



## Effect of Tai Chi Chuan on balance in women with multiple sclerosis



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### A B S T R A C T

#### Keywords:

Tai Chi Chuan  
Balance  
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**Objective:** To examine the effect of Tai Chi Chuan on balance in women with multiple sclerosis in Iran.  
**Design:** 36 women with multiple sclerosis who were members of the Iranian Multiple Sclerosis Society participated in this study. 18 participants were allocated to the intervention group and 18 allocated to the control group. The intervention consisted of Yang style Tai Chi Chuan exercise sessions twice a week for 12 weeks.

**Main outcome measures:** This study used a demographic questionnaire and the Berg Balance Scale (BBS) to collect data.

**Results:** After 12 weeks, the mean score of the BBS in the intervention group demonstrated a statistically significant improvement in comparison with baseline status.

**Conclusions:** The results suggest that Tai Chi Chuan could be used as a safe complementary intervention to increase balance in patients with multiple sclerosis.

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## 1. Introduction

Multiple sclerosis (MS) is a chronic progressive disease of the central nervous system (CNS) that affects a wide range of neurologic functions, including cognition, vision, muscle strength and tone, coordination, sensation and balance [1] which can lead to disability, functional limitations and a poor quality of life [2]. MS is the most common neurologic disease of young adults [3] and is approximately two to three times more common in women than in men [4]. Symptoms of MS can affect all aspects of a person's life [5]. The signs and symptoms of MS are varied and multiple, reflecting the location of the lesion (demyelinated plaque) or combination of lesions. The most commonly reported and primary signs and symptoms are fatigue, depression, weakness, numbness, difficulty in coordination, loss of balance and pain [6].

One of the most common problems encountered by people with MS is loss of balance which can result in falls and serious injuries [7]. People with MS have a normal life expectancy, therefore, they may have to live for many years with severe mobility problems and require regular therapeutic interventions [2]. Ambulation problems in people with MS can range from a mild difficulty to a complete inability to stand or walk independently [4]. Balance can be defined

either as “the ability to maintain the body's center of gravity within the base of support with minimal sway” [8] or “the ability to maintain body equilibrium, postural stability during quiet standing or perturbed standing with voluntary movement” [9]. The control of human balance during upright stance depends on the integration of visual, vestibular and somatosensory (proprioception) inputs reaching the CNS [8,10].

Due to the widespread distribution of CNS damage in MS, the deficient integration of these pathways can influence postural response in maintaining correct balance and consequently predispose MS patients to fall. Because bone mineral density is reduced in most MS patients [8], the high incidence of falls increases the risk of fractures in these subjects, especially those with osteoporosis [8]. A decrease in mobility is strongly associated with osteoporosis aggravation and muscle wasting as well as more frequent falls. Therefore, simply due to a fall, an MS patient may suffer from a major fracture leading to prolonged bed rest and experience further loss of bone density and muscle mass worsening the patients' disability [11].

Fall incidence was reported in 6 studies from 34% to 64% of MS patients with frequencies of two falls in the last 2 months [11]. Falls can cause physical injuries, such as fractures, soft tissue damage, activity restrictions and reduced mobility. Moreover, psychological consequences, including loss of self-confidence, increased dependence on others, decreased participation in social activities, loss of control over personal lives and fear of further falls ultimately

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undermine the patient's quality of life [10]. Current findings suggest that people with MS receive substantial benefits from physical activity. Health-promoting behaviors, such as physical exercise, represent a good example of the way people with MS may participate in their own care management process [12]. Yet, people with MS significantly engage in less physical activity compared to their non-diseased counterparts [2]. Many studies have demonstrated the benefits of physical exercise on fitness levels, life quality, balance and walking capacity in people with MS [13].

Tai Chi Chuan also called Tai Chi is an ancient Chinese martial art, which is characterized by slow and controlled movements, deep relaxed breathing and correct posture enacted within a state of awareness and concentration [14]. Tai Chi is one of the mind-body therapies in complementary and alternative medicine [15]. The primary goal of Tai Chi is relaxation of the body and the mind. Since many of the fundamental principles of Tai Chi are directly related to the issues of postural control, researchers have begun to scientifically address the extent to which Tai Chi improves postural balance and function [16]. Most research on Tai Chi has focused on balance, particularly in older adults [17]. Tai Chi appears to improve flexibility, range of motion, muscle strength and balance which may thus be beneficial for MS patients [15]. There are three pilot studies which recommend Tai Chi as a treatment intervention for MS patients. Improvements in depression [7], quality of life [18] and balance [7,19,20] are the key findings in the relevant literature.

The purpose of this study was to investigate the effect of Tai Chi intervention on balance in women with MS in Iran.

