Original Article

Psychometric Properties of the Persian Version of the "Multidimensional Assessment of Fatigue Scale"

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Abstract

Background: Fatigue is a common symptom in office workers. The purpose of this study was to assess the psychometric properties of the Persian version of the Multidimensional Assessment of Fatigue (P-MAF) scale and its association with productivity among Iranian office workers. **Methods:** In order to validate the MAF scale, using "forward-backward" translation, cognitive debriefing, and cultural adaptation procedure, the English version of the MAF was translated into Farsi. A total of 129 Iranian office workers with at least 1-year job experience were included in the study. The Persian version of the Health and Work Questionnaire was used for assessment of the productivity in the participants. **Results:** Internal consistency for all subscales of the P-MAF scale was acceptable ($\alpha \geq 0.854$). The correlation of convergent validity and the correlation of discriminant validity for all subscales ranged from 0.466 to 0.948 and 0.121 to 0.5, respectively. Internal consistency of each subscale of P-MAF for sex, marital status, job tenure, and daily working hours was high (0.810–0.952). Factor analysis of the P-MAF scale revealed that its items were related to severity, distress, timing of fatigue, interference with activity at home, and interference with activity away from home. The results showed significant correlations between the score of fatigue and some subscales of P-MAF, including concentration/focus ($r = 0.649$, $P < 0.001$) and impatience/irritability ($r = 0.334$, $P = 0.001$). **Conclusions:** The P-MAF had appropriate structural characteristics, was a valid and reliable instrument, and could be used for measuring fatigue among Iranian office workers.

Keywords: *Assessment, fatigue, health, multidimensional, Persian*

Introduction

Fatigue is a common symptom of illness. It can also be observed in healthy people.[1] Fatigue has been described as being more severe, enduring, and persistent than tiredness, which is usually relieved by enough rest.[2] Fatigue is not only experienced physically in terms of reduced energy and activity levels, but may also affect mental or cognitive functions, such as motivation, concentration, and thinking.[3] In addition, this disorder (fatigue) is related to symptoms of stress,[4] depression,[5] cognitive impairment,[6] and exercise intolerance.[7] In addition, fatigue could negatively affect perseveration, planning,[2] activity monitoring,[8-10] and the person's ability to retrieve information.[1] Reynolds *et al*. revealed that economic loss and decline of productivity were the common adverse effects of fatigue.[11] Based on the literature, health-related lost productive time in workers with fatigue and in those without fatigue has been reported to be 65.7% and 26.4%, respectively.[12]

Barker and Nussbaum in their study reported that fatigue levels are negatively associated with working performance. They also found that work environment variables are strongly associated with differences in perceived levels of fatigue.[13] Figure 1 shows the framework of correlation of fatigue with muscle activity, proprioception, and cognitive function which was developed by Abd-Elfattah *et al*.[14]

Epidemiologic studies found prevalence rate of fatigue in specified populations to range from 7% to 45%.[15,16] In Ricci *et al's*. study, the prevalence of fatigue during the 2-week period among the United States workers was reported to be 37.9%.[12] Based on Azad *et al's*. study among Yazd steel industry workers (Iran), the prevalence rates of severe acute and chronic fatigue was 30.49% and 55.4%, respectively.[17]

The initial text about "fatigue" was published in 1947 by Bartley and

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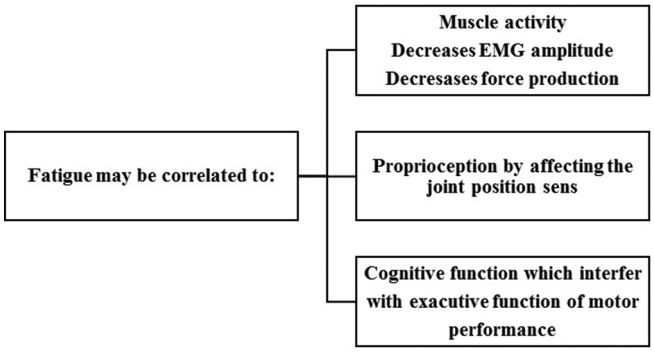

Figure 1: Exploratory framework of correlation of fatigue with muscle activity, proprioception, and cognitive function(14)

