Effect of Selective Aerobic Training Program on Quality of Life in Male Patients with Multiple Sclerosis

Pormenati M[1], Shabkhiz F[2], Khabiri M[3], Rezasoltani N[1]

[1-] MD. Of Sports Psychology, Physical Education and sports science Faculty, university of Tehran, IRAN
[2-]Assistant professor of sports Physiology department in Physical Education and sports science Faculty, university of Tehran, Iran
[3-]Professor of Sports management department in Physical Education and sports science Faculty, university of Tehran, Iran

Abstract: Multiple sclerosis is one of the most common chronic diseases of the central nervous system and one of the most important diseases that changes life, especially in passing adolescent to midlife periods. This causes a severe decrease in quality of life of affected patients that will gradually put the person towards disability. This research is aimed to investigate the effects of selective aerobic training program on quality of life in male patients with multiple sclerosis (MS) as a complementary therapy on quality of life in these individuals. **Method:** In a semi experimental study, 60 individuals from Iran's M.S association were availability selected from an elderly and disabled sanatorium in Kahrizak, Iran. Participants were divided into practice and control groups. After familiarizing experimental group with the goals and interventional methods, a selective aerobic exercise program (27 sessions of 60 minutes aerobic exercise during 9 weeks) was carried out while any intervention was not performed on the control group. Information gathering tools included demographic questionnaire, short form of Quality of Life (SF-8) and the self-reported forms. Descriptive statistical tests, ANOVA with repeated measures, and independent sample t test were used to analyze the data. **Results:** Results of repeated measure variance analysis showed that between subject effects (intervention effect), within subject effects (time effect), and interaction effects (interaction between intervention and time) were significant for physical and quality of Life dimensions, and total score in men with Multiple Sclerosis (MS). **Conclusion:** These results generally indicate that aerobic exercises lead to improved quality of life for people with MS and these effects increase as the time passes. Therefore, this complementary therapy is recommended as an effective and economical method for MS patients.
[Pormenati M, Shabkhiz F, Khabiri M, Rezasoltani N. **Effect of Selective Aerobic Training Program on Quality of Life in Male Patients with Multiple Sclerosis**. *Life Sci J* 2013;10(9s):344-351] (ISSN:1097-8135). http://www.lifesciencesite.com. 48

Keywords: Selective Aerobic Exercise Program, Life Quality, Multiple Sclerosis

1. Introduction

Multiple sclerosis (MS) is an autoimmune chronic disease of central nervous system that usually occurs between the age of 20 and 45 years old and its causes are not correctly known; but, studies have shown that environmental, immunological and genetic factors have an important role in the emergence of MS. There is no definite treatment for MS and, accordingly, its treatment has concentrated on immunomodulatory by beta interferon, control of symptoms and non-pharmacological interventions Including behavior therapy, self-care and exercise (1). American National Multiple Sclerosis Society stated that about 2.5 million people suffer from MS worldwide and 200 people are added to this number every week. From this population, around 500 thousand people are from USA and 8000 new cases are diagnosed every year. MS is the third cause of disability in America (2). According to a report by Iranian MS Society, there are about 40,000 people suffering from MS in Iran (3) and this number is increasing (4). People with this disease face many problems which restrict patient's participation in health-promoting activities and, as a result, lead to secondary symptoms and limitation in independent life and finally negative effects on patient's quality of life are induced (5). Physical, psychological, social and economic dimensions of life quality are subject to many changes in chronic diseases. Nowadays, most governments consider promotion of life quality as an important and integral part of social and economic development (6). Although many measures have been taken for reducing clinical symptoms and improving level of life quality for these patients, each of these solutions has their complications which make their use difficult. For example, one of these solutions is drug therapy which has many complications and problems. Due to the excessive problems and complications of drug therapy, using non-pharmacological treatment which can reduce problems and improve life quality in the patients with multiple sclerosis seems logical. Nowadays, non-pharmacological methods, known as complementary therapies, have attracted the attention of all patients

