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Reliability and viability of using the Multidimensional Fatigue Inventory-20 in patients with chronic coronary artery disease

Confiabilidade e viabilidade de uso do *Multidimensional Fatigue Inventory – 20* em pacientes com doença arterial coronariana crônica

Confiabilidad y factibilidad de empleo del *Multidimensional Fatigue Inventory – 20* en pacientes con enfermedad arterial coronaria crónica

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ABSTRACT

Objective: To verify the reliability and viability estimates of using the translated and adapted version of the Multidimensional Fatigue Inventory-20 for use in Brazil in patients with chronic coronary artery disease. **Method:** A methodological study. The instrument was answered by the participants without the help of the researchers. Filling time was recorded, and facilities and difficulties were documented. The viability of use was analyzed through acceptability, practicality, ceiling and floor effects. Reliability was estimated by internal consistency. **Results:** The sample consisted of 201 participants. The mean fatigue score was 51.9 + 14.0. There was a small rate of unanswered items (0.65%), although 30.3% of participants requested some clarification after reading the instructions; 37.3% reported that they had doubts when answering the items, especially number 19. The response time was 4.8 + 1.9 minutes. There were no ceiling or floor effects. The reliability estimate was adequate. **Conclusion:** The instrument needs adjustments to the wording of the instructions and some items, although it has good acceptability and reliability estimates.

DESCRIPTORS

Fatigue; Coronary Artery Disease; Validation Studies; Cardiovascular Nursing.

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INTRODUCTION

Fatigue is a nursing diagnosis[1] manifested by patients with coronary artery disease (CAD)[2] and has been recognized as one of its symptoms[3]. The prevalence of fatigue in these patients may be high, above 60%[4-5].

Studies have shown that fatigue is a predictor of fatal and non-fatal coronary events[6]. Fatigue is associated with sleep disturbance, anxiety, depression and coping strategy efficiency in people who have suffered an acute coronary event, and is a persistent symptom until 2 years after such an event[7-9]. Researchers have found that 48% of patients who had suffered a heart attack two years earlier are still fatigued, and part of them had a diagnosis of associated depression[9].

Moreover, fatigue can negatively affect the functional capacity and quality of life of these people[10]. In a study of 240 patients in the third stage of a cardiac rehabilitation program, exercise capacity was found to be strongly associated with the presence of physical fatigue and social fatigue, and independently predicted the sensation of energy loss and malaise[11].

The diagnosis of fatigue in patients with CAD can be difficult, since it is a subjective phenomenon whose concept is associated with other feelings/conditions such as weakness, lethargy and lack of motivation, which share similar attributes[12]. The use of a reliable instrument which is easy and quick to apply and can be properly understood by patients is essential for professionals to use systematically in clinical practice and research, as well as for the accurate diagnosis of the phenomenon.

Several validated instruments are available for assessing fatigue, such as the *Dutch Fatigue Scale* (DUFS), the *Dutch Exertion Fatigue Scale* (DEFS), the *Piper Fatigue Scale* and the *Multidimensional Fatigue Inventory-20* (MFI-20)[13]. Among these, the MFI-20[14] is one of the translated and adapted instruments for use in Brazil[15], and has been widely used in patients with CAD[9,16]. The MFI-20 seems adequate to evaluate fatigue in clinical and research environments as it is a short, easy-to-apply and self-reported instrument[14]. Some psychometric properties of the original version and the version adapted for use in Brazil of the MFI-20 have been evaluated, such as construct validity, which confirmed its multidimensionality[14-15]; its convergent validity, which showed weak to strong correlations between the different MFI-20 subscales and the visual analog fatigue scale[14]; and the internal consistency of the subscales, which was satisfactory for four of the five subscales in the version adapted for use in Brazil[14-15]. More recently, a study investigating the instrument's psychometric properties in patients with myocardial infarction suggested that the MFI-20 is a one-dimensional scale[16].

