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The Multidimensional diary of fatigue-fibromyalgia (MDF-fibro-17): Evidence from validity, reliability and cross-cultural comparison between Portugal and Brazil

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Study 1 Abstract

The Multidimensional Daily Diary of fatigue-fibromyalgia - 17 (MDF-fibro-17) instrument explores and evaluates the different components of fibromyalgia syndrome-related fatigue. Current study examined the factor structure of the MDF-fibro-17 so that it is possible to understand the general complexity of how fatigue directly affects individuals with this syndrome. Additionally, a cross-cultural analysis was carried out between a sample of Portuguese and Brazilian patients. Confirmatory Factor Analysis was used to examine the psychometric properties, as well as the measures invariance between the samples of these two cultures. In total, 209 Portuguese women aged between 21 and 75 years (M = 47.44; SD = 10.73) and 429 Brazilians women, aged 16 to 77 years (M = 46.51; SD = 9.24) participated in this study. The results revealed that the measurement model provided an acceptable fit to the data in both Portuguese and Brazilian samples, also displaying convergent and discriminant validity. In addition, the model showed acceptable internal consistency and was invariant between cultures. All in all, the MDF-fibro-17 can be applied to patients with fibromyalgia syndrome in both Portuguese and Brazilian women to measure which domain of fatigue it has the greatest impact; thus, clarifying the possible treatments to this disease.

Keywords

Fibromyalgia; Fatigue; Questionnaire; Cross-cultural validity; Measurement invariance

Study 2 Abstract

Fibromyalgia syndrome (FM) is one of the most common causes of chronic musculoskeletal pain and is widespread in the mid-adult population (between 30 and 50 years old), affecting mainly female people. It is estimated that 2% to 4% of the world population suffers from FM symptoms. As it is a chronic syndrome, younger patients, who have a positive diagnosis for FM, report a fear that their symptoms will worsen as they get older. So the aims of this study, is to verify the differences in the perceptions of fatigue between patients with FM in Brazil and in Portugal, as well as to evaluate and verify if there are differences in the perceptions of fatigue between the ages of the patients and the time when they were diagnosed. In total, 209 Portuguese women aged between 21 and 75 years (M = 47.44; SD = 10.73) and 429 Brazilians women, aged 16 to 77 years (M = 46.51; SD = 9.24) participated in this study. The results revealed that Brazilian women have a greater perception of fatigue than Portuguese women. In addition, the model showed that regardless of the time of diagnosis and age of the patient, fatigue and its components remain relevant. The verification of the perception of the components of fatigue in comparison between cultures, and through the age and time of diagnosis bring significant contributions to the literature in the scope of FM.

Keywords

fibromyalgia; fatigue; age; time of diagnosis, MDF-fibro-17

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Acronym List

AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
df	Degrees of freedom
DTG	Diagnostic Time Group
DTG 1	Diagnostic Time Group 1
DTG 2	Diagnostic Time Group 2
FIQ	Fibromyalgia Impact Questionnaire
FM	Fibromyalgia
G	Age Groups
G1	Age group 1
G2	Age group 2
G3	Age group 3
M	Mean
MDF	Multidimensional daily diary of fatigue-fibromyalgia - 17 items
MFI	Multidimensional Fatigue Inventory
N	Samples Size
p	level of significance
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SRMR	Standard Mean Root Square Residual
t	T test
TD	time of diagnosis
TLI	Tucker-Lewis Index

General Introduction

Fibromyalgia syndrome (FM) is a chronic condition that affects 2% to 4% of the world population, with middle-aged women (between 30 and 50 years old) being the main carriers of this disorder (Assumpcao et al., 2018; Saral et al., 2016). The quality of life of these women is substantially compromised, as it causes a series of disorders, such as musculoskeletal pain without external stimuli, chronic fatigue syndrome, decreased maximum muscle strength and some psychological problems such as sleep disorders, anxiety and depression (Busch et al., 2011; Chang et al., 2019).

Although the origin of FM is not yet fully understood, it is currently known that there is a relationship with the nervous system and neurochemical imbalances, for the appearance of the first symptoms of this syndrome (Demirbag & Bulut, 2018). The association between the nervous system and neurochemical imbalances ends up making the pharmacological treatment generic and acts only on the signs and symptoms presented by the patient during crises (Demirbag & Bulut, 2018). The signs and symptoms of FM vary from individual to individual; however, excessive fatigue, sleep problems, depressive symptoms, anxiety, irritability, generalized pain and pain at specific points known as "tender points" are the most reported by people with this syndrome (O'Dwyer et al., 2019; Queiroz, 2013).

Another factor that makes treatment difficult is the lack of evaluation and means for diagnosing FM, as the individual must reach certain values in two questionnaires, one focusing on the severity of pain and the other on generalized muscle pain (Wolfe et al., 2010). After combining these two criteria, without changing the intensity of the symptoms for more than three months and without any other medical condition that justifies these symptoms, we can diagnose individuals with this syndrome (Bernard et al., 2018). Despite the intense pain that individuals feel during everyday life, fatigue is one of the main disabling factors for patients with FM and is used as a reference when asked about their well-being and quality of life (Arnold et al., 2011; Hudson et al., 2009; Morris et al., 2017).

Therefore, this work aims to translate and validate this questionnaire for the Portuguese and Brazilian population, and thus to verify the differences between the perception of fatigue between these two cultures. In addition to this we intend to verify: 1) determine

the effect of the issues addressed; 2) Check the invariance according to the cultures analyzed; 3) Analyze whether age influences the feeling of fatigue; 4) Check if the duration of diagnostic increases or decreases the scores of perception of fatigue among patients.

Study 1: The Multidimensional daily diary of fatigue-fibromyalgia 17 items (MDF-fibro-17): evidence from validity, reliability and transcultural invariance between Portugal and Brazil

Introduction

Fatigue is widely known and understood, because it is a natural response of the body to some sort of physical stress, but it can also be a sign of possible physical and mental disorders (Finsterer & Mahjoub, 2014; Ulus et al., 2019). In healthy individuals, fatigue is a physiological reaction to prolonged intense activity to which the body can easily recover with rest which normally does not interfere with their day-to-day activities. In individuals who have some type of disease (e.g., FM, anemia, hypothyroidism, Chronic Obstructive Pulmonary Disease) or physical limitations, symptoms of fatigue have a different meaning when compared to healthy individuals (Finsterer & Mahjoub, 2014). Specifically, FM patients report that their fatigue is characterized by excessive physical tiredness and that it is usually not eased after hours of sleep or rest, which ends up making it the biggest obstacle to overcome physical inactivity and to perform daily tasks (Arnold et al., 2011; Finsterer & Mahjoub, 2014; Humphrey et al., 2010).

As described earlier on pain, fatigue is also measured through a self-reported measure, in which the patients make a critical and subjective analysis of their perception of this symptom. One of the most used instruments is the Multidimensional Fatigue Inventory (MFI), which has been used in the past to measure subjective fatigue (Smets et al., 1995). While the MFI has displayed utility in identifying symptoms of fatigue in several chronic patients, it has not been tested and validated for FM patients, making it ineffective for a deep understanding of fatigue individuals experience by this clinical condition (Humphrey et al., 2010). So due to this lack of validated instruments on measuring fatigue, specific for FM patients, the Multidimensional daily diary of fatigue-fibromyalgia - 17 (MDF-fibro-17) was develop (Li et al., 2017; Morris et al., 2017). MDF-fibro-17 was created to explore and evaluate the different components of FM-related fatigue so that it

could be possible to understand the general complexity of how fatigue directly affects people with this syndrome (Li et al., 2017). The questionnaire comprises 17 items that measure five dimensions of FM: i) Global Experience; ii) Cognitive Fatigue; iii) Physical Fatigue; iv) Motivation; and, v) Impact on Function. This subdivision is due to the recognition and acceptance of fatigue as a multidimensional-related factor and by the need for investigation and treatment for each specific dimension of fatigue (Morris et al., 2017). For a better understanding of each subscale, a definition is presented.

Global Fatigue Experience

This domain is used to capture and demonstrate certain general points of fatigue, which are not suitable for other more specific domains as FM carriers use a variety of terms to speak and describe their fatigue. This dimension presents itself as paramount, since several global terms have been used involving important and comprehensive elements to capture the experience of fatigue in a global manner (Arnold et al., 2008; Morris et al., 2017).

