Shiatsu-associated physical therapy on pain and fatigue on people with multiple sclerosis

Shiatsu associado à fisioterapia na dor e fadiga em pessoas com esclerose múltipla

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Abstract

Introduction: Pain and fatigue are common symptoms in multiple sclerosis (MS). Shiatsu, a technique that uses the pressure of fingers, associated with manual therapy, exercises and stretching can be used to control these symptoms. **Objective:** To evaluate the effect of Shiatsu associated with physical therapy on pain and fatigue on people with MS. **Methods:** Randomized clinical trial with people diagnosed with MS divided into two groups: intervention group (IG) - Shiatsu-associated physical therapy (n = 9), and control group (CG, n = 8). Participants were assessed before and after treatment by the Expanded Disability Status Scale (EDSS), Neuropathic Pain Questionnaire (DN4), Visual Analog Scale (VAS) and Fatigue Impact Scale (MFIS), and description of sociodemographic. **Results:** Seventeen people with MS (9 men) aged 45.18 ± 3.06 years participated in this study. In the total sample, the average of DN4 was 1.65 ± 20.02, VAS was 2.29 ± 2.80, MFIS was 39.47 ± 29.67, and 52.9 % had a score > 38 in the MFIS that corresponds to presence of fatigue. The values pre/post-intervention/grade of p, respectively in the IG were DN4: 2.78 ± 2.16/2.0 ± 2.12/0.432, EVA: 3.22 ± 3.27/0.33 ± 1.00/0.023, total MFIS: 44.44 ± 35.91/35 ± 31.70/0.068. In the CG the values were DN4 : 0.38 ± 0.744/2.25 ± 2.71/0.054, EVA : 1.25 ± 1.83/3.63 ± 2.38/0.043, and MFIS : 33.88 ± 21.68/25.13 ± 24.22/0.379. **Conclusion:** Shiatsu associated with Physiotherapy was effective in improving pain and fatigue in individuals with MS.

Keywords: Fatigue. Multiple sclerosis. Pain. Physical therapy. Shiatsu.

Resumo

Introdução: *A dor e a fadiga são sintomas comuns na esclerose múltipla (EM). O Shiatsu, técnica que utiliza a pressão dos dedos, associado à terapia manual, exercícios e alongamentos pode ser utilizado para controlar esses sintomas.* ***Objetivo:*** *Avaliar o efeito do Shiatsu associado à fisioterapia na dor e fadiga em pessoas com EM.* ***Métodos:*** *Ensaio clínico randomizado com pessoas com diagnóstico de EM, divididas aleatoriamente em grupo intervenção (GI), que recebeu fisioterapia associada ao Shiatsu (n = 9), e grupo controle (GC, n = 8). Os participantes foram avaliados antes e após o tratamento pela Escala Expandida do Estado da Incapacidade (EDSS), questionário para dor neuropática (DN4), Escala Visual de Dor (EVA) e Escala de Impacto da Fadiga (MFIS), edescrição dos dados sociodemográficos.* ***Resultados:*** *Participaram deste estudo 17 pessoas com EM (9 homens), com idade média de 45,18 ± 3,06 anos. Na amostra total, a média do DN4 foi de 1,65 ± 20,02, da EVA foi de 2,29 ± 2,80, MFIS foi de 39,47 ± 29,67 e 52,9% apresentaram escore > 38 no MFIS, que corresponde à presença de fadiga. Os valores no pré/pós-intervenção/valor de p no GI foram, respectivamente, DN4: 2,78 ± 2,16/2,0 ± 2,12/0,432, EVA: 3,22 ± 3,27/0,33 ± 1,00/0,023, MFIS: 44,44 ± 35,91/35 ± 31,70/0,068. No GC foram DN4: 0,38 ± 0,744/2,25 ± 2,71/ 0,054, EVA: 1,25 ± 1,83/3,63 ± 2,38/0,043 e MFIS: 33,88 ± 21,68/25,13 ± 24,22/0,379.* ***Conclusão****: O Shiatsu associado à fisioterapia foi eficaz na melhora da dor e fadiga em indivíduos com EM.*