Despite the validity data of the MFI-20, as far as the authors know there are no studies available which have investigated the reliability and viability estimates of the MFI-20 version adapted for use in Brazil in patients with CAD. Therefore, this study aimed to verify the reliability and viability estimates of the translated and adapted version of the Multidimensional Fatigue Inventory-20 for use in Brazil with chronic CAD patients.

METHOD

Study design

A methodological study.

Scenario

The research was conducted at the inpatient units (IU) of a public reference cardiology hospital in São Paulo (SP), from May 2016 to August 2017.

The sample consisted of 201 participants, defined according to the criteria established in the literature, which recommend the inclusion of 10 participants per item in measurement instrument validation studies[17]. Eligible patients, as identified through the hospital census list, were invited by one of the researchers to participate in the study. Those who met the following criteria were included: being over 18 years old; knowing how to read and write; not having cognitive impairment as verified by the Mini-Mental State Examination (MMSE)[18]; presenting stable chronic CAD, according to the diagnosis described in the medical records; and having no current medical diagnosis of cancer. Patients with visual impairment which did not allow them to read the items on the data collection instrument were excluded.

Data collection

Sociodemographic variables (age, gender, education, nationality, place of birth, origin, current occupation, profession and marital status) and clinical variables (weight, height, body mass index, hypertension, dyslipidemia, diabetes, smoking, physical inactivity, family history of cardiovascular disease, acute myocardial infarction, unstable/stable angina, heart failure, stroke, angioplasty and/or previous myocardial revascularization surgery, and medications in use) were obtained from the medical record or asked to participants when information was not documented.

Multidimensional Fatigue Inventory-20

The MFI-20 is a self-reported instrument that contains 20 items arranged in five dimensions (general fatigue, physical fatigue, reduced activity, reduced motivation and mental fatigue)[14]. Each dimension contains four items, two indicative and two counter-indications of fatigue. Items are answered using a five-point scale, ranging from "yes, it's true" to "no, it's not true". The scores of items 2, 5, 9, 10, 13, 14, 16, 17, 18, 19 need to be reversed before computing the total scores. Each subscale score ranges from four to 20. There is no single cut-off point to indicate the degree of fatigue, but the higher the score, the higher the level of fatigue intensity[14-15]. Although the authors of the scale suggest not adding the subscale scores to obtain a total score, a study that analyzed their psychometric properties using the Rasch method indicated that it is possible to obtain a single score, since the scale has shown to be one-dimensional[16].

For applying the MFI-20, the participants were instructed to read the instructions contained in the instrument regarding its completion; any questions about understanding the instrument were resolved in advance. The MFI-20 was answered by

the participants without any help from the researchers. The time from the beginning to the end of the instrument was measured by the researchers and recorded in a specific instrument. At the end the researchers checked the unanswered items, advised the patients if they had any questions, and recorded the answer(s) so that all the items were answered for analyzing the MFI-20 score. They then asked participants about their facilities and difficulties in answering any items on the MFI-20 and their answers were documented. The content of the answers was qualitatively analyzed, in which the answers were then grouped into categories according to their similarity.

Data analysis and treatment

The variables were analyzed by descriptive statistics. The viability of using the MFI-20 was analyzed by means of:

1. Acceptability: determined by the percentage of unanswered items and the proportion of patients who responded to all items of the instrument[19].

2. Practicality: determined by measuring the application time of the questionnaire and evaluating the facilities and difficulties in this process[19].

3. Floor and ceiling effect: were considered present if 15% of the participants scored the lowest (floor) or the highest (ceiling) MFI-20[19-21].

Reliability was estimated by internal consistency (Cronbach's alpha coefficient)[19]. Adequate internal consistency was considered $\alpha \geq 0.70$[17].

Ethical aspects

This study was approved by the Ethics Committee of the proposing institution (Opinion No. 1.400.127/2016) and co-participant (Opinion No. 1.412.540/2016), in accordance with Resolution No. 466/2012 of the National Health Council. Patients who voluntarily agreed to participate in this study signed the Informed Consent Form.

