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The Measurement of Fatigue in Patients With Multiple Sclerosis

A Multidimensional Comparison With Patients With Chronic Fatigue Syndrome and Healthy Subjects

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Objective: To provide a multidimensional characterization of fatigue in patients with multiple sclerosis (MS).

Design: Cross-sectional design. Fifty patients with clinically definite MS were compared on the dimensions of fatigue with 51 patients with chronic fatigue syndrome (CFS) and 53 healthy subjects.

Results: Forty-six percent of the patients with MS reported fatigue to be present at least once a week. Patients with MS and patients with CFS had significantly higher subjective fatigue severity scores than healthy subjects. Patients with MS and patients with CFS had significantly higher scores on measures of psychological well-being than healthy subjects. Patients with MS had scores similar to those of patients with CFS, except that patients with CFS had significantly higher somatization scores. High somatization scores reflect strong focusing on bodily sensations. Both groups of patients were significantly less active than the healthy sub-

jects. The Kurtzke Expanded Disability Status Scale (EDSS) and the Beck Depression Inventory scores were not related to subjective fatigue severity. In patients with MS and in patients with CFS, subjective fatigue severity was related to impairment in daily life, low sense of control over symptoms, and strong focusing on bodily sensations. In CFS, but not in MS, evidence was found for a relationship between low levels of physical activity and attributing symptoms to a physical cause and between subjective fatigue severity and physical activity.

Conclusions: Patients with MS experienced significant fatigue, which had a significant impact on daily functioning and was not related to depression or Expanded Disability Status Scale score. Psychological factors, such as focusing on bodily sensations and low sense of control, play a role in the experience of fatigue in MS and CFS.

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FATIGUE IS frequently reported by patients with multiple sclerosis (MS). Subjective fatigue in a patient with MS is perceived as different from the fatigue experienced when that patient was still healthy.¹⁻³ In one study, 87% of patients with MS reported fatigue to be a problem; fatigue was the presenting symptom in 33% of the patients; and a similar percentage of the patients indicated that fatigue was the most troubling symptom.⁴ In view of the fact that fatigue is a frequent symptom in MS, it is surprising that it has received little attention in research. Multiple sclerosis is an inflammatory disease of the central nervous system. It is therefore reasonable to assume that fatigue in MS is related to somatic processes, but evidence for this hypothesis is lacking. The role of psychological factors with respect to fatigue in MS is also unclear.

This lack of clarity may be attributable in part to the fact that fatigue has been

notoriously difficult to define or measure.⁵ In a study of patients with chronic fatigue syndrome (CFS), we found that different dimensions of fatigue could be discerned: subjective feeling of fatigue, psychological well-being, functional impairment, level of physical activity, sleep problems, social functioning, neuropsychological functioning, attributions with respect to the causes of complaints, and sense of control over symptoms (self-efficacy expectations).⁵ These dimensions were shown to be relatively independent. Thus, each dimension provides a unique contribution to the description of the patient. Comprehensive assessment of fatigue should therefore entail multidimensional assessment. Studies using only 1 type of questionnaire, such as

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PATIENTS AND METHODS

PATIENTS

Fifty patients with clinically definite MS¹² participated in this study (chronic progressive, n=19; relapsing-remitting, n=31). All patients were mobile. The mean Kurtzke Expanded Disability Status Scale (EDSS)¹³ score was 2.8 (range, 1-6). Seventy-five percent of the patients had EDSS scores between 2 and 3.5.

Fifty-one patients with chronic subjective fatigue were randomly selected from our CFS database, acquired by referral to the General Internal Medicine outpatient clinic of the University Hospital Nijmegen, Nijmegen, the Netherlands, by a family physician or specialist, and by self-referral. These patients had to have experienced disabling fatigue for at least 6 months for which no somatic explanation could be offered and that did not subside with bedrest.¹⁴ Fifty-three healthy subjects were selected through a regional newspaper advertisement. All patients participating in this study underwent a full physical examination and a standard neurologic examination at the beginning of the study and, if indicated, further technical investigations. Patients with MS and healthy subjects were matched to the patients with CFS in regard to age, sex, and educational level. The study was approved by the ethics committee of our hospital and patients gave their informed consent.

INSTRUMENTS

In a previous study, we developed a multidimensional fatigue assessment method.⁵ In the present study, these dimensions were measured by questionnaires and by a self-observation list and a Sleep Pattern Observation List over a 2-week period. For all instruments, high scores indicate nonfavorable functioning.

Subjective Fatigue

Subjective fatigue was measured by the Subjective Fatigue subscale of the Checklist of Individual Strength (CIS).⁵ On the self-observation list, subjective fatigue was measured 4 times a day on a 4-point scale (Daily Observed Fatigue score).

