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Original articles

Assessing fatigue in multiple sclerosis : Dutch Modified Fatigue Impact Scale

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Abstract

The aim of this study is to evaluate the reliability, validity and responsiveness of the Dutch version of the Modified Fatigue Impact Scale. Fifty-one randomly selected subjects with definite multiple sclerosis (MS) (mean age 51.9 ± 10.5 years, 25 women) and 20 healthy controls (mean age 50.6 ± 14.0 years, 13 women) filled in the Modified Fatigue Impact Scale (MFIS), the Fatigue Severity Scale (FSS) and the fatigue subscale of Guy's Neurological Disability Scale (GNDS). All tests were repeated with an interval of maximum three days. The hospitalised individuals with MS (n = 20) were assessed at intake and discharge.

No significant difference was found between first and second administration of MFIS (z = -.519, p = .603, Wilcoxon signed ranks test), with a good correlation (.729). MFIS was able to distinguish individuals with MS from controls, and subjects with fatigue from the non-fatigued group. MFIS showed no floor or ceiling effect. MFIS correlated moderately with Fatigue Severity Scale (.447) and the fatigue subscale of GNDS (.487). The 20 hospitalised subjects had significant lower MFIS scores (z = -3.401, p = .001) after a four-week rehabilitation programme, whereas the FSS did not change.

This study indicates that the Dutch version of the MFIS is a reliable, valid and responsive tool to assess the impact of MS-related fatigue on daily life.

Key words : multiple sclerosis ; fatigue ; self-report assessment ; rating scales ; psychometric properties

Introduction

Fatigue is reported as a frequent and disabling symptom of multiple sclerosis (Bergamaschi R. *et al.*, 1997 ; Freal J. E. *et al.*, 1984). It has a major impact on work, social and family life as well on overall quality of life (Fisk J. D. *et al.*, 1994 ; Iriarte J. *et al.*, 1999 ; Provinciali L. *et al.*, 1999 ; Jackson *et al.*, 1991). MS-related fatigue is distinct from normal fatigue because it is elicited by small efforts, worsens with heat, interferes with physical functioning and role performance (Krupp L. B. *et al.*, 1998). Possible fatigue management strategies include (a combination of) medication, exercise and instruction of energy conservation principles (Comi G. *et al.*, 2001).

Assessing MS-related fatigue is complicated because of its subjective, multidimensional and fluctuating nature. The most commonly used method in clinical practice and in research is the self-report assessment tool, despite its disadvantages (Schwid S. R. *et al.*, 2002). During the past decade, several instruments have been developed and evaluated for this purpose (Flachenecker P. *et al.*, 2002 ; Kos D. *et al.*, in press).

In 1998, the panel of the Multiple Sclerosis Council for Clinical Practice Guidelines recommended the shortened version of the 40-item Fatigue Impact Scale (FIS) (Fisk J. D. *et al.*, 1994) the 21-item Modified Fatigue Impact Scale (MFIS) for clinical use and for research. The MFIS is a component of the Multiple Sclerosis Quality of Life Inventory and, like the FIS, evaluates the impact of fatigue on physical, cognitive and psychosocial functioning. People are asked to rate on a Likert scale (range 0-4) how often they have experienced 21 problems due to fatigue during the last month.

Although no comprehensive analyses have been performed yet, the Modified Fatigue Impact Scale has been used in several clinical trials (Gillson G. *et al.*, 2002 ; NASA/MS Cooling Study Group, 2003 ; Rammohan K.W. *et al.*, 2002). To date, no evaluations are reported of translated versions of the scale. We translated the Modified Fatigue Impact Scale into Dutch and evaluated its clinimetric properties.

Sample and methods

SAMPLE

The study was approved by the hospital ethics committee and all participants signed informed consent.