Palavras-chave: *Fadiga. Esclerose múltipla. Dor. Fisioterapia. Shiatsu.*

Introduction

Multiple sclerosis (MS) is a neurological degenerative and chronic disease that occurs in the central nervous system (CNS) and its peculiarity is the destruction of the myelin coating that lines the neurons, being distinguished as a demyelinating pathology.[1]

According to the Ministry of Health (MH), MS affects individuals in the age group 18 - 55 years of age, and the incidence in Brazil is approximately 15 cases per 100,000 inhabitants. This disease is considered impacting and affects young adults, mainly women.[2,3] The main symptoms that can be experienced in MS are usually changes in movement, march, balance and coordination disorders, muscle weakness, fatigue, spasticity, visual and emotional disorders, speech-language disorders, and impairment of sexuality that are a result of the process of degeneration of axons and impairment of nerve conduction, detected in the disease.[4,5]

Pain is characterized as a common symptom in MS and is directly related to the disease and its consequences. MS patients may have both types: neuropathic and/or neurogenic pain, which is directly related to central nervous system myelin rupture and nociceptive pain, which is secondary to skeletal muscle changes that occur in patients, such as weakness and spasticity.[6]

Fatigue is a subjective symptom, defined as a feeling of deep physical or mental tiredness, loss of energy or even a feeling of exhaustion with characteristics different from those observed in depression or muscle weakness. In MS, it is a frequent and disabling symptom that accommodates 75% of patients, not correlated with age, gender, depression or degree of neurological impairment.[7]

Physical therapy in the treatment of individuals with MS aims to preserve skeletal muscle integrity, maintain and/or gain joint mobility, improve postural stability, minimize changes in muscle tone, improve fatigue, and prevent secondary deficits such as joint contractures caused by spasticity. In addition, it is also important to maximize social and labor returns and to develop movement strategies, improving quality of life and general movement patterns.[8,9]

Complementary and alternative medicine (CAM) contribute to the expansion of health care offerings, for the rationalization of health actions, stimulating innovative and socially contributing alternatives to the sustainable development of communities; it motivates actions related to social participation, encouraging the responsible and continuous involvement of users, managers and workers in the different instances of the implementation of health policies, besides providing greater resolution of health services.[10,11]

Shiatsu is a form of CAM which primarily developed in Japan. Both Shiatsu and acupressure have roots in Chinese medicine and embrace the philosophy of yin and yang, the energy meridians, the five elements and the concept of Ki, or energy. This concept of affecting the balance of energy through acupoints on the meridians is similar to acupuncture, where needles or heat is applied to acupoints. Shiatsu literally means "finger pressure",

but it uses gentle manipulations, stretches and pressure using fingers, thumbs, elbows, knees and feet. Shiatsu incorporates acupressure, which is similar but applies pressure for longer on specific pressure points on meridians, following the Traditional Chinese Medicine (TCM) theory.[12] No studies were found in the consulted literature on the use of shiatsu to treat pain and fatigue in people with MS and not even in other neurological conditions.

Shiatsu is useful for people with MS primarily for reducing stress and boosting the immune system, potentially reducing the risk or severity of recurrent symptoms.[13] Bastani et al.[14] indicated that the use of acupressure has a significant effect on improving symptoms, including fatigue in women with MS.

The aim of this study was to evaluate the effect of Shiatsu associated with physical therapy on pain and fatigue in people with MS.

Methods

Design and ethical aspects of the study

This research was characterized as quantitative; the study design was experimental, prospective, about the effect of an intervention.

The Research Ethics Committee of Centro Universitário Filadélfia (UniFil) approved the study under No. 3.206.299 (CAAE: 04557418.6.0000.5217). The study is registered in the Brazilian Registry of Clinical Trials (ReBeC) under the number RBR-2c6ymn. All study participants signed the informed consent form of the study that was conducted in accordance with the Declaration of Helsinki.

Sample size and statistical analysis

To estimate the number of participants in this study, the z family test (G*Power 3.1.9.7) was used for logistic regression, with binomial distribution and input effect size as two probabilities, alpha of 5 %, power of 80 %. The estimated sample was 10 individuals for each group, considering $\alpha = 0.5$ and $\beta = 0.2$, for an average difference of 3 on the analogue visual pain scale.[15,16]

For categorical variables, values are expressed as relative and absolute frequency, whereas for numerical variables data are presented as median and quartiles (25-75%). The t-test was used for parametric distribution, while for intragroup analysis the paired t-test distribution was used. The chi-square test was used for association relationships of categorical variables. Significance level was considered at $p < 0.05$.