Cognitive Fatigue

FM patients report that their fatigue affects them both physically and mentally(Dailey et al., 2015; Morris et al., 2017). With this, there are cognitive limitations that are described by these people, where they describe mental tiredness, which ends up impacting their concentration to perform tasks, to think clearly or remember something. For this reason, this domain has the role of measuring how much fatigue affects and limits the cognition of the patients of the disease (Dailey et al., 2015; Morris et al., 2017).

Physical Fatigue

People with FM report that physical fatigue is one of the biggest barriers and problems, reported by muscle weakness and a feeling of heaviness in their body (Dailey et al., 2015; Morris et al., 2017). Therefore, this domain has the function of assessing how much this physical fatigue affects patients with FM (Dailey et al., 2015; Morris et al., 2017).

Motivation

Patients with FM describe motivation as a direct and integral factor than fatigue, as they have severe difficulties to motivate themselves causing a greater effort to perform any activity physical or just an activity of their daily routine and customary. So, this domain

is used to check how much motivation (or lack) hinders FM carriers to act upon a given activity or behavior (Humphrey et al., 2010; Morris et al., 2017).

Impact on Function

One of the main issues that FM patients describe is that fatigue influences their functional capacity, even in their daily activities. Therefore, this domain has the function of evaluating, in a specific manner, how fatigue affects and disturbs patients affected by FM in the performance of their basic functions (Humphrey et al., 2010; Morris et al., 2017).

Past Limitations and Current Research

Previous studies have shown that fatigue is the main symptom reported by patients, when asked what most affects your general health and overall perception of the disease (Arnold et al., 2008; Hudson et al., 2009). Even though this is a major impact factor in this disease, fatigue is not always included and evaluated in clinical FM research (Mease et al., 2007; Morris et al., 2017). One of the possible reasons why this happens is because it does not have a specific fatigue measurement tool for patients with FM, which means that the results end up not being accurate or inconclusive (Mease et al., 2009). For this reason, the MDF-fibro-17 was developed to capture aspects of global fatigue and its constructs (Morris et al., 2017). To the best of our knowledge, the original research of MDF-fibro-17 has only been carried out with only one sample considering FM patients with similar socio demographic characteristics. Thus, the MDF-fibro-17 lacks a cultural variance, since multigroup analyzes allow to assess the equivalence of the measurement model between groups with different characteristics and to demonstrate whether there is a difference between the perception of the disease (Sass, 2011). So, the process of cross-cultural adaptations is essential when the instrument is validated for a specific type of population but being used in different cultures (Cid et al., 2016; Mease et al., 2007; Mease et al., 2009; Sass, 2011).

Cross-cultural studies must have a substantial sample size, an adequate model specification, and that item meanings do not suffer differences between the groups with different characteristics (Sass, 2011). Another important factor in intercultural studies is to verify the possible difference in the perception of certain points of the same factors and to be able to compare them (Cid et al., 2016; He & van de Vijver, 2012; Karl et al.,

2020; Vlachopoulos et al., 2013). In Portugal, the prevalence of the disease is between 1.3 to 2.1% of the population, that is, more than 200,000 adults have been diagnosed (EpiReuma, 2013). Women are the most affected by FM, with a proportion of six cases to just one case among males (Gomes & Campos, 2010). The study by Branco et al. (2010) shows that Portugal presents more FM carriers and great parameters in the questionnaire for pain arising when compared to other Western European countries (Spain, France, Germany and Italy). In Brazil, it is estimated that 2% of the population has a positive diagnosis for FM, that is, approximately 4.2 million Brazilians suffer from this disease, with the proportion of every 1 man with a positive diagnosis, there are 5.5 women (Souza & Perissinotti, 2018). These findings support previous mentioned literature that this disease largely affects women compared to men.

Therefore, considering the dynamic and continuous process of validating the instrument, the present study performed the translation of MDF-fibro-17 for a sample of Portuguese and Brazilian patients with FM.

Several authors have described the importance of performing the measurement invariance test between groups to determine whether they can be applied to different groups with different characteristics (Byrne, 2010; Cheung & Rensvold, 2002). So, for this, a multigroup analysis was performed to assess the invariance according to the cultures analyzed.

Methods

Participants

Two independent samples were collected for the present study. Sample 1 consisted of a total of 290 Portuguese women aged between 21 and 75 years (M = 47.44; SD = 10.73) who were invited to participate in the study. The Portuguese participants were diagnosed with FM on average 7.71 ± 6.04 years. Sample consisted of data from 429 Brazilians women aged between 16 and 77 years (M = 46.51; SD = 9.24). The Brazilian individuals were diagnosed with FM on average 7.71 ± 6.04 years.

Procedure: Data Collection

After obtaining the responses from each panel of specialist, we contacted the doctors responsible for the specific FM groups on Facebook, so that they could administer and forward the questionnaires to the members of the group who had this disease. All individuals participated voluntarily in this study. Participants did not receive any monetary reward for their contribution. Before data collection, ethical approval was obtained from the ethic and scientific board of the Research Centre in Sport, Health and Human Development (CIDESD) under the reference UID04045/2020, Portugal. Current study was conducted according to the Helsinki declaration and its latter amendments.

Instrument

The MDF-fibro-17 (Morris, et al., 2017) was used to measure the different components of FM-related fatigue. This 17-items consists of five subscales: global fatigue experience (four items; e.g., "*How severe was your fatigue today*"); Physical fatigue (three items; e.g., "*How weak did your muscles feel today*"); Cognitive fatigue (four items; e.g., "*How difficult was it to concentrate because you were tired today?");* Motivation (three items; e.g., "*How much of an effort was it to do things today?*"); and, Impact on function (three items; e.g., "*Did you do things more slowly because you were tired today?*"). Participants responded to each item using a 10-point scale ranging from 0 ("not at all") to 10 ("extremely"). Higher scores indicated greater fatigue severity. Previous studies supported the validity and reliability of this questionnaire (Li, et al., 2017).

Procedures: Translation of the questionnaire

The translation of the MDF-fibro-17 from English to Portuguese was done using the committee approach methodology (see Brislin, 1980) as suggested by Banville et al (2000). The process includes five stages:

1) Preliminary Translation: The first stage was carried out by researchers with the help of three bilingual (English-Portuguese) teachers where the original questionnaire was translated into Portuguese which resulted in its first draft;

2) First Evaluation Panel: An analysis of the initial version of the MDF-fibro-17 Portuguese version was carried out individually by specialists from different areas, such as two medical doctors specialized in FM and four research specialists in psychometric validations. Items received slight syntax and semantic modifications as proposed by their revisions and feedback;

3) Second Evaluation Panel: A revised version of the questionnaire was sent again for a new evaluation to another panel formed by three other specialists in the same categories as the previous ones (i.e., two medical doctors and four research specialists in psychometric validations). This panel examined all the items encompassed in the questionnaire and pointed out some small changes, which were accordingly accepted and modified so that a new version could be used for preliminary testing;

4) Pilot study: The revised questionnaire was answered by a group of 50 FM patients (22 from Portugal and 28 from Brazil), to determine if all items were properly clear and understandable;

5) Final revision: two Portuguese and two Brazilian teachers revised the final translated version of the MDF-fibro-17 to identify possible syntax, spelling, and grammar issues.

Statistical analysis

Descriptive statistics (means and standard deviation), as well as bivariate correlation, were calculated for all variables under analysis. For test-retest reliability evaluation, 40 Portuguese and Brazilian subjects were considered as recommended by Banville et al. (Banville et al., 2000). Based on the probability theory, a sample size of n = 30 approximates a normal distribution and therefore is considered acceptable and

recommended (Hair et al, 2019). The time between questionnaire administrations was four weeks as suggested by Banville et al (Banville et al., 2000).

For model assessment, a Confirmatory Factor Analysis (CFA) using the maximum likelihood estimator in AMOS 23.0 (Arbuckle, 2014) was conducted. Measurement model adequacy was verified by the traditional absolute and incremental indices, namely: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standard Mean Root Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) with a confidence interval of 90%. For model adequacy, the following cutoffs suggested by several authors (Byrne, 2016; Marsh, Hau, & Wen, 2004) were considered: CFI and TLI ≥ 0.90, SRMR and RMSEA ≤ 0.8.