Out of all in- and outpatients attending the rehabilitation service of the National MS Centre of Melsbroek (Belgium), a computer assigned randomly 85 individuals with clinically definite MS to the study group. Subjects were included when adequate physical and cognitive functioning was demonstrated. The physical performance was determined by a minimum score of 30 or more on the subscore self-care of the Functional Independence Measure. Cognitive function was established by a Rao's neuro-psychological battery of 3 or more. Of the fifty-one individuals who met all criteria and were included in the study, one subject was lost for follow-up after the first assessment due to personal reasons.

Of the total sample, twenty individuals were hospitalized during the study period. They were assessed at intake and discharge.

Twenty-one employees of the centre volunteered as healthy controls, one of them did not perform the second assessment.

Methods

The Modified Fatigue Impact Scale was translated by a bilingual psychologist and backtranslated by a physician and a blinded linguist who did not have access to the original version of the MFIS. Linguistic discrepancies were discussed in a panel. Five bilingual individuals with MS completed the scale in order to detect and eliminate vagueness or difficulties (see Appendix for final version).

To evaluate the convergent validity, the translated MFIS was administered simultaneously with the Fatigue Severity Scale (FSS) (Krupp L. B. *et al.*, 1989) and the fatigue subscale of the Guy's Neurological Disability Scale (GNDS) (Sharrack B. , Hughes R. A., 1999 ; Nuyens G. *et al.*, 2002), in a random order.

The Fatigue Severity Scale (FSS) is the most commonly used measure for fatigue in multiple sclerosis. In the FSS, people have to rate their agreement (range 1-7) with nine statements concerning the severity, frequency and impact of fatigue on daily life.

The Guy's Neurological Disability Scale (GNDS) is a disability measure developed for use in multiple sclerosis ; it consists of 12 categories, including fatigue. The fatigue score (range 0-5) is based on the presence and severity of fatigue and its impact during the last four weeks.

Divergent validity was considered with Kurtzke's Expanded Disability Status Scale, the Functional Independence Measure, the neuro-psychological battery of Rao, Zung self-rating depression scale and the Mental Health Inventory of the MS Quality of Life Inventory.

To evaluate the reproducibility of the scale, the measurement was repeated within three days in all subjects, at the same time of the day. The twenty hospitalised individuals were assessed at intake and discharge to determine the responsiveness of the MFIS.

Statistics

All results were analysed using the software package SPSS for Windows Standard Version 11.0.1, 2001.

Since the data of the fatigue scales are ordinal, we used non-parametric statistics. Differences between groups were analysed using the Mann-Whitney rank sum test. To evaluate the reproducibility and responsiveness, we used the non-parametric Wilcoxon signed ranks test. Correlation analyses were performed with Kendall's tau-b correlation.

Results were considered statistically significant when $p < .05$.

Results

Table 1 describes the characteristics of the sample. Of the 51 individuals with MS, 11 (22%) had a primary progressive form of MS, 15 (29%) a relapsing-remitting and 25 (49%) a chronic progressive course of MS. The EDSS score ranged between 3 and 8.5 with a median score of 6.5. The mean duration of disease was 16.6 ± 8.9 years, ranging from 1 to 43 years. Whereas persons with MS and healthy controls did not differ significantly in age or gender, the total scores on the fatigue scales were all significantly different.

As reflected in Table 2, the scores of the FSS, MFIS and GNDS of subjects with MS did not change significantly after three days, with a moderate to good correlation. None of the 21 items differed significantly between the repeated measurements. The same pattern was observed in healthy controls.

The Modified Fatigue Impact Scale, as well as FSS and GNDS were able to distinguish individuals with MS from healthy controls (Table 1).

We used the cut-off value of the Fatigue Severity Scale as suggested by Flachenecker P. *et al.* (2002) to compare fatigued (FSS ≥ 5) and non-fatigued subjects (FSS < 5). MFIS was able to discriminate between these groups, using the median values (Fig. 1). However, the 25-75% boxes showed an overlap of MFIS values between the groups.

