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**EFFECT OF SELECTED WATER EXERCISES ON BALANCE AND LIFE QUALITY  
OF WOMEN WITH MULTIPLE SCLEROSIS**

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**ABSTRACT**

Multiple sclerosis is a chronic inflammatory autoimmune disease that destroys the myelin of the central nervous system. It is more common among women than men and subsequently leads to the emergence of movement and mental difficulties of which balance disorder is of particular importance because of the consequences such as loss of functional independence, expanded disability and increased risk of falling. This study examined the effect of 12 weeks of exercise (aerobic and balance) in water on balance and life quality of women with MS. For this purpose, 15 MS women with an average age of 33.93 participated in aerobic and balance water exercises for 12 weeks- 2 sessions per week and each session lasting 45 minutes. MSQoL-54 questionnaire was used to assess the quality of life as well stork static test and time dynamic test of get up & go time was used to assess the balance. Related test results showed that there is a significant difference between the pre-test scores of life quality (2.81), static balance test (32.49), dynamic balance test (12.75), and post-test scores (11.55, 44.46, 3.23, respectively) ( $p < 0.05$ ). Due to the positive effects of aerobic and balance exercises on life quality factor and balance of women with multiple sclerosis in current research, using of physical exercise as an appropriate intervention method in conjunction with other treatments is recommended for patients.

**Keywords: Multiple Sclerosis, water exercises, balance, life quality.**

## INTRODUCTION

Multiple sclerosis is a progressive chronic inflammatory demyelinating disease in central nervous and vision systems (White et al, 2004). It damages myelin sheath and oligodendrocytes cells which produce myelin (Steve Bergen et al, 2006). After trauma MS lesions are the second common neurological disability during early and mid-adulthood (Safdari et al, 2012). According to the Iranian MS Association statistics in 2014, currently the association has 21746 members. Spread rate of the disease in Iran is estimated 57 individuals out of 100,000 (Noor Nematollahi et al, 2012). MS reduces life expectancy to 10 years fewer than patients' real age ( Leon et al, 2003) as well the onset of illness often results in the initial or comprehensive reduction of physical, social, cognitive functions of an individual and affects negatively life quality of the patients and their close people.

Normally nervous system disorders automatically emerge after the first attack and over the time. Along with the disorders and due to the development of the disease physical, psychological, and social problems appear. MS symptoms may cause physical inactivity. Lack of balance with impaired coordination, decreased walking disability, muscle cramping, exhaustion, blurred vision,

squint, depression, trembling, dizziness, dysfunction of bowel and sexual activities are considered as MS symptoms ( Hejazi et al, 2012; White, 2004; Noor Nematollahi, 2012; Steve Bergen et al, 2006). Lack of balance and decreased walking ability affect daily activities performance and life quality more than other symptoms as well could be considered as one of the main reasons of patients' immobility. Feeling of exhaustion and the related outcomes such as decreased life quality is a worrying side effect of MS. Considering its negative effects on daily activities and life quality of the patients, reduction of mobility and motor function, high medicine costs also deleterious effects of medicine use demands the need for attention and care of the patients. At the moment, there is not a definitive treatment for MS, however, by providing a special treatment plan using new medication, rehabilitation techniques as well appropriate sport programs it is possible to decrease symptoms of the disease and its development. Diet therapy, rehabilitation and sport are non- pharmacological methods that have been suggested for reducing the troubles of the patients. Meanwhile, sport and physical activity because of their multi-dimensional role are of a particular

importance; according to the previous studies static and dynamic balance of elders improve through the physical exercise in an out of water (Sohbatiha et al, 2011). Regarding the findings of Sadeghi & Alirezaeei (2007) who studied the effect of a water exercise training period on elderly women's static and dynamic balance, we can say that applying a training course in water program for elders, challenges the involved psychological systems resulting in improved static and dynamic balance.

Ebrahimi Atri et al (2013) found out that physical activity improves fatigue intensity and balance of MS patients. In addition, the results found by Kargarfard et al (2012) showed that exercise therapy in water can be used as a useful and effective method for improving balance and consequently daily performance of Parkinson patients. Sadeghi et al (2009) examined the effect of functional training for 6 weeks on static and dynamic balance of healthy elder men. Their findings highlighted the role of functional training on static and dynamic balance of healthy elders; however, because of non-improvement of control group subjects' balance, improvement of experimental group's balance can be attributed to the exercises. Gasemhi et al (2009) reported that functional training may effectively improve elderly

