Multiple sclerosis (MS) is an inflammatory demyelinating disease of the central nervous system characterized by sensory and motor impairment as well as fatigue and cognitive difficulties.1 Fatigue, a highly subjective feeling that may contribute to declines in cognitive and motor function, is acknowledged to be one of the most disabling symptoms among people with MS.2 Executive function deficit is one of the most widely reported cognitive impairment in MS, leading mainly to difficulties in cognitive abilities such as planning, problem-solving, and self-monitoring.3 In particular, problem-solving is considered important as coping strategy because...
it requires foresight, planning, and development of perspective in patients with MS.\textsuperscript{4} Recent development in the field of MS proposes the theory of cognition-fatigue linkage in MS, and emphasizes the need for more research on investigating such a linkage.\textsuperscript{5} On this basis, it is proposed that cognitive training in patients with MS might lead to improvements in self-reported fatigue outcome measures.\textsuperscript{6} With regards to abovementioned recent perspective, the objective of our study was to examine the association between fatigue and problem-solving ability in a sample of Iranian people with MS.

**Materials and Methods**

This observational, descriptive study, carried out between February 2019 and May 2019, recruited a convenience sample of 85 patients with MS who were selected from Shiraz Multiple Sclerosis Association, Shiraz, Iran. Eligible subjects included those (a) with a definite diagnosis of MS (all subtypes) made by a neurologist, (b) ages of 18-75 years, (c) able to walk independently, and (d) mentally competent enough to understand and complete research self-reported questionnaires.

To obtain data on two research variables including problem-solving and fatigue, two self-report questionnaires were used. Levels of problem-solving ability was measured with a 24-item standardized Persian version of Cassidy Problem Solving Inventory (PSI).\textsuperscript{7} For this questionnaire, negative items were recoded, so that a higher value indicated by the questionnaire contributed to the higher levels of the problem-solving construct. Examinees were required to circle ‘Yes’, ‘No’, or ‘Don’t Know’ that corresponded to each questionnaire item. The total score of the scale (range 0-24) was used for the statistical analysis purposes of this study, whereby higher scores indicated higher levels of problem-solving capacity.

The Fatigue Severity Scale (FSS), a 9-item and 7-point Likert scale, was administered to examinees, so that they could best describe their degrees of fatigue severity by choosing a number from 1 to 7 to indicate their degree of agreement with each scale item.\textsuperscript{8} The total scale scores were divided by 9, resulting in the score ranges from 1 to 7, whereby higher scores identified examinees with higher degrees of fatigue.

The Institutional Review Board at Shiraz University of Medical Sciences, Iran, approved this study. Informed consent was obtained from all participants. Using Pearson’s Product Moment Correlation Coefficient, SPSS software (version 23, IBM Corporation, Armonk, NY, USA) was applied to analyze the data.

**Results**

The mean age of the participants was 38.3 ± 8.9 years, and mean disease duration was 7.5 ± 5.4 years. A statistically significant difference was found for gender distribution ($\chi^2 = 49.7$, $P < 0.001$). Namely, women composed 88.2% ($n = 75$) of the participants. No significant gender difference was found for mean scores of PSI and FSS. The mean value for the scores obtained from the PSI and FSS were as follows: PSI [15.9 ± 3.7, range (6-21)], and FSS [4.1 ± 1.6, range (1-7)].

For Pearson’s Product Moment Correlation Coefficient, preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity occurred. There was a moderate negative correlation between the two variables, namely problem-solving and fatigue, [$r = -0.381$, $P = 0.009$], whereby higher levels of problem-solving ability was associated with lower degrees of fatigue.

**Discussion**

This study suggested a moderate, negative association between levels of problem-solving ability and degrees of fatigue in people with MS. Although, the correlation coefficient was moderate, this finding is in line with the previous recent research\textsuperscript{9} that supports the theory of linkage between cognition and fatigue in MS.

An implication of this research finding is the possibility that cognitive training, aimed at reducing cognitive deficits, might be useful for controlling fatigue in MS. However, studies with more rigorous methodology are needed to determine which aspect of cognitive capacity, such as memory, problem-solving or attention, merits more consideration for clinical improvement.\textsuperscript{9} For example, following a working memory training strategy, a sample of people with MS experienced significant decrease in their self-reported fatigue symptom.\textsuperscript{8} Since deficits in problem-solving ability, as one aspect of cognition, is a common cognitive impairment in people with MS,\textsuperscript{10} it seems appropriate that cognitive training aiming at addressing this deficit may help patients in better controlling
their fatigue, according to finding of this study.

This study experienced certain limitations regarding sampling procedure and methodology such that this study could serve as a pilot to design more rigorous research. This descriptive study allows finding a non-causal relationship between problem-solving ability and fatigue severity in MS. If the effectiveness of problem-solving training is to be discovered, future research should include randomized controlled trials.

Conclusion
In conclusion, the results of our study suggest a moderate, negative correlation between problem-solving and fatigue in MS. It seems that higher levels of problem-solving is associated with lower degrees of fatigue. Yet, experimental investigations are needed to clarify a causal linkage between the two constructs.

Conflict of Interests
The authors declare no conflict of interest in this study.

Acknowledgments
None.

References