Original Article

The Reliability and Validity of the Turkish Version of the Fatigue Assessment Scale in Patients with Multiple Sclerosis

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Abstract

Objective: To demonstrate the psychometric properties of the Turkish Fatigue Assessment Scale (FAS). **Materials and Methods:** A total of 104 patients were recruited. The patients were assessed twice, 1 week apart. Patients completed the FAS, Fatigue Severity Scale (FSS), EuroQol-5 dimensions-3 L (EQ-5D-3 L), and Beck Depression Scale (BDS) in the initial assessment. Thirty-four patients completed the FAS again in the second assessment. **Results:** The mean age of the patients with multiple sclerosis (MS) was 37.6 ± 10.1 years. The intraclass correlation coefficient (ICC) of the FAS was excellent (ICC = 0.812). The Cronbach alpha coefficient of the FAS was 0.914. The alpha of the FAS was excellent (>0.80). Standard error of measurement and minimal detectable change of the FAS were 3.51 and 9.73 respectively. The relationship between the FAS (test, retest) and the FSS was excellent (r_1 = 0.767, r_2 = 0.782, $P < 0.01$). The EQ-5D-3 L index score was both strongly related with FAS (test, retest) (r_1 = −0.500, r_2 = −0.745, $P < 0.01$). The EQ-5D-3 L Visual Analog Scale score was also highly correlated with FAS (test, retest) (r_1 = −0.536, r_2 = −0.764, $P < 0.01$). Besides, FAS (test, retest) scores were strongly correlated with BDS total scores (r_1 = 0.540, r_2 = 0.571, $P < 0.01$). **Conclusions:** The Turkish FAS is a reliable and valid scale for individuals with MS.

Keywords: *Adaptation, fatigue, multiple sclerosis, Turkish version*

Introduction

Fatigue is a frequent and essential parameter.[1] Although the etiology of fatigue associated with multiple sclerosis (MS) is related to clinical and psychosocial features, it is still a matter of debate.[2,3] However, fatigue can be observed in many neurologic diseases. It has been reported that the prevalence of fatigue is between 36% and 77% in stroke and 33%–83% in MS.[4] According to international guidelines, fatigue is a subjective parameter observed in MS. Fatigue is defined as a physical and mental deficiency.[5,6] It has been reported that the fatigue seen in individuals with MS is apart from the fatigue felt by other patients and creates more physical and mental stress in daily life activities.[7] Although MS-related fatigue has been revealed to be due to primary and secondary causes in the literature, the mechanisms are still not fully clarified. The underlying mechanisms of fatigue may be directly related to MS or specific factors other than the disease. The cause of primary fatigue has been stated as dysfunctional neuronal circuits.[8] Furthermore, these primary causes contribute to some secondary causes. These have been reported as insufficient sleep, depressive symptoms, cognitive impairment, as well as physical deconditioning associated with fatigue and decreased physical activity.[8-10] All of these reasons cause individuals with MS to feel more tired during daily life activities.[2] It has been shown that the symptoms of fatigue in individuals with MS increase in the afternoon in particular, and hot weather and hot environments.[7]

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In the assessment of fatigue, generally subjective self-rating scales are used. The connections of these scales with objective mental or physical performance scales have been reported to be weak.[11,12] This situation reveals the inconsistency between the perception of fatigue and performance fatigability.[4]

Some scales are preferred in assessing fatigue in individuals with MS (e.g., Fatigue Severity Scale [FSS], Fatigue Impact Scale [FIS]).[13-15] The Fatigue Assessment Scale (FAS) was created by Michielsen *et al*. in English to assess fatigue.[16,17] The psychometric properties of FAS were investigated and demonstrated in Chinese,[18] Swedish,[19] Croatian,[20] Greek,[21] Spanish,[22] Persian,[23] and Indonesian.[24] However, so far, both the validation and other psychometric analysis of the Turkish FAS have not been studied in evaluating fatigue in patients with MS. This research aimed to prove the reliability and validity of the Turkish version of the FAS in Turkish individuals with MS.