including MS patents. Complementary therapies are therapies with a comprehensive nature which are used to enhance psychological and physical comfort of patients (7). Using complementary therapy among patients with chronic diseases such as MS is becoming increasingly more common (8). Also, acceptability of using complementary therapies has increased in health-care systems and using non-pharmacological interventions for completing advanced medication is increasing among nurses in clinical and health experiences (9). Complementary therapies can reduce the process of disease and number of attacks and can also postpone the onset of permanent disability (10). Aerobic exercises are an appropriate non-pharmacological treatment method that can enhance muscle and joint flexibility, bone movements and thus reduce muscular spasms and enhance people's power and strength (10). Many studies have shown positive effects of regular aerobic exercises in reducing the symptoms related to psychological disorders and enhancing life quality and improving mood state (11,12). For example, the results of a study conducted by Steve Bergman et al. (2006) which aimed at investigating the effect of exercise on daily limitations and life quality in patients with multiple sclerosis showed that complementary therapies such as aerobic exercises have a significant effect on reducing muscular spasm and waist pain as well as increasing self-confidence, balance and fitness (13). With increasing skeletal muscle activity during exercises, the level of blood flow to the muscles is increased. During exercising, heartbeat rate, left vascular stroke volume and consequently cardiac output will increase. On the other hand, with arteriolar vasodilatation in skeletal muscles, more blood and oxygen is carried to muscle tissues (14). With increasing physiological activity during exercising, body needs more oxygen and this need is responded by increasing respiratory rate, lung vital capacity and alveolar ventilation (15). Exercises can increase strength; flexibility and muscle tone and maintain normal joint motion. Physical exercises, especially of aerobic type, can reduce the ability associated with central nervous system and can improve development of parameters related to life quality (1). National American Center on Physical Ability and Disability in MS states that, although multiple sclerosis is in conflict with the situation of psychological and physical health, it has been determined that regular sports activities and stretching and flexibility exercises enhance health level in terms of both psychological and physical states (16). But, unfortunately, despite the useful and known benefits of exercises, most people with chronic diseases such as MS have a sedentary and sometimes dilatory life style (17). Therefore, considering that 1) different and annoying symptoms of MS can severely reduce life quality in these patients, 2) aerobic exercises have advantages such as convenient training, cost-saving, lack of need for special equipment and possibility of easy run by MS patients, 3) previous studies have investigated the effect of aerobic exercises on other symptoms such as pain, muscular spasm and psychological problems like anxiety, decrease or lack of confidence, etc. and 4) there is a diversity of approaches to doing exercises, the difference of this study from the previous ones which were conducted on other symptoms in other diseases with different methods is tangible and the importance of such a study seems essential. Considering the mentioned issues, the present research was conducted to investigate the effect of selective aerobic training program on life quality of male patients with multiple sclerosis.

2. Research Method

This study was of quasi-experimental type which was conducted from September to December 2011. The statistical population of this study was all men between 20 and 50 years old with multiple sclerosis who were members of Iranian MS Society. They were under treatment, had no drug changes during the study and their score of expanded disability status was 0 -5.5. To select participants in this study, several exclusion criteria were considered that included history of doing a specific sports activity during past six months, suffering from other chronic or acute disorders (such as disabling heart diseases, respiratory, liver, skeletal, muscular-skeletal or kidney), mental or psychological diseases such as major depression (using Beck's depression inventory questionnaire and rendering physician's comments), speech or hearing disorders and illiteracy for filling research questionnaire. Statistical samples were 60 patients who were selected accessibly from Kahrizak Charity Foundation and all were members of Iranian MS Society. The number of samples was considered 30 for both control and experimental groups. These people were matched in two groups in terms of education, disease type and marital status. In both groups, there were 4 people with secondary education, 12 with high school diploma and 14 with higher than high school diploma. To match marital status, in each of the two groups, 13 single patients and 17 married patients were selected. Depending on the type of disease, there were 19 patients with relapsing-remitting MS and 11 patients with primary-progressive MS in both groups. It should be noted that there were 10 losses by the end of this project. Familiarizing and seeking permission from the participants were carried out orally and personally. A briefing session was held for all the samples of test

group to present information on the research, goal of the research and some points about methodology of the selective exercises (aerobic exercises) and its benefits.

