



## Evaluation of Fatigue in Scientific and Clinical Practice - Review of Assessment Scales

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**Abstract**

*Chronic Fatigue Syndrome/Myalgic Encephalomyelitis (CFS/ME) is a severe, disabling disease characterized with unexplained fatigue lasting for six or more consecutive months and other, additional symptoms. The etiology has not been proven yet, and the diagnosis is clinical, made on exclusion of other illnesses connected with fatigue and fulfil of special diagnostic criteria. To properly conduct scientific research and clinical practice with CFS patients, there are needed objective measuring scales for evaluation the severity of fatigue, as well as other accompanying symptoms. Objective assessment of fatigue is difficult to achieve. In this paper review we present a current knowledge update, about the fatigue and non-fatigue measures scales for CFS patients.*

**Key words:** chronic fatigue syndrome, fatigue, fatigue scales, fatigue evaluation.

## Introduction

Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) is a chronic, disabling illness, characterized by unexplained, debilitating fatigue lasting at least 6 months, accomplished by diverse set of symptoms [1]. Diagnosis is purely clinical, based on patients' past medical history, physician's examination and additional laboratory tests, aimed to exclude any other illnesses causing fatigue in its clinical picture. To diagnose CFS/ME it is necessary to fulfil the Centers for Disease Control and Prevention (CDC) criteria from 1994, also known as the Fukuda criteria (Table 1) [2,3]. CFS/ME occurs in children and adolescents, as well as adults. The etiology has not been established. Nowadays scientific interests of this problem significantly increased. Apart from diagnostic methods, it is important to use proper fatigue measure tools, to objectively evaluate level of fatigue and allow to compare prevalence, severity and progress of CFS symptoms [3]. The aim of this article is to present a review of fatigue measure tools for CFS patients. Each scale is described in following aspects: structure, interpretation, utility and psychometric properties.

## Materials and methods

PubMed and Google Scholar database were searched and available literature was subjectively selected due to its usefulness in assessing fatigue in CFS patients for scientific or clinical purposes.

## Results

### *Fatigue Severity Scale (FSS)*

The 9-item Fatigue Severity Scale (FSS) is widely used self-report questionnaires to measure fatigue in patients with neurological disorders [4]. The concept of fatigue is based on the patients' own perceived state of energy or lack of it. The subjective nature of fatigue makes it difficult both to define and to measure [5]. It consists of nine statements, which

each patient evaluates in seven-point scale. It is useful in CFS, because this unexplained disease indicates symptoms from muscles and nervous systems. Primarily, it was considered mainly as brain disease, so FSS is widely used to evaluate fatigue in numerous research about CFS.

### ***Fatigue Assessment Scale (FAS)***

Fatigue Assessment Scale (FAS) as a one-dimensional scale is used to measure the level of fatigue, mainly in patients who suffer from chronic diseases such as cancer or multiple sclerosis [6]. It consists of 10 statements about daily well-being over the past year in the context of fatigue and the answers can be given on a five-point scale. The overall result is a summation of the points given and is a representation of the severity of fatigue. A high result indicates signs of chronic fatigue [7].

The questions concern only the aspect of fatigue in everyday life. This scale describes fatigue in quantitative terms and is independent of other factors such as depression.

Researches show that the accuracy and reliability of FAS reach a high level, which goes hand in hand with usefulness [6]. In addition, the research analysis reports that FAS is a coherent scale, and the Cronbach's Alpha coefficient of 0.86 proves that FAS is a useful diagnostic tool in the process of diagnosis of chronic fatigue [7].

The reliability of the FAS scale was assessed relative to other scales, such as FS, WHOQOL-EF, CIS or MBI-EE, tested and used in daily clinical practice. It has been shown that among the compared scales, the FAS scale is most oriented towards the issue of fatigue, and the greatest similarity and correlation is with the FSS and CIS scale – Subjective Experience of Fatigue. An important issue to note is that the FAS scale shows a lower standard deviation from the commonly used scale, which is the CIS scale, however, higher than the FS scale. Nevertheless, the FAS scale is comparable to the other scales [8].