RESULTS

Sociodemographic and clinical characteristics of participants

Table 1 describes the sociodemographic characteristics of interest for this study.

Table 1 – Sociodemographic characteristics of the participants – São Paulo, SP, Brazil, 2016-2017.

Sociodemographic characteristics	Participants (n=201)
Age in years, mean (SD)	62.0 (8.7)
Male, n (%)	150.0 (74.6%)
White skin, n (%)	136.0 (67.7%)
Number of years attending school, mean (SD)	8.1 (4.0)
Body Mass Index (Kg/m^2), mean (SD)	28.4 (4.2)
Marital status, yes, n (%)	55.0 (27.4%)
Economically active, yes, n (%)	67.0 (33.3%)

SD: standard-deviation.

The mean MFI-20 score was 51.9 (SD = 14.0), ranging from 20 to 92.

A high prevalence of cardiovascular risk factors was observed. Ninety-one percent (91%, n = 183) of participants had a diagnosis of hypertension, 78.1% (n = 157) of dyslipidemia, and 38.3% (n = 77) of diabetes; 82.6% (n = 166) reported being sedentary and 13.9% (n = 28) reported smoking. Furthermore, 50.2% (n = 101) of the participants had a history of myocardial infarction, 16.4% (n = 33) and 1.5% (n = 3) had previously undergone angioplasty or myocardial revascularization surgery, respectively.

Regarding medications in current use, 94.0% (n = 189) were using statins and platelet antiaggregants, 82.6% (n = 166) beta-blockers, 73.6% (n = 148) antihypertensive drugs, 24.4% (n = 49) nitrates, 18.4% (n = 37) oral hypoglycemic agents, 11.9% (n = 24) insulin and 2.0% (n = 4) anti-ischemic drugs.

Viability of using the MFI-20

Acceptability

Considering that the total number of items was 4,020 (20 items x 201 participants) and 26 items were not answered, the percentage of unanswered items corresponded to 0.65%. Of these items, 19 (73.1%) were not answered because patients reported that they forgot to answer them or accidentally skipped to the next item. Also, 182 participants answered all the items, which determines a proportion of 90.5%.

Practicality

The average time taken to answer the MFI-20 was 4.8 (SD = 1.9) minutes, ranging from 1.7 to 12.0 minutes. Sixty-one (61) participants (30.3%) asked for clarification regarding any questions after reading the instructions before responding to the instrument items. After completing the instrument, 37.3% (n = 75) of the participants mentioned having questions to answer one or more items. Item 19 presented the highest proportion of participants with questions (6.0%; n = 12) and item 11 the lowest proportion of participants with questions (0.5%, n = 1). The facilities reported by the participants were: the layout of the questionnaire on just one sheet, the number of questions and the formulation of the questions making most of them short and easy to understand. The difficulties mentioned were: lack of clarity in the instructions, items written with negative polarity, the interpretation of the word "distracting me" in item 19 is ambiguous and can be understood as entertainment or loss of attention.

Floor effect and ceiling effect. Table 2 shows the distribution of participants' responses according to the possible scores for each item. Score 1 represents the floor effect for the item, and score 5 represents the ceiling effect.

Table 2 – Distribution of participants' responses according to the possible scores for each item of the Multidimensional Fatigue Inventory-20 – São Paulo, SP, Brazil, 2016-2017.