Recruitment

The participants were selected in the Londrina Association of Patients with Multiple Sclerosis (LAPMS), composed of 50 registered patients from Londrina (Brazil) and region, of both sexes. Among them, only 30 subjects were eligible for MS confirmed by a neurologist at least 12 months before the experiment and their inclusion in the study was performed according to the prono (EDSS); however, ten did not meet the inclusion criteria and were excluded.

The presentation of the project to the participants was made during the LAPMS meetings, through orientation and awareness lectures on the variables that would be evaluated. The evaluations were previously scheduled through telephone contact and performed at the Physical Therapy Clinic of UniFil, on Saturdays, from 2 pm to 6 pm. This evaluation was performed through questionnaires and specific test evaluations.

For inclusion in the study, all participants should be 18 years of age or older, live in Londrina, have a MS diagnosis with EDSS from 0 to 6 ("walk independently" without the aid of a cane or crutch), be under medical supervision, and no relapse during the 3-month period prior to study inclusion. As exclusion criteria, subjects with traumatic injuries, neuropathies and cognitive impairment, unable to understand or perform the tests proposed in the study or their rejection to participate in the study and being hospitalized or having an outbreak at the time of data collection could not participate in the research.

The evaluations were performed by blind evaluators (physiotherapists), through a complete anamnesis on sociodemographic data, background and general health status, physical therapy and physical activity. In addition, the following instruments were used:

1) EDSS is a method that quantifies disabilities used to classify MS, quantifying the disabilities present in the process of disease progression. It is composed of tests that evaluate eight functional systems, being those of pyramidal, cerebellar, brainstem, sensory that occur during the course of the disease, and it is composed of

eight functional systems (FS),visceral, intestinal, visual, mental and other functions.[17] The scale ranges from 0 to 10, where 0 indicates a neurologically healthy individual and 10 an individual who died due to MS. This scale widely used scientifically, however it is not yet valid for the Portuguese language

2) The Modified Fatigue Impact Scale (MFIS) is a subjective scale for fatigue assessment, being a questionnaire where the information obtained is self-reported. It has a multidimensional character, and consists of 21 items, subdivided into three domains (physical, cognitive and psychosocial), obtaining scores from 0 to 4 for each item, being 84 a maximum score. The determination of fatigue is verified when the scores are equal to or higher than 38; therefore, a score lower than 38 indicates the absence of fatigue. It was validated to Portuguese.[18]

3) The questionnaire for neuropathic pain (ND4), originally in French, was properly translated and validated to Portuguese, and was used to identify non-neuropathic and neuropathic neuropathies in patients with pain. It consists of 10 items subdivided into two parts: sensory descriptors (seven items) and related signs for sensory examination (three items).[19]

4) Analog visual scale (VAS) for pain: one-dimensional instrument for pain intensity assessment. It is a line with the ends numbered 0-10. At one end of the line is marked "no pain" and at the other "worst pain imaginable". The patient is then asked to evaluate and mark the pain present at that time.[20]

Randomization and intervention

After the evaluations, randomization was performed by a researcher who did not participate in the recruitment or data collection; therefore, without direct contact with the research member.

For randomization, brown envelopes were used and sealed with an internal card identifying the type of group. The envelopes were arranged in a single column, interspersed with each other. Each volunteer randomly removed an envelope from the column. Participants were randomly divided into two groups of 10 patients each: Intervention group (IG) and control group (CG). After their group was defined, the patients underwent eight Shiatsu-associated physical therapy treatment physiotherapy appointments in their respective groups. Figure 1 shows the distribution of patients by group.