Other Complaints

Other complaints were assessed by the Complaints Probing List, in which specific complaints were rated on a 4-point scale as follows: 1, never present; 2, several times a month; 3, several times a week; and 4, every day.

Psychological Well-being

The Beck Depression Inventory (BDI)^{15,16} is a standardized self-report questionnaire for measuring depression. Subjective fatigue was excluded as a symptom. The Symptom Checklist (SCL)¹⁷ is an indicator of psychological disturbances.

Impairment in Daily Life

The Sickness Impact Profile (SIP)^{18,19} measures the influence of complaints in different areas of daily functioning. On the self-observation list, patients indicated 4 times a day whether they had failed to perform activities as a result of fatigue.

Level of Physical Activity

The Physical Activities subscale of the CIS and the Mobility subscale of the SIP measure the level of physical activity. On the Physical Activities Rating Scale, patients indicated if they had engaged in 20 different activities ("never," "rarely," "now and then," "often," and "very often"). On the self-observation list, level of physical

Continued on next page

the Fatigue Severity Scale, do not provide a comprehensive assessment of fatigue, as the subjective feeling of fatigue is the only dimension measured.

In understanding fatigue in MS, patients with CFS may serve as a useful comparison group for 2 major reasons: (1) fatigue is the key symptom in CFS and (2) there are indications that avoidance of physical activity, depression, and cognitions and attributions can perpetuate fatigue in CFS.^{6,7} Patients with CFS avoid physical activity⁵ because in their view activity causes symptoms. This avoidant behavior in turn leads to more symptoms through physical deconditioning. Patients with CFS attribute their symptoms to an organic cause and show a resistance to psychosocial interpretations of the complaints.^{5,8-10} Attributing complaints to an organic cause may reinforce the idea that physical activity is harmful. Depression may develop as a result of prolonged disability and feelings of helplessness with respect to controlling complaints.^{6,7} Since depressed patients have low levels of physical activity, depression may contribute to the establishment of low levels of physical activity. Depression may also directly produce fatigue. In a longitudinal

study, we found that cognitions concerning subjective sense of control over symptoms are a powerful predictor of fatigue and chronicity in CFS.¹¹ It would be most valuable to investigate whether these psychological factors are involved in fatigue in MS as well.

In the present study, patients with MS were compared with patients with CFS and healthy subjects to evaluate the status of the dimensions in MS and to evaluate the relationships between the dimension of subjective fatigue and the other dimensions.

RESULTS

DEMOGRAPHICS

Information on age, sex, education, and duration of complaints are summarized in **Table 1**. There were no significant differences between groups in these variables. There were also no significant differences in premorbid or current occupational situations between patients with MS and patients with CFS (**Table 2**). Compared with healthy subjects, significantly more patients with MS received

activity was rated daily on a 7-point Likert scale (Daily Observed Activity score).

Causal Attributions

Each patient's opinions concerning the causes of the complaints were measured with the Causal Attributions List. Eight possible causes of the complaints were presented. Patients could indicate on a 5-point Likert scale if they agreed or disagreed with each cause. There are 2 subscales: Physical and Psychosocial (Cronbach α reliability coefficient was .71 and .75, respectively).

Sense of Control Over Symptoms

The subjective sense of control over symptoms was measured by a specific 5-point scale question ("Do you think you can influence your complaints?") and selected items of the modified Pain Cognition List.²⁰ The modification entails the replacement of the word *pain* by *fatigue*. The Cronbach α reliability coefficient for this scale was .74.

Neuropsychological Functioning

The dimension of neuropsychological functioning was measured by the Concentration subscale of the CIS and the SIP.

Social Functioning

For social functioning, general questions were asked concerning satisfaction in social life and problems in social relationships. The Social Interactions subscale of the SIP was also included.

Sleep Disturbances

On the self-observation list, quality of sleep ("slept well," "problems falling asleep," "restless sleep," and "early

awakening in the morning") was recorded daily (Daily Observed Quality of Sleep scores). A special Sleep Pattern Observation List was completed in combination with the self-observation list. Retrospectively, the patient recorded daily every 30 minutes if resting or asleep. The following parameters were calculated over the 12-day period: hours asleep at night, hours asleep during the day, hours awake before falling asleep, hours awake during the night, hours resting after waking up in the morning, and hours resting during the day (Daily Observed Sleep Pattern score).

Information was collected concerning age, sex, education, premorbid and current occupational situation, and duration of complaints. Education level was determined by a Dutch standardized scoring system (range, 1-7), which is especially applied in research. On the self-observation list, patients reported once a day the hours spent on occupational activities.