Chute. The first instrument for assessing tiredness was developed during the 1920s.[18] Now, there are numerous methods and instruments for assessing fatigue, such as Bristol Rheumatoid Arthritis Fatigue-Multidimensional Questionnaire, Chalder Fatigue Questionnaire, Checklist Individual Strength (CIS20R and CIS8R), Fatigue Severity Scale, Multidimensional Fatigue Inventory, and Multidimensional Assessment of Fatigue (MAF) scale.[19]

The MAF scale has been translated into 25 languages and used for patients with 24 different diseases.[20] Thorp *et al*. used the MAF scale for assessment of fatigue among office workers in two working conditions: sit and sit-stand.[21]

In summary, MAF scale is a proper instrument for assessing the fatigue among individuals. The strength of the MAF is that it measures four aspects of fatigue, and completion of the MAF imposes a low-response burden for respondents and has fair-to-good psychometric properties.[22]

The prevalence rate of fatigue is high in sedentary workers such as office personnel. Persian version of the MAF (P-MAF) scale can be a useful instrument for assessment of fatigue in this working group. The purpose of the present study was to: (a) translate and examine the validity and reliability of the MAF among Iranian office workers and (b) determine the relationship of fatigue with productivity in the studied population.

Methods

In this study, the sample was 129 office workers of Shiraz University of Medical Sciences (SUMS), with at least 1-year work experience. Individuals with underlying diseases (e.g., mental illness and hormonal disorders) or accidents affecting the musculoskeletal system were excluded from the study. Variables such as age, gender, marital status, and education level were recorded. All individuals voluntarily participated in the study after receiving information about the purpose of the project. All participants signed an informed consent form before commencement of the study.

Data gathering tools and study procedure

Persian version of Multidimensional Assessment of Fatigue scale

MAF scale was developed by Belza *et al*. among older adults with rheumatoid arthritis (RA).[23] The MAF is a scale with 16 items that assesses various aspects of fatigue.[24] This scale (MAF) is a self-administered questionnaire to assess four dimensions of fatigue, including degree and severity, amount of distress it causes, its timing, and the degree to which fatigue interferes with daily living activities. Respondents are asked to reflect their experience of fatigue for the past week.[23]

Scoring for the scale (MAF) is as follows:

A Numerical Rating Scale (NRS) was used to rate MAF items. NRS was a scale of 1-10 for items of 1 to 14, and 1-4 for items of 15 and 16. Finally, a Global Fatigue Index (GFI) is calculated. For GFI, the score range is 1–50 (1 = no fatigue, 50 = severe fatigue). To calculate the GFI, first, the rated score of item 15 (1-4) should be converted into a 10-point scale via multiplying by 2.5. Then, GFI calculated by formula as follows: GFI score= Summation of rated scores of items 1-3+Average of rated scores of items 4–14+ New score of item 15. Item 16 is not included in the GFI.[25]

The instrument has shown evidence of strong reliability and validity in patients with RA[23] and healthy controls.[26]

This scale was originally developed in the English language. Over time, the MAF scale has been translated to numerous language versions.[25]

Translation and adaptation

In this study, translation and cultural adaptation of the MAF scale into Farsi was done by forward-backward procedure. The final version was examined in a pilot study with twenty participants and the comprehensibility of each question was verified.

Persian version of the Health and Work Questionnaire

Health and Work Questionnaire (HWQ), developed by Shikiar *et al*., is an instrument for assessing the various dimensions of workplace productivity. The HWQ consists of thirty items with a 10-point Likert scale for each item, which has been categorized into six subscales: productivity, concentration/focus, supervisor relations, work and nonwork satisfaction, and impatience/irritability.[27]

In our previous study, the validity and reliability of the Persian version of the HWQ (P-HWQ) were examined among Iranian office workers. Internal consistency of the P-HWQ was acceptable for all subscales (0.65 ≤ Cronbach's alpha). In addition, internal consistency was satisfactory for both demographic (sex and marital status) and working characteristics (job tenure and daily working hours) (0.65 ≤ Cronbach's alpha). Factor analysis of the P-HWQ for each item related to its subscale was acceptable.[28]

Data analysis

The Statistical Package for the Social Sciences 16 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Cronbach's alpha and Spearman's correlation coefficients were used for assessing internal consistency reliability and convergent validity. Construct validity was examined through factor analysis procedure. Furthermore, Pearson's correlation coefficient was used for assessing the correlation between fatigue and various aspects of productivity. It is worth mentioning that Kolmogorov–Smirnov test was used to test the normality of the data.