## 2. Materials & methods

### 2.1. Participants

This was a quasi-experimental study on two groups with before-after design. Based on Pocock's formula, a power of .90 at a 5% significant level (two-sided), the sample size calculation showed that 21 participants were required per group. The study was conducted in 2012 and 36 women with MS who were members of the Iranian Multiple Sclerosis Society participated in the study. They were selected through purposive sampling and then randomly assigned to either the intervention (18 women) or control group (18 women). Because of their time constraints, two patients didn't follow the study and thus were excluded.

Inclusion criteria were: 1) Women between 20 and 60 years old, diagnosed with MS by a physician specialist based on their medical records, 2) Expanded Disability Status Scale (EDSS) scores equal to or less than 5/5 based on medical records, 3) No other acute or chronic debilitating conditions, such as lung and heart diseases, musculoskeletal disorders (joint replacement, etc.), mental or psychological problems (depression, cognitive impairment, etc.) based on patients' statements and medical records, 4) Absence of any stage of pregnancy.

Exclusion criteria were: 1) Experiencing acute and severe recurrences of disease, 2) Involvement in any other exercises, 3) Refusing Tai Chi sessions during the study.

### 2.2. Procedures

Researchers provided information about the study and Tai Chi exercises to participants via educational pamphlets. Participants were informed about the aim of the study and asked to sign consent forms.

The Tai Chi classes included 45 min to 1 h group-based exercise sessions twice a week for 12 weeks taught by a trained researcher and an official Tai Chi instructor. Tai Chi training was scheduled based on six simple and fundamental forms of *Yang style*

movements chosen from the original 24-form of *Yang style Tai Chi* because they were easier and faster to learn than other longer forms. Each training session started with warm up exercises (including stretching, balance exercise etc.), continued to practice of the Tai Chi forms and finished with Tai Chi cool down exercises.

Participants imitated the instructors' postures and movement techniques under close supervision. Participants' progress was monitored and feedback was provided to them in each session. In addition, participants in the intervention group were supplied with an audio-visual instructional DVD, containing exercises as well as Tai Chi music. They were also encouraged to further practice the techniques at home. The control group only received the usual services. Both intervention and control groups received usual services, such as psychological classes and physical therapy.

### 2.3. Measures

The study used a demographic questionnaire and the Berg Balance Scale (BBS) to collect data before and after intervention in both groups. The demographic questionnaire had two parts: personal information (including age, marital status, educational level and Body Mass Index) and disease information (i.e. type and duration of MS diagnosis, frequency of recent relapses, physician visits and hospitalizations due to MS, and the last EDSS score in patient's medical records).

The BBS is a special assessment measure in MS patients [21]. The BBS is a clinical scale that evaluates balance in sitting and standing positions and rates various kinds of physical performances from 0 (no performance at all) to 4 (normal performance) [2]. This scale has 14 items, including sitting to standing, standing unsupported, sitting unsupported, standing to sitting, transfers, standing with eyes closed, standing with feet together, reaching forward with outstretched arm, retrieving objects from the floor, turning to look behind, turning 360 degrees, placing alternate foot on stool, standing with one foot in front (Tandem Stance) and standing on one foot. The maximum score in this scale is 56 [10]. The reliability of this instrument has been evaluated and confirmed in several studies [21] and it has also been validated for use in people with MS [2]. In this study, the BBS form was first translated to Persian language and then face and content validity of the translated version of the form were confirmed based on Lawshe's Content Validity Ratio (CVR) by experts' opinions (11 faculties reviewed and confirmed the item validity by  $CVR = 0.802$ ). Internal consistency was confirmed by Cronbach's Alpha (0.78).

### 2.4. Ethical considerations

Patients were informed about the study and informed consent was obtained. After completion of the study, all participants in the control group received an educational pamphlet and a DVD, containing Tai Chi music and exercises. The research proposal was submitted to the Iranian Registry of Clinical Trials and received due ID (2013; Registration ID: IRCT2013021312466N1). The University of Social Welfare and Rehabilitation Sciences' ethical review board approved this study.