Internal consistency was examined through composite reliability coefficients adopting ≥.70 as cutoff (Hair, Black, & Anderson, 2014). Average Variance Extracted (AVE) was calculated to examine convergent validity accepting values >.50 as proposed by several authors (Kline, 2016; Hair et al., 2019). Discriminant validity was achieved when AVE values were greater than the squared correlation across constructs of the measurement model (Hair et al., 2014).

Multigroup analysis

Several authors (Chen, 2007; Cheung & Rensvold, 2002) have shown that measurement invariance is a crucial analysis to determine whether certain measurements can be applied to different groups with different characteristics. A multigroup analysis between the Portuguese and Brazilian samples was conducted based on author recommendations (Byrne, 2016; Chen, 2007; Cheung & Rensvold, 2002). Specifically, two criteria had to be met to achieve measurement invariance: (1) the measurement model should provide acceptable fit in each sample; (2) configural, metric, scalar and residual invariance criteria should be respected. In this study, invariance criteria were evaluated considering different cutoffs, specifically: configural invariance, differences in CFI(ΔCFI) should be less than .01 (Cheung & Rensvold, 2002); for metric invariance, differences in CFI (ΔCFI) should be less than .01, differences in SRMR (ΔSRMR) should be less than .030 and differences in RMSEA (ΔRMSEA) should be less than .015; and, for scalar invariance, ΔSRMR should be less than .010, ΔRMSEA should be less than .015 and differences in CFI (ΔCFI) should be less than .01 as stated in previous literature (Chen, 2007).

Results

Preliminary Analysis

A preliminary inspection of the data showed no missing values or outliers (both univariate and multivariate). Skewness and kurtosis values are comprised within cutoffs revealing no violation from univariate data distribution. Nevertheless, Mardia's coefficient for multivariate kurtosis exceed the recommended value in all samples (Byrne, 2016). Consequently, a Bollen-Stine bootstrap (2000 samples) was performed for further analysis (Nevitt & Hancock, 2001).

Test-retest analysis

Test-retest analysis showed that the correlations from responses given to each item in the first and second administrations of the instrument varied from .72 (Item 14) to .89 (Item 15) in the Portuguese Sample; and ranged from .71 (Item 16) to .87 (Item 12) in the Brazilian Sample. In this regard, acceptable test-retest correlations (>.70) were found indicating that the items had a high degree of temporal reliability. For detailed information see Table 1 (i.e., Portuguese sample) and 2 (i.e., Brazilian sample).

Table 1. Test-retest reliability analysis (Portuguese Sample)

Items	M±SD	*r*	*p*	Alpha
Item 1 Pre-Post	7.24±1.62 – 7.38±1.77	.83	<.001	
Item 2 Pre-Post	7.24±1.68 – 7.72±1.91	.82	<.001	
Item 3 Pre-Post	7.88±1.34 – 7.82±1.56	.86	<.001	
Item 4 Pre-Post	7.39±1.71 – 7.74±1.82	.76	<.001	
Item 5 Pre-Post	7.48±1.64 – 7.46±2.05	.81	<.001	
Item 6 Pre-Post	7.82±1.79 – 8.03±1.86	.80	<.001	
Item 7 Pre-Post	7.70±1.55 – 8.00±1.72	.81	<.001	
Item 8 Pre-Post	7.06±2.16 – 7.33±2.02	.78	<.001	
Item 9 Pre-Post	7.06±2.20 – 6.23±2.04	.76	<.001	
Item 10 Pre-Post	7.48±2.03 – 7.69±1.72	.71	<.001	
Item 11 Pre-Post	7.27±1.86 – 7.36±1.97	.81	<.001	
Item 12 Pre-Post	7.79±1.45 – 7.90±1.68	.84	<.001	
Item 13 Pre-Post	7.89±2.05 – 7.67±2.19	.76	<.001	
Item 14 Pre-Post	7.45±2.18 – 7.56±2.43	.72	<.001	
Item 15 Pre-Post	7.64±1.64 – 7.77±1.95	.89	<.001	
Item 16 Pre-Post	7.64±1.95 – 7.51±2.45	.74	<.001	
Item 17 Pre-Post	7.85±.1.73 – 7.82±2.32	.86	<.001	
Global Fatigue Experience Pre-Post	7.44±.1.47 – 7.67±1.58	.87	<.001	0.77 - 0.78
Physical Fatigue Pre-Post	7.67±1.47 – 7.83±1.75	.76	<.001	0.80 - 0.77
Cognitive Fatigue Pre-Post	7.22±1.94 – 7.40±1.83	.84	<.001	0.81 - 0.83
Motivation Pre-Post	7.70±1.61 – 7.71±1.74	.81	<.001	0.82 - 0.81
Impact on Function Pre-Post	7.71±1.67 – 7.71±2.18	.74	<.001	0.78 - 0.77

Note. M = Mean; SD = Standard Deviation; r= bivariate correlations; *p* = level of significance

Table 2. Test-retest reliability analysis (Brazilian Sample)

	M±SD	*r*	*p*	Alpha
Item 1 Pre-Post	6.39±2.43 – 7.03±2.34	.80	<.001	
Item 2 Pre-Post	6.70±2.16 – 7.32±2.17	.86	<.001	
Item 3 Pre-Post	7.04±2.08 – 7.46±2.18	.80	<.001	
Item 4 Pre-Post	7.00±2.52 – 7.59±2.41	.77	<.001	
Item 5 Pre-Post	7.43±2.31 – 7.78±2.12	.84	<.001	
Item 6 Pre-Post	7.78±2.28 – 8.05±2.05	.83	<.001	
Item 7 Pre-Post	7.74±2.09 – 8.11±1.98	.84	<.001	
Item 8 Pre-Post	6.70±2.34 – 7.51±2.24	.80	<.001	
Item 9 Pre-Post	6.65±2.34 – 7.38±2.67	.79	<.001	
Item 10 Pre-Post	6.17±2.64 – 7.14±2.58	.72	<.001	
Item 11 Pre-Post	6.43±2.57 – 7.19±2.45	.83	<.001	
Item 12 Pre-Post	7.39±2.25 – 7.89±2.12	.87	<.001	
Item 13 Pre-Post	7.43±1.95 – 7.89±2.05	.75	<.001	
Item 14 Pre-Post	7.22±2.76 – 7.54±2.56	.73	<.001	
Item 15 Pre-Post	7.35±1.99 – 7.95±1.94	.88	<.001	
Item 16 Pre-Post	7.00±2.45 – 7.76±2.35	.71	<.001	
Item 17 Pre-Post	7.26±.2.40 – 7.92±2.29	.84	<.001	
Global Fatigue Experience Pre-Post	6.78±.2.06 – 7.35±2.05	.88	<.001	0.76 - 0.74
Physical Fatigue Pre-Post	7.65±2.10 – 7.98±1.44	.79	<.001	0.81 - 0.79
Cognitive Fatigue Pre-Post	6.49±2.37 – 7.30±2.30	.86	<.001	0.79 - 0.78
Motivation Pre-Post	7.35±2.10 – 7.77±2.03	.85	<.001	0.80 - 0.81
Impact on Function Pre-Post	7.20±2.18 – 7.87±2.12	.77	<.001	0.78 - 0.76

Note. M = Mean; SD = Standard Deviation; r= bivariate correlations; *p* = level of significance

Descriptive Statistics, Internal Consistency, and Convergent and Discriminant Validity

Table 3 presents descriptive statistics, internal consistency estimates, AVE scores, and bivariate correlations for all factor under analysis in both the Portuguese and Brazilian samples. Results showed that individuals from both countries presented a high mean (i.e., above midpoint) values in all factors. Moreover, there is evidence that all factors have adequate internal consistency values, and convergent validity criteria was respected in both samples. Discriminant validity was confirmed for 8 of the 10 possible comparisons in the Portuguese sample. Only the interaction between Global Fatigue Experience and Physical Fatigue, and between motivation and impact on function did not displayed discriminant validity. In the Brazilian sample, discriminant validity was confirmed for 7 of the 10. Discriminant validity was not achieved in the following interactions: Global Fatigue Experience and Physical Fatigue; between Global Fatigue Experience and motivation; between physical fatigue and motivation; and, between cognitive fatigue and motivation.