DATA ANALYSIS

Logarithmic transformations were performed on variables with a skewness of more than 1. The analysis of differences between groups on nominal variables was carried out with the χ^2 test and on ordinal variables with the Mann-Whitney test. In these tests, Bonferroni correction for multiple comparisons was applied. Because there were 3 experimental groups, 3 comparisons were made. Assuming a significance level of .05, a difference was considered significant if the *P* value was less than .02. The analysis of differences between groups on ratio variables was performed by analysis of variance. Multiple comparisons were made by Duncan multiple range tests. Unless stated otherwise, reported significant differences refer to Duncan multiple range tests with a *P* value of less than .05. The relationship between subjective fatigue and other dimensions was evaluated by χ^2 tests in the case of nominal and dichotomous variables. For other variables, the Pearson correlation coefficient was used. To control the type I error due to multiple correlations, only *P* values of less than .01 were considered significant.

disablement insurance benefits ($P < .001$), and significantly more patients with CFS were on sick leave ($P = .003$) or received disablement insurance benefits ($P < .001$). Results of the self-observation list show that the patients with MS who indicated that they had been working worked an average of 2.7 d/wk (range, 0.5-4.5 d/wk) for 5.3 h/d (range, 1-10 h/d). Patients with CFS who had jobs worked an average of 2.2 d/wk (range, 0.5-5 d/wk) for 4.1 h/d (range, 1.5-11.5 h/d). Healthy subjects who had been working worked on average 3.2 d/wk (range, 0.5-6 d/wk) for 6.2 h/d (range, 2-11 h/d). There was a significant difference between patients with CFS and healthy subjects with respect to how many hours they worked per day ($P = .001$). In both patient groups, there was no relationship between subjective fatigue and any demographic variable.

DIMENSIONS

Subjective Fatigue and Other Complaints

Nineteen (39%) of the patients with MS reported fatigue to be present several times a week (CFS, 13 [26%];

healthy, 8 [15%]), and 23 (46%) reported fatigue to be present every day (CFS, 38 [74%]; healthy, 0). Results on the Complaints Probing List (**Table 3**) show that there is a considerable overlap in symptoms between patients with MS and patients with CFS. Scores on the CIS Sub-

Table 1. Characteristics of 50 Patients With Multiple Sclerosis (MS), 51 Patients With Chronic Fatigue Syndrome (CFS), and 53 Healthy Subjects

Characteristics	MS	CFS	Healthy*
Sex, No. (%)			
M	17 (34)	12 (24)	13 (24)
F	33 (66)	39 (76)	40 (76)
Mean age (range), y	35.8 (19-56)	36.3 (19-54)	37.1 (19-63)
Mean education (range)†	3.6 (3-6)	4.2 (3-7)	4.3 (3-7)
Median duration of complaints (range), y	5 (0.5-22)	5 (1-48)	...

*Ellipses indicate data not applicable.

†Education level was determined according to a Dutch standardized scoring system (range, 1-7).

Table 2. Occupational Situation Before Onset of Complaints and Current Occupational Situation of Patients With Multiple Sclerosis (MS), Patients With Chronic Fatigue Syndrome (CFS), and Healthy Subjects

Occupation	No. (%)				
	MS		CFS		Healthy, Current
	Before Onset	Current	Before Onset	Current	
Working	35 (70)	14 (28)	37 (72)	14 (27)	25 (47)
Housekeeping	0 (0)	15 (30)	0 (0)	9 (18)	14 (26)
Unemployed	12 (24)	3 (6)	7 (14)	3 (6)	3 (6)
Retired	0 (0)	1 (2)	0 (0)	0 (0)	2 (4)
Disablement Insurance benefits	0 (0)	11 (22)	0 (0)	13 (25)	0 (0)
Sick leave	0 (0)	5 (10)	0 (0)	10 (20)	1 (2)
School	3 (6)	1 (2)	7 (14)	2 (4)	8 (15)

Table 3. Prevalence of Complaints Based on the Complaints Probing List of Patients With Multiple Sclerosis (MS), Patients With Chronic Fatigue Syndrome (CFS), and Healthy Subjects*

Complaints	Percentage			P (χ^2), MS and CFS
	MS	CFS	Healthy	
Fatigue	85†	100†	13	.01
Sleep problems	34	59†	15	.03
Postexertional malaise	34†	68†	0	.003
Myalgia	39†	85†	6	.001
Muscle weakness	49†	69†	2	.06
Headache	39†	33‡	6	.60
Dizziness	15†	41†	0	.008
Memory problems	45†	69†	4	.03
Concentration problems	46†	74†	6	.01
Sore throat	3	18	4	.02
Tender lymph nodes	0	21‡	2	.002
Arthralgia	30	49†	9	.04
Irritability	39†	31†	4	.44
Depressed mood	29†	18	6	.23

*Complaints were rated present if they occurred at least several times a week.

†Significant difference when compared with healthy subjects ($P < .001$ [χ^2]).