Figures 2 and 3 represent the distribution of the Modified Fatigue Impact Scale and Fatigue Severity Scale. Only the total scores of the FSS show a small floor effect (2%, n = 1 with lowest score 9) and ceiling effect (2%, n = 1 with highest score 63). When plotted against the disability measure EDSS (Fig. 4), the MFIS scores are distributed over the whole range, even for the higher EDSS scores.

Table 1

Demographic and clinical characteristics

	People with MS N = 51	Healthy controls N = 21	Difference, z*	p value
Gender :				
Male	26 (51%)	11 (45.8%)	- .413	.680
Female	25 (49%)	13 (54.2%)		
Age :				
Mean (SD)	51.9 (10.5)	50.6 (14.0)	- .227	.820
Range	23 - 75	22 - 75		
FSS :				
Median (Q)	48 (10.5)	21.5 (9.5)	- 5.336	.000
Range	9 - 63	0 - 46		
MFIS :				
Median (Q)	45 (23.5)	20 (11.75)	- 4.461	.000
Range	3 - 74	0 – 56		
GNDS_f :				
Median (Q)	3 (1)	0 (1,5)	- 2.886	.004
Range	0 – 5	0 – 3		

* Mann-Whitney U.

FSS : Fatigue Severity Score ; MFIS : Modified Fatigue Impact Scale ; GNDS_f : Guy's Neurological Disability Scale, subscale fatigue.

Table 2

Reproducibility of the tests

	Time 1 : 0 days (N = 51), Me (min-max)	Time 2 : max. 3 days (N = 50), Me (min-max)	Wilcoxon signed ranks test, z	Correlation, Kendall's tau_b
FSS	48 (9-63)	48,5 (9-61)	-.723 (p = .470)	.645**
MFIS, total score	45 (3-74)	40,5 (0-77)	-.519 (p = .603)	.729**
MFIS, physical subscale	18.5 (0-35)	17 (0-36)	-1.214 (p = .225)	.712**
MFIS, cognitive subscale	15.5 (0-32)	15 (0-34)	- .077 (p = .938)	.736**
MFIS, psychosocial subscale	3 (0-8)	4 (0-8)	-1.408 (p = .159)	.597**
GNDS_f	3 (0-5)	3 (0-5)	-.872 (p = .383)	.787**

** p < .0001.

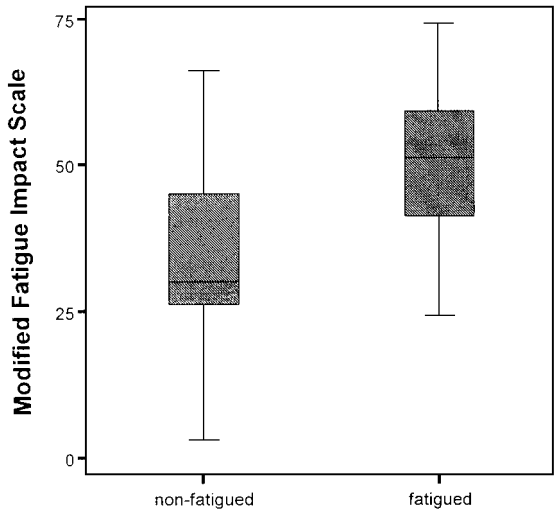

FIG. 1. — Ability of MFIS to distinguish between fatigued (FSS ≥ 5) and non-fatigued people with MS (FSS < 5).

Boxes represent 25-75% of the cases ; whiskers are minimum and maximum values, lines : median values. Differences are statistically significant (p<.001, Mann-Whitney rank sum test).

The Modified Fatigue Impact Scale was correlated with duration of the disease, Zung depression measure, Fatigue Severity Scale and the fatigue subscale of Guy's Neurological Disability Scale (Table 3).