Item	Scores of the items				
	1 n(%)	2 n(%)	3 n(%)	4 n(%)	5 n(%)
1	63 (31.3)	32 (15.9)	30 (14.9)	28 (13.9)	48 (23.9)
2	35 (17.4)	25 (12.4)	30 (14.9)	34 (16.9)	77 (38.3)
3	68 (33.8)	23 (11.4)	35 (17.4)	38 (18.9)	37 (18.4)
4	141 (70.1)	24 (11.9)	18 (8.9)	11 (5.5)	7 (3.5)
5	42 (20.9)	25 (12.4)	39 (19.4)	38 (18.9)	57 (28.3)
6	58 (28.9)	25 (12.4)	31 (15.4)	34 (16.9)	53 (26.4)
7	127 (63.2)	32 (15.9)	23 (11.4)	14 (7.0)	5 (2.5)
8	43 (21.4)	26 (12.9)	37 (18.4)	35 (17.4)	60 (29.9)
9	120 (59.7)	34 (16.9)	16 (8.0)	10 (5.0)	21 (10.4)
10	47 (23.4)	19 (9.5)	36 (17.9)	33 (16.4)	66 (32.8)
11	103 (51.2)	42 (20.9)	23 (11.4)	20 (10.0)	13 (6.5)
12	103 (51.2)	36 (17.9)	30 (14.9)	11 (5.5)	21 (10.4)
13	85 (42.3)	39 (19.4)	18 (9.0)	33 (16.4)	26 (12.9)
14	60 (29.9)	26 (12.9)	37 (18.4)	31 (15.4)	47 (23.4)
15	148 (73.6)	18 (9.0)	13 (6.5)	9 (4.5)	13 (6.5)
16	41 (20.4)	28 (13.9)	29 (14.4)	33 (16.4)	70 (34.8)
17	51 (25.4)	29 (14.4)	27 (13.4)	43 (21.4)	51 (25.4)
18	125 (62.2)	27 (13.4)	18 (9.0)	15 (7.5)	16 (8.0)
19	78 (38.8)	31 (15.4)	24 (11.9)	22 (10.9)	46 (22.9)
20	47 (23.4)	19 (9.5)	40 (19.9)	27 (13.4)	68 (33.8)

Regarding the total scale score, 0.5% (n = 1) of the participants scored on the lowest score of the scale, and none scored on the highest score (Figure 1). The percentage of responses for the possible total scores, i.e. 0 to 100, ranged from 0% to 4.98%.

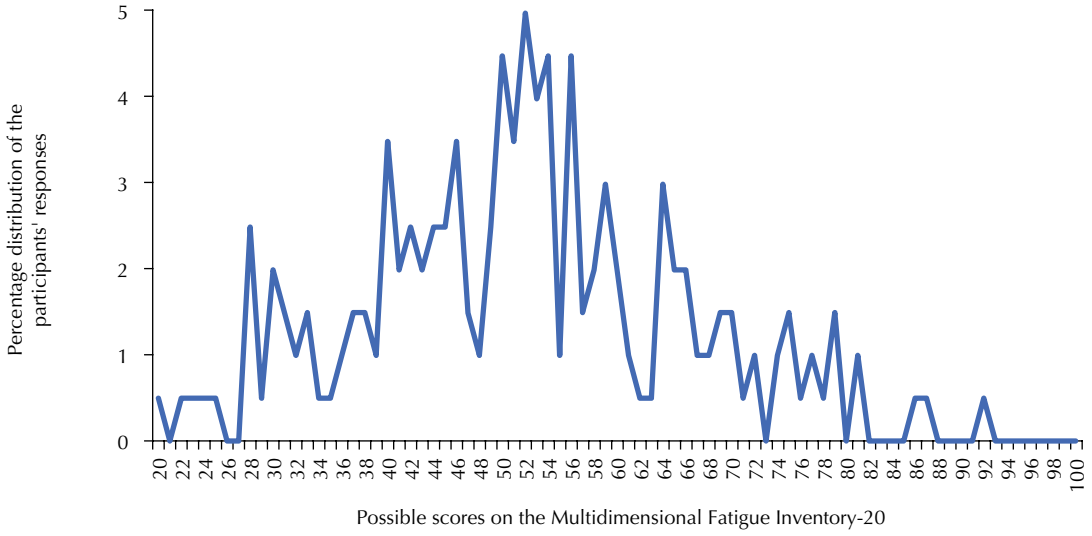

Figure 1 – Percentage distribution of participants according to the possible total scores of the Multidimensional Fatigue Inventory-20 – São Paulo, SP, Brazil, 2016-2017.