women's dynamic balance and may play a significant role on their healthy life. Likewise, Rample et al (2007) studied the effect of an aerobic program for 8 weeks on patients with mild to moderate levels of disability. They found out that physical readiness factors dimension and life quality of the patients improved. Masoodinejad et al (2012) investigated the effect of a compound program on the strength of MS women and revealed that a compound training increases muscles strength and improves the patients' motor function. In relation to the impact of exercises and water therapy, Gaffari et al (2008) examined the effect of water therapy on life quality of 50 MS women for 24 sessions during 3 month. They realized that water therapy leads to the promotion of life quality level of experimental group patients than control group. It seems that life quality as a cognitive factor regardless of physical disability level as well the measuring tool improves through the exercises (not only aerobic) (Taghizade et al, 2013). Barnadoter et al (2007) investigated the impact of aerobic and resistance compound exercises on life quality and physical disability. Their findings implied that life quality improved relatively but physical disability didn't change. Furthermore, Moradi et al (2011) after the investigation of effects of resistance

training on muscle strength and balance of men with MS realized that resistance training is an appropriate action for improving resistance and balance of MS patients. Sport and rehabilitation are considered as useful agents for reduction of falling risk and increase of MS patients' balance. Katano et al (2007) found out that rehabilitation can act as an important factor for reduction of falling and improvement of balance skills among people with MS as well as practice on different sensory fields leads to the increase of dynamic balance.

There are numerous studies about the positive effects of patients', but effects of aerobic and balance exercises in water on life quality of MS patients particularly the balance have not been studied. Despite the increasing development of medical science over the past, there is not a definitive treatment for MS and medicine treatments are mostly applied for reduction of disease progression speed or pain relief. Increasing the number of MS patients and enhancement of treatment costs also positive effects of physical activities on MS patients, using physical training and exercise as an appropriate intervention method besides the medication drew the researchers' attention. In one hand, easiness of physical training implementation, its low costs, and non-

requirement of certain facilities and on the other hand significance of progressive balance weakness and low life quality of these individuals motivated the scholars to investigate the impact of a selected water exercises course on life quality and balance of women with MS by using exercise in water method. According to the previous studies water exercises have certain advantages compared to land exercises.

### **METHODOLOGY**

Current study conducted through a semi experimental method and is a kind of applied research. The sample of the study consist of 20-50 years old women suffering from multiple sclerosis who referred to the MS Association of North Khorasan. 15 women with age average of 33.93, weight of 25.59 kg, height of 162.6 cm, systolic blood pressure of 12 mercury ml, and diastolic blood pressure of 76.13 mercury ml were selected to participate in study. The basic criteria of sample selection listed as bellow:

No history of epilepsy

No history of cardiovascular disease

No history of arthritis

No history of psychological problems

Non- attendance in physical therapy sessions during the training period

Exclusion criteria of participants follow as:

Being absent in more than 3 sessions of the training period

Relapse during the training period

To conduct the study subjects were invited to attend in the site of MS Association of North Khorasan before the start of training. After introduction, purpose of the research, positive effects of physical activity, intensity, duration, repeat times, and implementation of the training program were explained by a physical training instructor and under the supervision of a physician. Then, consent and cooperation forms, ready- to -start a physical activity questionnaire, demographic and medical data, and health standard (forms) were distributed among the participants asking them to take part in study and avoid other sports by the end of investigation period. A day before the start of water exercise, static and dynamic balance of the patients were measured by stork and get up & go time tests. In addition, the patients' life quality was assessed by MSQoL-54 questionnaire. Water training program for patients included balance and aerobic activities in water for 12 weeks- 2 sessions per week, each session lasting 15 minutes. In order to prevent from any probable injury, training sessions started after 5-10 minutes warm-up exercises including stretching, jumping, and walking.

In second part, subjects conducted a specific training for 30 minutes including balance training for 15 minutes and aerobic training for the next 15 minutes. 15-minute balance training consist of: walnut break by foot, standing on one leg for 15 seconds, reciprocating motion on heel, hugging knees, angle with support, and others. 15-minute aerobic training included: slow running and 10 last minutes were assigned for fun games with ball for cooling. A physical education specialist ever supervised the training protocol. Intensity of the training was increased according to the overload principle. It was ever pointed that patients' body temperature not to be increased unusually.

In the present study, motor function was measured by stork static tests and dynamic tests of get up& go time as well MSQoL-54 questionnaire were used to evaluate life quality before and after the implementation of the training protocol.