Table 3. Descriptive statistics, composite Reliability coefficients, AVE scores and correlations

	M	SD	CR	AVE	r^2				
Portuguese Sample					1	2	3	4	5
1 - Global Fatigue Experience	7.25	1.58	.93	.77	1	-	-	-	-
2 - Physical Fatigue	7.49	1.64	.92	.80	.83	1	-	-	-
3 - Cognitive Fatigue	7.20	1.85	.95	.84	.55	.59	1	-	-
4 - Motivation	7.50	1.70	.88	.72	.69	.71	.65	1	-
5 - Impact on Function	7.45	1.83	.92	.80	.67	.65	.65	.89	1
Brazilian Sample									
1 - Global Fatigue Experience	7.72	1.73	.92	.73	1	-	-	-	-
2 - Physical Fatigue	8.22	1.58	.89	.73	.80	1	-	-	-
3 - Cognitive Fatigue	7.88	1.82	.95	.83	.63	.58	1	-	-
4 - Motivation	8.19	1.71	.84	.64	.67	.72	.70	1	-
5 - Impact on Function	8.26	1.80	.92	.80	.55	.70	.61	.80	1

Note. M = Mean; SD = Standard Deviation; CR = Composite Reliability; AVE = Average Variance Extracted; r^2 = squared correlations; * p<.01.

Confirmatory Factor Analysis

Results from the measurement models in each group are displayed in Table 4. The current study showed that the CFA model specification provided an acceptable fit in both the Portuguese and Brazilian versions of the original version. In addition, items presented factor loadings equal to/ or greater than 0.50, explaining at least 25% of the variance of the latent factor. For detailed information of the factor structure of the model see Figure 1 and 2 (Portuguese and Brazilian samples, respectively).

Table 4. Goodness-of-fit indexes of the Portuguese and Brazilian versions and original model of MDF-fibro-17

Models	χ2	df	B-S p	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI
MDF-fibro-17- PT version	369 381	109	>.001	.954	.943	.030	.080	.076-.082
MDF-fibro-17- BR version	381.48	109	.002	.962	.953	.026	.076	.068-.085
MDF-fibro-17- Original	213.43	109	-	.950	.930	.025	.071	.109-.186

Note. χ^2 = chi-squared; df = degrees of freedom; B-S p = Bollen-Stine bootstrap; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Squared Error of Approximation; CI = Confidence Interval; PT = Portugal; BR = Brazil