Results

Validity and reliability of Persian version of the Multidimensional Assessment of Fatigue scale

Table 1 presents some personal characteristics of the studied office workers.

Table 1: Some personal characteristics of the participants in the study (*n*=129)

Variable	Values
Age (years)	36.22±7.72
Weight (kg)	69.80±16.60
Stature (cm)	166.40±11.84
Job tenure (years)	12.16±7.28
Working hours per day	8.14±1.01
Working hours per week	44.59±9.57
Hours of exercise per week	2.58±2.86
Sex (%)	
Male	44 (34.1)
Female	85 (65.9)
Marital status	
Single	40 (31)
Married	89 (69)
Educational level	
Associate degree and lower	17 (13.17)
Bachelor of science and higher	112 (86.83)

The reliability of the P-MAF subscales was assessed by Cronbach's alpha coefficient [Table 2]. As presented in this table, internal consistency for subscales was good ($\alpha \geq 0.854$).

Table 3 shows the internal consistency (Cronbach's α) of each subscale of P-MAF scale by sex, marital status, job tenure, and daily working hours.

The correlations of each item of P-MAF scale with the rotated factors are presented in Table 4.

Relationship between fatigue and productivity

Table 5 shows the mean ± standard deviation and minimum and maximum of the scores of total fatigue and other four subscales obtained from the P-MAF scale and the score of total productivity and other six subscales obtained from the P-HWQ in the studied participants.

The correlations between GFI and score of various aspects of productivity derived from P-HWQ are presented in Table 6. As shown in this table, the correlations between the score of fatigue with subscales of P-HWQ including concentration/focus ($r = 0.649$, $P < 0.001$) and impatience/irritability ($r = 0.334$, $P = 0.001$) are significant.

Discussion

The purpose of this study was to translate the MAF scale into Farsi and to examine its reliability and validity in Iranian office workers. The mean ± standard deviation of age and working hours per week in the studied office participants were 36.22 ± 7.72 years and 44.59 ± 9.57 h, respectively. Nearly 65.9% of the participants were female and others (34.1%) were male workers.

Internal consistency for all subscales of P-MAF by Cronbach's α coefficient was good ($\alpha \geq 0.854$). Internal consistency for two subscales, including distress and timing of fatigue, has not been calculated, because there is only one item in each of these subscales. The range of the correlations for convergent validity for all subscales was

Table 2: Reliability of subscales of the Persian version of Multidimensional Assessment of Fatigue scale

MAF subscale	Number of items per scale	Convergent validity* (range of correlation)	Scaling success**	Scaling success†	Internal consistency (Cronbach's α)	Discriminant validity†† (range of correlation)
Degree and severity	2	0.767-0.948	2/2	100	0.854	0.129-0.340
Distress that it causes	1	NC+	NC+	NC+	NC+	NC+
Degree of interference in activities of daily living	11	0.555-0.744	11/11	100	0.873	0.130-0.500
Timing of fatigue	1	NC+	NC+	NC+	NC+	NC+
Total fatigue/GFI	15	0.466-0.767	15/15	100	0.859	0.121-0.237

*Convergent validity: The extent to which a measured variable is found to be related to other measured variables designed to measure the same conceptual variable (31), **Number of correlations between items and hypothesized scale corrected for overlap >0.4/total number of convergent validity tests, †Scaling success rate of previous column as percentage, ††Discriminant validity: The extent to which a measured variable is found to be unrelated to other measured variables designed to measure other conceptual variables (31), +NC=Since in these dimensions, there is only one question. GFI=Global Fatigue Index, NC=Not calculated, MAF=Multidimensional Assessment of Fatigue

Table 3: Internal consistency (Cronbach's α) of each subscale of Persian version of Multidimensional Assessment of Fatigue scale by sex, marital status, job tenure, and daily working hours

MAF subscale	Sex		Marital status		Job tenure		Daily working hours	
	Male	Female	Single	Married	≤10 years	<10 years	≤8 h	<8 h
	Cronbach's α							
Degree and severity	0.868	0.829	0.898	0.827	0.897	0.810	0.832	0.952
Distress that it causes	NC+	NC+	NC+	NC+	NC+	NC+	NC+	NC+
Degree of interference in activities of daily living	0.870	0.867	0.857	0.884	0.849	0.891	0.884	0.818
Timing of fatigue	NC+	NC+	NC+	NC+	NC+	NC+	NC+	NC+
Total fatigue/GFI	0.847	0.854	0.840	0.872	0.843	0.870	0.869	0.804

