



The Effects of a Yoga Intervention on Balance, Speed and Endurance of Walking, Fatigue and Quality of Life in People with Multiple Sclerosis

by

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Multiple sclerosis (MS) is a disease of the central nervous system that results in many symptoms including mobility limitation, fatigue and reduced quality of life.

The purpose of this study was to determine the effect of a yoga intervention on balance, speed and endurance of walking, fatigue and quality of life in MS patients.

21 women with MS (34.38±5.68) with Expanded Disability Status Scale scores 1.0 to 4.0, have been randomly assigned to a yoga group or control group. Yoga group subjects participated in a thrice weekly 60-70 minute sessions of Hatha yoga intervention for 8-weeks. Balance, speed and endurance of walking, fatigue and quality of life were measured by Berg Balance scores; 10-m time and 2-minute distance walking, Fatigue Severity Scale (FFS) and Multiple Sclerosis Quality of Life-54 questionnaire (MSQOL-54) respectively.

Comparison of results of pre and post intervention revealed significant improvement on balance score, walking endurance, FFS and some of MSQOL-54 scale scores in the yoga group ($p \leq 0.05$ respectively). There were no clear changes in 10-m times ($p = 0.132$), related to yoga group. No changes were observed for control group.

These results suggest that yoga intervention can be beneficial for patients with MS

Key words: multiple sclerosis, yoga, balance, fatigue, ambulatory function, quality of life

Introduction

MS is a demyelinating disease that affects the white matter of the central nervous system (CNS) (Kent-Braun, 1997). The symptoms vary widely across MS patients and can include loss of function and feeling in limbs, fatigue, loss of balance and coordination, pain, cognitive dysfunction and depression (Motl, 2005). These and other symptoms reduce individuals' ability to perform activities of daily living (White, 2004). The disease usually begins in early adulthood (ages 20-40 years) but cases can begin in

early childhood or after age 65 (Kishiyama, 2002). With a prevalence rate of 110/100,000, MS is one of the most frequent neurological diseases (Mostert, 2002) and affects approximately 1,000,000 individuals worldwide (Kantarci, 2006). Even though these patients are often young and initially exhibit barely perceptible symptoms, there will be a decrease in optimal physical activity (Svensson, 1994).

It is estimated that between 65-87% of people with MS have some form of balance or mobility impairment and this impacts the quality of life of people with MS (Jaime, 2006). Fatigue is one of the major

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debilitating symptoms of MS (Hale, 2003) and is reported by 70%-90% patients (Fisk, 1994). However the definition and pathophysiology of fatigue in MS are still debated, and despite the scarcity of objective markers correlated with the subjective sensation of fatigue (Béthoux, 2006). MS patients have been advised to avoid physical activity because symptoms may worsen with an elevated body temperature (Schulz, 2004). Beside decreased physical activity which tends to increase deconditioning and alters fitness (Gallien, 2007) and led to weakness resulting from atrophy and reduced cardiorespiratory fitness (Kent-Braun, 1997, Killeff, 2005). Much of the literature has focused on the comparison of people with MS with healthy individuals and researchers suggest the disparity in aerobic capacity is related to disease severity; aerobic capacity declines as physical impairment increases (Killeff, 2005).

In some review of literature showed that exercise is a low-cost form of therapy that has been gaining recognition as a realistic and positive way for people with MS to care for them. For example Mostert and Kesselring reported improvement in aerobic threshold, work rate and activity level after 4 weeks of aerobic exercise training (Mostert, 2002). Also treadmill training, aquatic, cycling and resistance training may be beneficial for patients with MS (White, 2004, Newman, 2007, Romberg, 2004, Rampello, 2007, Snook, 2009).

Moreover, many people with MS have taken yoga classes and report high satisfaction (Oken, 2004). Yoga is an ancient Indian science and its practice is known to improve and maintain health status by improving cardio-vascular, cardio-respiratory and other functional capabilities and also prevent various ailments (Prasad, 2001). Information on the response of MS patients to yoga is limited. Oken et al showed a significant improvement in measures of fatigue after the 6-month yoga class in people with MS but there were no clear changes in cognitive function (Oken, 2004). In addition yoga postures may be employed with great success to decrease fatigue, abnormally high muscle tone, and spasticity, promote muscle relaxation, elongate soft tissues and thereby or indirectly improve muscle strength (Zwick, 2004). Thus, the purpose of this study was to evaluate the effectiveness of a yoga intervention on balance, ambulation, fatigue and quality of life in individuals with MS.