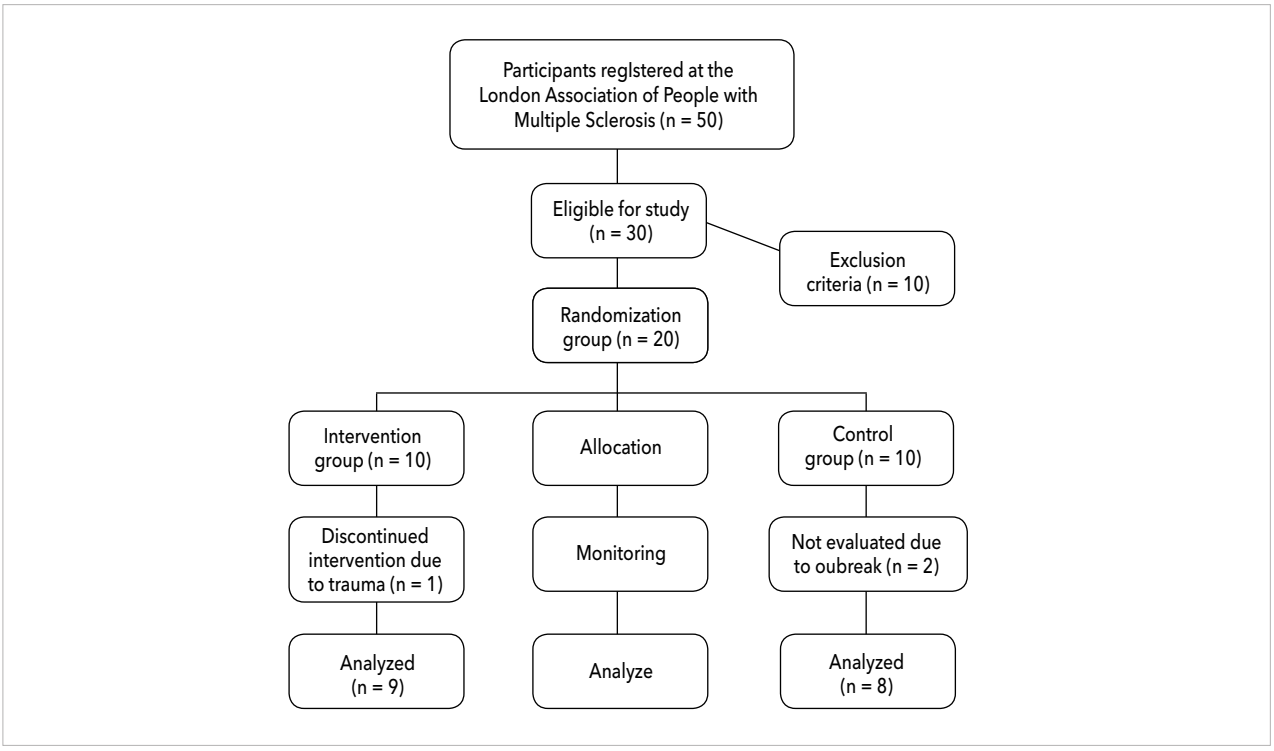

Figure 1 - Flowchart of the distribution of patients by group.

The IG consisted of a specific Shiatsu protocol associated with physical therapy exercises (the intervention protocol can be found in Table 1) created by two Shiatsu-trained professionals with extensive experience in the technique and a physical therapist with extensive training and experience in neurofunctional physical therapy, with an average duration of 60 minutes, attended once a week, totalizing physiotherapy 8 appointments. CG patients received an educational booklet and were invited to exercise regularly, to maintain their usual activities and standard medical care, and to be monitored regularly during this period; after reevaluation, these patients were invited to participate in the treatment (intention-to-treat analysis).