+NC. NC=Not calculated, MAF=Multidimensional Assessment of Fatigue, GFI=Global Fatigue Index

Table 4: Factor analysis of the Persian version of Multidimensional Assessment of Fatigue scale

MAF item number	Descriptor	Factor loadings		
		Degree and severity, distress that it causes, and timing of fatigue	Interference with activity at home	Interference with activity away from home
1	Degree of fatigue	0.852		
2	Severity of fatigue	0.850		
3	Distress of fatigue	0.816		
15	Frequency of fatigue	0.776		
4	Do household chores		0.717	
5	Cook		0.760	
6	Bathe or wash		0.812	
7	Dress		0.835	
10	Engage in sexual activity		0.535	
8	Work			0.539
9	Visit or socialize with friends or family			0.584
11	Engage in leisure			0.850
12	Shop and do errands			0.836
13	Walk			0.813
14	Exercise, other than walking			0.887

MAF=Multidimensional Assessment of Fatigue

0.466–0.948, and the range of correlations for discriminant validity for all subscales was found to be 0.121–0.5. Also, the internal consistency (Cronbach's α) of each subscale of P-MAF by sex, marital status, job tenure, and daily working hours was high (0.810–0.952).

Based on a study by Belza *et al*., it was reported that Cronbach's α for the original version of MAF for internal consistency was 0.93 in the original visual analog scale version and 0.92 for the final NRS version.[23,29,30] In addition, in a 25-year review and evaluation of MAF by Belza *et al*., the average of Cronbach's α for internal consistency of MAF was found to be 0.93 (0.88–0.99).[20]

On the other hand, the Pearson's correlation coefficient indicated that the MAF has convergent validity with the Profile of Mood States (POMS) fatigue subscale ($r = 0.78$, $P < 0.001$) and divergent (discriminant) validity with the POMS vigor subscale ($r = -0.60$, $P < 0.001$).[23] Fairbrother *et al*. reported good psychometric properties of the MAF scale among pregnant and postpartum women and stated that the MAF is a useful measure of fatigue among pregnant and postpartum women.[31]

Turkish version of MAF (MAF-T) on 69 chronic musculoskeletal physical therapy patients showed that the internal consistency reliability (Cronbach's α) and intraclass correlation coefficient[12] reliability of the MAF-T are 0.90 and 0.96, respectively. In this study, the item discriminant validity was calculated between $r = 0.14$ and $r = 0.82$.[32] Despite the differences between the participants in our study and the studied populations in other studies, internal consistency for the subscales of P-MAF was nearly in line with those of previous studies.

Factor analysis of the P-MAF scale revealed that items 1, 2, 3, and 15 were related to degree and severity, distress that it causes, and the timing of fatigue. Items 4, 5, 6, 7, and 10 were related to interference with activity at home and items 8, 9, 11, 12, 13, and 14 were related to interference with activity away from home.

Table 5: Score of total fatigue and other four subscales obtained from the Persian version of Multidimensional Assessment of Fatigue scale, and the score of the six subscales obtained from the Persian version of the Health and Work Questionnaire (*n*=129)

P-MAF subscale	Mean±SD	Minimum	Maximum
Degree and severity (2 items)	5.77±2.05	1	10
Distress that it causes (1 item)	4.77±2.68	1	10
Degree of interference in activities of daily living (11 items)	4.47±1.93	1.18	9.09
Timing of fatigue (1 item)	6.21±2.13	2.5	10
Total fatigue/GFI (15 items)	27.11±6.31	15.14	37.95
P-HWQ subscale			
Productivity (11 items)	7.38±1.46	3.09	10
Own assessment (5 items)	7.22±1.44	3.2	10
Other's assessment (6 items)	7.51±1.72	0	10
Concentration/focus (4 items)	4.28±2.21	1	9
Supervisor relations (2 items)	7.10±2.10	1.5	10
Nonwork satisfaction (3 items)	7.10±1.58	3	10
Work satisfaction (4 items)	6.83±1.38	3.75	10
Impatience/irritability (3 items)	3.09±1.76	1	9

GFI=Global Fatigue Index, P-MAF=Persian version of Multidimensional Assessment of Fatigue, SD=Standard deviation, P-HWQ=Persian version of the Health and Work Questionnaire