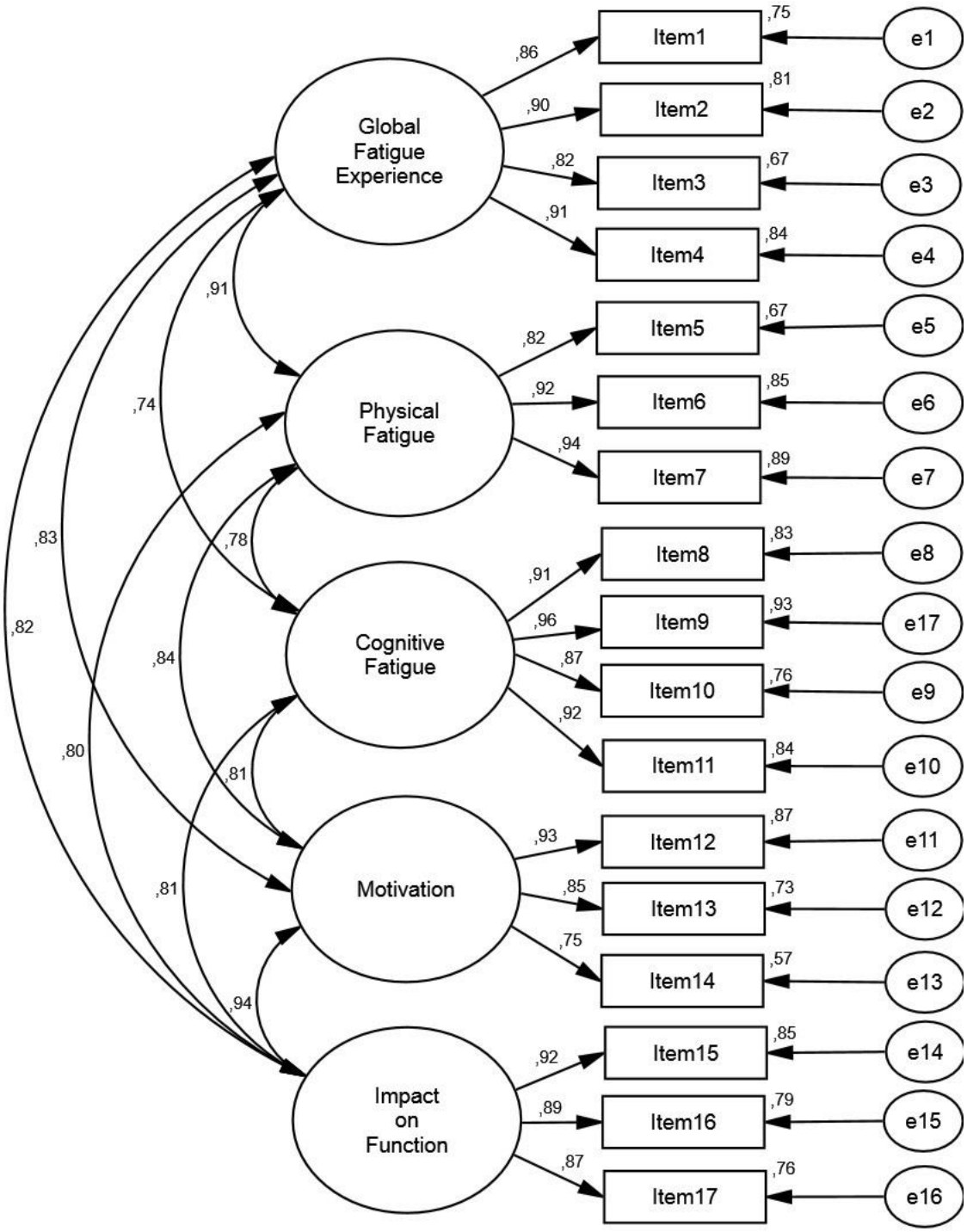

Figure 1. Measurement model in the Portuguese sample

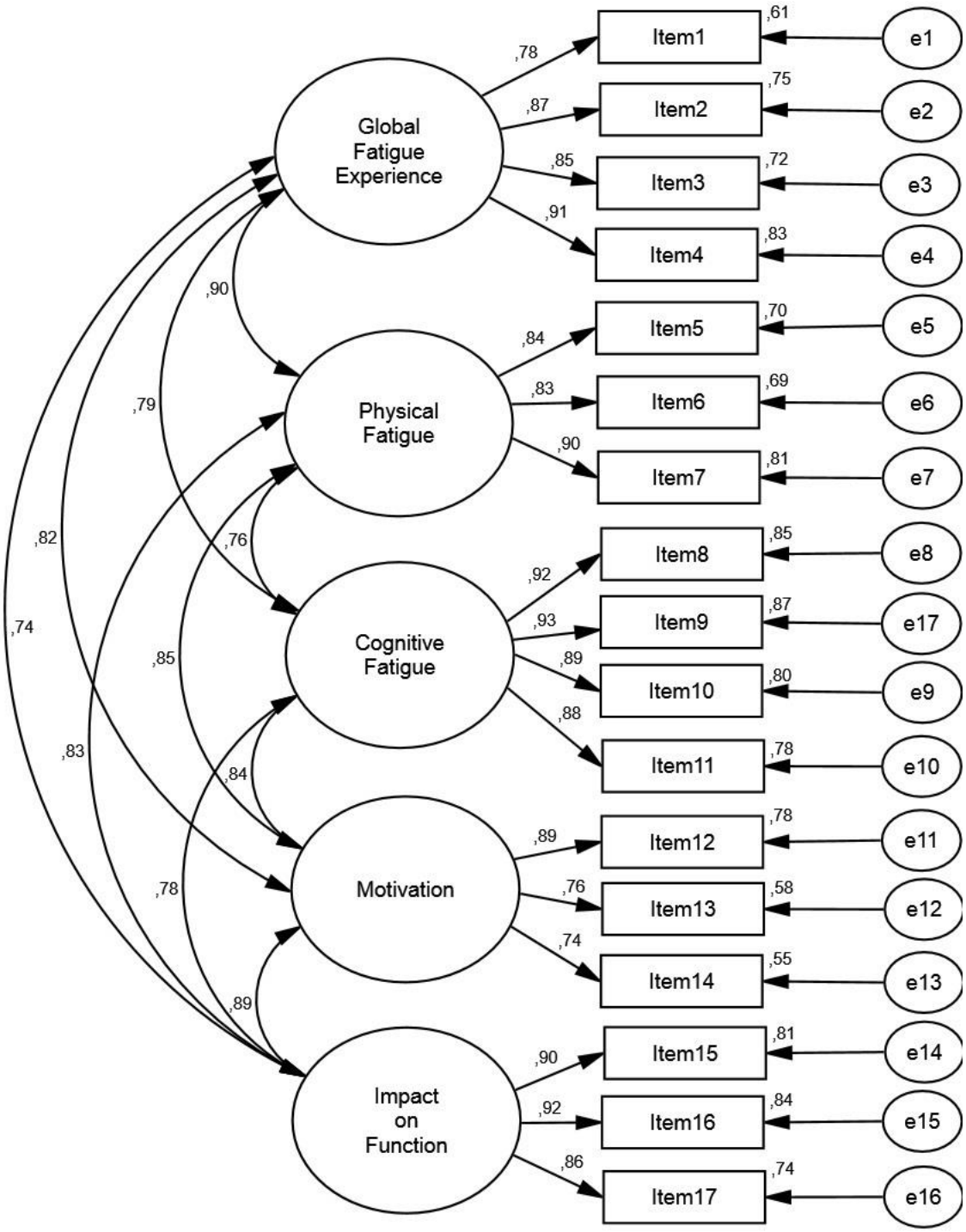

Figure 2. Measurement model in the Brazilian sample

Measurement Invariance

To test measurement invariance between cultures, the configural model was compared with the metric model, the scalar model, and the residual model. Multigroup analysis (see Table 5) revealed that the differences in CFI, RMSEA, and SRMR between configural model and nested models were below cutoffs. These analyses suggest that invariance remained stable with each subsequent parameter restraint, displaying that the model does not differ across cultures due to the sufficient model fit in each model (i.e., metric, scalar, and residual).

Table 5. Goodness-of-Fit Indexes of the multigroup analysis between Portugal and Brazil

	χ2	df	Δ χ2	Δdf	p	CFI	ΔCFI	RMSEA	ΔRMSEA	SRMR	ΔSRMR
Configural Invariance	750,938	218	-	-	-	.959	-	.058	-	.0301	
Metric Invariance	769,693	230	18,755	12	.095	.958	.001	.057	.001	.0292	.009
Scale Invariance	817,251	245	66,313	27	<.001	.956	.003	.057	.001	.0340	.004
Residual Invariance	968,208	262	217,27	44	<.001	.945	.014	.061	.003	.0458	.015

Note. χ^2 = chi-squared; df = degrees of freedom; $\Delta\chi^2$ = differences in chi-squared value; Δdf = differences in the degrees of freedom; CFI = Comparative Fit Index; ΔCFI = differences in the value of the Comparative Fit Index; RMSEA= root mean square error of approximation; ΔRMSEA= differences in root mean square error of approximation value; SRMR = standardized root mean square residual; ΔSRMR= difference in standardized root mean square residual.

Discussion

The purpose of the present study was to address an existing gap in the literature by developing and testing the MDF-fibro-17 in a sample of Portuguese and Brazilian patients, different from the original instrument in English, an instrument designed to measure five dimensions of FM. Additionally, a cross-cultural invariance between Portugal and Brazil samples was analyzed. The development and testing of measures have become an important focus of research among scholars and medical doctors. Overall, the findings support the utility of the MDF-fibro-17 as a method to provide reliable assessment of FM symptoms/dimensions in individuals from two distinct cultures.

Factorial Validity of the MDF-Fibro-17

The present results suggest that the proposed five-factor solution assess the dimensions of fatigue according to the original model/instrument. Specifically, current findings provide support for the psychometric proprieties of the MDF-fibro-17 in the Portuguese and Brazilian samples. Item correlations ranged from .71 (Item 10 in the Portuguese model and item 16 in the Brazilian version) to .89 (Item 15), as seen in Table 1 and in Table 2. Thus, findings provide acceptable test-retest correlations (> .70), indicating that MDF-Fibro-17 had a high degree of temporal reliability, in both versions. Regarding internal consistency, the results of the present research showed that composite reliability coefficients showed acceptable internal consistency (Hair et al., 2014). Similar results have been reported elsewhere (Li et al., 2017) showing a good degree of reliability of the translated versions. Additionally, AVE scores in the present study were above cutoffs, achieving convergent validity in all factors in both samples.

All factorial loadings in the Portuguese adapted 17-item version exhibited acceptable factor loadings (>.50) and loaded significantly their respective factors ($p<.01$), following previous assumptions (Byrne, 2010; Hair et al., 2019). The multidimensional structure of MDF-Fibro-17 allows scholars and medical doctors to verify with reliable capacity the fatigue factor in which the individual is most affected (Brislin, 1980). These results provide further support of the validity of the MDF-fibro-17 in both Portuguese and Brazilian samples, as several criteria for acceptable factor structure were respected (Hair et al., 2019).

When analyzing for discriminant validity, some dimensions did not meet the criteria. Specifically, the factors between the Experience of Global Fatigue and Physical Fatigue, and between Motivation and Impact on Function displayed some issues in the Portuguese sample. Looking at the Brazilian sample, the relationship between the Global Fatigue Experience and Physical Fatigue can also be verified, but there is also a relationship between Physical Fatigue with Motivation and also Cognitive Fatigue with Motivation. Current findings were was not showed in the original study Li and colleagues (Li et al., 2017) only found discriminant validity issues between motivation and physical fatigue. This can demonstrate that different populations, with different cultures, can demonstrate different perceptions of fatigue in relation to the disease. Current results may also be explained by the differences among cultures. Portuguese native speaking FM patients could perceive and experience fatigue more as a global perception, rather than specific dimensions as English native speaking FM patients tend to experience. However, this is only speculative and more studies with other samples from different cultures are warranted to explore the discriminant validity of the factors. Additionally, future studies with exploratory models and bifactor specifications are needed to examine the dimensionality of the MDF-fibro-17 not only e Portuguese speaking individuals, but also on the original scale. All in all, more intercultural studies, like this one, are paramount to explore in more detail FM patient perception of fatigue and their characteristics (Gomez-Calvente et al., 2015; Seo et al., 2015).

Measurement invariance

Regarding measurement invariance of the 17-item model, present findings demonstrate the equivalence of the instrument between the two analyzed cultures. Specifically, the adapted MDF-fibro-17 Portuguese and Brazilian versions are conceptualized and understood in the same manner between these cultures. Considering the premises of model invariance analysis, defined in the method section (Byrne, 2010; Cheung & Rensvold, 2002), results show that: a) the theoretical model of the MDF-fibro-17 is the same for both countries (configural invariance); b) the factorial weight of the items is equivalent for both countries (invariance of the measure), that is, each item has the same importance regardless of the group; and, c) the results can be compared between the two countries using the same questionnaire (scale invariance). (Li et al., 2017). According to some authors (Byrne, 2016; Cheung & Rensvold, 2002), residual invariance is optional, as it is very difficult to achieve. Thus, there is linguistic equivalence and operational applicability of this instrument, between the two culturally different countries.

