14.09	59.08 ± 11.76	56.89 ± 11.67
Sex				
F	95 (64.19%)	38 (69.09%)	60 (80.00%)	73 (65.77%)
M	53 (35.81%)	17 (30.91%)	15 (20.00%)	38 (34.23%)
Marital status				
Married	108 (72.97%)	40 (72.73%)	52 (69.33%)	71 (63.96%)
Divorced	20 (13.51%)	6 (10.91%)	12 (16.00%)	20 (18.02%)
Widowed	13	2	3	9
Single	7	7	8	11
Employment status				
Retired	70 (47.30%)	26 (47.27%)	36 (48.00%)	45 (40.54%)
Working	7 (4.73%)	23 (41.82%)	26 (34.66%)	58 (52.25%)
On leave	63 (42.57%)	5	4	1
Unemployed	6	1	7	7
Homemaker/student	2	-	2	-
Primary diagnosis				
Breast	61 (41.22%)	20 (36.36%)		
Colorectal	30 (20.27%)	6 (10.91%)		
Prostate	8	8		
Hematological	11	3		
Gynecologic	4	5		
Skin	4	3		
Stomach	6	1		
Others	24	9		
Cancer treatment				
Surgery	108 (38.99%)	44 (38.94%)		
Chemotherapy	106 (38.27%)	25 (22.12%)		
Radiotherapy	27	26		
Immunotherapy	15	4		
Hormonotherapy	18	12		
Pharmacotherapy	3	2		

Measures

All participants completed a self-reported survey comprising demographic information (age, marital status, and education level) and medical questions. Noncancer participants were asked if they had been diagnosed with any chronic disease (and, if so, their diagnosis). For cancer patients, medical questions included type of cancer and treatments performed.

Eastern Cooperative Oncology Group (ECOG) Performance Status Rating (PSR) Scale[24]

The ECOG is a single-item scale assessing their overall ambulatory ability and physical status (where 0 = fully active; 3 = in bed at least 50% of the time), was previously filled by a clinician for cancer patients.

Multidimensional Fatigue Symptom Inventory-Short Form [Portuguese version (IMSF-FR)][20,21]

The MFSI-SF is a 30-item self-reported instrument that

provides five empirically derived dimensions of fatigue: general fatigue, emotional fatigue, physical fatigue, mental fatigue, and vigor. Each subscale has six items rated on a 5-point Likert scale, with higher scores indicating more fatigue. Respondents indicate the extent to which they have experienced each symptom during the previous week (0 = not at all; 4 = extremely). Ratings are summed to obtain scores for each subscale. A total fatigue score can be calculated by subtracting the vigor subscale score from the sum of the four fatigue subscales. The original version of the MFSI-SF has demonstrated to be a valid and reliable scale [general (α = 0.96), emotional (α = 0.92), physical (α = 0.87), mental fatigue (α = 0.91) and vigor (α = 0.90)].[21] The European Portuguese version of the tool is henceforth referred to as the IMSF-FR.

Mood States Fatigue Scale (POMS-F)[25,26]

In this 7-item measure assessing the feeling of weariness and low energy, participants indicated the extent to which they had experienced each feeling during the previous week on a 5-point Likert scale (0 = not at all; 4 = extremely). The global score ranges from 0 – 28, with higher scores indicating more fatigue. In the current study the Cronbach's alpha (α) and McDonald's omega (ω) coefficients were 0.93 for the total sample.

Medical Outcomes Study 36-Item Short Form – Vitality Scale (SF-36 VT)[27,28]

For this 4-item measure, respondents were asked to rate on a 6-point Likert scale (1 = all the time; 6 = none of the time) the degree to which they felt energetic or worn out during the preceding four-week period. The transformed score ranges between 0 - 100, with a higher score denoting greater vitality. Its α and ω coefficients in the present study were 0.88 and 0.89, respectively, for the total sample.

Epworth Sleepiness Scale (ESS)[29,30]

This 8-item questionnaire was used to assess the unintended propensity to daytime sleepiness. Respondents were asked to indicate their usual chances of dozing off in eight distinct everyday situations on a 4-point scale (0 = no probability; 3 = high probability of dozing). The ESS score ranges from 0 - 24. Higher scores denote a higher sleep propensity (normal range is 0 - 10, scores of 11 - 12 indicate mild sleepiness, 13 - 15 moderate sleepiness and 16 - 24 severe sleepiness). Cronbach's α coefficient was 0.83 and McDonald's ω was 0.86.