‡Significant difference when compared with healthy subjects ($P < .02$ [χ^2]).

jective Fatigue subscale and the self-observation list are presented in **Table 4**. There were no differences in subjective fatigue scores between patients with chronic progressive MS and patients with relapsing-remitting MS. To evaluate whether fluctuations in subjective fatigue severity exist over time, separate subjective fatigue severity scores were calculated for week 1 and for week 2 on the self-observation list. The correlation between the scores for weeks 1 and 2 was $r=0.89$ in patients with MS and $r=0.88$ in patients with CFS. The mean difference in subjective fatigue severity between weeks 1 and 2 was 4% for patients with MS, 3% for patients with CFS, and 21% for healthy subjects. These results indicate that, in contrast to healthy subjects, patients with MS and patients with CFS experience little short-term fluctuation in subjective fatigue severity over time. The EDSS score was not related to subjective fatigue in MS.

Psychological Well-being

Results on the SCL are displayed in **Figure 1**. Patients with MS had significantly lower scores than patients with CFS on the Somatization and Cognitive Difficulties subscales. On all other subscales, both patient groups had similar scores. When compared with healthy subjects, patients with MS and patients with CFS did not have significantly different scores on interpersonal sensitivity. On the other subscales, the patients in both groups had higher scores than did healthy subjects. The mean \pm SD BDI score was 10.0 ± 6.5 for patients with MS and 10.8 ± 4.7 for patients with CFS, which was not significantly different. The BDI score of healthy subjects was 2.7 ± 3.7 , which was significantly lower than the scores in the 2 patient groups. Using a BDI cutoff score of 16 or above, 17% of patients with MS, 16% of patients with CFS, but no healthy subjects had current depression. Depression is thought to be a result of a prolonged disability or loss of sense of control over symptoms. However, in both patient groups, the BDI score was related only to the SIP Social Interactions subscale (CFS, $r=0.41$; MS, $r=0.68$), not to any other measure of impairment in daily life, duration of complaints, or sense of control. Depression is also hypoth-

esized to cause subjective fatigue directly or through producing low levels of physical activity. No evidence was found for these associations in MS or CFS. In patients with MS and in patients with CFS, subjective fatigue severity was only related to the Somatization subscale of the SCL ($r=0.43$ and $r=0.48$, respectively).

Impairment in Daily Life

On the self-observation list, patients with MS reported less often than patients with CFS that they had failed to perform activities as a result of the complaints (Daily Observation Impairment score, 46.0 and 23.9, respectively; $P=.001$). Results on the SIP are displayed in **Figure 2**. Patients with MS had significantly lower scores than patients with CFS on the Activities at Home, Social Interactions, Concentration Problems, and Recreation and Pastimes subscales. On all subscales, patients with MS and patients with CFS had higher scores than healthy subjects. In patients with MS and in patients with CFS, the CIS Subjective Fatigue subscale was related to Activities at Home ($r=0.51$ for both groups) and Recreation and Pastimes of the SIP ($r=0.42$ and $r=0.44$, respectively). On the self-observation list, the Daily Observed Fatigue score was related to the Daily Observed Impairment score in MS ($r=0.40$) and in CFS ($r=0.63$).

Level of Physical Activity

Results on physical activity are presented in Table 4. In CFS, evidence was found for the relationship between level of physical activity and physical attributions (physical attributions with Mobility of the SIP, $r=0.35$) and between subjective fatigue and physical activity: CIS Subjective Fatigue with Mobility of the SIP ($r=0.47$), Physical Activity of the CIS ($r=0.52$), the Physical Activities Rat-

Table 4. Results on Subjective Fatigue Severity, Physical Activity, and Neuropsychological Functioning of Patients With Multiple Sclerosis (MS), Patients With Chronic Fatigue Syndrome (CFS), and Healthy Subjects*

Variables	MS	CFS	Healthy	Duncan Multiple Range Test		
				MS and CFS	MS and Healthy	CFS and Healthy
Subjective fatigue						
CIS	5.4±1.3	6.0±1.0	2.2±1.3	...	...	...
Daily Observed Fatigue	5.6±3.0	7.9±2.4	1.6±1.4	...	...	...
Physical activity						
Daily Observed Activity	3.7±1.1	4.2±1.3	5.4±1.0	...	...	...
Physical Activities Rating	3.7±0.4	3.9±0.4	2.8±0.5	.05	...	...
SIP, Mobility	5.3±8.2	7.5±8.7	0.2±1.5	.13	...	...
CIS, Activity	4.6±1.7	4.8±1.7	17.4±4.5	.65	...	...
Neuropsychological						
CIS, Concentration	4.1±1.9	5.2±1.4	1.9±1.0	...	...	...
SIP, Concentration	21.3±18.9	35.0±18.7	1.1±0.3	...	...	...