After holding the briefing session for the samples of the experimental group, they were asked to participate in the exercise program which was designed in their location every other day (Yas Complex, maintenance location of MS patients in Kahrizak). 60 min sessions were set up and performed by patients under the supervision and guidance of the researcher during 9 weeks (27 sessions). Before the start of each session was asked to participants, be present earlier 30 minutes in the club. How to measure carotid and wrist pulse was explained to participants. According to beginning participants and also being aerobic movements, intensity of exercise was considered moderate (0/50 – 0/75MHR) (17). In every 60 min aerobic session, selective aerobic training exercises were done in different parts as follows: in every session before starting the training program, the patients were asked to do warm-up with stretching exercises for 10 min in the presence of the researcher assistant and physical education specialist. Then, the samples attended the designed exercise training program for 30 min: 1- preliminary activities (5 min) including fast walking forward, backward and from side to side along with moving hands. Waking distance was 63 m (4 times on the width of hall). 2- Selective aerobic activities (30 min) including 9 phases. 3- Relaxation activities for the cool-down (15 min). After finishing the selective aerobic exercises, the patents were asked to walk from around the hall while moving their hands. The researcher asked the patients to breathe easily and think about pleasant matters and the researcher started to massage (with two hands and slow and fast movement) the patients' legs, abdomen and thighs.

There were no interventions for the control group. Data collection instruments in this research included personal information questionnaire with two parts of demographic characteristics (age, weight, marital status and education) and information about the disease (duration, frequency of recurrence and number of hospitalization during the recent year, first symptom of the disease, major debilitating problem of the disease, suffering from other diseases, type of consumed drugs, type of multiple sclerosis and status of spreading disability) and short form of life quality assessment and self-report checklists.

Short form of life quality consisted of 8 questions in two physical and psychological dimensions (4 questions for each dimension). In the above instrument, the score related to each question was 0 to 100 and the total score and score of each life quality dimension was 0 to 100. Score of 0 indicated the least life quality and 100 showed the top level of life quality. Face validity and content validity related to the assessment of personal data and short form of life quality-8 (SF8) was validated by ten professors of physical education and psychology at University of Tehran. For the reliability of SF8, test-retest method was used. The above questionnaire was completed in two sessions with 7 days of time interval by 15 qualified patients with multiple sclerosis and was confirmed by r=0.89. In general, the SF8 questionnaire was completed four times (at the start of the study i.e. the first day, 3 weeks, 6 weeks and 9 weeks after the intervention) by the participants in both control and experimental groups.

In this study, the severity of patient's disability was measured using expanded disability status scale (EDSS) by a neurologist physician. EDSS is a method for measuring physical and neuromuscular disability in MS and investigating functions of pyramidal, cerebrum, brainstem, cerebellar and sensory paths. Its score is from 0 to 100; 0 indicates lack of any problem or physical disorder in terms of system functions and 10 shows severe disability (18). It should be noted that, before the intervention, the patients were assured that the information related to them will be studied under complete confidentiality and anonymity and eventually will be reported in general (not in cases). The staff working in the research location was also assured that they will be aware of the results of the research.

Finally, raw data were analyzed using SPSS software, version 18, by independent t-test and analysis of variance (ANOVA) with repeated measurement.

3. Findings

All the participants were men and, considering 10 losses, the final sample was reduced to 50 people, among whom 24 people were without any history of hospitalization, 16 people had the history of one hospitalization and 10 people had more than one hospitalization. Also, mean age of the participants was 34.57 with the standard deviation of 5.91.

Nevertheless, to compare body mass index in control and experimental groups (mean of 20.93 and standard deviation of 3.85), independent t-test were used. The results of this test showed no significant differences between the two groups in terms of body max index (P=0.018, T =1.27, df =48).

Moreover, independent t-test was used to compare life quality dimensions between the two groups before the intervention. The results of the comparison of the two groups in terms of total score (p=0.23, T= 1.21, df= 48) and dimensions of life quality (physical: p=0.19, T=1.31, df= 48, psychological: p=0.31, T=0.96 df=48) indicated no

significant differences between control and experimental groups.