Daytime Sleepiness Perception Scale (DSPS-4)[31]

Respondents evaluated their subjective perception of sleepiness through DSPS-4. A composite score, ranging from 0 - 16, is obtained summing up the ratings of the four Likert-type items, each scored from 0 (never) to 4 (always). The higher the score, the higher the perception of sleepiness. α and ω coefficients were 0.82 and 0.83, respectively.

Cognitive Failures Questionnaire (CFQ)[32,33]

In this 25-item questionnaire measuring the frequency of everyday lapses of memory, cognition and attention, respondents rated the frequency of their slips during the previous six months on a 5-point scale (0 = never; 4 = very often). The summing of ratings yields a score from 0 - 100, with higher scores denoting more cognitive failures. In this study, both its α and ω coefficient was 0.94 for the entire sample.

Hospital Anxiety and Depression Scale (HADS)[34,35]

Symptoms of anxiety and depression were measured through the HADS, a questionnaire with seven items each for depression and anxiety subscales. Scoring for each item ranges 0 - 3 and total scores range from 0 - 21, with scores < 7 indicating non-cases, 8 - 10 mild symptoms and scores > 15 denoting severe symptoms. Cronbach's α and McDonald's ω were 0.86 for the anxiety and 0.79 for the depression subscale.

Statistical methods

Data were analyzed using the 22nd version of IBM® SPSS. Descriptive statistics (frequencies and means) were generated to characterize the sample according to sociodemographic and medical parameters. The factorial structure of the IMSF-FR was assessed via an exploratory factor analysis, considering the Portuguese version has never been tested. Principal axis factoring followed by an oblimin rotation was performed using five factors for extraction. Reliability was estimated by Cronbach's α and McDonald's ω coefficients as measures of internal consistency, computed for each of the five empirically derived subscales and the total score. Item homogeneity was investigated by corrected item-total correlations. The construct validity of the IMSF-FR (convergent *versus* discriminant approach) was evaluated through the Pearson product-moment correlation coefficients of the IMSF-FR total score, as well as each of the 5 subscale scores, with other measures administered in the protocol. Convergent validity was examined by computing correlations between the IMSF-FR and the POMS-F and the SF-36 VT scales (we predicted the IMSF-FR would be moderately to highly correlated with these measures of fatigue). We predicted the HADS, ESS, DSPS-4 and CFQ, measures of concepts related to fatigue used to examine the discriminant validity, would be moderately correlated with the IMSF-FR. Correlations were interpreted as small ($0.1 \leq |r| \leq 0.29$), medium ($0.3 \leq |r| \leq 0.49$), and as large ($|r| \geq 0.5$) following Cohen's criteria.[36]

Criterion concurrent validity was evaluated by comparing IMSF-FR scores between cancer patients and noncancer controls and determining the relationship between the IMSF-FR subscale scores and the Performance Status among cancer patients. ANOVAs, *post-hoc* tests, partial *eta* squared (η_p^2) and Pearson's *r* were computed. We anticipated cancer patients would report greater fatigue than noncancer controls. For the latter approach, patients with cancer were categorized according to ECOG PSR Scale (0 = fully ambulatory, 1 = restricted in physical strenuous activity but ambulatory, 2 to 3 = capable of limited self-care), and a MANOVA was performed. We expected a poorer performance status would be associated with greater fatigue.

RESULTS

Scale structure

The Keyser-Meyer-Oklin value was 0.96 and the Barletts' test reached statistical significance. Factors explained 55.03, 7.41, 7.05, 3.60, and 2.43% of the variance, respectively. Factor 1 included items 2, 4, 6, 16, 19, 26 (corresponding to the Physical Subscale) and 17 (Table 2). Factor 2 was comprised of items 5, 7, 9, 22, 24 and 29, corresponding to the Vigor Subscale. Factor 3 comprised items 1, 11, 15, 20, 25 and 27, corresponding to the Mental Subscale. Factor 4 comprised items 3, 8, 13, 21, 23, 30, corresponding to the Emotional Subscale. Factor 5 comprised items 12, 10, 18, 14 and 28, corresponding to the General Subscale, except for item 17, which loaded primarily on Factor 1.

Reliability and item homogeneity

The overall α Cronbach coefficient of the IMSF-FR was 0.97 [total sample (ONC + H: α = 0.96, SUR + CD: α = 0.97)], with corrected item-total correlations ranging from 0.57 to 0.86. McDonald's ω for the total IMSF-FR score was 0.95 in the total sample (ONC + H: ω = 0.93, SUR: ω = 0.95, CD: ω = 0.94).