*CIS indicates Checklist Individual Strength (from Vercoulen et al⁵); SIP, Sickness Impact Profile (from Bergner et al⁸ and Jacob et al⁹); and ellipses, $P < .05$. Unless otherwise indicated, values are mean±SD.

ing List ($r=0.35$), and the Daily Observed Activity ($r=0.34$). In MS, no such relationships were found.

Attributions Regarding the Causes of the Complaints

The patients' opinions concerning the causes of the complaints are presented in **Table 5**. Of the patients with MS, 15 (30%) named at least 1 psychosocial cause, compared with 7 (14%) of the patients with CFS (χ^2 test, $P=.04$). Forty-four (88%) of the patients with MS and 40 (78%) of the patients with CFS named at least 1 physical cause, which was not significantly different. There were no significant differences between both patient groups in total scores regarding physical attributions and psychosocial attributions. To evaluate whether there is a resistance to psychosocial interpretations of the complaints, correlations between psychosocial attributions and measures of psychological well-being (total scores on the BDI and the SCL) were calculated. In CFS, there were no significant correlations between these variables. In MS, on the other hand, attributing complaints to psychosocial causes was related to high total scores on the BDI ($r=0.52$) and the SCL ($r=0.64$).

Sense of Control Over Symptoms

There were no significant differences in sense of control over symptoms between patients with MS and patients with CFS. Based on the sense of control question, 19 (38%) of the patients with MS and 12 (24%) of the patients with CFS were convinced that they could influence their complaints. Sense of control was related to subjective fatigue severity in MS and in CFS ($r=0.41$ and $r=0.38$, respectively).

Neuropsychological Functioning

In patients with MS, the prevalence of self-reported concentration problems was significantly lower than in patients with CFS (23 [46%] vs 38 [74%]), but there were

no significant differences in the prevalence of self-reported memory problems (22 [45%] vs 35 [69%]) (Table 3). In both patient groups, these prevalence rates were significantly higher than in healthy subjects. These findings were confirmed by results on the CIS and SIP Concentration subscales (Table 4). There was no relationship between subjective fatigue severity and memory and concentration problems on any instruments in MS or CFS.

Social Functioning

Eleven (21%) of the patients with MS reported difficulties in social relationships (CFS, 13 [16%]; healthy, 10 [19%]), and 5 patients (10%) (CFS, 9 [18%]; healthy, 5 [9%]) reported that they were dissatisfied with social functioning. There were no significant differences in these variables between the 3 groups. On the Social Interactions subscale of the SIP (see "Impairment in Daily Life" section), both patient groups had abnormal scores. There was no relationship between subjective fatigue and any social functioning variable in MS or CFS.

Sleep Problems

For self-reported prevalence rates of sleep problems see Table 3. There was no significant difference between patients with MS and patients with CFS in the SCL Sleep Disturbances subscale, but patients in both groups scored higher than healthy subjects (Figure 1). Results on the self-observation list on the Sleep Pattern Observation List are presented in **Table 6**. In both patient groups, subjective fatigue was not related to any variable measuring aspects of sleep.

COMMENT

The main aims of the present study were to better characterize fatigue in patients with MS and to investigate the relationships between the subjective experience of fatigue and impairment in daily life, depression, level of