Hypothesis

1. Yoga practice has a significant effect on balance in individuals with MS.
2. Yoga practice has a significant effect on speed of walking in individuals with MS.
3. Yoga practice has a significant effect on endurance of walking in individuals with MS.
4. Yoga practice has a significant effect on fatigue in individuals with MS.
5. Yoga practice has a significant effect on quality of life in individuals with MS.

Materials and Methods

Subjects: Twenty-one women with MS (19-/54 years old) volunteered to participate and had physician clearance prior to study enrolment. Subject inclusion criteria consisted of physician diagnosed MS with a self assessed Kurtzke Expanded Disability Status Scale (EDSS) score between 1 and 4. No one of subjects participated in physical activity for three months prior to the study. Subjects using MS disease-modifying drugs (i.e. Interferon beta 1a and 1b, Avonex and Rebif) were included. Individuals with cardiovascular disease, liver or kidney failure, symptomatic lung disease, diabetes, thyroid disorders, gout or orthopedic limitations were excluded. In addition, individuals pregnant and addict were also excluded. All subjects provided written informed consent. After completion of the baseline evaluations, subjects were randomized to one of the two experimental group lasting 8 weeks yoga intervention, or wait-list control groups. Subject characteristics are presented in table 1.

Assessments: After screening medical history, participants were asked to complete the FFS (Newman, 2007, Van den Berg, 2006), and MSQOL-54 (Rampello, 2007) to assess the level of fatigue and health-related quality of life. FFS is looking at the impact of fatigue on function (Killeff, 2005) and the 54 items MSQOL-54 are divided into 12 multiple item scales (physical function, role limitations physical, role limitations emotional, pain, emotional wellbeing, energy, health perception, social function, cognitive function, health distress, sexual function) and 2 single-item scales (change in health, satisfaction with sexual function). A higher score in each scale indicates a better health-related quality of life. Physical health composite and mental health composite scores were calculated as a weighted sum of selected scale scores. The reliability and validity of

Table 1

Characteristics and assessment results of the 21 subjects with multiple sclerosis enrolled in this study as the yoga and control groups

Variable	All Subjects (n=21)	Yoga group (n=11)	Control group (n=10)	P value*
Age (year)	34.38(19-53)±9.05	32.27(22-53) ±8.68	36.70(19-49)±9.32	0.27
Disease duration (year)	4.85(1-20) ±4.47	4.72(1-20) ±5.62	5.00(1-9)±3.05	0.89
EDSS score (0-10)	2.11(1-4)±1.15	2(1-4) ±1.09	2.25(1-4)±1.25	0.63
Balance score	46.19(28-54) ±8.1	47.72(34-54) ±6.78	44.50(28-54)±9.43	0.37
Walk time (second)	8.96(6.62-12.24) ±1.8	8.18(7.20-11.85) ±1.79	9.16(6.62-12.01)±1.88	0.64
Walk distance (meter)	115(71-172)±23.15	109(85-133)±17.44	121.505 (71-172)±27.73	0.24
FFS score	4.07(1.11-5.78) ±1.11	3.98(2.11-5.33) ±0.99	4.17(1.11-5.78)±1.28	0.70
MSQOL-54 score*	115.57(69.36-174.74) ±27.2	110.25(74.07-139.38) ±2.08	121.4 (72.77-153.7)±34.04	0.37

*: Physical health composite+ mental health composite

+: P values assessed by one-way ANOVA

the MSQOL-54 scores have been confirmed in subjects with MS (Rampello, 2007).

Balance and walking were evaluated as indicators of ambulatory function (Hale, 2003). Balance was assessed using the Berg Balance Scale (Hale, 2003, Berg, 1992), 10-m timed walk and 2-minute walk were employed to evaluate walking speed and endurance respectively (Newman, 2007, Rossier, 2001). Walking speed was assessed with the time taken to walk 10 m over a straight walk path, as fast as they could. Then participants rested for a period of 20 minutes. Distance completed walking with Preferred Pace, for 2 minutes around a hallway track was recorded, in the test patients. All participants were then assessed immediately prior to (baseline) and following the 8-week intervention.