Materials and Methods

Translation of the Fatigue Assessment Scale

The developers of the FAS granted the required permits for translating the questionnaire into Turkish. Internationally acknowledged methodological criteria were chosen for the translation and adaptation of FAS.[25,26] "Forward-translation" is the first phase in the translation process. In this period, the questionnaire was independently translated into Turkish by four academics (three physiotherapists and one neurologist, a native Turkish speaker, and a professional in English). The "synthesis of the translations" is the procedure's second stage.

The "back-translation" is the third stage (draft version). A qualified bilingual native English-speaking translator reviewed the combined translation efficiency by translating it from Turkish to English. The translation committee reassembles in the fourth phase to assess the Turkish version's semantic unity. The fifth level is to conduct the pilot analysis to pretest the questionnaire. A pretest was conducted on 20 Turkish-speaking individuals who were chosen at random.

Sample size estimation

A quantitative calculation was used to assess the study's sample size. Terwee *et al*. suggested a sample size of at least 10 times of the items in the scale[27] One hundred four individuals were recruited in the research. Based on an effect size of 0.4, a power of 0.80, and a possibility of error of 0.05, the sample size to conduct test-retest reliability was determined using the G * Power 3 for Mac program.[28] As a result of the calculation, it was found appropriate to have the repeatability of at least 34 subjects.

Study design

Our study was conducted in Ege University, Department of Neurology. The study protocol was approved by the ethics committee of Ege University (No: 21-3.1T/2). The research involved individuals who had been diagnosed as having MS by a neurology specialist according to the revised McDonald criteria. The inclusion criteria were as follows: (1) being Turkish and literate, (2) at least 18 years of age, (3) no relapses >1 month, and (4) Expanded Disability Status Scale (EDSS) ≤7.5. The following were the study's exclusion criteria: (1) acute relapse, (2) comorbidities that impair physical or mental function, (4) patients who declined to be involved in the research.

Personal information of the individuals was collected. The neurologist scored the EDSS of the patients.[29] The patients were assessed twice after a 1-week interval. Patients completed the FAS,[16] FSS,[13] EuroQoL-5 Dimensions (EQ-5D-3 L).[30] and the Beck Depression Scale (BDS) in the initial assessment.[31] Thirty-four patients completed the FAS again in the second assessment.

Fatigue Assessment Scale

FAS assesses physical and mental aspects of fatigue signs. It is a 10-item reporting system that can be completed in about 2 min. Questions describes the personal feels (1 = Never, 2 = Sometimes; 3 = Regularly; 4 = Frequently; and 5 = Always). The 4th and 10th items were reversed scored.[16]

Fatigue Severity Scale

The FSS evaluates fatigue and includes nine questions in total. Each question is scored between 1 and 7. The Turkish validation of the FSS was conducted by Armutlu *et al*.[13]

EuroQol-5 dimensions-3 L

The EQ-5D-3 L includes two subscales: The index score and the visual analog scale (VAS) score. The index score consists of five aspects. Each dimension is evaluated at three levels. The VAS subscale rates the health status of the patients with a vertical line from 0 to 100. The Turkish validation has been demonstrated.[30,32]

Expanded Disability Status Scale

The EDSS was created by Kurtzke to describe disease progression in patients with MS and evaluate the effectiveness of therapeutic interventions in clinical trials. It is scored from 0 to 10.[29]

Beck Depression Scale

Beck *et al*. developed the scale. Turkish version of the scale has been validated. The BDS defines depression severity. All of the items of the BDS are scored from 0 to 3. A higher score indicates greater severity of depression.[31]

Statistical analysis

The SPSS for Mac 25.0 (SPSS Inc, IBM Corp, Armonk, New York) software was used for statistical analyses. The Kolmogorov–Smirnov test was chosen to demonstrate the homogeneity. The confidence interval of 95% was set. The Cronbach alpha was measured for FAS. A greater alpha coefficient of FAS indicates greater consistency of the items. An alpha score of ≥0.8 was excellent.[33] An intraclass correlation coefficient (ICC) of more than 0.8 suggests excellent reproducibility.[34] The generally accepted formulas below were preferred to quantify the standard error of measurement (SEM_{95}) and minimal detectable change (MDC_{95}).”[35]