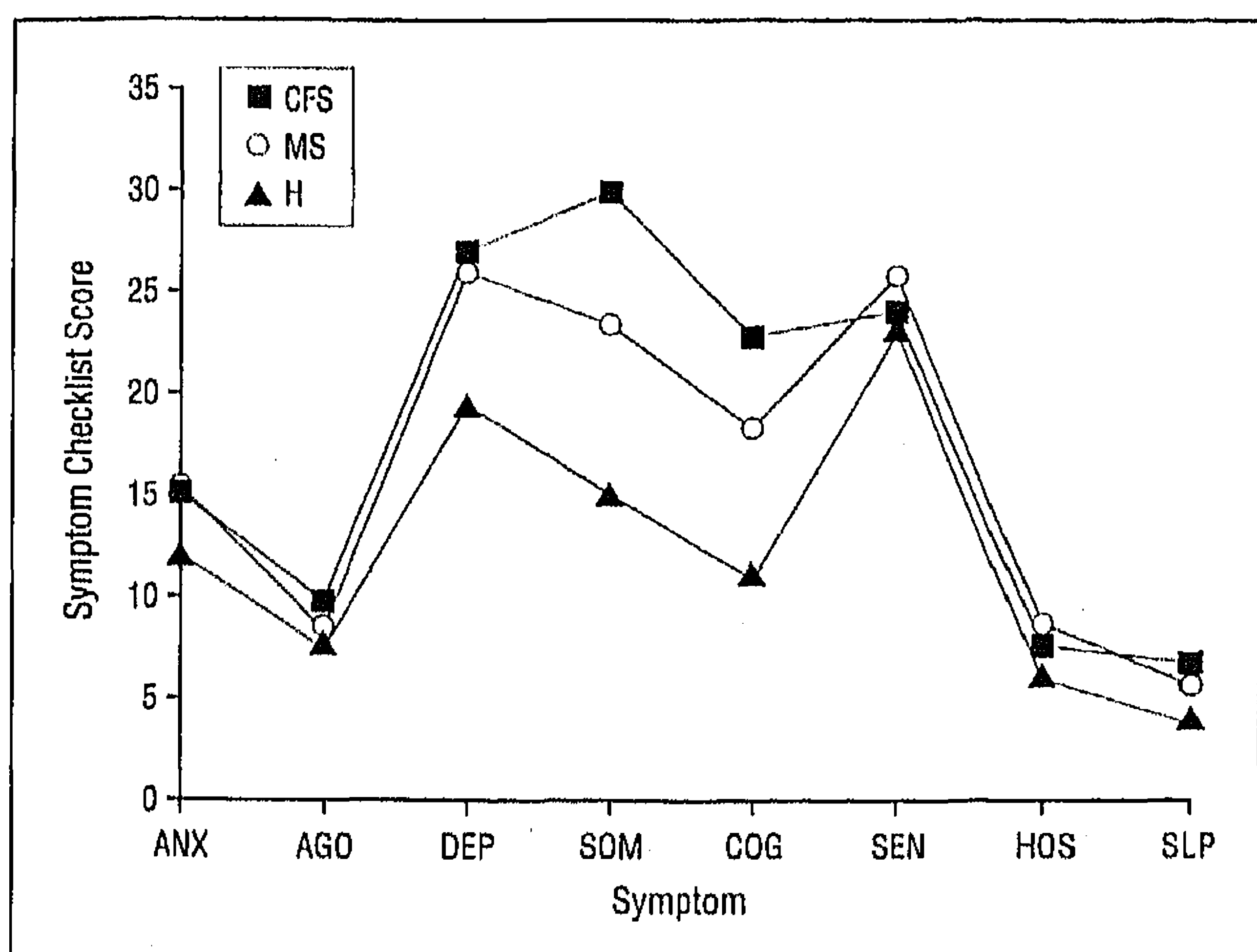


Figure 1. Symptom Checklist¹⁷ scores of patients with chronic fatigue syndrome (CFS), patients with multiple sclerosis (MS), and healthy subjects (H). Data were available on 35 healthy subjects. ANX indicates anxiety; AGO, agoraphobia; DEP, depression; SOM, somatization; COG, cognitive difficulties; SEN, interpersonal sensitivity; HOS, hostility; and SLP, sleep disturbances.