Reliability

Cronbach's alpha coefficient for the total MFI-20 was 0.830. The other results pertinent to the reliability of the instrument are described in Table 3.

Table 3 – Item-total correlation and Cronbach's alpha coefficient of Multidimensional Fatigue Inventory-20 in patients with coronary artery disease – São Paulo, SP, Brazil, 2016-2017.

Item	Item-total correlation	Cronbach's alpha total score if item deleted
1	0.474	0.819
2	0.306	0.828
3	0.589	0.813
4	0.328	0.826
5	0.400	0.823
6	0.336	0.826
7	0.499	0.820
8	0.528	0.816
9	0.248	0.830
10	0.239	0.831
11	0.526	0.818
12	0.312	0.827
13	0.356	0.825
14	0.512	0.817
15	0.146	0.833
16	0.444	0.821
17	0.538	0.816
18	0.461	0.820
19	0.297	0.829
20	0.539	0.816

DISCUSSION

The results of this study suggest that the MFI-20 is an instrument which presents good estimates of acceptability and reliability for assessing fatigue in patients with chronic CAD. However, in terms of practicality, although the time required to respond to items is short, adjustments to instructions and items seem to be necessary.

The MFI-20 presented an adequate reliability estimate. There were items that presented a low magnitude of the item-total correlation. However, removing these items would not improve the Cronbach's alpha coefficient. The internal consistency in other studies ranged from 0.80 to 0.93[22-23].

The results suggest that the participants had satisfactory acceptance of the instrument, as there was a small proportion of unanswered items. Still, the proportion of patients who answered all items was high and similar to that found in other studies of a similar nature to this one[24-25].

The completion time of each instrument item was approximately 30 seconds when considering the maximum time spent to answer all items. Although this result suggests the practicality of applying the MFI-20, it should be considered that the participants had questions regarding the instructions and completion of items, especially item 19. The difficulty reported in this item was the use of the word "distracting me", which for the participants could have a double meaning. Depending on the interpretation given to the word, the construct measured by the item could be different.

The presence of items with negative polarity was one of the difficulties reported by the participants (item 18). Interpreting such items may be more difficult. Authors investigating the factorial structure of the General Health Questionnaire 12 found that negative items presented greater variability than positive items and differed in relation to kurtosis. However, it should be considered that the random error is approximately equal for items with positive and negative polarities, so that the variance can be attributed to the response bias[26-27].

Participants also reported difficulties in interpreting item 19, similar to the findings in adapting the French-Canadian version of MFI-20. There was a possible translation error for these authors. In the factor analysis, item 19 was loading on an unexpected factor (reduced activity rather than mental fatigue). Thus, item 19 (in addition to other items) was removed from the adapted and validated version for Canada, resulting in MFI-15[28]. It was observed that the removal of item 19 in this study would not affect the internal consistency of the MFI-20 (α Cronbach coefficient total = 0.830; α Cronbach coefficient with the removal of item 19 = 0.829). Thus, removing this item with a subsequent evaluation of the psychometric properties of the instrument is suggested.

Guidelines are recommended for the construction of measuring instruments. Thus, the elaboration of the items must follow strict criteria, including clarity[29-30]. Failure to meet these criteria may compromise test results. Different factors may interfere with the clarity of a particular instrument or item. The education level, for example, may interfere with patients' ability to understand and interpret text[31]. In this sense, although an instrument has been previously tested, confirming the results of its validity seems pertinent when it comes to its use in a different patient profile.

In terms of viability, a floor effect was observed for all items and a ceiling effect for 12. No floor effect was observed for the total score, although 2.5% of participants scored between scores 20 and 25, neither constituting a ceiling effect. In other words, there were participants who scored at the lowest levels of the measure in this study, but there were no participants who scored at the highest levels. This suggests that although no floor effect was observed, the distribution of the scores seems to have asymmetric behavior, which may compromise the instrument's ability to detect

variability in the participants' responses[32] who score in the lower scores of the MFI-20.