Training program: Eleven patients in the yoga group completed an 8-weeks yoga class. Yoga classes were 60-70 minutes in duration and three sessions per week. The postures started with stretching techniques followed by standing, supine and prone-lying and sitting postures. Our yoga teacher was familiar about problems common to the persons with MS. In this regard, she employed the

previous studies to design a Hatha yoga program with the following techniques: breathing techniques, arms overhead stretches (static), eagle pose (garudâsana), side bending triangle posture (trikonasana), forward bending (padahasthasana), side lateral bending (ardhakati chakrasana), ankle on knee forward bend, warrior II (on chair) (vîrabhadhrâsana II), side angle pose (parshvakonâsana), seated twist (bharadvajâsana I), tree pose (supported by wall) (vrikshâsana), reclining bound angle (suptabaddha- konâsana), supported downward dog (adhomukha shvanâsana), cat pose, pose of a child (balâsana), hand to toe (supta-padângushthâsana), supported back bend, rising sun twist, variation of jathara-parivartanâsana, legs up the wall (viparîtakaranîmudrâ) and followed by relaxation technique in supine posture with closed eyes and relaxation of every part of the body (Kishiyama, 2002, Oken, 2004, Chaya, 2006, Nagarathna, 2004). Each pose was held for approximately 10 to 30 seconds (even 8 seconds for subjects who were unable to maintain some techniques) with rest periods between poses lasting 30 seconds to 1 minute. Patients were supported for majority of poses, with a chair or Swiss ball or wall.

Table 2

Pre intervention and post intervention values for balance, 10-m timed walk, 2-minute walk tests and Fatigue Scale Score in the 21 subjects with multiple sclerosis (yoga and control groups).

Variable	Yoga group (n=11)			Control group (n=10)			F	P value*
	Pre-intervention	Post-intervention	P value*	Pre-intervention	Post-intervention	P value*		
Balance score	46.19(28-54) ±8.1	53.81 (45-56) ±3.4	0.00	44.50(28-54) ±9.43	41.70(28-54) ±8.48	0.07	19.84	0.00
Walk time (second)	8.96(6.62-12.24) ±1.8	8.13(6.12-11.25) ±1.87	0.13	9.16(6.62-12.01) ±1.88	9.47(7-12.75) ±1.92	0.14	4.47	0.04
Walk distance (meter)	115(71-172) ±23.15	120.36 (86-162.5) ±20.6	0.00	121.5 (71-172) ±27.73	119.05(73-165) ±27.12	0.15	15.50	0.00
FFS score	4.07(1.11-5.78) ±1.11	2.44(1.44-6.66) ±1.5	0.01	4.17(1.11-5.78) ±1.28	4.23(1.78-5.33) ±1.04	0.82	6.59	0.01

*: P values assessed by paired t-test

+: P values assessed by one-way ANOVA

Usually class began with calmative music. The yoga class set up in a physiotherapy clinic and was supervised by a neurologist and physiotherapist.

Data analysis: pre-test data were examined at first to accomplish reassessment for between group differences. Comparisons between pre and post-training measures of balance, walking speed and endurance, fatigue and Quality of Life were analyzed using a paired t-test. Between-group differences of this study were examined using the one way ANOVA. Data was analyzed with SPSS version 16.0, using a significance level of $p \leq 0.05$.

Results

Eleven MS women in yoga group and ten MS women in the control group conducted the test procedures of this study. No subjects' increase in severity was reported during the yoga classes. Rather patients were asked to continue with the yoga class after the trials were finished. There were no differences between the groups at baseline in either age, EDSS score, disease duration, balance score, walk time, walk distance, FFS score, MSQOL-54 score (p values greater than 0.2 respectively) (table. 1). Balance score was increased significantly by 12.76% ($p=0.00$) in the yoga group and decreased insignificantly by 7.19% ($p=0.07$) in the control group after 8-weeks (hypothesis1). In the training group the mean 10-m timed walk decreased by 7.40% ($p=0.13$), whereas this factor in the control group increased by 3.38% ($p=0.14$), but these changes were not significant. When interventions were analyzed between groups, mean 10-m timed walk after 8-weeks was significantly increased compared with control group ($p=0.04$) (hypothesis2). Mean 2-minute walk distance increased significantly in the yoga group by 9.96% ($p=0.00$) and almost remained unchanged in the control group by 2.89% decline ($p=0.15$) (hypothesis3). For evaluation of level of excessive fatigue the FFS score was used in this study. It was observed that the fatigue levels were significantly lower during post-test than pre-test in the yoga group by 38.69% ($p=0.01$) and a negligible increase by 1.41% ($p=0.82$) in the control group (hypothesis4). The MSQOL-54 scale was used to assess quality of life before and after the eight-week intervention. The yoga intervention group showed a significant increase in physical function, role limitations emotional, emotional wellbeing, energy, cognitive function, overall quality of life, physical and mental health composite by 11% ($p=0.01$), 38% ($p=0.01$), 22%