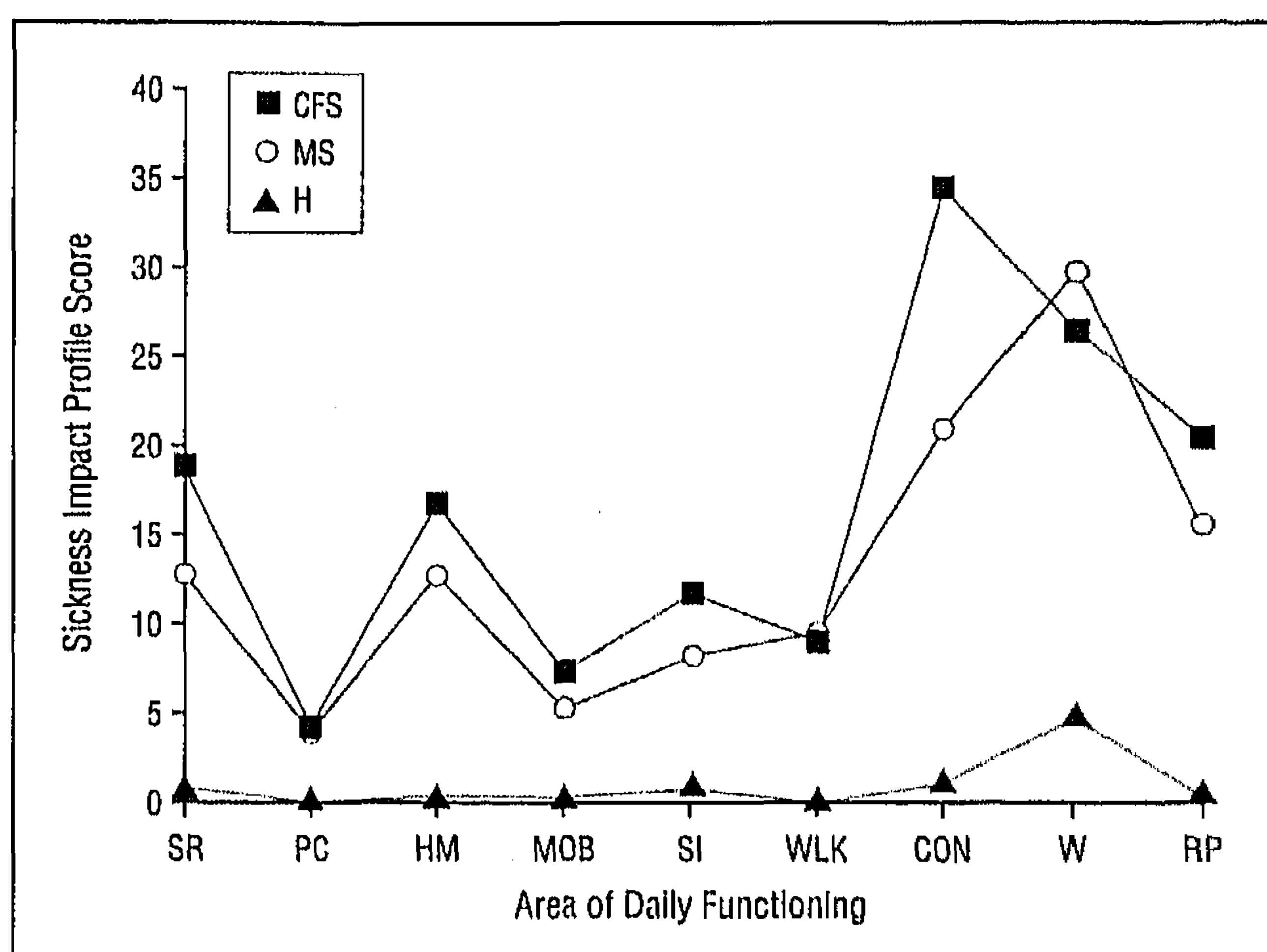


Figure 2. Sickness Impact Profile scores of patients with chronic fatigue syndrome (CFS), patients with multiple sclerosis (MS), and healthy subjects (H). SR indicates sleep/rest; PC, personal caretaking; HM, activities at home; MOB, mobility; SI, social interactions; WLK, walking; CON, concentration; W, work; and RP, recreation and pastimes.

physical activity, cognitions and attributions, sleeping problems, and neuropsychological complaints.

The present study shows that fatigue in MS is a serious problem. Almost half of the patients reported that they felt fatigued every day, and fatigue was present in 85% of the patients at least once a week. Also, the patients with MS experienced high fatigue severity levels, almost as high as those of the patients with CFS. Furthermore, in a 2-week period, subjective fatigue severity was shown to be stable over time and was closely related to impairment in daily life.

Although problems in occupational situation were marked, which was most apparent from the substantial number of patients who were on sick leave or received disablement insurance benefits, occupational situation was not related to the level of subjective fatigue. This finding might suggest that fatigue is not a problem that is serious enough to cause a patient with MS to quit his or

Table 5. Patients' Opinions Regarding the Causes of the Complaints*

Causes	Percentage Agreed		P (χ^2)
	MS	CFS	
Psychosocial			
Work situation	2	4	.60
Home situation	4	0	.14
Life too busy	17	6	.09
Childhood	4	8	.44
Worry too much	33	4	.002
Physical			
Virus	22	43	.03
Physical abnormalities	83	75	.28
Physical disease	82	49	.001

*MS indicates multiple sclerosis; CFS, chronic fatigue syndrome.

her job. However, in patients with CFS, the key symptom of fatigue caused a similar percentage of patients to be on sick leave or to receive disablement insurance benefits, and in this group there was also no relationship between the level of subjective fatigue and occupational situation.

With respect to the hypothesized role of psychological factors involved in the perpetuation of complaints, as outlined in the introduction, it can be concluded that patients with MS and patients with CFS have similar profiles of depression, physical activity, sense of control over symptoms, and causal attributions. Regarding the relationships between the relevant dimensions, several findings indicate similarities, but also differences, between patients with MS and patients with CFS with respect to the processes involved in the experience of fatigue.

First, sense of control appears to play an important role in subjective fatigue in CFS as well as in MS. In the present study, sense of control was closely related to subjective fatigue in both patient groups. In a prospective study on the natural course in CFS, we found that a low sense of control was the strongest predictor of chronicity and a determinant of high subjective fatigue severity.¹¹

Second, present data do not support the hypothesized role of depression in fatigue in MS or CFS. No evidence was found in either patient group for the hypothesis that depression may develop as a result of prolonged disability or perceived helplessness in controlling complaints. Also, the BDI score was not related to subjective fatigue in MS or CFS.