Cronbach's α and McDonald's ω coefficients for the subscales Emotional Fatigue (total sample: α and ω = 0.94; ONC: α and ω = 0.94; SUR: α = 0.91, ω = 0.93; CD: α and ω = 0.93; H: α and ω = 0.90), General Fatigue (total sample: α and ω = 0.96; ONC, SUR, CD: α and ω = 0.95; H: α and ω = 0.94), Mental Fatigue (total sample: α = 0.92, ω = 0.93; ONC: α and ω = 0.94; SUR: α and ω = 0.92, CD: α and ω = 0.89; H: α = 0.88, ω = 0.89), Physical Fatigue (total sample: α and ω = 0.92; ONC: α and ω = 0.88; SUR: α = 0.90, ω = 0.91; CD: α and ω = 0.91; H: α = 0.90, ω = 0.89) and Vigor (total sample, SUR: α = 0.90, ω = 0.89; ONC: α = 0.88, ω = 0.89; CD: α and ω = 0.88; H: α and ω = 0.85) suggest all scales have strong internal consistency.

Validity

As for convergent validity, we found strong correlations

Table 2 – Factor structure of the IMSF-FR

Items	Factors				
	1	2	3	4	5
26 (heavy body)	0.87				
16 (weak arms)	0.82				
4 (weak legs)	0.81				
2 (muscles ache)	0.78				
17 (sluggish)	0.77				(-0.76)
19 (ache)	0.76				
6 (heavy head)	0.72				
7 (lively)		0.85			
5 (cheerful)		0.80			
29 (cal)		0.75			
9 (relaxed)		0.75			
24 (energetic)		0.73			
22 (refreshed)		0.66			
27 (forgetful)			0.89		
15 (attention)			0.85		
20 (concentrate)			0.84		
1 (remembering)			0.82		
25 (mistakes)			0.75		
11 (confused)			0.75		
30 (distressed)				0.87	
21 (depressed)				0.84	
13 (sad)				0.82	
23 (tense)				0.80	
3 (upset)				0.79	
8 (nervous)				0.73	
12 (worn out)					-0.96
10 (pooped)					-0.94
14 (fatigued)					-0.94
18 (run down)					-0.92
28 (tired)					-0.90
Factor correlation					
1		-0.45	0.52	0.40	-0.79
2			-0.39	-0.56	0.55
3				0.54	-0.58
4					-0.54

Extraction methods: Principal axis factoring. Rotation method: Oblimin with Kaiser-Normalization. Except for item 17, only the principal loadings are presented. Factor 1, Physical subscale. Factor 2, Vigor subscale. Factor 3, Mental subscale. Factor 4, Emotional Subscale. Factor 5, General subscale (except item 17).
Factor 1 included items 2, 4, 6, 16, 19, 26 (corresponding to the Physical subscale) and 17 (Table 2). Factor 2 was comprised of items 5, 7, 9, 22, 24 and 29, corresponding to the Vigor subscale. Factor 3 comprised items 1, 11, 15, 20, 25 and 27, corresponding to the Mental subscale. Factor 4 comprised items 3, 8, 13, 21, 23, 30, corresponding to the Emotional subscale. Factor 5 comprised items 12, 10, 18, 14 and 28, corresponding to the General subscale, except for item 17, which loaded primarily on Factor 1.

between the MFSI-SF subscales and the POMS-F; and between the IMSF-FR subscales and the SF-36 VT (Table 3). For discriminant validity there were significant but correlations with small-to-medium effect sizes between the Fatigue subscales and the ESS, the DSPS-4 and the CFQ – except for CFQ and the Mental subscale, which were highly correlated. Contrary to hypotheses, correlations between the HADS and the IMSF-FR subscales were strong, albeit somewhat lower than the correlations between the IMSF-FR and other measures of fatigue. We found a strong correlation between the HADS and Emotional fatigue.