### ***Chalder's Fatigue Scale***

Chalder's Fatigue Scale (Table 2) was originally developed to measure fatigue in CFS, however, it has been expanded over time and nowadays has a much wider application [9].

In the original version (CFQ 11) it is a scale consisting of 11 questions regarding the level of mental and physical fatigue. The extended scale CFQ 14 has been refined and questions including their quantity have been modified, however both scales serve the same purpose and have the same application in clinical practice. Both scales are used to describe the functioning and activity of patients with CFS, nevertheless, it is not possible to differentiate CFS from chronic fatigue syndrome in chronic diseases [2].

This theory is confirmed by B. Strouten in his research, in which he questions the credibility of the conducted tests of the effectiveness of the Chalder's scale, which was carried out by the author of the scale himself. B. Strouten shows that the CFQ scale is a good scale that meets all the requirements of a correct and reliable source for diagnosing CSF among healthy people, but it does not provide a comprehensive answer on the characteristics of a given fatigue or its source [10].

Among the general population in mainland China, studies differentiating the effectiveness of the 11-element scale from the 14-element scale were accomplished. Researchers based on the assumption that the 14-element scale is more often used in China compared its effectiveness with the 11-element scale regularly used in other regions. The research showed that both versions of the Chalder's Fatigue Scale have good reliability of internal consistency, although the ECV value in the 14-element version was 4.6 percentage points higher compared to the 11-element version. The value of the omega coefficient determined indicates satisfactory internal credibility. In addition, the result of the research was structural correctness for both Scale models, although the 11-element version proved to be better than the 14-element version in terms of efficiency of the data model. However, the general conclusion is that Chalder's Fatigue Scale is a reliable tool for assessing fatigue among the population studied [11].

### ***Fatigue Impact Scale (FIS)***

The Fatigue Impact Scale (FIS) was established in 1994 and has since been especially recognized and popular both among researchers and in clinical practice. The proof for this claim is that the scale has been translated and approved in 30 languages. Furthermore, new, modified versions are created on its basis, usually in a short version, due to the fact that the scale is quite extensive and detailed – it consists of 40 elements, each of which is scored from 0 points (no problem) up to 4 points (very significant problem). Adding the obtained points to gives a score from 0 to 160, which relatively determines the degree of severity of symptoms of chronic fatigue [12]. FIS assesses the degree of fatigue in three areas of everyday life: cognitive functioning (10 elements), physical functioning (10 elements) and psychosocial functioning (20 elements).

The reliability and usefulness of the full-scale FIS scale was tested and compared to the MFIS and D-FIS scale, which are derived from the native FIS 40-element scale among patients with chronic gastrointestinal disorders and liver diseases. It has been shown that both the FIS and MFIS scale are effective and suitable for every day clinical practice, however the FIS scale can be problematic due to its size. In addition, the researchers came to the conclusion that the FIS scale shows a wide internal dependence, which definitely disturbs the correctness of the structure, which affects the independence of the scale, which is obligatory in the summing scales (only 11 out of 40 items did not show any relation to another element of the scale). What does not change the fact that Cronbach's alpha reliability coefficient, after performing Rasch analysis, in the FIS scale is high ( $\alpha=0.94$ , and according to researchers J. Frith and J. Newton  $\alpha \geq 0.87$  [1]), which also defines the scale as useful, though not entirely practical in its application [13].

### **Modified Fatigue Impact Scale (MFIS)**

Modified Fatigue Impact Scale (MFIS) is a derivative of the 40-element FIS scale and was created during the development of the Multiple Sclero-

sis Life Inventory (MSQLI) to assess the degree of fatigue in people with chronic diseases, especially multiple sclerosis. National Multiple Sclerosis Society members chose 21 items among 40 entities on the FIS scale, which showed the smallest correlation features between the elements and showed the smallest intrinsic relationship. This resulted in a collection of 9 elements from the category of physical functioning, 10 elements of the position of cognitive functioning and 2 entities of psychosocial functioning. The rating scale and scoring rules are no different from the standard version of the FIS test. The authors of the MFIS scale as well as persons participating in the modification of the FIS scale did not publish the justification for the selection of elements of individual subscales or evidence of verification of changes in the structure of the basic scale. By completing the MFIS questionnaire you can get points from 0 to 86, which is equivalent to the degree of severity of symptoms of fatigue [13].