This study has limitations. Illiterate participants were not included in the study, which may have implications for generalizing the study results. Participants' guidance on items which they were in doubt or those which they had failed to answer and then obtained this answer may have contributed to increasing the MFI-20 reliability estimates. On the other hand, this data add evidence of MFI-20 validity to the literature, which may bring benefits to interpreting its results when the instrument is used in other studies. In addition, identifying instrument weaknesses (practicality) contributes to guide its use in clinical practice and highlights opportunities for adjustments of the instrument for use in Brazil.

CONCLUSION

The MFI-20 is an instrument with good estimates of acceptability and reliability. Although individual items of the scale had ceiling and floor effects, this phenomenon was not observed in the total score. Despite being a quick instrument to fill-out, the practicality was compromised due to the questions presented by the participants in interpreting instructions and items. Therefore, it is suggested that adjustments are made to the Brazilian version of the MFI-20.

RESUMO

Objetivo: Verificar as estimativas de confiabilidade e viabilidade de uso da versão traduzida e adaptada para uso no Brasil do *Multidimensional Fatigue Inventory* – 20 em pacientes com doença arterial coronariana crônica. **Método:** Estudo metodológico. O instrumento foi respondido pelos participantes sem auxílio das pesquisadoras. O tempo de preenchimento foi cronometrado, e as facilidades e dificuldades foram documentadas. A viabilidade de uso foi analisada por meio da aceitabilidade, praticabilidade, efeitos teto e chão. A confiabilidade foi estimada por meio da consistência interna. **Resultados:** A amostra foi composta de 201 participantes. O escore médio de fadiga foi 51,9 + 14,0. Houve pequena taxa de itens não respondidos (0,65%), embora 30,3% dos participantes solicitaram algum esclarecimento após a leitura das instruções; 37,3% relataram que tiveram dúvida ao responder aos itens, em especial, o 19. O tempo de resposta foi de 4,8 + 1,9 minutos. Não houve efeitos teto e chão. A estimativa de confiabilidade foi adequada. **Conclusão:** O instrumento necessita de ajustes na redação das instruções e de alguns itens, embora apresente boas estimativas de aceitabilidade e de confiabilidade.

DESCRITORES

Fadiga; Doença da Artéria Coronariana; Estudos de Validação; Enfermagem Cardiovascular.

RESUMEN

Objetivo: Verificar las estimaciones de confiabilidad y factibilidad de empleo de la versión traducida y adaptada para uso en Brasil del *Multidimensional Fatigue Inventory – 20* en pacientes con enfermedad arterial coronaria crónica. **Método:** Estudio metodológico. El instrumento fue respondido por los participantes sin auxilio de las investigadoras. El tiempo de relleno fue cronometrado, y las facilidades y dificultades fueron documentadas. La factibilidad de empleo fue analizada mediante la aceptabilidad, practicabilidad, efectos techo y suelo. La confidencialidad fue estimada mediante la consistencia interna. **Resultados:** La muestra estuvo compuesta de 201 participantes. El score medio de fatiga fue de 51,9 + 14,0. Hubo pequeña tasa de ítems no respondidos (0,65%), aunque el 30,3% de los participantes solicitaron alguna aclaración tras la lectura de las instrucciones; el 37,3% relataron que tuvieron duda al responder a los ítems, en especial, el 19. El tiempo de respuesta fue de 4,8 + 1,9 minutos. No hubo efectos techo y suelo. La estimación de confiabilidad fue adecuada. **Conclusión:** El instrumento necesita ajustes en la redacción de las instrucciones y de algunos ítems, aunque presente buenas estimaciones de aceptabilidad y de confiabilidad.

DESCRIPTORES

Fatiga; Enfermedad de la Arteria Coronaria; Estudios de Validación; Enfermería Cardiovascular.

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