Conclusions

Limitations

The present findings showed that the adapted MDF-Fibro-17 provided acceptable fit to both samples and has a great capacity to verify the five components of fatigue in patients with FM. However, current findings should be considered in relation to some limitations. First, this research did not directly measured whether the participants were currently endorsed in therapies or physical activities to control the symptoms resulting from FM. This factor can be explored in future research, with control groups to verify the effectiveness of certain therapies to improve certain aspects of fatigue in patients with this disease. Second, current findings cannot be generalized to other countries or contexts, as further research is needed to establish the validity of these scales (i.e., Portuguese and Brazilian versions). Specifically, future studies should examine the factor structure of the MDF-fibro-17 in other groups with different characteristics. It is worth to mention that the 17-item model showed an acceptable fit similar to those results reported by previous literature (Li et al., 2017; Morris et al., 2017). This fact shows that current Portuguese and Brazilian versions are reliable sources for measuring symptoms of fatigue and that current samples interpreted the meaning of each component similarly, when compared to the participants in the original study.

Practical Implications

The validated MDF-fibro-17 Portuguese and Brazilian versions make significant contributions to the literature concerning the measurement of FM patients. The instruments complement limited literature examining the factor structure of the MDF-fibro-17 (Li et al., 2017).In general, the results obtained by this study provide support for the validity of the original MDF-Fibro-17 adding new evidence to distinguish FM dimensions. The present study reinforces the importance of assessing fatigue in FM patients, since it is one of the main issues and limitations in this population.

All in all, current findings show that MDF-fibro-17 is a relevant, necessary, and sensitive multidimensional instrument for detecting clear definitions of fatigue responses. In general, this questionnaire has the potential to be a reliable tool for assessing clinical results to verify which dimension of fatigue the patient is most precarious or better so that there is a greater focus on treatment in both Portuguese and Brazilian patients.

Study 2: Differences between Brazil and Portugal in the perception of fatigue components in fibromyalgia in relation to age and time of diagnosis

Introduction

Fibromyalgia syndrome (FM) is one of the most common causes of chronic musculoskeletal pain and is widespread in the mid-adult population (between 30 and 50 years old), affecting mainly female people (Neumeister & Neumeister, 2020; Saral et al., 2016).

It is estimated that between 2% to 4% of the world population suffers from FM symptoms (Assumpcao et al., 2018). In Portugal, the prevalence of the disease is 2.1% of the population, that is, more than 200,000 people have a positive diagnosis for FM, with the proportion that there are 6 women with FM for each man with a positive diagnosis (EpiReuma, 2013; Gomes & Campos, 2010). The study by Branco et al (Branco et al., 2010) shows that Portugal has more FM carriers when compared to other Western European countries (Spain, France, Germany and Italy). In Brazil, it is estimated that 2% of its population has FM, which represents approximately 4.2 million Brazilians with FM, with the proportion that for every 1 man with a positive diagnosis, there are 5.5 women (Souza & Perissinotti, 2018).

Among the main symptoms reported by patients, there are musculoskeletal pain without external stimuli, specific places of musculoskeletal sensitivity (also called tender points), decreased muscle strength, chronic fatigue syndrome, and psychological adversities such as sleep disorders, anxiety and depression (Busch et al., 2011; Chang et al., 2019).

Although there is no certainty about the origin of FM, it is currently known that there is a relationship between the nervous system and neurochemical imbalance, for the appearance of the first symptoms of this syndrome (Demirbag & Bulut, 2018). With this, FM is a multifactorial health condition, that is, its symptoms worsen or are maintained based on the interaction of several factors, being biological, psychological and social (Climent-Sanz et al., 2020).

Due to these multiple factors that FM involves, the pharmacological treatment for this disease turns out to be generic, being only taken into account the signs and symptoms presented by the patient during crises (Demirbag & Bulut, 2018).

Another factor that makes the treatment of this disease difficult is the lack of evaluations and means for the diagnosis (Branco et al., 2010; Wolfe et al., 2010). For a health professional to diagnose FM, the patient must obtain certain values in two questionnaires established by the American College of Rheumatology (Branco et al., 2010; Wolfe et al., 2010). These two questionnaires focus on the severity of the pain the patient is feeling, and the other on the intensity of generalized muscle pain (Wolfe et al., 2010). After combining the results of these two questionnaires and without any change in symptom intensity for more than three months, it can be diagnosed that the patient has FM (Bernard et al., 2018). However, fatigue is the main symptom, which patients report to be the most disabling of the harm caused by FM, thus interfering drastically in their well-being and quality of life (Arnold et al., 2011; Branco et al., 2010; Hudson et al., 2009; Morris et al., 2017).

Studies show that FM patients show less quality of life when compared to people with any other rheumatic disease (Castro, Kitanishi, & Skare, 2011; Letieri et al., 2013). To assess the impact of FM on quality of life, the Fibromyalgia Impact Questionnaire (FIQ) (Burckhardt, Clark, & Bennett, 1991) is used to assess questions about physical dysfunctions, psychological changes and even the professional situation of each person (Castro et al., 2011; Letieri et al., 2013).

Inability to perform work or day-to-day tasks, not fully understanding the symptoms, feeling of disability, negative impact on interpersonal relationships, isolation, social exclusion and the difficult control of the various symptoms end up leading to a deterioration in quality of life and a significant worsening of their health status, both physical and mental, which ends up increasing the severity of the disease and its symptoms in its carriers (Lobo et al., 2014; McInnis et al., 2015). The study by Ghavidel-Parsa et al (2015) found that FM patients had the second lowest quality of life, when compared to patients of other pathologies and that affect the perception of quality of life of their patients.

Difference in FM perception through age and time since diagnosis

As it is a chronic syndrome, younger patients, who have a positive diagnosis for FM, report a fear that their symptoms will worsen as they get older (Burckhardt, Clark, & Bennett, 2010). However, some studies have evaluated that over the years, the symptoms, especially pain, of the studied patients had a decrease in their intensity (Granges, Zilko, & Littlejohn, 1994; Kennedy & Felson, 1996).

This finding was also confirmed by the study conducted by Burckhardt et al (2010), where it was found that the group that had older age had lower levels of pain intensity in specific locations. Regarding the time of diagnosis, the study developed by Berber et al (2005), demonstrated that the longer the time of diagnosis, the more the patients had better levels of quality of life and lower scores on the pain scale.

However, to best of our knowledge no studies were found in the literature that specifically worked on the perception of fatigue through age and time of diagnosis. For this reason, this study aims to verify the differences in the perceptions of fatigue between patients with FM between Brazil and in Portugal, as well as to evaluate and verify if there are differences in the perceptions of fatigue between the ages of the patients and the time when they were diagnosed.

Methods

Participants

Two independent samples were collected for the present study. Sample 1 consisted of 290 Portuguese women, aged between 21 and 75 years (M = 47.44; SD = 10.73), invited to participate in the study. The Portuguese participants were diagnosed with FM in a physician who was 7.71 ± 6.04 years old. Sample 2 consisted of data from 429 Brazilian women aged between 18 and 77 years old (M = 46.52; SD = 9.23). Brazilian women were diagnosed with FM on average 7.86 ± 6.48 years. For the purpose of this study two-groups in each sample were created: (a) diagnosis time, considering the media value for 5 for the Portuguese samples and 6 for the Brazilian sample; (b) age-groups, considering the division into three groups, where group 1 had people with FM who were between 18 and 29 years old, group 2 with 30 to 50 years old, and group 3 with over 51 years old. This was done based on the literature that says that middle-aged women, around 30 to 50 years old, are the most affected by FM (Assumpcao et al., 2018; Saral et al., 2016).

Data collect

We contacted the doctors responsible for the specific FM groups on Facebook, so that they could forward and administer the questionnaires to members with FM. All individuals participated voluntarily in this study, receiving no monetary reward for their contribution. Before data collection, ethical approval was obtained from the ethical and scientific director of the Center for Research in Sport, Health and Human Development (CIDESD) under the reference UID04045 / 2020, Portugal. The current study was conducted in accordance with the Helsinki declaration and its latest amendments.

Instrument

For this study, MDF-fibro-17 validated for Brazilian and Portuguese populations was used (previously in Study 1) to measure the different components of FM-related fatigue. These 17 items consist of five subscales: global fatigue experience (four items; for example, "How severe was your fatigue today"); Physical fatigue (three items; for example, "How weak your muscles were today"); Cognitive fatigue (four items; for example, "How hard was it to concentrate because you were tired today?"); Motivation (three items; for example, "How much effort was made today?"); and Impact on function (three items; for example, "Did you do things more slowly because you were tired today?"). Participants responded to each item using a 10-point scale, ranging from 0

("nothing") to 10 ("extremely"). Higher scores indicated greater fatigue severity. Previous studies supported the validity and reliability of this questionnaire (Hudson et al., 2009).