Table 1 - Training protocol for intervention in people with multiple sclerosis

Positioning	Therapy
Part 1 - Shiatsu points, manual techniques and passive mobilization[21]	
Patient in prone position with head resting on pillow and relaxed arms.	1) Sacral to cranial (cervical) sliding; 2) Transverse process adjustment; rotational pressure - circular over the shoulder blades; 3) Pressure applied by the therapist with both thumbs for 5 seconds and repeated three times at the following Shiatsu´s points: occipital region (GB20)*, oblong medulla (GV16), inter-scapular (BL14), suprascapular (VB-21), brachomedial (HT8), infra-scapular (BL-17), lumbar crest (BL23), sacral (BL25;BL 26), gluteal (GB29), Namikoshi point, femoral posterus (BL36, BL37) , popliteal (BL40) posterior crural (BL57) BP6 (ankle)*, calcaneal tuberosity (BL60), plantar region (R1).
Right and left lateral decubitus: patient with extended lower limbs.	4) Passive upper trunk rotation exercise with hand stabilizing in pelvis and shoulder facilitation - 3 repetitions; 5) Passive lower trunk rotation exercise with hand stabilizing at shoulder and skin facilitation - 3 repetitions; 6) Passive mobilization of shoulder blade; 7) Sliding massage on triceps and buttocks; 8) Lumbar vertebrae rotation maneuver.
Supine: patient with extended lower limbs, arms at sides, relaxed, palms up.	9) Global pompage; 10) Upper trapezoid pompage; 11) Pressure applied by the therapist with both thumbs for 5 seconds and repeated three times at the following Shiatsu´s points: medial brachial region (CY1; CY3), ulnar fossa (HT3), antebrachial region (LU5, CY3, HT3), deltopectoral groove (LU1), lateral brachii (LI14), lateral forearm, dorsal region of the hand (LI4), dorsal finger region(HT7), palmar (CY8), femoral anterior (ST34), femoral medial (GB31), femoral lateral(ST-36),patellar (ST-35), tarsic region (ST-41) and dorsal crural region toes (ST-44) and digital (RL-3)*.
Part 2 - Active exercises and balance training[22]	
Supine	1) Lumbar flexion: orthostatic position; feet farther than the shoulders; the trunk flexed forward until the hands touch the ground and return to the initial position, for 30 seconds, one repetition. 2) Active hip abduction exercise for 30 seconds, one repetition. 3) Active shoulder flexion exercise with extended elbows holding a ball, 3 sets of 10 repetitions. 4) Lying hip lift: dorsal decubitus on mat (ground); legs flexed at 90 degrees; patient extends hip keeping the shoulders and arms in the ground, contracting the glutes and abdomen; the movement goes up to the hip to align with the spine and then returns to the initial position, 3 sets of 10 repetitions. 5) Patient with flexed knees, with the aid of the ball, performs active trunk flexion exercise, contracting the abdomen. 3 sets of 10 repetitions.
Sitting on the chair	6) Active knee extension and flexion exercise, 3 sets of 10 repetitions. 7) Patient with crossed upper limbs in the chest performs the sitting and rising motion of the chair, 1 set of 10 repetitions. 8) Balancing exercises: standing balance will be worked, in which the patient will stay with only one foot fixed on the ground and another suspended, first with open eyes and then with closed eye.

Note: BL = bladder; CY = conception vessel; HT = heart; GB = gallbladder; GV = governor vessel; KI = kidney; LI = large intestine; LR = liver; LU = lung; SI = small intestine; SP = spleen; ST = stomach; TE = triple energizer; R1 = Yongquan point.

Results

In total, 17 (9 men and 8 women) people with MS, aged 25 to 70 years (45.18 ± 3.06 years), participated in this study. The frequencies of the types of sclerosis that composed the sample were 88.2% relapsing-remitting MS with a mean time of diagnosis of 9 ± 4.63 years. The characterization of the sample is shown in Table 2. After the intervention, for data analysis, eight patients remained allocated in the CG and nine patients in the IG (Figure 1). Table 3 describes the results obtained in the comparison of pain and fatigue between the groups.

The statistical power of the results was calculated using the power and sample size program. The difference in means between two groups was used in the treatment group (-2.89 ± 1.75) and in the control group (1.033 ± 0.921) by the VAS variable. with a power value equal to 1.