The total IMSF-FR score was significantly higher in the group of cancer patients (M_{ONC}: 42.93 ± 26.69) than in chronic disease patients (M_{CD}: 23.60 ± 23.98), cancer survivors (M_{SUR}: 22.91 ± 25.34) and healthy controls (M_H: 8.96 ± 19.07), and the magnitude of this difference was large (H = 101.61, $p < 0.001$, $\eta_p^2 = 0.25$). Games-Howell *post-hoc* tests indicated that the mean score for cancer patients was significantly different compared to the other groups (ONC > CD,SUR > H). There were also statistically significant differences in all MFSI-SF subscale scores for the four subsamples: Emotional [M_{ONC}: 11.31 ± 6.81; M_{SUR}: 7.60 ± 5.59; M_{CD}: 8.57 ± 6.15; M_H: 5.36 ± 4.91: (H = 53.39, $p < 0.001$, $\eta_p^2 = 0.14$, *post-hoc*: ONC > SUR,CD,H; CD > H)], General [M_{ONC}: 15.16 ± 6.87; M_{SUR}: 8.64 ± 6.61; M_{CD}: 8.43 ± 6.20; M_H: 5.04 ± 5.24: (H = 122.94, $p < 0.001$, $\eta_p^2 = 0.31$, *post-hoc*: ONC > CD, SUR > H)], Mental [M_{ONC}: 9.04 ± 6.87; M_{SUR}: 7.13 ± 5.53; M_{CD}: 7.16 ± 4.85; M_H: 5.10 ± 4.37: (H = 21.53, $p < 0.001$, $\eta_p^2 = 0.07$, *post-hoc*: ONC, CD > H)], Physical [M_{ONC}: 13.07 ± 6.48; M_{SUR}: 7.69 ± 6.00; M_{CD}: 8.19 ± 5.75; M_H: 4.03 ± 4.54: (H = 116.18, $p < 0.001$, $\eta_p^2 = 0.29$, *post-hoc*: ONC > CD, SUR > H)], and Vigor [M_{ONC}: 5.64 ± 5.63; M_{SUR}: 8.15 ± 4.81; M_{CD}: 8.75 ± 4.77; M_H: 10.57 ± 4.33: (F = 21.35, $p < 0.001$, $\eta_p^2 = 0.14$, *post-hoc*: ONC < SUR < CD, H)]. Statistically significant differences between the oncologic and healthy groups were found for every IMSF-FR item. These differences were associated with moderate-to-large effect sizes [η_p^2 ranging from 0.06 to 0.37, except items 1 ($\eta p^2 = 0.02$) and 3 ($\eta p^2 = 0.05$)].

Also concerning concurrent validity, a significant main effect of performance status was found for the total score and every subscale of the IMSF-FR (Table 4). Follow-up multiple comparisons using Tukey's range test indicated significant increases in fatigue for each successively lower level of performance status for General, Physical and Vigor subscales, as well as for the IMSF-FR total score. The Games-Howell *post-hoc* tests indicated the same tendency for the Emotional, but not the Mental subscale.

DISCUSSION

In this study, we first set out to adapt the English-language Multidimensional Fatigue Symptom Inventory-Short Form to European Portuguese and explore its factorial structure. An exploratory factor analysis of the IMSF-FR

Table 3 – Correlations of MFSI-SF subscales with other measures

MFSI-SF	Correlation coefficient (r)						
	POMS-F	SF-36 VT	HADS anxiety	HADS depression	ESS	DSPS-4	CFQ
Total Fatigue	0.82***	-0.77***	0.70***	0.70***	-0.09	0.26***	0.37***
Emotional Fatigue	0.65***	-0.60***	0.76***	0.71***	-0.09	0.23***	0.33***
General Fatigue	0.88***	-0.078***	0.56***	0.58***	-0.13*	0.21***	0.27***
Mental Fatigue	0.59***	-0.057***	0.58***	0.61***	0.08	-0.31***	0.55***
Physical Fatigue	0.75***	-0.071***	0.51***	0.53***	-0.09	0.22***	0.30***
Vigor	-0.60***	0.61***	-0.61***	-0.62***	0.14**	-0.13**	-0.18**

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

Table 4 – Mean MFSI-SF scale scores at each level of ECOG PSR

IMSF-FR/ECOG	0 (n = 37)	1 (n = 80)	2 + 3 (n = 85)	Test		Effect size
	Mean ± SD			*F*	*Post-hoc* test	η_p^2
Total	10.37 ± 22.84	37.91 ± 22.76	49.26 ± 27.64	33.91***	0 > 1 > 2 + 3	0.26
Subscales						
Emotional	5.89 ± 5.07	10.03 ± 5.74	12.67 ± 7.05	H = 26.45**	0 < 1 < 2 + 3[a]	0.14
General	6.41 ± 6.75	13.27 ± 6.36	16.60 ± 6.43	31.01***	0 < 1 < 2 + 3	0.24
Mental	5.32 ± 5.14	8.49 ± 6.24	9.91 ± 6.89	H = 13.17**	0 > 1 and 2 + 3[a]	0.06
Physical	5.14 ± 4.84	11.96 ± 6.21	14.18 ± 6.15	29.85***	0 < 1 < 2 + 3	0.23
Vigor	12.38 ± 6.28	5.83 ± 3.73	4.09 ± 4.68	40.99***	0 > 1 > 2 + 3	0.29