Mean and standard deviation indices were used for data description. Table 1 shows these indices for dimensions of life quality in 4 states before the intervention, 3, 6 and 9 weeks after the intervention in both control and experimental groups. The table also shows the results of independent t-test for paired comparison of the two studied groups in the fourth stage of assessment.

The scores of life quality (total, physical and psychological) in control and experimental groups before the intervention and 3 weeks after the intervention did not have any significant differences while these scores were significantly different from each other on 6th and 9th weeks after the intervention (Table 1). In other words, quality of life in the experimental group had a significant increase 6 and 9 weeks after the intervention.

Finally, to assess the overall effect of time factor, group factor and the interaction of group and time factors on different dimensions of life quality in patients with MS and the control group, repeated-measures Analysis of Variance was used. As a presupposition, first, Mauchly's test was done to investigate covariance of life quality scores in four stages before performing repeated-measures Analysis of Variance. The results of this test demonstrated that this test was not significant for total score, physical dimension and physiological dimension of life quality. The covariance of life quality scores in four stages was the same and this analysis could be done by considering the assumption of sphericity. Table 2 shows the results of this repeated-measures Analysis of Variance with separating life quality dimensions and time, group, interaction between group and time and error factors.

Table 1) Descriptive statistics of life quality dimensions and their comparing in 4 states before the intervention, 3, 6 and 9 weeks after the intervention in both control and experimental groups

Dimensions of quality of life	Measuring stage	Experimental group		Control group		Independent t-test	Sig
		Mean	SD	Mean	SD		
Total score	Before the intervention	56.84	8.50	53.92	8.43	1.21	0.229
	3 weeks later	57.87	7.62	54.35	8.79	1.51	0.137
	6 week later	67.84	6.35	55.88	8.24	5.75	0.001
	9 weeks later	76.60	6.49	54.80	7.69	12.1	0.001
Physical dimension	Before the intervention	26.73	4.45	25.27	4.21	1.31	0.19
	3 weeks later	27.24	3.74	25.64	4.66	1.45	0.12
	6 week later	32.23	3.17	26.25	4.12	6.23	0.001
	9 weeks later	36.61	2.34	25.51	3.82	12.77	0.001
Physiological dimension	Before the intervention	30.67	4.40	28.73	4.20	0.96	0.311
	3 weeks later	30.62	3.81	29.86	3.87	1.15	0.241
	6 week later	36.21	3.27	29.71	4.09	6.17	0.001
	9 weeks later	40.11	2.59	29.09	3.84	11.74	0.001

The results in Table 2 indicated that group factor had a significant effect on dimensions of life quality, i.e., in general, there was a significant difference between control and experimental groups in terms of dimensions of life quality. The results of this table also showed that time factor also had a significant effect on dimensions of life quality. In other words, there was a significant difference between scores of quality of life dimensions during four stages of assessing life quality. Finally, these results also indicated significant interaction between group and time. Here, significant interaction showed that time stages of life quality assessment had significant differences between control and experimental groups.

In general, the results of this research showed that, although there was no significant change in life quality in patients with MS 3 weeks after the intervention, after 6 and 9 weeks of intervention, the effect of intervention on the patients' life quality was revealed. To better understand the problem, Figures 1, 2 and 3 schematically show total scores of life quality, physiological dimension and physical dimension of life quality.

Table 2) Repeated measures Analysis of Variance to assess the effect of group factor, time factor (evaluation stages) and interaction effect of time and group with separating dimensions of life quality