Table 2 - Sample characterization - epidemiological profile

Variable	Sample total (Average/Frequencies%)	Control group (n = 8)	Intervetion group (n = 9)	p-value
Gender (men/women)	9/8 (52.9/47.1)	5/3(62.5/37.5)	4/5 (44.4/55.6)	0.63
Age (years)	45.18 ± 12.63	46.88 ± 15.60	43.67 ± 10.03	0.33
Time of diagnosis (years)	8.00 ± 4.52	7.25 ± 5.23	8.67 ± 4.00	0.34
EDSS	2.91 ± 1.20	3.06 ± 0.97	2.77 ± 1.41	0.44
MS type (RR/others)	15/2 (88.2/11.8)	6/2 (75/25)	9/0 (100/0)	0.20
Physical therapy (Yes/No)	4/13 (23.5/76.5)	2/6 (25/75)	2/7 (28.5/71.6)	0.66
Physical activity (Yes/No)	4/13 (23.5/76.5)	3/5 (37.5/62.5)	1/8 (11.1/99.9)	0.24
ND4	1.65 ± 2.02	0.38 ± 0.74	2.78 ± 2.16	0.006*
VAS	2.29 ± 2.80	1.25 ±1.83	3.22 ± 3.27	0.009*
MFIStotal	39.47 ± 29.67	33.88 ± 21.68	44.44 ± 35.91	0.07
MFIS >38	52.9% (9)	50.0% (4)	55.6% (5)	0.60

Note: EDSS = Expanded Disability Status Scale; MS = multiple sclerosis; RR = Relapsing-remitting; ND4 = questionnaire for neuropathic pain; VAS = visual analog scale; MFIS = Modified Fatigue Impact Scale. Absolute frequencies, T-test for comparison of means between groups, and chi-square for frequencies.

Table 3 - Comparison of pain and fatigue between intevention group and control of multiple sclerosis patients

Variables	Intervention group (n = 9)				Control group (n = 8)			
	Pre-intervention	Post-intervention	(95% CI)	p-value	Pre-assement	Post-assement	(95% CI)	p-value
ND4 (0-10)	2.78 ± 2.16	2.0± 2.12	[-1.3;2.9]	0.43	0.38 ± 0.744	2.25 ± 2.71	[-3.7;0.04]	0.05
ND4	4 (44.44%)	2 (22.22%)	-	0.72	0	2 (25%)	-	0.03
VAS (0 -10)	3.22 ± 3.27	0.33 ± 1.00	[0.50;5.27]	0.02*	1.25 ± 1.83	3.63 ± 2.38	[-4.65;-0.09]	0.04*
MFIS total (0-84)	44.44 ± 35.91	35 ± 31.70	[-8.98;19.78]	0.068	33.88 ± 21.68	25.13±24.22	[-9.98;19.78]	0.37
MFIS cognitive (0-40)	18.56 ± 14.03	15.00±14.85	[-0.87;7.99]	0.10	11.13±11.49	9.38±10.92	[-7.40;10.9]	0.665
MFIS physicist (0-36)	23.22 ± 18.80	17.00 ±14.28	[-0.93;13.37]	0.080	19.25±10.75	13.25±13.17	[-5.55;17.55]	0.25
MFIS psychosocial (0-8)	3.33 ± 3.35	3.00 ± 3.53	[-0.75;1.42]	0.500	3.88 ± 3.18	2.50 ± 2.50	[-1.44;4.19]	0.28
Fatigue (MFIS > 38)	5 (55.6%)	4 (44.4%)	-	0.040*	4 (50%)	3 (37.5)	-	0.11

Note: Test t and chi-square. ND4 = questionnaire for neuropathic pain; VAS = visual analog scale; MFIS = Modified Fatigue Impact Scale. Data are expressed in median (95% confidence interval); *p < 0.05.

Discussion

Shiatsu associated with physical therapy reduced the pain and fatigue intensity of the patients. with a statistically significant difference between TG and CG. Pain is one of the signs of excess vital energy at points in the meridian where energy flow has been blocked. Most of the pain observed in this study with Shiatsu-associated physical therapy can be attributed to the unblocking of vital energy flow by pressure stimulation of the meridians and their respective points, helping to restore energy balance according to Shiatsu principles. There is evidence of involvement of neural mechanisms, such as the Gate Control Theory of Pain, and release of endogenous opioids with the acupressure technique.[11,14,23] It may be suggested that Shiatsu produces analgesia by the same mechanisms.[23]

From the point of view of Western medicine, the reduction in pain observed in this study can be attributed to reduced muscle tension, increased circulation favoring the removal of toxic metabolism products and release of natural painkillers such as serotonin, provided by Shiatsu acupressure and associated with active and stretching exercises of the intervention protocol.[24]