F: ANOVA; *H:* Kruskal-Wallis; a: Games-Howell (homogeneity of variances not assumed); η_p^2: partial eta squared.
**$p < 0.01$; ***$p < 0.001$

supported the 5-factor structure, as identified in the original 83-item version and the further validation studies,[20,21] corresponding to the Physical, Vigor, Mental, Emotional and General subscales of the 30-item MFSI-SF. Principal loadings were in the expected subscales for all items, except for item 17 ("I feel sluggish"), which loaded primarily in the Physical subscale instead of the General Fatigue subscale. As previously noted, some of the factors were highly correlated, and several items had secondary loadings in other factors, suggesting the factors of the IMSF-FR share variance and are not completely distinct.[20,21]

In agreement with previous validation studies, we found very good estimates of internal consistency for all subscales and the total score of the IMSF-FR in all subsamples (cancer patients, survivors, chronic disease, and healthy participants). The correlation pattern indicated the POMS-F and the fatigue subscales of the IMSF-FR, as well as the Vigor subscale and the Vitality scale of the SF-36, measured similar constructs (supporting convergent validity), while the IMSF-FR and the ESS, the DSPS-4 and the CFQ measured different constructs (supporting discriminant validity). Although the correlations we found between the HADS and the IMSF-FR were strong, they were lower than the correlations with other measures of fatigue (apart from the correlation between the Emotional Fatigue subscale and the HADS). This could mean emotionally distressed participants were prone to experience higher levels of fatigue. Even though findings opposed our hypothesis, they are in line with previous studies bearing on the correlations between the MFSI-SF and depression and anxiety measures.[37] Lukas *et al*[38] have reported a correlation between Total Fatigue score and the HADS total of 0.74. The mean correlation of eight studies reporting the associations of Total Fatigue with another measure of depression was 0.77.[37]

Concurrent validity analyses showed every item and subscale of the IMSF-FR could accurately differentiate between cancer patients and healthy participants in terms of fatigue. Furthermore, fatigue scores were significantly higher according to performance status measured by ECOG. This shows the IMSF-FR can accurately distinguish between clinician rated levels of performance ratings.

Study limitations

Overall, our results suggest that the IMSF-FR is a valid and reliable measure to assess fatigue in Portuguese-speaking patients with different diagnoses and sex. However, our sample was heterogeneous in terms of medical conditions. Future studies should determine the extent to which the factor structure of IMSF-FR is confirmed for specific groups with different health status/diagnoses, as response patterns may differ. Due to sample size limitations, we could not compare IMSF-FR scores among cancer types. Our oncologic sample was composed predominantly of women, precluding adequate numbers to make sex comparisons, although it should be noted there were no significant differences in sex across the sub-samples. The one-time administration prevented us from computing test-retest reliability.

Clinical implications

Our results highlight the research and clinical value of the IMSF-FR, the European Portuguese version of the MFSI-SF. By assessing fatigue using a multidimensional approach, this instrument may help clinicians to identify patterns within individuals and select targeted interventions for managing fatigue. The IMSF-FR may be incorporated into routine clinical assessments, throughout cancer treatments, to compare groups in studies of fatigue, or to obtain baseline data in patients initiating treatments in which fatigue is a common effect.

CONCLUSION

This paper established the psychometric properties of a measure of fatigue for use with European Portuguese-speaking cancer patients. As cultural background may shape the meaning of fatigue, examining the properties of cross-cultural measures is paramount to establish its accurate assessment. The European Portuguese version of the MFSI-SF revealed strong internal consistency and favorable convergent and discriminant validity. Concurrent validity analyses showed the IMSF-FR can accurately distinguish cancer from noncancer participants, as well as between clinician rated levels of performance.

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AUTHOR CONTRIBUTIONS

MIC: Conception, data collection; data analysis and interpretation; drafting the article.

KS, MCC: Discussion; critical revision.

AAG: Conception; critical revision.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki

Declaration of the World Medical Association updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

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