Dimension	Sources of variance	Factors	Sum of squares	Degree of freedom	Mean of squares	F	Sig
Total score	Inter-group (two groups)	group	5050.152	1	5050.125	28.847	0.001
		error	8403.280	48	175.068		
	Within participants (4 stages of assessment)	time	3610.024	3	1203.341	61.078	0.001
		error	2837.024	144	19.702		
	interaction	Group * time	2939.855	3	979.952	49.740	0.001
Psychological dimension	Inter-group (two groups)	group	1125.016	1	1125.016	26.972	0.001
		error	2002.102	48	41.710		
	Within participants (4 stages of assessment)	time	1027.853	3	342.618	55.267	0.001
		error	892.698	144	6.199		
	interaction	Group * time	649.456	3	216.485	34.921	0.001
Physical dimension	Inter-group (two groups)	group	1272.601	1	1272.601	32.476	0.001
		error	1880.950	48	39.186		
	Within participants (4 stages of assessment)	time	791.941	3	263.980	40.467	0.001
		error	939.370	144	6.523		
	interaction	Group *time	806.614	3	268.871	41.216	0.001

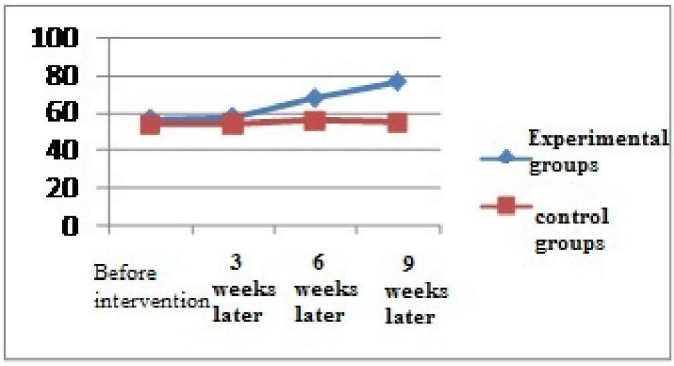

Figure 1- Total score of life quality in four stages in two experimental and control groups

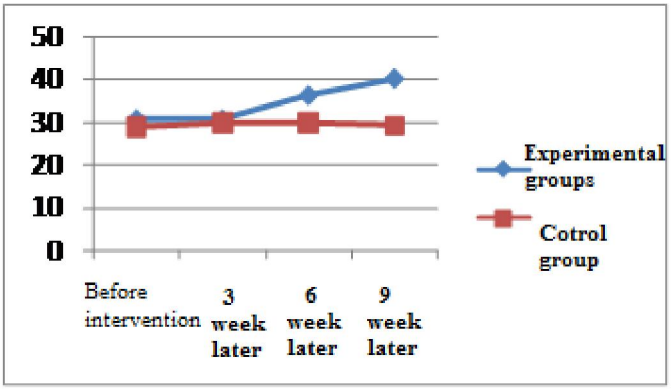

Figure 2- Score of psychological dimension of life quality in four stages in two experimental and control groups

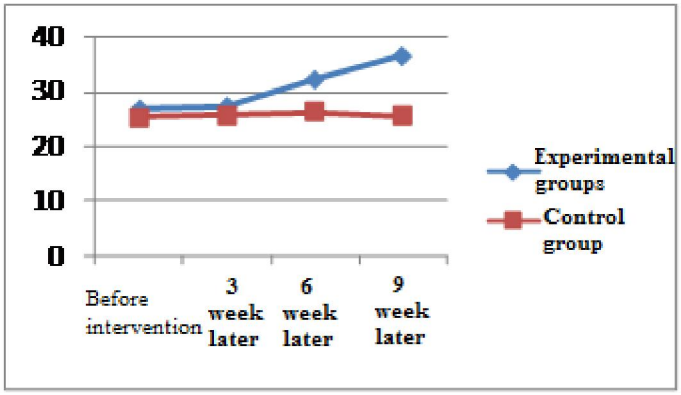

Figure 3- Score of physical dimension of life quality in four stages in two experimental and control groups