Validity

Pearson’s correlation coefficient (r) was used for the construct validity analysis. FAS was correlated with the FSS, EDSS, EQ-5D-3 L, and BDS scores. Convergent validity was predicted to have high correlation coefficients. If the coefficient was higher than 0.5, it was deemed strong, and moderate if it was between 0.5 and 0.35.[36]

Results

One hundred and four participants (79 women, 25 men) with an average age of 37.6 ± 10.1 years were recruited in the research. The individual data of the individuals are given in Table 1. The average duration after the MS diagnosis was 7.5 ± 5.8 years. The majority of the patients had bachelor’s or postgraduate degrees (58.6%). The majority of the patients were married (57.7%). The absolute values of the FAS, FSS, EQ-5D-3 L index, EQ-5D-3 L VAS, BDS, and EDSS were 25.43 ± 8.10, 4.47 ± 1.44, 0.77 ± 0.17, 75.74 ± 17.82, 9.77 ± 8.12, and 1.79 ± 1.71, respectively [Table 2]. In terms of comprehensibility, there were no difficulties in the pilot survey.

Reliability

The ICC of the FAS was 0.812. The reproducibility was excellent (>0.80). The items’ ICC values ranged between 0.596 and 0.935 [Table 3]. The Cronbach alpha coefficient of the FAS was 0.914 for the total score [Table 3]. The items’ alpha values ranged from 0.898 to 0.917. Internal consistency was also excellent for the total score and all items of FAS (>0.80). The SEM_{95} and MDC_{95} of FAS were 3.51 and 9.73, respectively [Table 3].

Table 1: The data of the individuals (*n*=104)

	Total
Age (years, mean±SD)	37.6±10.1
BMI (kg/m^2, mean±SD)	23.9±4.3
Sex, *n* (%)	
Women	79 (76.0)
Men	25 (24.0)
MS duration	7.5±5.8
Education status, *n* (%)	
Primary education	21 (20.2)
High education	22 (21.2)
Bachelors or higher	61 (58.6)
Marital status, *n* (%)	
Married	60 (57.7)
Single	44 (42.3)
Work status, *n* (%)	
Yes	47 (45.2)
No	57 (54.8)
Comorbid diseases, *n* (%)	
Yes	19 (18.3)
No	85 (81.7)

SD: Standard deviation, BMI: Body mass index

Table 2: Mean scores of the patients (*n*=104)

	Mean±SD	Range
FAS	25.43±8.10	10-46
FSS	4.47±1.44	1-7
EDSS	1.79±1.71	0-7.5
EQ-5D index	0.77±0.17	0.17-1.0
EQ-5D VAS	75.74±17.82	30-100
BDS	9.77±8.12	0-34

EQ-5D: EuroQoL-5 Dimensions, SD: Standard deviation, n: Number of patients, FAS: Fatigue Assessment Scale, FSS: Fatigue Severity Scale, EQ-5D index: Index score of the EQ-5D-3L, EQ-5D VAS: Visual Analog Scale of the EQ-5D-3L, BDS: Beck Depression Scale, EDSS: Expanded Disability Status Scale

Validity

The relationship between FAS (test) and the FSS was excellent (r = 0.767, P < 0.01). Also, the FAS (retest) was strongly related to the FSS (r = 0.782, P < 0.01). The EQ-5D-3 L index score was both strongly related to FAS (test) and FAS (retest) (r_1 = −0.500, r_2 = −0.745, P < 0.01). The EQ-5D-3 L VAS score was also highly correlated with FAS (test) and FAS (retest) (r_1 = −0.536, r_2 = −0.764, P < 0.01). In addition, FAS (test) and FAS (retest) scores were strongly correlated with BDS total scores (r_1 = 0.540, r_2 = 0.571, P < 0.01). There was a low correlation between FAS (test) and EDSS (r = 0.412, P < 0.01) [Table 4].

Discussion

The Turkish version of the FAS was demonstrated to be a reliable and valid survey for individuals with MS.