Stork tests: this test was used to measure static balance. The test was conducted in order that the subjects' premier leg to be specified, then, the subject stood on a flat surface in a way that he kept his hands beside the body and lift the non- premier leg keeping it at inner side of the premier leg. Once familiarizing with the test and adopting the proper position, the test started by a

stopwatch measuring the time that subject could stand on his leg. The test was repeated 3 times with short intervals and the best record was registered in seconds as an index for subjects' performance on balance test. If the subject's reliance leg moved or the other leg left the knee, examiner would stop the stopwatch. According to Hodwy (2007) validity of the test was 0.99 and its reliability was about 0.87.

Get up & go time test: this was a performance test evaluating movement speed, balance and performance. It was conducted in a way that without using hands the subject got up from a chair without categories and returned after passing a 3-km route, then sat on the chair again. All subjects took the test twice and their best records were recorded. Reliability of the test was 0.99 (Paual, 2000).

Life quality questionnaire: MSQoL questionnaire including 54 questions was used to measure life quality of the participants. Average time for answering the questions was 17 minutes. Wickery (1995) designed multiple sclerosis specific questionnaire of life quality with 54 questions which examines life quality in 14 areas and 2 compound areas of body and mental health. Masoodi et al (2008) reports confirmed tools reliability with correlation

coefficient of 0.86. Along with statistical analysis of data by SPSS software descriptive and inferential statistics were presented. In descriptive part variables average were calculated before and after the training period and in inferential part in order to examine the difference between variables average before and after the training, t- test with paired samples was used.

### **FINDINGS**

Subjects' individual characteristics are shown in table 1. Table 2 displays the findings of subjects' life quality, static and dynamic balance tests before and after the training. Table 1 and 2 show that scores average of life quality is 2.81 before the test which has increased to 3.23 after the training period, namely the rate of increase was 0.42 percent. Moreover, figure 2 shows that the scores average of subjects' stork static balance was 32.49 before the training period which has changed to 44.46 due to an increase by 12.45 percent. According to the table 2 and figure 3, the average of subjects' pre-test and post- test scores for dynamic balance of get up & go is 12.75 and 11.55, respectively which is decreased by 1.09 seconds after the training. Comparison of the average in table 3 suggests that there is a significant difference between pre and post training life quality scores ( $p < 0.05$ ). By

comparing the scores average of pre and post training dynamic balance p was calculated (0.021) suggesting that there is a significant difference between pre and post training scores.

Table 1: Average of measured profile of women with MS

Group index	age	Weight (kg)	Height (cm)	Systolic blood pressure (ml of mercury)	Diastolic blood pressure
Subjects	33.93	59.25	5162.6	12	76.13

Table 2: Distribution of mean and standard deviation in pre-test and post-test

Variable stages	Life quality	Stork (second)	Get up& walking time ( second)
pre test	2.81±1.05	32.49±29.51	12.75±7.29
post test	3.23±1.08	44.46±35.17	11.55±6.99

Table 3: The difference of quality of life and static and dynamic balance test before and after the training

Statistic Variable	Life quality	Stork (second)	Get up& walking time ( second)
T	-0.42	-11.97	1.2
P	.0000	0.005	0.021

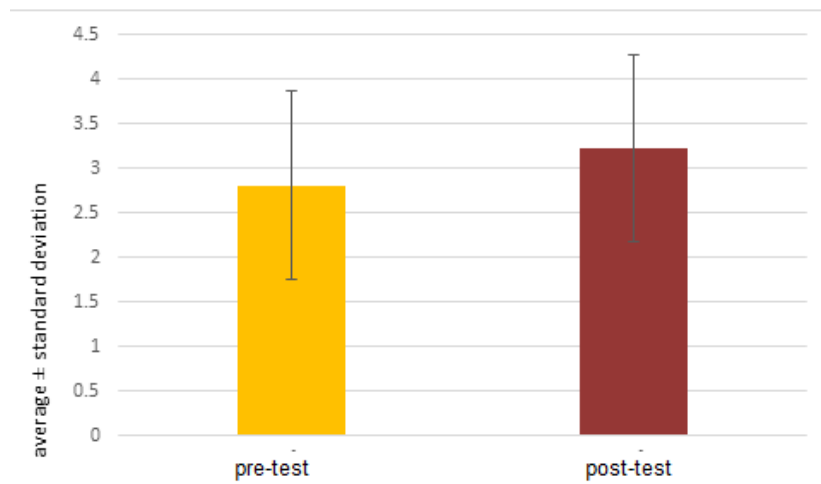


Figure 1: Subjects' life quality questionnaire data before and after the exercise