MS patients often request alternative therapies in different ways, but the effectiveness of these therapies has not been demonstrated in patients with MS. A recent study found that 50-75% of MS patients used alternative therapy because it reduces the severity of painful symptoms and offers functional improvement.[25]

Castro-Sánchez et al.,[26] investigating the effectiveness of an aquatic exercise program against pain and other symptoms in MS patients, found that the experimental group showed a significant decrease in pain VAS score after week 20 ($p < 0.039$). In our study, there was a reduction in pain in the TG ($p = 0.023$) assessed by VAS after eight weeks of intervention. In addition, the CG showed worsening of pain ($p = 0.043$) on reevaluation. In the study by O'Connor et al.,[27] 75% of patients reported pain within one month of evaluation.

In addition to pain, fatigue and depression are clinical conditions reported in patients with MS. Fatigue and depression are one of the strongest psychiatric predictors and should be considered as an integral part of treatment. These symptoms may be present early in the course of the disease, as well as specific cognitive impairment may be found in more than half of the patients in the early stages. Fatigue can be considered a multifactorial factor and is attributed to primary factors, such as inflammation and demyelination, and factors secondary to the illness such as problems with sleep, depression and lack of physical activity.[28]

In our study, the mean total MFIS was 39.47 ± 29.67, and 52.9% scored higher than 38 points on this scale, which corresponds to the presence of fatigue. According to Ribas et al.,[28] it was found through the application of the MFIS that 66.7% of participants experience fatigue, in agreement with Lopes et al.,[29] that state that fatigue is considered a common symptom in MS, affecting about 50% to 70% of individuals. In Brazil, fatigue is present in 67.4% of MS patients, and it is very important to evaluate specific fatigue scales adapted to the Brazilian population.

In our study, we observed that the TG presented fatigue reduction, related to the score > 38, $p = 0.040$. In patients with neurological diseases, fatigue is different from that reported by others, leading to greater impairment of quality of life. According to Manjaly et al.,[30] fatigue can be defined as "a subjective absence of physical and/or mental energy that is perceived by the individual to interfere with usual and designated activities". Unlike what happens in other situations, in MS fatigue is more intense, common throughout the course of the disease and appears even when performing small efforts;[30] further it acts directly on the functional capacity of exercise.[31] In a study that aimed to determine the effects of aerobic exercise in MS patients, McCullagh et al.[32] identified improvement in exercise capacity, QOL and lower levels of fatigue after three months and after six months of intervention.

A systematic review found that physical training is associated with improved activity and walking mobility in MS patients.[33] Individuals with MS should be encouraged to undergo physical therapy and physical activity to reduce progressive impairment of mobility, especially given the prevalence of inactivity among these patients, which in our total sample was 76.5% of physical inactivity/non-physical therapy practice.

According to the research conducted by this work, we can conclude that Shiatsu is an effective technique in the treatment against MS, resulting in reduction of fatigue and pain. Although the current study provides important information on the benefits of Shiatsu on improving the quality of life of MS patients, it has some limitations that should be considered. First, we included

only individuals with mild to moderate MS. Our results, therefore, may not be generalizable to people with more severe MS. With only seventeen subjects in our study, we could not compare the differences in the training response of participants with different levels and forms of MS. Additional studies with a more representative sample size could strengthen the findings of this study.

Conclusion

Shiatsu associated with physical therapy was effective in reducing pain and fatigue in individuals with MS. These findings are significant given the prevalence of fatigue and pain in people with MS, and the extent to which these symptoms affect an individual's perception of health and quality of life. Concerns related to MS usually include the risk of causing an increase in symptoms, such as fatigue or pain. However, this study showed that exercise-associated Shiatsu is safe for people with MS and can be applied in the clinical practice of MS patients to achieve analgesia and improved fatigue. The subjects were not followed up in medium and long term, and it was not possible to verify the long term effects of Shiatsu.

Authors' contribution

All authors contributed to the study conception and discussion of the results. MMAF, RN, HGGR were responsible for the data collection and manuscript writing; MMAF, RTN, GAS and JMB, for the data analyses. RN, RTN, GAS, JMB and HGGR contributed to the critical review of the manuscript, and MMAF, RTN, GAS and JMB to the final supervision of the manuscript writing.

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