Table 3: The reliability of the Fatigue Assessment Scale

	Test (mean±SD)	Retest (mean±SD)	ICC (95% CI)	α	SEM_{95}	MDC_{95}
Item 1	2.78±1.04	2.64±0.91	0.930 (0.86-0.96)	0.901	0.275	0.762
Item 2	2.97±1.12	2.64±1.09	0.735 (0.46-0.86)	0.900	0.576	1.598
Item 3	2.26±1.00	2.08±1.02	0.539 (0.07-0.77)	0.917	0.678	1.881
Item 4	2.95±1.15	2.91±1.23	0.927 (0.85-0.96)	0.906	0.310	0.861
Item 5	2.59±1.07	2.52±0.99	0.825 (0.64-0.91)	0.900	0.447	1.240
Item 6	2.43±1.13	2.52±0.99	0.935 (0.87-0.96)	0.899	0.288	0.798
Item 7	2.04±0.96	1.97±0.75	0.854 (0.70-0.92)	0.916	0.366	1.016
Item 8	2.24±1.07	2.17±1.08	0.866 (0.73-0.93)	0.898	0.391	1.085
Item 9	2.25±1.10	2.32±1.00	0.867 (0.73-0.93)	0.902	0.401	1.111
Item 10	2.88±1.09	3.11±1.00	0.826 (0.65-0.91)	0.913	0.454	1.260
FAS (sum)	25.43±8.10	24.94±7.81	0.812 (0.62-0.90)	0.914	3.512	9.734

n: Number of patients, ICC: Intra-class correlation coefficient, CI: Confidence interval, α: Cronbach's alpha, SEM: Standard error of measurement, MDC: Minimal detectable change, FAS: Fatigue Assessment Scale

Table 4: Correlation between the questionnaires (n=104)

	FAS (test)	FAS (retest)
FSS	0.767**	0.782**
EQ-5D index	−0.499**	−0.745**
EQ-5D VAS	−0.536**	−0.764**
EDSS	0.101	0.412*
BDS	0.540**	0.571**

*P<0.05, **P<0.01. EQ-5D: EuroQoL-5 Dimensions, FAS: Fatigue Assessment Scale, FSS: Fatigue Severity Scale, EQ-5D index: Index score of the EQ-5D-3L, EQ-5D VAS: Visual Analog Scale of the EQ-5D-3L, BDS: Beck Depression Scale, EDSS: Expanded Disability Status Scale

FAS is a self-reported tool that evaluates the physical and emotional fatigue of patients with MS.[16] FAS can be used confidentially to assess the fatigue levels of Turkish patients with MS.

In evaluating fatigue in patients with MS, two more valid and reliable questionnaires are available in Turkish. FIS has a long structure with 40 questions and evaluates fatigue comprehensively.[14] Due to its long structure, FIS can provide a multidimensional and practical evaluation. However, it can sometimes cause a waste of time for patients and the physician. Another questionnaire, FSS, can evaluate fatigue together with its physical and mental dimensions in nine items.[13] However, the FSS focuses more on the impact of fatigue. It should be noted that both surveys (FIS and FSS) are valid and reliable and have been widely used for many years. FAS offers an alternative and practical evaluation considering its short structure. It also provides a comprehensive evaluation from a one-dimensional perspective because it was developed by compiling fatigue-related parameters of different questionnaires. FAS can be preferred as an alternative tool to the other two questionnaires to evaluate MS and other chronic diseases.[16,20]

Until now, seven language version studies of FAS have been demonstrated to be valid and reliable.[18-21] However, in this study, the reliability and validity of FAS in MS have been studied for the first time. In this respect, the present study has a unique design. Internal consistency was excellent in the Greek version (Cronbach's alpha = 0.761). The construct validity was revealed by factor analysis (2-factor structure, mental and physical dimensions). The authors reported that the Greek FAS could be used in individuals with chronic diseases. However, in the Greek version study, the sample consisted of all patients with chronic diseases.[21] The Croatian study was conducted on individuals with sarcoidosis. The internal consistency of the Croatian FAS was 0.91. In addition, the scree plot for the FAS items' exploratory factor analysis demonstrated that FAS had one factor (loadings, 0.85 = physically exhausted to 0.58 = concentration).[20] The Swedish version found the Cronbach alpha score of FAS 0.82 in their study on a stroke population. The test-retest reliability was adequate (ICC = 0.73). The authors demonstrated the correlation analysis. The Swedish FAS was found to be related to the Short Form-36 (vitality subscale) (r = −0.73) and Geriatric Depression Scale-15 (r = 0.62).[19] The Chinese version revealed validity and reliability in individuals with stroke who had depressive symptoms. They demonstrated internal consistency with a Cronbach's alpha of 0.71–0.82. The ICC value of the reproducibility was 0.77–0.95. The Chinese FAS was found to be correlated with the Mental Fatigue Scale (r = 0.68) and FSS (r = 0.57) for the construct validity.[18] The Spanish version was assessed in postpartum women. The Cronbach alpha coefficient was 0.80 and also its validity was calculated by descriptive and explanatory factor analysis.[22] The study of the Persian version calculated the Cronbach's alpha scores as 0.945 and 0.896 for the physical and mental departments in the study, which was conducted