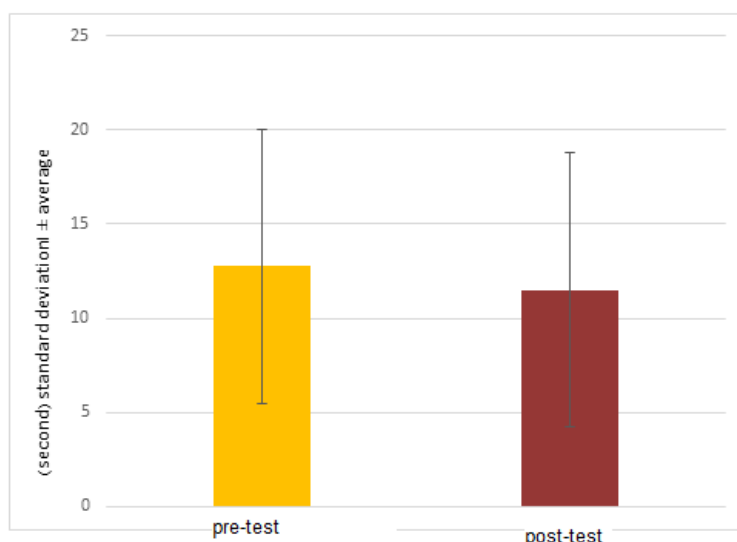


Figure 2: Data related to the subjects' stork static balance test before and after the exercise

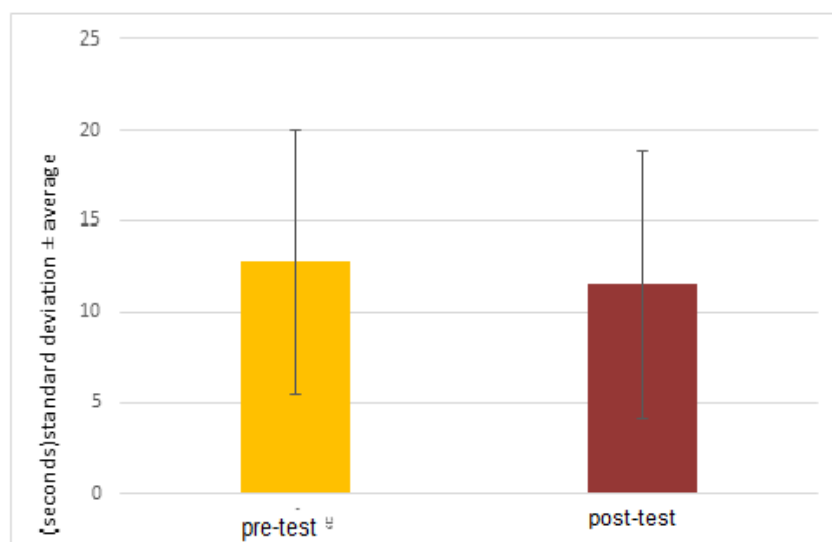


Figure 3: Data related to the subjects' dynamic balance test for get up & go time

## DISCUSSION

The main objective of this study was to evaluate the effect of 12 weeks selected water exercises on the balance and life quality of patients with multiple sclerosis. The results indicate that balance and aerobic water exercises affect significantly MS women. Positive effects of physical exercises on different physical and mental dimensions due to the numerous studies confirm the reported results of the present research. Effects of aerobic and balance training on life quality results suggests that doing water exercises for 12 weeks by MS patients leads positive and significant changes. Results of this part are in consistent with the findings of Petajan et al (1996) who explored the impact of aerobic exercises on life quality of MS patients. Seedrov et al (2003) discovered that patients with chronic diseases can tolerate

water therapy at ease and as immersion in water increases muscle, skeletal, and cardiovascular function, psychological problems such as stress, anxiety decrease; thus, patients' life quality promotes. Barker et al (2003) justified the mentioned effects stating that buoyancy in water provides a type of mind peace and lessen psychological pressures as well secretion of epinephrine, hence, affects psychological troubles positively (Gaffari, 2008). Results of this part are in compatible with the findings of Taghizade (2013) and Steveteli et al. Their studies didn't show significant changes in life quality of MS patients through doing aerobic exercises. In addition, Solari et al (1999) couldn't report remarkable changes in the part of life quality questionnaire. According to Solari the difference of physical disability level among MS patients



can be considered as one of the reasons for this contradiction. Previous studies indicated that patients with lower levels of physical disability, demonstrated better psychological effect by doing aerobic exercises (Taghizadeh, 2013), whereas, according to the scale of EDSS subjects of Taghizadeh and Steveteli's research were suffering from higher levels of physical disability. Therefore, despite the positive effects of aerobic exercises on life quality, statistically it didn't provide significant changes.