($p=0.04$), 22% ($p=0.04$), 27% ($p=0.00$), 16% ($p=0.02$), 10% ($p=0.02$) and 24% ($p=0.00$) respectively, after 8-weeks. But in the subjects of control group none of MSQOL-54 scale scores changed significantly. Analyzed between groups, differences were found in physical function ($p=0.01$), emotional wellbeing ($p=0.03$), cognitive function ($p=0.01$), physical health composite ($p=0.04$) and mental health composite ($p=0.01$) scores (table 3) (hypothesis 5).

Discussion

Several studies have indicated the beneficial effects of yoga technique on various disorders such as diabetes, asthma and hypertension (Sahay, 1986, Nagendra, 1986, Selvamurthy, 1998). Thus we decided to study the effects short-term yoga practice in people with MS.

Our study revealed that, in subjects with mild to moderate disability due to MS, balance score improved significantly after 8-weeks of yoga intervention. It is thought that the changes in balance and mobility accompanying yoga intervention occur due to the improvement of slow controlled movement in shifting the center of mass (Jaime, 2006). Whereas De-Bolt and McCubbin (2004) showed that balance did not change after 10-weeks training. Romberg et al (2004), also did not report any change for balance after 6 months exercise program (strength training and aquatic training) for MS patients with mild to moderate disability (EDSS 1.0 to 5.5).

Our results showed that yoga practices did not lead to a significant improvement in 10-m timed walk after 8-weeks. However, we found a significant difference between the yoga group and the control group ($p=0.04$) for this parameter. In the Romberg et al study (2004) the duration of the 7.62m walk decreased by 12% relative to baseline after 6 months exercise, also according to Newman et al (2007) a 12% reduced mean 10m time was observed after 4weeks treadmill training. Perhaps long-term yoga practice can be effective for improvement of this factor in MS patients.

In the present study, we found that yoga intervention induced a significant change in mean 2-minute walk. It has been reported that the practice of yoga program improved VO₂ (Raju, 1994), heart rate and metabolic rate (Telles, 2000) that probably would be beneficial for improvement of endurance in MS patients. Even small savings in energy for those with more restricted mobility could be functionally important, allowing activity for a longer pe-

Table 3

Pre intervention and post intervention multiple sclerosis Quality of Life-54 Questionnaire Scores in the 21 subjects with multiple sclerosis(yoga and control groups)