MFIS is a short questionnaire and easy to execute among patients. Unfortunately, it does not provide sufficient opportunity to differentiate diseases such as depression, chronic fatigue syndrome, and chronic fatigue syndrome in chronic diseases. However, it has been proved that it is a helpful tool in the diagnosis of fatigue in itself, which in every day clinical practice can prove to be an invaluable help [14].

### ***Fibro Fatigue Scale (FFS)***

The Fibro Fatigue Scale (FFS) (Table 3), as the name suggests, was created for people with fibromyalgia disease. FFS consists of 12 elements measuring both the degree of fatigue and the severity of other symptoms such as pain, intestinal disorders, irritability, sadness, changes in muscle tone, sleep disturbance, memory loss, difficulty concentrating, autonomic disorders, headache and subjective experience of infection. Each element is subject to a 7-point rating from 0 – no symptoms after 6 – the strongest symptom. It may seem that Fibro Fatigue Scale is created individually for an individual disease entity, however, both fibromyalgia and CFS have a lot in common. Despite differences in diagnostic criteria, both diseases are characterized by a number of similar symptoms and ambigu-

ous origin of the disease, which allows matching the same questionnaire for both patients with fibromyalgia and chronic fatigue syndrome [15].

Inter-rater reliability FFS was tested and a very high correlation among scale components was proved (the scale was tested using ANOVA and the index for the whole test was 0.98). This is a promising indicator of the usefulness and reliability of the test [15].

### ***Functional Assessment of Chronic Illness Therapy (FACIT)***

Fatigue is one of the most frequent complaints of older adults and is strongly associated with loss of independence, decreased physical activity, and functional decline. Although there are several validated tools for the measurement of fatigue, there is no gold standard [16]. One self-report questionnaire that has been validated for use with older adults is the Functional Assessment of Chronic Illness Therapy (FACIT) Fatigue Scale (Version 4) [17]. The FACIT Fatigue Scale is a short, 13-item, easy to administer tool that measures an individual's level of fatigue during their usual daily activities over the past week. The level of fatigue is measured on a four-point scale (4 – not at all fatigued to 0 – very much fatigued) [18]. The FACIT Fatigue Scale is part of a collection of health-related quality of life (HRQOL) questionnaires targeted to the management of chronic illnesses. Current research has demonstrated that the FACIT Fatigue Scale has sound measurement properties and is an appropriate and interpretable assessment of fatigue among individuals with various underlying conditions [17].

### ***Supplementary scales used in fatigue evaluation***

In addition to the typical scales intended for objective assessment of fatigue or the diagnosis of Chronic Fatigue Syndrome/Myalgic Encephalomyelitis, we also use some supplementary scales in conducting scientific research, as well as in clinical practice with CFS patients. These scales are not originally intended for assessing fatigue, but they allow to have a better view on the quality of life of CFS patients, or any other accompanying symptoms.



For patients, fatigue significantly reduces their mood, attitude, decreases their daily functioning, social contacts, occupational activity, leads to a multifactorial reduction in the quality of life. The patient does not specifically feel fatigue, but rather mainly feels the worse quality of his life, caused by fatigue. Therefore, the assessment of quality of life (QOL) and health-related quality of life (HRQOL) indicators gives indirectly very clear information on the patient's general well-being. The better we treat the patient, reduce his fatigue, enable him to return to his everyday life, the more the patient will assess higher the quality of his life. Currently, many scales are being developed to assess QOL and HRQOL, the most commonly used are: SF-36, CIS20r, EQ-5D.