4. Discussion and Conclusion

In this research, selective aerobic exercise program as a complementary therapy method caused a significant difference in quality of life in patients with MS 3, 6 and 9 weeks after the intervention between two experimental and control groups and increased quality of life in the experimental group in comparison with the control one. A study entitled "effect of aerobic exercises on health and quality of life in patients with MS" was conducted by Janardan et al. (2002) on 46 patients in two control and experimental groups during 15 weeks, which showed that exercise as a complementary therapy can improve quality of life in patients with MS (19). The results of a study by Barker et al. (2003) quoted from Masoudi (2008) demonstrated that aerobic exercises in water or on land as a complementary therapy in patients who suffer from chronic waist pain can considerably reduce patients' fatigue as a result of pain, muscular spasm and inability to perform daily tasks and lead to improving their life quality, which confirms the effectiveness of aerobic exercises in water and on land on skeletal and muscular diseases (16). The result of study by Sidr et al. (2003) indicated that aerobic exercises in water was tolerated very well by the elderly patients or patients with chronic diseases and being immersed in water increased muscular-skeletal and cardiovascular functions and reduced psychological problems such as stress, anxiety and depression; thus, quality of life improved in these patients (17). The results of a study conducted by Oken et al. (2004) to investigate yoga and aerobic exercises in MS patients showed that complementary therapy such as yoga and aerobic exercises can lead to significant increase in life quality in the experimental group in three stages of measurement in comparison with the control group (20). However, no significant relationship was found between quality of life and marital status, education level, income, type of MS and type of consumed drug. Idiman et al. (2006) also did not find any significant relationship between the above variables and quality of life among the patients (21). But, the result of this research showed that level of life quality was significantly different in different age groups while there was no significant relationship between quality of life in patients with MS and age in Idiman's (2006) research. It seems that chronic nature of MS and also pathophysiologic changes that occur with age lead to reduction in the quality of life among these patients as they become older. The existence of a significant reversal relationship between physical and physiological dimensions of life quality and situation of disability expansion was another conclusion obtained from this research. The results of Ozakbas et al. (2004) and Fischer et al. (1999) also indicated a significant relationship between disease severity and physical and physiological dimensions of life quality in the patients with MS. These results showed that, with increasing disease severity, the quality of life is reduced and this reduction is more tangible in the physical dimension of life quality (22, 23). The result of this research indicated that performing selective aerobic exercises by patients suffering from multiple sclerosis is completely simple and feasible. Easy training, cost effectiveness, no requirement for special equipment and possibility of easy performance by patients were other important achievements of this study.

The limitations of this study included personal differences and different moods of the participants in response to the intervention and its effectiveness level, effect of environmental and cultural factors on

their perception from the benefits of aerobic exercises and debilitating nature of the disease, which probably had an effect on their viewpoints.

5. Conclusion

Selective aerobic exercises could have a positive effect on improving quality of life in patients with MS. It should be noted that remarkable results was obtained considering environmental, economic, human and time limitations, nature of MS disease and psychological status of the patients. Performing this technique and investigating its effect on other symptoms of patients suffering from multiple sclerosis and also on other chronic diseases are recommended.

Acknowledgements

We express gratitude to all dear patients who participated in this research despite many problems caused by this disease. We also acknowledge the cooperation of staff in Iranian MS Society and Kahrizak Charity Foundation. Moreover, our gratitude goes toward the respected professors in Departments of Psychology, Physical Education and Sports Sciences, University of Tehran, for their encouragement and scientific supports.