The Modified Fatigue Impact Scale and Fatigue Severity Scale were administered at intake and discharge in twenty subjects. They followed a standard rehabilitation programme with a mean duration of 26 ± 7 days. Participants had significantly different MFIS scores after the four-week rehabilitation programme (Table 4), whereas FSS scores did not change. Seven subjects had an important decrease of more than 20 points, meaning their fatigue had a lower impact on their daily life. They were mainly female (6/7) and had a chronic progressive (5/7) or a relapsing-remitting (2/7) course of MS. These ratios differ significantly from the group with a decrease of MFIS scores of less than 20, with 27% women (3/11) and mainly the primary progressive (5/11) and relapsing-remitting (5/11) course of MS. The man and woman with a higher MFIS score had a chronic progressive form.

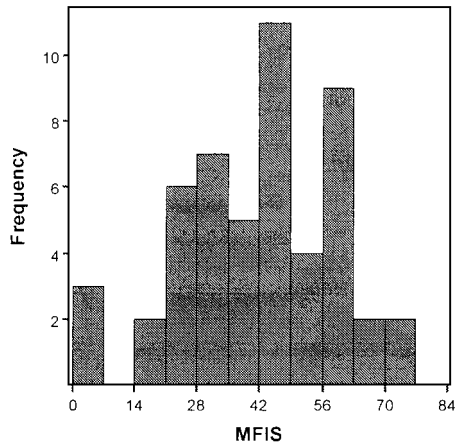

FIG. 2. — Distribution of total scores of Modified Fatigue Impact Scale (MFIS) (range 0-84).

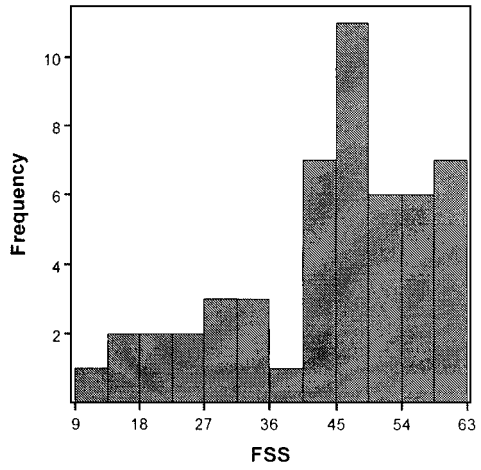

FIG. 3. — Distribution of total scores of Fatigue Severity Scale (FSS) (range 9-63).

Table 3

Correlation of the Modified Fatigue Impact Scale with variables

	Kendall's tau_b	p value
Age	-.003	ns
Gender	.046	ns
Course MS	-.013	ns
Years since diagnosis	.227	.023
EDSS	-.114	ns
Rao	-.053	ns
Zung	.290	.006
Mental Health Inventory	.088	ns
FIM_self care	-.034	ns
FIM_transfers	.140	ns
FSS	.447	.000
GNDS_f	.487	.000

ns : not significant ($p > .05$).

EDSS : Expanded Disability Status Scale, Rao : cognitive battery, Zung : depression scale, FIM : Functional Independence Measure, FSS : Fatigue Severity Scale, GNDS_f : fatigue subscale of Guy's Neurological Disability Scale.

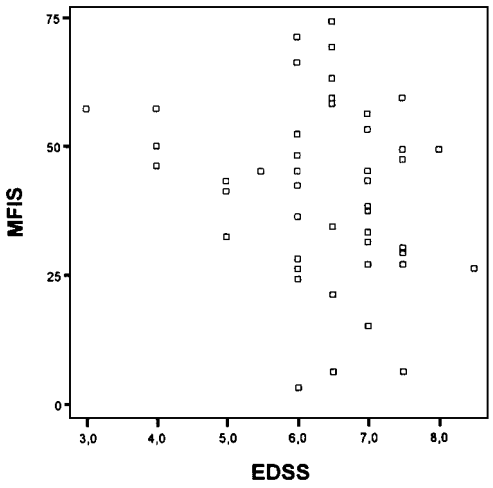

FIG. 4. — Distribution of MFIS scores for EDSS categories (normal full range : 0-9, in this sample : 3-8.5).

The EDSS scores or duration of the disease did not differ between these three groups.

Discussion

The aim of this study was to evaluate the reproducibility, validity and responsiveness of the Dutch version of the Modified Fatigue Impact Scale.