Reducing the level of professional and social activity, caused by increasing fatigue, very easily leads to the development symptoms of anxiety and/or depression. Therefore, for the purposes of diagnosing CFS/ME or assessing the severity of symptoms, the patient's evaluation should also include the assessment of psychiatric symptoms. In clinical and scientific practice, the Beck's Depression Inventory (BDI) and the Beck's Anxiety Inventory (BAI) are most often used. In order to obtain reliable results in scientific research, patients with co-depression or other mental illnesses are most often excluded from the diagnosis of CFS, therefore psychiatric consultation is important in multi-specialist assessment of the patient before diagnosis.

To assess a patient with CFS, scales can also be used to assess the severity of symptoms other than fatigue, which are additional to CFS. For this purpose, you can use the assessment of cognitive functions, memory tests, perceptiveness. In CFS there are often sleep disturbances overlapping, so it is useful to use also Epworth Sleepiness Scale (ESS).

There is definitely too little amount of scientific research about diagnosis and treatment of CFS/ME in children, which is the reason for the very rare diagnosis of this disease in the developmental population. At present, to recognize CFS in children and adolescents, we use exactly the same scales as in adults, due to the lack of validated scales for other age groups. However, it should be considered that the CFS/

ME clinical picture in children is different, for example they more often present pain or flu-like symptoms, and less often cognitive impairment. These parameters should be included in special, adapted to different age groups scales. A good example is the Pediatric Quality of Life Inventory (PedsQL) [19], which allows an adequate and objective assessment of the quality of life of children in different age groups. For each age group (teenager 13–18 years old, child 8–12 y.o., young children 5–7 y.o.) it contains separate forms for the child and for the parent, and for toddler's parents (2–4 y.o.) it contains form only for parents. The parent is asked to answer questions about the child, while the child, depending on his age, pictorial or verbal answers to simple questions about his or her well-being and quality of life. This example shows that in order to obtain reliable and objective results, it is not possible to use the same scales for adults and children, the scales assessing the children's population should take into account a separate clinical picture, age of children, division into questions for the child and parent to objectively assess the symptoms in a child and make a reliable diagnosis.

Ending the chapter on supplementary scales assessing the severity of fatigue, we want to mention about the interesting Inflammatory Bowel Disease Fatigue Scale (IBD-F) [20]. This scale was originally created to assess the fatigue in patients with Crohn's Disease (CD) or Ulcerative Colitis (UC). These are chronic diseases characterized by inflammation of bowel and various complications, which may be accompanied by fatigue. Diagnosis of CD or UC currently excludes patients Chronic Fatigue Syndrome's diagnosis, however, this scale presents a new approach to assessing of fatigue and can also be used in patients with CFS/ME. The IBD fatigue rating scale consists of 3 sections – Fatigue Assessment Scale (consisting of 5 questions about self-assessment of fatigue severity, giving points from 0 to 4), IBD-Fatigue Impact on Daily Activities Scale (30 questions also assessing the patient symptoms on a scale of 0 to 4 points) and Additional Questions about your Fatigue (to which the patient can answer in a descriptive way, thanks to which the scale takes on a more individualized character). With this fatigue scale CFS

patients are able to self-assess their fatigue and the impact it has on their lives, more easily raise their fatigue symptoms with healthcare professionals, assess whether changes in lifestyle are having any impact on fatigue levels, discuss their fatigue with family, friends and employers. This fatigue scale is an interesting measuring tool and should be included in the management of a patient with CFS/ME [20].

## Discussion

Chronic Fatigue Syndrome/Myalgic Encephalomyelitis (CFS/ME) is a genuine and disabling illness of unknown origin, that can profoundly affect the lives of patients [3]. Many healthcare providers do not have sufficient knowledge about this disease and are skeptical about the seriousness of CFS/ME, mistake it for a mental health condition, or consider it a figment of the patient's imagination. Misconceptions or dismissive attitudes on the part of healthcare providers make the path to diagnosis long and frustrating for many patients [3]. That is why there should be more clinical and scientific discussions about this serious, chronic disease.

CFS/ME is currently the subject of many scientific studies whose purpose is to determine its etiology, discover biological diagnostic marker, establish reliable and accurate diagnostic criteria, as well as determine the effective treatment. To properly conduct scientific research and clinical practice with CFS patients, there is a need of objective measuring tools for evaluation the severity of symptoms, including fatigue. It is necessary to determine the severity of the symptoms depending on the therapeutic attempts made. For this purpose, we use fatigue assessment scales, which have been presented and described in detail in the above article.