## 3. Results

Results showed that demographic variables were matched and there was no statistically significant difference between the two groups. All patients had relapsing-remitting MS. Table 1 presents the results obtained from demographic data in the Tai Chi and control groups. Table 2 shows the BBS scores in both groups at the beginning and at the end of the study. Mean of balance scores in the Tai Chi group showed a statistically significant difference before

**Table 1**  
Demographic information of MS patients and difference levels in the intervention and control groups.

Variable	Tai Chi (N = 16)		Control (N = 18)		P-value	
	N	%	N	%		
Age	20–30	6	37.5	6	33.3	0.089 <sup>a</sup>
	31–40	2	12.5	10	55.6	
	41–50	7	43.8	2	11.1	
	51–60	1	6.2	0	0	
Marital status	Single	6	37.5	9	50	0.746 <sup>b</sup>
	Married	8	50	8	44.4	
	Other	2	12.5	1	5.6	
Educational level	Under diploma	1	6.2	2	11.2	0.746 <sup>b</sup>
	Diploma	7	43.8	8	44.4	
	Academic degree	8	50	8	44.4	
BMI	Less than 18.5	1	7.1	1	7.1	0.456 <sup>a</sup>
	18.5–24.9 (Normal)	7	50	9	64.3	
	25–25.9	4	28.6	4	28.6	
	30–34.9	1	7.1	0	0	
	35–39.9	1	7.1	0	0	
Duration of MS disease	Less than 6 years	5	31.3	4	23.5	0.651 <sup>c</sup>
	6–10 years	3	18.7	6	35.3	
	More than 10 years	8	50	7	41.2	
Frequency of relapses	Less than 5 relapses	6	60	10	76.9	0.900 <sup>c</sup>
	More than 5 relapses	4	40	3	23.1	
Hospitalizations	Less than 5 times	8	66.7	13	81.3	0.262 <sup>c</sup>
	More than 5 times	4	33.3	3	18.7	
Last EDSS score	0–1	7	43.8	3	25	0.683 <sup>c</sup>
	1.5–2.5	4	25	6	50	
	3–4	3	18.8	2	16.7	
	4.5–5.5	2	12.4	1	8.3	

<sup>a</sup> T-test.

<sup>b</sup> Chi-square.

<sup>c</sup> Mann–Whitney U.

and after the intervention ( $p < 0.05$ ). There was no statistically significant change in mean of balance scores before and after the intervention in the control group ( $p > 0.05$ ). There was no statistically significant change between both groups before and after intervention ( $p > 0.05$ ) (Table 2).

After the training sessions, most of the participants in the Tai Chi group expressed satisfaction over perceived improvements in their control and body balance.

#### 4. Discussion

The study results indicated a beneficial effect of Tai Chi intervention on MS patients' balance. This finding is consistent with the results of Mills et al. preliminary study [7], which reported a significant improvement in balance of MS patients after Tai Chi intervention. Also, Maciaszek et al., in a randomized clinical trial, studied the effect of Tai Chi on body balance in patients with Osteopenia or Osteoporosis and reported a significant improvement in patients' balance in the intervention group [22]. Moreover, Hye-Jung Choi et al. study results on therapeutic effects of Tai Chi in

**Table 2**  
Comparison of means values scores of Berg Balance Scale in the intervention and control (Pre-test, post-test).

Variable	Tai Chi group		Control group		P-value <sup>a</sup>	
	Mean	Std	Mean	Std		
Balance (BBS)	Pre-test	52.25	3.39	53.22	2.23	0.496
	Post-test	53.94	2.23	53.61	2.14	0.548
	P-value <sup>b</sup>	0.003		0.088		–

<sup>a</sup> Mann–Whitney U.

<sup>b</sup> Wilcoxon.

patients with Parkinson's disease showed that there was a significant interaction effect on balance and agility in the Tai Chi group [23] and also Nguyen et al., in a randomized controlled trial, studied the effects of Tai chi exercise on balance, sleep quality and cognitive performance in community-dwelling elderly and reported a significant improvement in their balance score [24].

Our study showed that there was no reported significant difference between the mean of balance scores after the intervention in the two groups due to a lower balance mean in the intervention group than the control group before the study. The results suggested that Tai Chi could be an alternative exercise intervention to increase balance in patients with MS.

#### 5. Strengths and limitations

Our data demonstrate that a Tai Chi exercise intervention had a positive effect on multiple sclerosis young women patients' balance and could decrease their risk of falls. Despite these strengths, there were several limitations in the study, for example, the population was limited to Iranian young women who accepted to contribute to the intervention program and there was no measure of the impact of the participants' mental interest in Tai Chi on their performance in the intervention group. Moreover, there was no measure for group dynamics' effect on the control group.

#### 6. Implications and suggestions

The results emphasize that Tai Chi exercise intervention has the potential to improve the balance of multiple sclerosis young women and decrease their risk of falls. For nursing professionals, it is necessary to accommodate and consider the balance needs of these patients. Overall, nurses' attention to patients' balance needs and preparing some types of exercise may be useful to reduce the risk of falls in multiple sclerosis patients. Undertaking similar studies in other populations, such as men, is warranted. Also, a longer Tai Chi intervention period for these patients and a comparison of other types of Tai Chi exercises will be suggested.

#### Conflict of interest statement

The authors have no conflicts of interest related to this work.

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