Although all separate items of the MFIS were stable over the three days period, the repeated measurements of the psychosocial subscale correlated moderately. This subscale consists of merely two items (n° 8 and 9) (see Appendix), in contrast to the physical and cognitive subscale with nine and ten items, respectively. The limited number of items could explain the lower correlation. Further exploration of the psychosocial subscale should be conducted in future research.

Similar to the results of Flachenecker P. and colleagues (2002), the median value of the Modified Fatigue Impact Scale was able to distinguish fatigued (FSS ≥ 5) from non-fatigued individuals (FSS < 5) in this sample. Considering the total range of scores however, the MFIS showed an overlap between these groups. In the study of Flachenecker et al., individuals had to meet all of the following criteria to be allocated to the fatigue group : fatigue is one of the three most disabling symptoms, fatigue occurs daily or on most of the days and it limits daily activities. The subjects with one or two fulfilled criteria were classified as "borderline". In our study, we allocated participants either to the fatigued or to the non-fatigued group, showing an overlap of the MFIS scores. When we used an intermediate group with mean FSS scores ranging from 4 to 5, the overlap disappeared.

The moderate correlations of MFIS with Fatigue Severity Scale and the fatigue subscale of Guy's Neurological Disability Scale represent the related, yet not similar concepts all these scales assess.

Table 4

Median scores of measurements of fatigue scales at intake and discharge

	Intake (N = 20)	Discharge (N = 20)	Difference, z*
MFIS, total score	47.5 (27-74)	32 (11-53)	-3.401 (p = .001)
FSS, total score	46 (18-63)	42 (11-59)	-1.417 (p = .156)
GNDS_f	3 (0-5)	1 (0-5)	-2.517 (p = .012)

* Wilcoxon signed ranks test.

While the FSS and GNDS request people to rate the fatigue severity, frequency and impact, the MFIS only addresses the impact of fatigue. Flachenecker P. *et al*. (2002) found similar results. Though the MFIS was not related to age, gender, course of MS, disability or cognitive performance, it showed a weak correlation with duration of the disease and depression. Several studies reported the association between fatigue and depression (Bakshi R. *et al.*, 2000 ; Schreurs K. M. *et al.*, 2002 ; Provinciali L. *et al.*, 1999 ; Schwartz C. E. *et al.*, 1996), but the evidence of the relation with duration of disease is inconsistent (Casanova B. *et al.*, 2000 ; Colosimo C. *et al.*, 1995 ; Ford H. *et al.*, 1998). The Zung self-rating depression scale we used includes several items of fatigue and lassitude, which could explain the weak correlation.

The interference of fatigue with physical functioning is difficult to evaluate when physical abilities are severely limited. Therefore, a floor or ceiling effect of fatigue assessment instruments can be expected in the more disabled people. Our study could not confirm this hypothesis. We used the EDSS as a disability measure, but this tool has limited score variability (Hobart J. *et al.*, 2000). Still, when plotted against the Multiple Sclerosis – Functional Composite (Cutter G. R. *et al.*, 1999), no floor or ceiling effect of MFIS is demonstrated in this sample. A larger sample with the full range of EDSS or MSFC should be used in future studies to confirm our results.

Due to cognitive impairments, individuals with MS could experience difficulties in completing self-report instruments, such as the MFIS. Subjects were only included in our study when their Rao's neuropsychological battery score was at least three or more. Therefore, our results may be biased. Future studies should include persons with a larger range of cognitive abilities.