Difference of training period duration can be another reason of the incompatibility. In current research the training lasted for 12 weeks while training sessions of Taghizadeh's study took 6 weeks. Regarding the tests and training guidelines of Leenkad (2013) in the book of American Sports and Medicine Association Guidelines he points that positive effects of an exercise typically would be achieved after 16 weeks of training for healthy people and at least 8 weeks for patients and disable subjects. In consistent with findings of the current research Kleef and Eshborn (2005) examined the effect of aerobic exercises for 12 week on MS patients with moderate levels of disability and obtained to positive and significant results. Our results of balance are in line with the findings of Simdal et al (2006) who reported

a significant progression on walking and function of MS patients as a result of a selected training program. Our results also are in consistent with Moradi's (2011) study of examining the effect of resistance training for 8 weeks on muscle strength and balance of men with multiple sclerosis. Furthermore, the research conducted by Terin et al (2008) about the impact of water exercise for 8 weeks on postural control and balance of Parkinson patients as well the research by Zamani and Haghghi (2011) about the effect of water exercise for 12 weeks on postural control and pain levels of backache patients, in addition the reports of Park and Roov (2011) about the considerable effects of water exercise on postural balance of people with brain stork are in line with the results of our research. Likely the reason of mentioned results and positive effects of water exercises of balance can be explored in resistance property. Higher density of water than air produces higher resistance against the motion. A larger increase of cross-motion is faced with more resistance and demands more force for counter motion and running the move, whereas, resistance exercises provide positive effects on proprioceptive receptors activation leading to the control of the performance as well as balance

improvement of MS patients balance (Bayerketaf, 2013).

Although, considering the environmental conditions of the used exercise during the examination of physical exercises effects on balance will be important. Though, according to Diblet et al (2004) using a resistance training at home failed to achieve a significant improvement of balance among MS patients. Water environment advantage compared to a dry environment can be related to the difference of challenging level of systems involved in balance. Simon believes that forces destabilizing balance in water will provide a more suitable environment for balance activities and the involved systems. Furthermore, viscosity properties of water and the possibility of slower movements provide more reaction time for individuals. (Simon et al, 1996, Sadeghi, 2007).

In addition, Broodi and Gigile (2009) in the book *Water Exercises for Training and Rehabilitation* points the increasing of information from skin receptors and subsequently increased afferent nerve stimulation as well sending them to the central nervous system while locating in a water environment (Broodi, 2009).

Moreover, significant improvement of MS women's balance in current study might have

been because of motion errors, finding and correcting the errors while being in water. It is believed that water exercises help individuals to specify and correct the errors since water allows subjects to make mistakes in a broad range of their motions, receive feedback and correct the error without increased fear of falling or likely injury (Simon and Henson 1996). Regardless of whatever mentioned above, balance improvement through training could be related to gradual improvement of mental factors of life quality of current research subjects. In one hand, the relationship between psychological factors like fear, depression, anxiety, self-confidence, and self-esteem with physical factors particularly balance and falling problems or fear of falling (Sadeghi) and on the other hand, life quality improvement following doing the exercises through some unique properties of water environment like being sedative, floating, and reducing secretion of epinephrine, reducing exhaustion speed increase, so better performance of the motions and conversely increasing of self-confidence, doing team work consequently improvement of social performance (Kargarfard, 2010) brings this possibility to the mind that parallel with the great importance of life quality due to water

exercises, physical factors like balance which is highly dependent to psychological factors may change significantly.

As the lack of strength, lack of flexibility, loss of muscle synergy mechanisms and planning also motion control difficulties play role on MS patients' weakness, applying a physical readiness program including aerobic and balance assignments is an effective strategy for reduction of the patients' balance troubles because this results in increased muscle strength, flexibility, and motion control (Sadeghi, 2007). However, postural and balance assignments aren't like other assignments. Outcomes of a mistake while correcting a postural error may result in an injury and subsequently fear of falling. Therefore, postural skills should be exercised in a safe condition like a water environment.

### **CONCLUSION**

This study explored the effect of a balance and aerobic training in water on life quality and balance of MS women. The findings generally confirm the importance of water physical activities on improving the life quality and balance and specifically show that using balance and aerobic exercises can improve significantly the life quality and balance of MS women. Meanwhile, using water exercises for the low-risk nature of them and providing an effective and safe

environment condition will be useful for reducing balance difficulties of MS patients that because of progressive balance weakness and fear of falling lead to the immobility problem and make a vicious cycle.

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