Third, results with respect to the Somatization subscale of the SCL are of interest. It has been shown that although there is psychological disturbance in patients with CFS, this in general is of only mild severity and is not as severe as in psychiatric patients.^{5,21,22} In the present study, patients with MS and patients with CFS showed a similar profile on all measures of psychological well-being, with the exception of the SCL Somatization subscale. On this scale, patients with MS scored intermediately between healthy subjects and patients with CFS. In a previous study, we found that patients with CFS had somatization scores similar to those of psychiatric

Table 6. Results of Patients With Multiple Sclerosis (MS), Patients With Chronic Fatigue Syndrome (CFS), and Healthy Subjects (HS) on the Self-Observation List (Daily Observed Sleep Quality Scores) and Sleep Pattern Observation List (Daily Observed Sleep Pattern Scores)*

Criteria	MS	CFS	Healthy	Duncan Multiple Range Test†		
				MS and CFS	MS and Healthy	CFS and Healthy
Daily Observed Quality of Sleep‡						
Slept well	64±26.1	56±30.4	77±15.5	.02	...	...
Problems falling asleep	27±19.3	28±23.3	20±20.5	.49	.27	.83
Restless sleep	26±22.7	29±23.9	12±9.9	.76	.09	.05
Early awakening	21±24.1	16±23.1	16±8.2	.27	...	...
Daily Observed Sleep Pattern						
Hours asleep at night	7.6±1.0	8.0±1.7	7.5±0.7	.13	.99	.14
Hours awake before sleep	0.6±0.6	0.8±0.7	0.4±0.3	.11	.13	...
Hours awake during the night	0.4±0.4	0.4±0.5	0.1±0.1	.64	...	...
Hours staying in bed after sleep at night	0.4±0.4	0.5±0.4	0.3±0.3	.54	.27	.09
Hours asleep during the day	0.4±0.5	0.7±0.9	0.2±0.3	...	...	...
Hours rest during the day	0.5±0.5	1.1±1.2	0.2±0.3	...	...	...

* Unless otherwise indicated, values are mean±SD.

† Ellipses indicate $P < .05$.

‡ Mean percentage of occurrence.

outpatients.⁵ These results may indicate the presence of somatization disorder in CFS, which represents psychological disturbance expressed in multiple physical symptoms. In contrast to this hypothesis, we found that psychological disturbance in patients with CFS, as measured with the other SCL subscales and the BDI, was moderate and similar to that in patients with MS. In addition, other investigators have found the prevalence of somatization disorder in patients with CFS to be quite low (15%)^{23,24} and similar to that in other patient groups.²⁵⁻²⁷ Another interpretation of high somatization scores on the SCL may be that patients are highly tuned in to bodily sensations. Considering the close relationship between the SCL Somatization subscale and the CIS Subjective Fatigue subscale in CFS as well as in MS, focusing on bodily sensations may play a role in the experience of fatigue in both patient groups. This process appears to be most pronounced in CFS.

Fourth, patients with CFS and patients with MS showed significantly lower levels of physical activity than healthy subjects. However, the level of physical activity was related to subjective fatigue and causal attributions in CFS but not in MS.

Finally, patients with MS and patients with CFS did not differ in total scores in regard to causal attributions. However, when the context in which such attributions are made is considered, it can be seen that there are differences between both groups. In MS, there is a somatic substrate, which generally is presented to the patient as "probably related to a viral infection." In CFS, on the other hand, no somatic cause is established. Yet, the vast majority of patients with CFS named at least 1 physical cause and significantly more often than patients with MS indicated that a virus was responsible for their complaints. Furthermore, psychosocial attributions were more common in patients with MS than in patients with CFS, and these attributions were related to measures of psychological well-being in patients with MS but not in patients with CFS. These findings suggest that patients with MS are more open to psychosocial explanations

of the complaints than are patients with CFS, who show a strong resistance to this type of explanation, as has been documented previously.^{5,8-10} Causal attributions thus appear to play a different role in CFS than in MS.

In contrast to what was expected, EDSS scores were not related to subjective fatigue in MS. This finding suggests that subjective fatigue in MS is not related to the disease activity.

Two methodological issues need to be addressed. First, in the MS sample, the majority of patients were only mildly affected as measured by the EDSS. It is unclear whether in more severely affected patients with MS fatigue would be even more severe or whether the relationships between subjective fatigue and measures of the somatic substrate, physical activity, and attributions would yield different results. Second, in the present study, the EDSS was the only parameter reflecting somatic disturbance in MS. Future research should incorporate more explicit measures of the somatic substrate, notably magnetic resonance imaging.

Present findings indicate that fatigue is a serious problem in MS and provide a basis for future research. A multidimensional approach proves to be a valuable method for assessing fatigue, not only to characterize fatigue, but also to identify processes that may contribute to the subjective experience of fatigue. An important finding of the present study is that psychological factors, such as sense of control and focusing on bodily sensations, seem to play a role in the subjective experience of fatigue in MS. At present, no effective somatic treatment for fatigue exists. The recognition that psychological factors may be involved in the experience of fatigue opens possibilities for psychotherapeutic interventions.

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