References

1. Madainaval H. (2005) "Relationship with depression, fatigue and disability in patients with multiple sclerosis Dissertation." for degree of M.Sc. of Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, [Persian].
2. Adibnejad S. (2006) "Comprehensive living guide disease multiple sclerosis." Tehran, Institute Publication Hayan - Abasalh, [Persian].
3. Ghafari S., Ahmadi F., Nabavi M., Memarian R. (2008) "Effects of applying progressive muscle relaxation technique on depression, anxiety and stress of multiple sclerosis patients in Iran." National MS Society (Journal of the Shaheed Beheshti University of Medical Sciences and Health Services); 1(32): 45-53 [Persian].
4. Ale-Yasin H., Sarai A., Alaeddini F., Ansarian E., Lotfi J., Sanati MH.(2002) "Multiple Sclerosis: A study of 318 Cases." Archive Tran Med; 5(1):24-27.
5. Morgante L., Fraser C., Hadjimichael O., Vollmer T. (2004) "A prospective study of adherence to glatiramer acetate in individuals with multiple sclerosis." J Neuro.sci .Nurse; 36(3):120-9.
6. Petajan JH. (1996) "Impact of aerobic training on fitness and quality of life in Multiple Sclerosis. " Annals of Neurology; 39 (4): 432-441.
7. Mitchell AJ., Bentio-Leon J., Gonzalez JM., Rivera-Navarro J. (2005) "Quality of life and its assessment in multiple sclerosis: integrating psychological components of wellbeing ", Lancet Neural; 1(4): 556-66.
8. Bowling A. (2005) "Complementary and alternative medicine use in M.S. Rocky Mountain M.S." Center available at: http://WWW.hyperspayce.com. Access: 15.8.
9. Hayes J., Cox C. (2000) "Immediate effects of a five-minute foot massage on patients in critical care." Complementary Therapies in Nursing & Midwifery; 6 (1): 9-13.
10. Mills NJ., Allen S., Carey M. (2000)"Do Tai Chi / Qi Gong help patients with Multiple Sclerosis?" Journal of Body Work and Movement Therapies; 4(11): 39-48.
11. Soleimany M., Nasiri Z., Kermani A., Hosseini F. (2007) "Comparison of sleep quality in two groups of nurses with and without rotation work shift hours." Iran J. Nurse; 20(49): 29-38 [Persian].
12. Sutherland G., Andersen MB.(2001) " Exercise and multiple sclerosis: physiological, psychological, and quality of life issues" J Sports Med Phys Fitness; 41(4):421-32.
13. Stuifbergen AK., Blozis SA., Harrison TC., Becker HA. (2006) "Exercise, functional limitations, and quality of life: A longitudinal study of persons with Multiple Sclerosis." Archives of physical medicine and Rehabilitation; 87 (7): 935-943.
14. Hazrati M., Zahmat Keshan N., DejBakhsh T., Nik Seresht AR., Zeyghami B. (2005) "The effect of rehabilitation process on the quality of life in Multiple Sclerosis patients." Armaghane-Danesh (Journal OF Yasuj University OF Medical Sciences); 39(10): 64-53 [Persian].
15. Beiske AG., Naess H., Aarseth JH., Anderson D., Elovaara I. (2007) "Health related quality of life in secondary progressive MS." Mult. Scler; 13 (3): 386-392.
16. Masoodi R., Mohammadi E., Nabavi SM. (2008) "The effect of Orem based self-care program on physical quality of life in multiple sclerosis patients." Journal of Shahrekord University (Medical Sciences); 2(10): 21-29 [Persian].
17. Cider A., Schaufelberger M., Stibrant Sunnerhagen K., Andersson B. (2003) "Hydrotherapy—a new approach to improve function in the older patient with chronic heart

failure." The European Journal of Heart Failure; 5: 527–535.
18. Kurtzke JF. (1983) "Rating neurological impairment in multiple sclerosis: An expanded disability status scale (EDSS)."J. of Neurology; 33: 1444-1452.
19. Janardhan V., Bakshir R., Ozakbas S.(2002) "Quality of life in patient with MS." Journal of the Neurological Sciences; 205(1):51-8.
20. Oken B., Kishigama S., Zajdel D. (2004) "Randomized controlled trial Yoga and exercise in Multiple Sclerosis." Journal of Neurology; 62(11):2058 – 2064.
21. Idiman E.,Uzunel F., Ozakbas S., Yozbatiran N., Oguz M., Callioglu B., Gokce N., Bahar Z. (2006) "Cross- Cultural adaptation and validation of Multiple Sclerosis quality of life questionnaire (MSQOL-54) in a Turkish Multiple Sclerosis sample." Journal of the Neurological Sciences; 240: 77-80.
22. Ozakbas S., Cagiran I., Ormeci B., Idiman E. (2004) "Correlation between Multiple Sclerosis functional composite, expanded disability status scale and health-related quality of life during and after treatment of relapses in patients with Multiple Sclerosis." Journal of the Neurological Sciences; 208: 3-7.
23. Fisher JS., Larocca NG., Miller DM., Ritvo PG., Andrews H. and Paty D.(1999) "Recent development in the assessments of quality of life in Multiple Sclerosis." Mult. Seler; 5: 251-9.

8/12/2013