Statistical analysis

Descriptive statistics, including means and standard deviation were calculated of all studied variables in two samples. Subsequently, a t-test for independent sample was used to analyze the difference between the perceptions of the fatigue domains among Brazilian and Portuguese individuals, as well as, between diagnoses time in each sample. In addition, one away ANOVA was performed to analyze the differences between the perceptions of the fatigue domains across different age-groups, as suggested by Ho (2014) (Ho, 2014) . For these analyses, a p-value ≤ .05 was adopted to reject the null hypothesis. Finally, Cohen d and partial eta square, respectively were calculated to test the effect size and the following cut-off values were assumed: trivial (0–.19), small (.20–.49), medium (.50–.79) and large (.80 and greater) (Cohen, 2013). In case of differences between age-groups, the ANOVA was complemented with the Tukey post-hoc test (Ho, 2014).

Results

Preliminary analysis

A preliminary inspection of the data was performed, which showed no missing values or outliers. Skewness and kurtosis values are included in the cutoff points that do not reveal a violation of the univariate data distribution.

Comparison of fatigue components between Brazil and Portugal

The analysis of the t-test for independent samples showed that there are significant differences between the perception between Brazilians and Portuguese when asked about their perception of the components of fatigue ($p < 0.01$). For detailed information see Tables 6 and 7.

Table 6. Descriptive statistics between samples

		N	M	SD
Global Experience	Portugal	290	7.25	1.58
	Brasil	429	7.72	1.74
Physical Fatigue	Portugal	290	7.50	1.64
	Brasil	429	8.22	1.59
Cognitive Fatigue	Portugal	290	7.20	1.86
	Brasil	429	7.88	1.82
Motivation	Portugal	290	7.50	1.70
	Brasil	429	8.19	1.71
Impact on function	Portugal	290	7.45	1.83
	Brasil	429	8.27	1.80

Note. N = samples size; M = mean; SD = Standard Deviation.

Table 7. Comparison between the Brazil and Portugal samples in relation to the Fatigue domains

	t	df	p-value
Global Experience	-3.690	717	<.001
Physical Fatigue	-5.898	717	<.001
Cognitive Fatigue	-4.848	717	<.001
Motivation	-5.312	717	<.001
Impact on function	-5.847	717	<.001

Note. t= t test; df = degrees of freedom; p = level of significance.

Analysis of age in relation to the perception of fatigue in the samples

The age division was primarily divided into three groups, where group 1 (G1) had people with FM who were between 18 and 29 years old, group 2 (G2) with 30 to 50 years old, and group 3 (G3) with over 51 years old. This was done based on the literature that says that middle-aged women, around 30 to 50 years old, are the most affected by FM. This was done, in tables 8 and 9, in order to verify if there are differences in the perception between the components of fatigue through the age of the patient with FM.

Table 8. Descriptive statistics between the age groups of the Portuguese sample

	G	N	M	SD
Global Experience	G1	17	6.68	1.87
	G2	158	7.26	1.57
	G3	115	7.32	1.55
	Total	290	7.25	1.58
Physical Fatigue	G1	17	7.02	2.30
	G2	158	7.41	1.56
	G3	115	7.69	1.62
	Total	290	7.50	1.64
Cognitive Fatigue	G1	17	6.56	1.88
	G2	158	7.21	1.78
	G3	115	7.29	1.96
	Total	290	7.21	1.86
Motivation	G1	17	6.74	1.41
	G2	158	7.48	1.75
	G3	115	7.65	1.66
	Total	290	7.50	1.70
Impact on function	G1	17	6.50	2.53
	G2	158	7.46	1.79
	G3	115	7.57	1.75
	Total	290	7.45	1.83

Note. G= Age groups; N = number of patients; M = Mean; SD = Standard Deviation

Table 9. Comparison between age groups for each fatigue factor in the Portuguese sample.

		df	p-value
Global Experience	Between groups	2	.291
	In groups	287	
	Total	289	
Physical Fatigue	Between groups	2	.184
	In groups	287	
	Total	289	
Cognitive Fatigue	Between groups	2	.315
	In groups	287	
	Total	289	
Motivation	Between groups	2	.119
	In groups	287	
	Total	289	
Impact on function	Between groups	2	.080
	In groups	287	
	Total	289	

Note. df = Degrees of freedom; p = level of significance.

Using the same criteria for dividing the groups, based on the age of patients with FM, in Tables 10 and11, the test was performed to verify the differences in perception between the components of fatigue over the age of the patient with FM in the Brazilian sample.

Table 10. Descriptive statistics between the age groups of the Brazilian sample

	G	N	M	SD
Global Experience	G1	12	7.60	1.62
	G2	267	7.80	1.73
	G3	150	7.60	1.76
	Total	429	7.72	1.74
Physical Fatigue	G1	12	7.80	1.39
	G2	267	8.29	1.60
	G3	150	8.12	1.57
	Total	429	8.22	1.59
Cognitive Fatigue	G1	12	7.39	2.06
	G2	267	8.05	1.78
	G3	150	7.63	1.85
	Total	429	7.88	1.82
Motivation	G1	12	7.75	1.84
	G2	267	8.31	1.65
	G3	150	8.01	1.79
	Total	429	8.19	1.71
Impact on function	G1	12	8.05	1.91
	G2	267	8.36	1.75
	G3	150	8.11	1.89
	Total	429	8.27	1.80

Note. G= Age groups; N = number of patients; M = Mean; SD = Standard Deviation

Table 11. Comparison between age groups for each fatigue factor in the Brazilian sample

		df	p
Global Experience	Between groups	2	.532
	In groups	426	
	Total	428	
Physical Fatigue	Between groups	2	.365
	In groups	426	
	Total	428	
Cognitive Fatigue	Between groups	2	.052
	In groups	426	
	Total	428	
Motivation	Between groups	2	.153
	In groups	426	
	Total	428	
Impact on function	Between groups	2	.379
	In groups	426	
	Total	428	

Note: df = Degrees of freedom; p = level of significance.

Analysis of diagnostic time in relation to the perception of fatigue in the samples

To perform the analysis between the time of diagnosis (TD) and the fatigue components, a median of the values was performed in relation to the TD. For the Portuguese sample, the median value of 5. was obtained. With this we divided the samples into two large groups, where Group 1 (DTG 1) was the patients who had the diagnosis less than 5 years ago, and Group 2 (DTG 2) for the patients with a positive diagnosis. another 5 years. After performing this division between groups, tables 12 and 13 show the values obtained after performing the t for independent samples.

Table 12. Descriptive statistics between the age groups of the Portuguese sample

	DTG	N	M	SD
Global Experience	DTG 1	125	7.31	1.50
	DTG 2	165	7.20	1.65
Physical Fatigue	DTG 1	125	7.56	1.63
	DTG 2	165	7.45	1.65
Cognitive Fatigue	DTG 1	125	7.29	1.69
	DTG 2	165	7.14	1.98
Motivation	DTG 1	125	7.53	1.66
	DTG 2	165	7.48	1.73
Impact on function	DTG 1	125	7.57	1.74
	DTG 2	165	7.37	1.90

Note. GTD - Diagnostic Time Group; N = number of patients; M = Mean; SD = Standard Deviation

Table 13. Comparison between the time of diagnosis in relation to the fatigue domains in the Portuguese sample

	t	df	p
Global Experience	.593	288	.554
Physical Fatigue	.576	288	.565
Cognitive Fatigue	.701	288	.484
Motivation	.237	288	.813
Impact on function	.945	288	.346

Note. t= T test; df = degrees of freedom; p = level of significance.

For the Brazilian sample, the median value was 6. Then, again we divided the samples into two large groups, where Group 1 (DTG 1) was the patients who had the diagnosis less than 6 years ago, and Group 2 (DTG 2) for the patients with diagnosis positive for another 6 years. After performing this division between groups, tables 14 and 15 show the values obtained.

