

## Impact of a maximal exercise test on symptoms and activity in chronic fatigue syndrome

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### Abstract

**Objective:** This study examined the effects of exercise on symptoms and activity in chronic fatigue syndrome (CFS). **Methods:** Twenty CFS patients and 20 neighborhood controls performed an incremental exercise test until exhaustion. Fatigue, muscle pain, minutes spent resting, and the level of physical activity were assessed with a self-observation list. Physical activity was assessed with an actometer as well. Data were obtained 3 days before the maximal exercise test (MET) up to 5 days thereafter. **Results:** For CFS patients, daily observed fatigue was increased up to 2 days

after the exercise test. For controls, self-observed fatigue returned to baseline after 2 h. Both CFS patients and controls spent more minutes resting on the day before and on the day after the MET. For CFS patients, self-observed minutes resting increased on the day of the exercise test. For neither group, a decrease of actometer recorded or self-observed physical activity after exercise was found.

**Conclusion:** Fatigue in CFS patients increased after exercise, but the level of actual physical activity remained unchanged.

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**Keywords:** Chronic fatigue syndrome; Maximal exercise test; Impact

### Introduction

Chronic fatigue syndrome (CFS) is characterized by a severe, disabling, and unexplained fatigue, lasting for at least 6 months. CFS patients often report that even minimal exercise aggravates symptoms and leads to a decrease of physical activity [1]. Nevertheless, in several studies, gradually increasing activity programs have proven to be important in the treatment of CFS [2–7]. Although CFS patients seem to have the belief that activity is harmful, the effect of exercise on symptoms and activity in CFS patients is not known.

Until now, only a few studies examined exacerbation of symptoms and decrease of physical activity after exercise. Most of these studies mainly concern physiological responses to treadmill or cycle exercise tests in CFS. Two uncontrolled studies, one measuring on the seventh day after exercise [8] and one everyday up to 7 days [9], did not find any adverse effects of exercise on symptoms and activity. Conversely, two controlled studies did find an increase of fatigue after exercise. One study measured after 24 h [10], 1 up to 4 days [11].

In the studies mentioned, assessment took place by just asking for adverse after-effects following testing [8], by questionnaires like the modified version of the Profile Of Mood Scales (POMS; [9–11]), an activity restriction index [9], a symptom log [9], and daily ratings of fatigue [11]. Only in one study was an accelerometer used to measure the effect of exercise on physical activity. An unexplained reduction in activity on the fifth day after the exercise test was found for CFS but not for controls [12].

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It has been shown that self-report questionnaires on physical activity do not correlate very well with accelerometer readings [13]. Whereas questionnaires that require simple ratings of actual activity were related to the accelerometer, instruments that require general subjective interpretations of activity were not. Furthermore, questionnaires like the POMS do not seem sensitive for day-to-day changes in repeated measurements. Standardized self-observation measures seem more appropriate to assess fluctuations in fatigue [14,15].

The purpose of the current study was to investigate the effect of a maximal exercise test (MET) on fatigue, muscle pain, rest, and activity on the days surrounding the exercise test. In a former study [16], the physiological aspects of a MET in CFS compared with controls were described. No significant differences in physical fitness between CFS patients and their controls were found. In this same study, self-observation measurements, as well as an accelerometer, were used. These results are presented now. Symptoms and activity were measured the hours before and after the test, as well as the days before, of, and after the exercise test. CFS patients were compared with neighborhood controls. It was expected that after the MET for CFS patients, as well as for controls fatigue, muscle pain and rest will be increased and physical activity will be decreased as compared with baseline. In this context, a significant difference in the extent as well as in the duration of changes in symptoms and activity between CFS and controls was anticipated. CFS patients were expected to experience a more severe increase of symptoms, of longer duration, and a more prevalent and longer lasting decrease of activity.

## Methods

### *Participants*

Patients were recruited from a group of CFS patients diagnosed at the General Internal Medicine outpatient clinic of the University Medical Center Nijmegen, a national referral expert center for CFS. The diagnosis CFS was made after a thorough medical investigation. All patients fulfilled the Fukuda criteria for CFS [17].

As a rule, screening questionnaires were sent to all patients diagnosed with CFS at the outpatient clinic. For the present study, only CFS patients with a Checklist Individual Strength (CIS) fatigue severity score of 40 or more and a total score of the Sickness Impact Profile (SIP)-8 of more than 800 were included to guarantee severe fatigue and disability ([18]; see instruments). With these operational criteria, severe fatigue and impairment in CFS can be distinguished from fatigue and impairment in other conditions [18]. Finally, patients had to be able to recruit a neighbor of the same gender and about the same age, as a control. Twenty-six CFS patients, living in the surroundings of our hospital, were asked to participate. Twenty of these

met our additional CIS and SIP-8 criteria and found a neighborhood control. Prior to their commitment, all participants were completely informed about the method and procedure of the study. The physiological characteristics of these participants have been described in detail elsewhere [16].

### *Measures*

#### *Checklist Individual Strength*

The subscale fatigue severity of the fatigue questionnaire CIS [18] was used to assess overall fatigue. The subscale fatigue consists of eight items asking for fatigue severity during the last 2 weeks. Each item was scored on a seven-point Likert scale, thus, the range is 8–56. Cronbach's alpha is .88. This subscale has proved its usefulness in several studies and, for instance, distinguishes fatigue in CFS patients from fatigue in patients with functional bowel disorder and healthy controls [18].

#### *Sickness Impact Profile*

Functional impairment was assessed using the SIP [19,20]. This questionnaire measures the influence of complaints in different areas of daily functioning. The following eight subscales were used: alertness behavior, sleep, homemaking, leisure activities, work, mobility, social interactions, and ambulation. The sum of the weights of items of these subscales is referred to as the SIP-8. These subscales of the SIP are often used in CFS and distinguish functional impairment in CFS patients from patients with several other physical complaints [18].

#### *Maximal exercise test*

A bicycle ergometer test with incremental load was used as an exercise test [21]. The workload was increased every minute in steps of 10% of estimated maximal workload to complete all MET in approximately 10 min. Steps varied from 10 to 30 W/min. Participants were verbally encouraged to perform maximally until exhaustion. The time spent on the bicycle ergometer was  $8.0 \pm 2.3$  min for CFS and  $9.2 \pm 1.9$  min for the controls. The percentage of the predicted maximal workload reached, (value reached/predicted value)  $\times 100$ , was 83% for controls and 70% for CFS.

#### *Self-observation*

A self-observation list was used to assess fatigue, muscle pain, and activity from 3 days before up to 5 days after the MET.

#### *Daily assessment*

Except for the day before, the day of, and the day after the MET, self-observation scores were obtained at breakfast, lunch, dinner, and bed time, with 9 a.m., noon, and 6 and 10 p.m. as a directive, on a scale from 0 to 4. For daily observed fatigue and daily observed muscle pain, 0 meant *no symptoms* and 4 meant *very severe symptoms*. For daily

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