It should be remembered that none of these scales were typically created for assessing patients with CFS/ME only. These scales were primarily created for evaluation of patients with neurological and psychiatric units, and others causing fatigue as one of the symptoms in their clinical picture. Therefore, despite many advantages, none of the presented scales is an ideal tool for assessing a patient with CFS/ME.

Fatigue is a non-specific and highly subjective symptom, so it should be assessed extremely carefully, so that the result is most reliable. Features of good fatigue measuring tool are: simple questions, a simple way of answering, good psychometric properties, a tool designed to measure fatigue should also be short and concise [2]. For this reason, the simplest form of fatigue testing is a one-dimensional form in terms of assessing its intensity. For this purpose, a Visual Analog Scale (VAS) or a 10-point Numerical Rating Scale (NRS) are often used to subjective assessment of the intensity of fatigue in the examined patient. However, such tools can be used to assist in assessing treatment progress or screening at a very early stage and are generally not very useful [2].

The diagnostic procedure requires reliable fatigue characteristics in the examined person. More complex assessments, however, require a reference to a specific concept of fatigue, some interpretation of this symptom, limitation of the assessed parameters (e.g. relating to disorders of the autonomic nervous system, cognitive impairment or sleep quality), as well as the determination of the evaluated time period related to symptoms.

Whitehead et al [21] analyzed selected tools for measuring fatigue in patients with chronic diseases based on the model of the ideal tool he proposed: useful (easy to understand, complete and not burdensome), useful for research/clinical practice (differentiating patients from healthy, fully determining the severity of fatigue and its impact on functioning, sensitive to changes related to progression or treatment), having good psychometric indicators. As a result, it turned out that of the 22 tools they assessed, only 17 met some of these criteria, and none of the tools assessed met all 3 criteria. Among the tools with good psychometric indicators, the researcher mentioned Fatigue Severity Scale.

Schwartz et al [22] performed an analysis of selected tools in terms of assessing what the minimal difference in test results entitled to infer about the actual change in the clinical picture of patient fatigue. It turned out that assessing the dynamics of fatigue reduction is problematic and is not well mapped by the available measurement tools.

Comparative analysis of fatigue measurement tools performed by Jason's team [23] show that there are many scales that do not have sufficient sensitivity to isolate and differentiate people with CFS (positive and negative diagnosis). According to researchers, scales such as: Chalker's Fatigue Scale and Fatigue Severity Scale have sensitivity to distinguish people with Chronic Fatigue Syndrome from the group of healthy people, but they lack sufficient specificity (negative diagnosis). They also draw the problem of differentiating people with CFS from the population of patients with mental illness. The authors point to the assessment of post-exertional fatigue severity (post-exertional malaise, PEM), which is very characteristic symptom of CFS/ME and recommend taking it into account primarily on scales used to diagnose CFS from other chronic diseases [23]. The PEM assessment is included, for example, in the de Paul Questionnaire or in the ME/CFS Fatigue Types Questionnaire.

The presented scales, their theoretical and structural diversity and application possibilities require both the researcher and practitioner to learn them thoroughly.

## Conclusions

Presented scales for fatigue evaluation show a wide range of application possibilities. However, not all of them have equal scientific and practical value. Fatigue is a cognitive phenomenon, in which measuring tools have to be used with extreme caution, to achieve a reliable result and to make an objective assessment. None of the presented evaluation scales is a perfect measuring tool. To increase the objectivity of fatigue measurement for scientific or clinical purposes, it is recommended to use more than one scale, paying attention to CFS patient capabilities.

Analyzing the available scales of fatigue assessment, a conclusion is made that further scientific research on Chronic Fatigue Syndrome is necessary, also attempting to create improved measuring scales, designed specifically for CFS, that can reliably distinguish CFS from other, congenial chronic diseases, such as mental or neurological units.

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