Variable	Yoga group (n=11)			Control group (n=10)			F	P value ⁺
	Pre-intervention	Post-intervention	P value*	Pre-intervention	Post-intervention	P value*		
Physical function	57.27(20-90) ±20.04	66.45(45-100) ±16.65	0.01	70(25-95) ±24.72	67.50(25-100) ±24.63	0.44	7.08	0.01
Role limitations-- physical	31.81(0-100) ±31.8	27.27(0-100) ±32.5	0.58	55(0-100) ±36.89	57.5(0-100) ±40.9	0.84	0.22	0.63
Role limitations-- emotional	48.48(0-100) ±34.52	78.78(0-100) ±37.33	0.01	39.99(0-100) ±40.97	56.66(0-100) ±41.72	0.17	0.77	0.38
Pain	64.69(15-93.33) ±25.28	68.03(30-93.33) ±22.23	0.13	64.83(40-93.33) ±18.15	62.33(30-93.33) ±22.01	0.37	3.04	0.09
Emotional wellbeing	51.63(24-80) ±16.24	66.36(12-84) ±19.15	0.04	58.40(24-84) ±19.88	57.20(24-80) ±19.41	0.61	4.89	0.03
Energy	44.36(28-56) ±9.54	57.45(8-68) ±17.27	0.04	50(28-72) ±16.24	48.40(8-68) ±18.22	0.75	3.62	0.07
Health perception	52.27(35-75) ±13.48	48.18(35-70) ±12.89	0.20	61(35-90) ±18.07	59(30-85) ±16.79	0.72	0.11	0.73
Social function	71.9 (16.67-100) ±27.7	82.6(41.67-100) ±17.26	0.06	81.66(50-100) ±19.16	80.83(16.67-100) ±28.6	0.86	2.56	0.12
Cognitive function	53.63(25-95) ±20.25	73.63(60-90) ±10.5	0.00	64.5(30-100) ±23.14	66.50(25-100) ±27.39	0.68	8.24	0.01
Health distress	71.36(40-100) ±20.62	80.9(60-100) ±14.45	0.09	81(40-100) ±22.08	82.50(40-100) ±20.84	0.19	2.06	0.16
Sexual function	67.42(0-100) ±34.45	75.75(0-100) ±32.8	0.20	81.67(49.97-100) ±19.16	85.01(58.35-100) ±17.9	0.30	0.49	0.49
Change in health	40.9(0-100) ±34.04	52.27(25-100) ±23.59	0.24	50(25-100)±23.57	52.50(25-100) ±27.51	0.78	0.48	0.49
Satisfaction with sexual function	65.9(0-100) ±35.83	77.27(25-100) ±26.11	0.13	72.50(50-100) ±21/88	80(50-100) ±22.97	0.43	0.11	0.73
Overall quality of life	63.8 (18.35-100) ±24.4	76.35(41.6-100) ±17.18	0.02	71.83(55-86.65) ±9.88	76.82(55-91.65) ±11.33	0.22	1.57	0.22
Physical health composite	58.95(35.36-74.7) ±13	65.7 (46.2-86.98) ±11.5	0.02	67.24(39.4-81.7) ±12.87	66.64(41.6-84.09) ±12.3	0.79	4.53	0.04
Mental health composite	56.12(38.55-68.7) ±9.7	74.3(40.73-91.6) ±15.34	0.00	60.5(33.4-83.56) ±15.53	65.54(41-84.6) ±14.89	0.71	7.84	0.01

*: P values assessed by paired t-test

+: P values assessed by one-way ANOVA

riod (Newman, 2007). The effect of yoga on body function may be related to decreased arousal or a decrease in sympathetic nervous system activity (Chaya, 2006). To our knowledge, to date literature is witness of lack of project to study the effect of yoga intervention on walking speed and endurance in MS population.

General fatigue is a dominating problem for the majority of patients with MS (Svensson, 1994). Our findings in this study, by FFS scale showed that yoga practice led to a significant decrease of fatigue in MS patients. It has also been reported by Oken et al, that 6-month yoga intervention improved fatigue in people with MS (Oken, 2004). Some studies reported that various exercise training can also be useful to reduce fatigue in MS individuals (White, 2004, Fargoso, 2008). However, fatigue has several dimensions: physical and mental (Béthoux, 2006). Indeed yoga practice (relaxation techniques specially) can improve metabolic rate (Raju, 1994) and at the same time saving energy that may lead to decrease physical fatigue in daily activities. On the other hand, it has been reported that Hatha yoga produces im-

provements in mood (Berger, 1998) and calming of mind (Chaya, 2006) and may be effective to reduce mental fatigue. However, FFS do not distinguish physical and mental fatigues (Oken, 2004). Rather we must choose other fatigue scales to study two distinct fatigue subscales (physical and mental fatigues).

We also found that short-term yoga practice significantly induced increases in some MSQOL-54 scale scores by physical function, role limitations emotional, emotional wellbeing, energy, cognitive function, overall quality of life, physical health composite and mental health composite. The same researchers oken et al (2004) showed energy and fatigue (vitality) dimensions of the SF-36 (Short Form health-related quality of life) improved after 6-month yoga intervention in the home by once per week. But they showed no changes of mood and cognitive function. Nevertheless, other exercise programs can also led to improve in quality of life. Previous studies of MS individuals showed beneficial effects on health-related quality of life after, 4 weeks of bicycle exercise training (Mostert, 2002), or 5

weeks of aerobic and strength exercise (Bjarnadottir, 2007). In this connection, Rampello et al (2007), found after the 8-weeks bicycle exercise training program, the subjects showed a significant increase in 3 MSQOL-54 scale scores (emotional well-being, energy, and health distress). However, the mechanism of action of these changes in the quality of life is not completely clear (Rampello, 2007) but probably is affected by decrease of fatigue, improvement

of ambulatory function and mood for subjects participating in this study.

Conclusions

Based on these observations it can be suggested that even short period of yoga practice would be beneficial to individuals with MS in improvement of balance, speed and endurance of walking, reduction of fatigue and consequently led to some positive effects on quality of life.

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