on individuals with postpartum sarcoidosis. A two-factor structure was obtained by calculating validity by explanatory factor analysis.[23] The Indonesia version was conducted with nurses. The Cronbach's alpha score was calculated as 0.834.[24]

The internal consistency of FAS for all questions and the total score was excellent (α>0.80). The internal consistency value was slightly higher than the Greek, Chinese, Swedish, Spanish, and Indonesian versions and nearly equal to the Croatian version.[18,21,22,24] The Turkish FAS was consistent in individuals with MS. It is acknowledged that the items are harmonious, and fatigue can be assessed in individuals with MS.

The reproducibility for the total score of FAS was excellent (>0.80). The test-retest reliability for each item was calculated (ICC >0.70), except for the 3rd question. The 3rd item was asked if the individual did not do much activity during the day. The ICC of this item was 0.539. The reason for this low coefficient may be the workload of the individuals on two separate days, which were evaluated with a 1-week interval, or the state of fatigue may also vary.[27] Only the Chinese version study looked at ICC (0.77–0.95), and it was seen that our coefficient was higher.[18]

MDC reveals the lowest detectable difference in clinical dimensions between two patients.[35] In the Chinese version only, MDC was checked, and it was 4.96.[18] The low standard deviation or the analysis performed in different populations can be explained as a reason for these different results.

The relationship between FAS and FSS was strong (r > 0.50). We assumed that this high correlation was achieved due to both questionnaires' short and one-dimensional nature, effectively evaluating physical and mental fatigue.[13] FAS had a high level of correlation with the EQ-5D-3 L index and VAS scores, which assess the quality of life. Given that fatigue's negative effect on the quality of life is known, the expected result was a high convergent correlation (r > 0.50).[30,32] The EQ-5D-3 L was chosen for its short structure and high level of reliability. At the same time, EQ-5D-3 L was preferred instead of SF-36. This preference was due to the similarity of the questions of FAS and EQ-5D-3 L. Besides, FAS scores were strongly correlated with BDS total score (r > 0.50). BDS specifically meets the mental fatigue parameters of FAS.[31] On the other hand, there was a low correlation between FAS (test) and EDSS (r = 0.412, P < 0.01). It was thought that the focus of EDSS mostly was on disability, and individuals with a disability might sometimes be less tired due to the exacerbation periods of the disease. Similarly, in the Croatian and Chinese version study, correlations with a quality of life, fatigue, and a depression questionnaire with similar coefficients were obtained (Short Form-36 (vitality subscale: R = 0.73, Geriatric Depression Scale-15: R = 0.62, Mental Fatigue Scale: R = 0.68 and FSS: R = 0.57).[20]

Limitations

Limitations of the research should be specified. First, comparisons with more than one fatigue questionnaire could further increase the level of validity. For instance, FIS could also be used in benchmarking for structure validity.[14] However, asking patients a large number of questions with a large number of questionnaires could both create a burden and limit the collection of quality data. Second, for EDSS, a smaller limit range could be determined in the inclusion criteria, and fatigue could be approached more precisely with a more homogeneous sample. Third, other statistical analysis methods (e.g., factor analysis, item-total correlations, responsiveness analysis, minimal clinically detectable change) could be used and should be included in further studies. Finally, retesting could be performed with at least 50 individuals to reach the fair evidence level specified for Patient-reported outcome measures in the COSMIN guidelines. However, due to the COVID-19 process, existing facilities did not allow this setting.[37]

Conclusions

FAS was proven to be a reliable and valid tool for Turkish individuals with MS.

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Conflicts of interest

There are no conflicts of interest.

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