Table 6: Correlations between the score of fatigue of Persian version of Multidimensional Assessment of Fatigue scale and scores of various aspects of Persian version of the Health and Work Questionnaire (*n*=129)

P-HWQ subscale	Fatigue score/GFI *r* (*P* value)
Productivity	−0.066 (0.508)
Own assessment	−0.067 (0.506)
Other's assessment	−0.056 (0.574)
Concentration/focus	0.649 (*P*<0.001)
Supervisor relations	−0.144 (0.149)
Nonwork satisfaction	−0.009 (0.930)
Work satisfaction	−0.055 (0.584)
Impatience/irritability	0.334 (0.001)

P-HWQ=Persian version of the Health and Work Questionnaire, GFI=Global Fatigue Index

The original factor analysis of MAF showed that the 15 items comprise the GFI load on a single factor (all >0.55).[33] A later analysis indicated three factors: interference with leisure-type activities; interference with bathing/dressing; and fatigue frequency, degree, severity, and distress, with four further items loading across all the three factors equally.[22] It should be noted that the MAPI Research Institute has various versions of MAF.[19] Our results indicated that in addition to usefulness of P-MAF for assessing fatigue in various diseases, this scale could be an appropriate instrument for evaluation of fatigue in office workers.

The mean scores of various dimensions such as degree and severity, distress, interference in daily living activities, timing of fatigue, and GFI were found to be 5.77, 4.77, 4.47, 6.21, and 27.11, respectively. The results of this study showed that level of fatigue in the studied office workers was approximately moderate (ranging from 1 to 10 for the subscales and 1 to 50 for GFI).

In Belza *et al's*. study, the mean scores of degree of fatigue, severity of fatigue, distress of fatigue, and GFI were 5.5, 3.8, 3.4, and 22.8, respectively.[23] Additionally, the findings of Thorp *et al's*. study showed that GFI did not differ significantly between two working conditions in office workers, including sit and sit-stand (sit: 15.8 [95% confidence interval (CI): 11.6–19.9] vs. sit-stand: 13.0 [95% CI: 9.1–17.0]; $P = 0.47$).[21]

The results of the present study showed that the mean score of various subscales of P-HWQ ranged 3.09–7.38. In the study of Shikiar *et al*., the range of the mean score of various subscales of P-HWQ was 7.01–8.26.[27] This difference can be attributed to differences between racial, social, and cultural characteristics, interpersonal relationship, and organizational structure in the two studied populations.

The analysis of relationship between fatigue obtained from P-MAF (GFI) and various aspects of productivity derived from P-HWQ revealed that there was a significant correlation between the score of fatigue with concentration/focus ($r = 0.649$, $P < 0.001$) and impatience/irritability ($r = 0.334$, $P = 0.001$).

The results of Barker and Nussbaum indicated that mental fatigue significantly affected one measure of mental performance. Physical fatigue, however, had a significant negative effect on multiple measures of both physical and mental performance.[34] In another study, Barker and Nussbaum reported that all fatigue dimensions (mental, physical, and total fatigue dimensions) and states (acute and chronic fatigue) in nurses were negatively correlated with perceived performance.[13] Also, Schwartz *et al*. stated that fatigue could have a notable impact on role performance.[35] The findings of previous studies showed that a consequence of fatigue was reduction of concentration.[36,37] On the other hand, the results of previous studies revealed that fatigue, impatience, and irritability had positive associations.[38]

Strengths and limitations

Based on our findings, the P-MAF scale is a useful instrument for assessment of fatigue in office workers.

In this study, data were gathered by self-report methodology. Then, the findings of the study should be cautiously interpreted. In addition, our study was carried out among office workers in SUMS. Therefore, the results of the study may not be generalized to other working groups.

Conclusions

In this study, we performed the translation, cultural adaptation, validation, and reliability studies of MAF scale among Iranian office workers. The P-MAF scale can be considered as a useful and specific instrument to assess different dimensions of fatigue (degree and severity, distress that it causes, degree of interference in activities of daily living, timing of fatigue, and total fatigue) among Iranian office workers and is applicable in office workplaces. Furthermore, our findings showed a significant correlation between the score of fatigue and some subscales of P-HWQ, including concentration/focus and impatience/irritability.

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Conflicts of interest

There are no conflicts of interest.

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