Both the Modified Fatigue Impact Scale and the fatigue subscale of Guy's Neurological Disability Scale (GNDS_f) were able to detect a significant difference after a four-week rehabilitation programme, whereas the FSS did not change. The MFIS and GNDS_f ask for the impact of fatigue during the last four weeks (at discharge the last week), which is possibly more sensitive to change than the nine general statements of the Fatigue Severity Scale without any time indication. This could explain why the FSS did not change during this period. No specific treatment for fatigue was included, yet the beneficial effect of a multidisciplinary rehabilitation programme on reducing fatigue has been described in various studies (Jonsson A. *et al.*, 1996 ; Patti F. *et al.*, 2002 ; Wassem R., Dudley, 2003). Besides, the MFIS was able to detect a treatment effect of Prokarin" (Gillson G. *et al.*, 2002) and modafinil (Rammohan K. W. *et al.*, 2002), compared to placebo. In these studies, the mean differences in total MFIS score after treatment with Prokarin" and modafinil were 20.1 and 7, respectively. We found a mean decrease in MFIS scores after the rehabilitation programme of 15.5, which confirms the responsiveness of the Modified Fatigue Impact Scale. The main part of the subjects whose MFIS score decreased with more than 20 were female and suffered from a chronic progressive course of MS. Possibly they are more susceptible to the beneficial effects of the rehabilitation programme on fatigue impact. A larger sample is needed to make any conclusions regarding this topic.

In conclusion, our results indicate that the Modified Fatigue Impact Scale is a reliable, valid and responsive tool to assess the impact of MS-related fatigue on daily life.

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Appendix

Dutch version of the Modified Fatigue Impact Scale

Scores range from 0 (“nooit”) to 4 (“bijna altijd”), total score : summation of all scores (range 0-84), physical subscale : summation of all “F” items (9) (range 0-36), cognitive subscale : summation of all “C” items (10) (range 0-40), psychosocial subscale : summation of all “P” items (2) (range 0-8).

Vermoeidheid is een gevoel van fysiek moe-zijn en een tekort aan energie dat door veel mensen wordt ervaren. Maar personen met een ziekte zoals MS ervaren deze vermoeidheid vaker en met een grotere invloed dan anderen.

Hier volgt een lijst met vaststellingen die de effecten van vermoeidheid beschrijven. Gelieve elk van deze vaststellingen zorgvuldig te lezen en aan te duiden welk antwoord het best aangeeft hoe vaak vermoeidheid hierop een invloed gehad heeft gedurende de laatste vier weken.

Beantwoord elke vraag (zet een kruisje onder het geschikte antwoord). Als u niet zeker bent van een antwoord, kies dan het antwoord dat het best uw eigen situatie beschrijft.

Omwille van mijn vermoeidheid (gedurende de laatste 4 weken) …		Nooit	Zelden	Soms	Vaak	Bijna altijd
C 1	ben ik minder aandachtig geweest					
C 2	heb ik moeite gehad om me lange tijd te concentreren					
C 3	ben ik niet in staat geweest om helder te denken					
F 4	ben ik onhandig geweest en had ik coördinatieproblemen					
C 5	ben ik vergeetachtig geweest					
F 6	heb ik mijn fysieke activiteiten trager moeten uitvoeren					
F 7	ben ik minder gemotiveerd geweest om fysieke activiteiten uit te voeren					
P 8	ben ik minder gemotiveerd geweest om aan sociale activiteiten deel te nemen					
P 9	ben ik beperkt geweest in de mogelijkheid om dingen buitenshuis te doen					
F 10	heb ik moeite gehad om fysieke inspanningen voor langere tijd vol te houden					
C 11	heb ik moeite gehad om beslissingen te nemen					
C 12	ben ik minder gemotiveerd geweest om iets te doen waarbij ik moest nadenken					
F 13	voelden mijn spieren zwak aan					
F 14	voelde ik mij fysiek niet goed					
C 15	heb ik moeite gehad om taken af te werken waarbij ik moest nadenken					
C 16	heb ik moeite gehad om mijn gedachten te ordenen bij taken thuis of op het werk					
F 17	ben ik minder in staat geweest om taken af te werken die fysieke inspanning vragen					
C 18	is mijn gedachtengang vertraagd geweest					
C 19	heb ik moeite gehad me te concentreren					
F 20	heb ik mijn fysieke activiteiten beperkt					
F 21	heb ik vaker of langer moeten rusten					