Table 14. Descriptive statistics between the age groups of the Brazilian sample

	DTG	N	M	SD
Global Experience	DTG 1	236	7.74	1.77
	DTG 2	193	7.70	1.71
Physical Fatigue	DTG 1	236	8.16	1.64
	DTG 2	193	8.29	1.52
Cognitive Fatigue	DTG 1	236	7.88	1.96
	DTG 2	193	7.89	1.64
Motivation	DTG 1	236	8.20	1.76
	DTG 2	193	8.19	1.65
Impact on function	DTG 1	236	8.25	1.90
	DTG 2	193	8.28	1.69

Note. DTG - Diagnostic Time Group; N = number of patients; M = Mean; SD = Standard Deviation

Table 15. Comparison between the time of diagnosis in relation to the fatigue domains in the Brazilian sample

	t	df	p
Global Experience	.199	427	.842
Physical Fatigue	-.880	427	.379
Cognitive Fatigue	-.082	427	.935
Motivation	.059	427	.953
Impact on function	-.156	427	.876

Note. t= T test; df = degrees of freedom; p = level of significance.

Discussion

The aim of the present study was to address a gap in the literature, which was the verification and comparison of the perception of the 5 components of fatigue between two different cultures, just as the comparison was made through age and time of diagnosis. In general, the results confirmed that there are differences between the perception of fatigue components between Brazilians and Portuguese, however, unlike pain, fatigue proves to be a symptom that does not slow down with age and time of diagnosis.

Comparison of fatigue components between Brazil and Portugal.

The present results suggest that Brazilian women with FM, when compared to Portuguese women, tend to have a more pronounced perception of the components of fatigue, as can be seen by the mean values in table 1 and the significance in table 2 ($p < .001$). This can demonstrate that different populations, with different cultures, can demonstrate different perceptions of fatigue in relation to the disease.

One of the factors that can explain this difference in the perception of fatigue between cultures is the level of physical activity. McLoughlin et al (McLoughlin, Stegner, & Cook, 2011), reported that individuals who performed regular physical activities had better parameters for modulation and control of pain in FM. However, according to data from Eurobarometer (2018), Portugal had a 68% rate of physical inactivity among its population, while Brazil has a 62% rate of physical inactivity, according to the Brazilian Institute of Geography and Statistics (IBGE, 2015). This demonstrates that physical activity is beneficial for pain control, however, in the context of fatigue, the same, if not performed in a controlled manner or accompanied by a specialist, can cause an increase in the perception of fatigue in patients with FM.

Another factor that may explain these differences between perceptions of fatigue among Brazilian and Portuguese, is that Brazil, having a greater geographical proportion, ends up having different social realities between states and regions, which ends up causing social inequalities, with that, it ends up for making it difficult to access the complex diagnosis of the disease and its pharmacological and non-pharmacological treatments (Souza & Perissinotti, 2018). Future research aimed at checking the level of physical activity among patients with FM and making a comparison between cultures

would help to clarify whether physical activity in a controlled and monitored manner improves fatigue levels.

Analysis of age in relation to the perception of fatigue in the samples

The results of this study showed that fatigue components are not significant in age groups, regardless of the cultural sample analyzed, as demonstrated by the values shown in tables 4 and 6 (p> .050). This demonstrates that fatigue, and its components, tend to be relevant symptoms and that they deteriorate the quality of life of FM patients, regardless of their age. This finding differs from studies by Burckhardt (Burckhardt et al., 2010), Kennedy (Kennedy & Felson, 1996) and Granges (Granges et al., 1994), who indicated that pain tends to decrease over the years. This may reveal that fatigue is the most persistent symptom and that there is no slowing down over the years in FM patients.

Analysis of diagnostic time in relation to the perception of fatigue in the samples

When comparing the perception of fatigue domains and the time of diagnosis, we found that there are no significant differences, as can be analyzed in tables 8 and 10 (p> 0.050). That is, regardless of the time the patient has a positive diagnosis, fatigue and its components, it continues to be felt over time. This result confronts the study by Berber et al (Berber et al., 2005), which demonstrated that the longer the time of diagnosis, the better the quality of life and pain perception in patients with FM.

Conclusion

Limitations

The present findings showed that despite the difference between the perception of fatigue between Brazilian and Portuguese, there are no significant differences between the components of fatigue over the years and the time of diagnosis. This shows that fatigue is the symptom that persists the most during the disease. However, the current findings must be considered in relation to some limitations. First, this survey did not directly measure the level of physical activity among the participants. This fact can be explored in future research to verify which physical activity or exercise improves the components of fatigue. Second, the findings of this study cannot be used for comparison between other cultures, as more research is needed to establish this comparative pattern. So future studies should examine these parameters in other groups with cultural differences.

Practical implications

The analysis of the perception of the components of fatigue in comparison between cultures, and through the age and time of diagnosis bring significant contributions to the literature in the scope of FM. These findings complement the limited literature regarding FM fatigue. The present study reinforces the real importance of assessing fatigue in patients with FM, as it is an extremely relevant symptom, regardless of the time of diagnosis or age of the patient.

General Conclusion

Analyzing the main objectives of this thesis, in relation to our review of the literature, translation and validation of the questionnaire, the results can be summarized in the following points:

i) The review showed several gaps in the literature, specifically with regard to investigations on the effects of fatigue and its components in patients with FM.

ii) The translated and validated scales can be used with a high degree of reliability and validity in FM patients, checking the 5 components of fatigue.

iii) the theoretical model of the MDF-fibro-17 is the same for both countries (configural invariance) and the factorial weight of the items is equivalent for both countries (invariance of the measure), that is, each item has the same importance regardless of the group.

iv) The level of perception of fatigue among FM patients is high, showing that this symptom is extremely relevant to their patients and their well-being. However, when comparing this perception between cultures, it appears that Brazilian women tend to have more problems than Portuguese women;

v) There is no significant difference in relation to the perception of fatigue, even at older ages, as at younger ages, which shows that fatigue is equally debilitating at any age of the patient.

vi) As with age, the time of diagnosis did not show a significant difference when comparing patients with recent diagnosis with patients with older diagnosis. Which also demonstrates that fatigue is a symptom that lasts over time.

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Appendix

Brazilian and Portuguese version of MDF-Fibro-17

Idade: Nacionalidade: Cidade onde Reside: Tempo de Diagnostico:	**Nenhuma**	**Leve**			**Moderada**			**Severa**			**Extrema**
1) Quanto severa foi a sua fadiga hoje?	0	1	2	3	4	5	6	7	8	9	10
2) Quão desgastado(a) se sentiu hoje?	0	1	2	3	4	5	6	7	8	9	10
3) Com que facilidade se sentiu cansado(a) hoje?	0	1	2	3	4	5	6	7	8	9	10
4) Quão exausto(a) se sentiu hoje?	0	1	2	3	4	5	6	7	8	9	10
5) Quanto enfraquecidos sentiu os seus músculos hoje?	0	1	2	3	4	5	6	7	8	9	10
6) Quão pesado sentiu o seu corpo hoje?	0	1	2	3	4	5	6	7	8	9	10
7) Quanto cansado sentiu o seu corpo hoje?	0	1	2	3	4	5	6	7	8	9	10
8) Quanto difícil foi concentrar-se devido ao cansaço hoje?	0	1	2	3	4	5	6	7	8	9	10
9) Quanto difícil foi pensar com clareza devido ao cansaço hoje?	0	1	2	3	4	5	6	7	8	9	10
10) Quanto difícil foi lembrar-se de algo hoje devido ao cansaço?	0	1	2	3	4	5	6	7	8	9	10
11) Quanto difícil foi focar-se em algo hoje?	0	1	2	3	4	5	6	7	8	9	10
12) Quanto esforço foi necessário para fazer algo hoje?	0	1	2	3	4	5	6	7	8	9	10
13) Quanto se forçou para fazer algo?	0	1	2	3	4	5	6	7	8	9	10
14) Quanto difícil foi motivar-se para fazer algo hoje?	0	1	2	3	4	5	6	7	8	9	10
15) Quanto o seu cansaço dificultou que fizesse coisas hoje?	0	1	2	3	4	5	6	7	8	9	10
16) Demorou mais tempo para fazer algo hoje devido ao cansaço?	0	1	2	3	4	5	6	7	8	9	10
17) Fez algo mais devagar porque estava a sentir-se cansado(a) hoje?	0	1	2	3	4	5	6	7	8	9	10