Original Article
2024, 14(2): 7-15
DOI: 10.22038/EBCJ.2024.77231.2959

Received: 13/01/2024
Accept & ePublished: 18/06/2024

Evidence Based Care Journal
http://ebcj.mums.ac.ir
Online ISSN: 2008-370X

The Effect of Sole Reflexology Massage vs. Stretching Exercises on Fatigue Dimensions in Patients with Rheumatoid Arthritis

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Abstract

Background: Fatigue is the most common complaint among patients with rheumatoid arthritis, leading to decreased productivity and reduced quality of life.

Aim: The present study was conducted with aim to compare the effect of sole reflexology and stretching exercises on fatigue of rheumatoid arthritis patients.

Method: This clinical trial study was conducted on patients with rheumatoid arthritis in Yasuj city of Iran during 2017-2018. Participants were selected through convenience sampling method but randomly allocated to one of the three groups using randomized block allocation. Multidimensional fatigue questionnaire was used to collect data at two times of pre and post interventions. The interventions were performed during 30 minutes per session for three sessions per week over one month.

Results: Mean scores of global fatigue before the interventions in the sole reflexology group was 80.72±8.61, in stretching exercise group 81±7.30, and in control group (76.43±8.17), however, these values for post intervention were reported to be 68.72±8.59, 50.95±5.73, and 76.82±7.43, respectively. Intergroup comparison showed significant differences between the sole reflexology and stretching exercise groups with the control group (p<0.001); also the two intervention groups significantly differed (p<0.001).

Implications for Practice: Both sole reflexology and stretching exercises could improve fatigue of patients with rheumatoid arthritis, but this improvement was higher by stretching exercises than sole reflexology.

Keywords: Fatigue, Massage, Reflexology, Rheumatoid Arthritis, Stretching Exercises

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Introduction

Rheumatoid arthritis (RA) is the most common type of autoimmune arthritis (1). RA is characterized by synovitis due to the continuous accumulation of inflammatory infiltrate into the synovial membrane, leading to gradual joint architecture destruction (2). The prevalence of RA ranges from 0.5% to 2% in the general population (3). This systemic disease can also affect organs close to joints, such as lungs, heart, blood vessels, kidneys, and liver. Thus, malaise, weight loss and fatigue are also found in RA patients (4). The results of Overman et al.'s study showed that severe fatigue was observed in 41 to 57 % of patients with a single inflammatory rheumatic disease such as rheumatoid arthritis (5). Rheumatoid arthritis is a progressive, chronic systemic inflammatory disease which imposes a significant economic burden on patients and societies if not controlled (6). Half of the affected patients will not be able to work within 5-10 years of its diagnosis. The resulting physical disabilities lead to a significant economic burden and reduce their productivity and quality of life (7). Also, in addition to physical problems such as fatigue and pain that limit the daily activities of these patients, they are more susceptible to anxiety, depression and cognitive disorders compared to healthy population (8).

Various treatments are used for rheumatoid arthritis, but the most important is Glucocorticoids. Glucocorticoids are powerful, broad-spectrum anti-inflammatory agents, but their use is complicated by an equally broad range of adverse effects (9). Therefore, it is important to use non-pharmacological methods in addition to drug treatment. It is necessary for the patient and his/her family to participate in the disease control program through simple and acceptable educational methods and also low cost non-pharmacological techniques (NPT). NPTs, including many exercise modalities, psychological interventions, physio- and balneotherapy, dietary interventions, and education with their complex action can have a synergistic additive effect with targeted pharmacological therapies (10).

It is very necessary to prevent the progression of the disease, frequent hospitalizations and subsequent complications for better management of this chronic disease. Therefore, the present research was conducted with aim to compare the effect of sole reflexology massage and stretching exercises on the dimensions of fatigue in patients with rheumatoid arthritis.

Methods

This clinical trial study was conducted on RA patients referring to the rheumatology clinic of Yasuj city in Iran during 2017-2018. Ninety and one RA patients were assessed for eligibility. Sixteen patients were excluded and 75 patients were included in the study. Sample size was calculated based on G power 3.1.9.2 with input parameters of $\alpha = 0.05$, $1-\beta = 0.8$, number of groups (n=3) and d=0.4 or effect size. Proposed values of the effect size by Cohen for ANOVA (f test) for mean difference and the three independent groups was selected. Finally, total sample size was estimated to be 66 participants that considering 10% drop of population, a total sample size of 75 participants was estimated. Eligible participants were selected using a convenience sampling method. They were then equally assigned to one of the three groups of sole reflexology (n=25), stretching exercises (n=25) and control (n=25) using randomized block allocation. Since there were three groups in this study, we created six blocks, namely, ABC, ACB, BAC, BCA, CAB, and CBA based on the factorial rule. There were three participants in each block with ratio 1.1.1 for each group. However, their arrangement varied. Six participants dropped out due to emigration, aggravated clinical condition or unwilling to continue the study (Figure 1).

The inclusion criteria were the patient's willingness to participate in the study, age > 18 year, final diagnosis of RA by a rheumatologist, at least one year passed from diagnosis of the disease, obtaining a total fatigue score of 50 based on multidimensional fatigue inventory (MFI), no use of narcotic analgesic, no history of skin diseases, and sensory and vascular disorders in the legs, no history of sole reflexology massage during three months ago, having no wound or ulcer, fracture, and movement disorders in feet, no history of sports program participation on a regular basis over the previous 6 months, and being allowed to participate in the sports program with the opinion of a specialist doctor. The patient's unwillingness to participate in the study and recurrence of disease were considered as exclusion criteria.

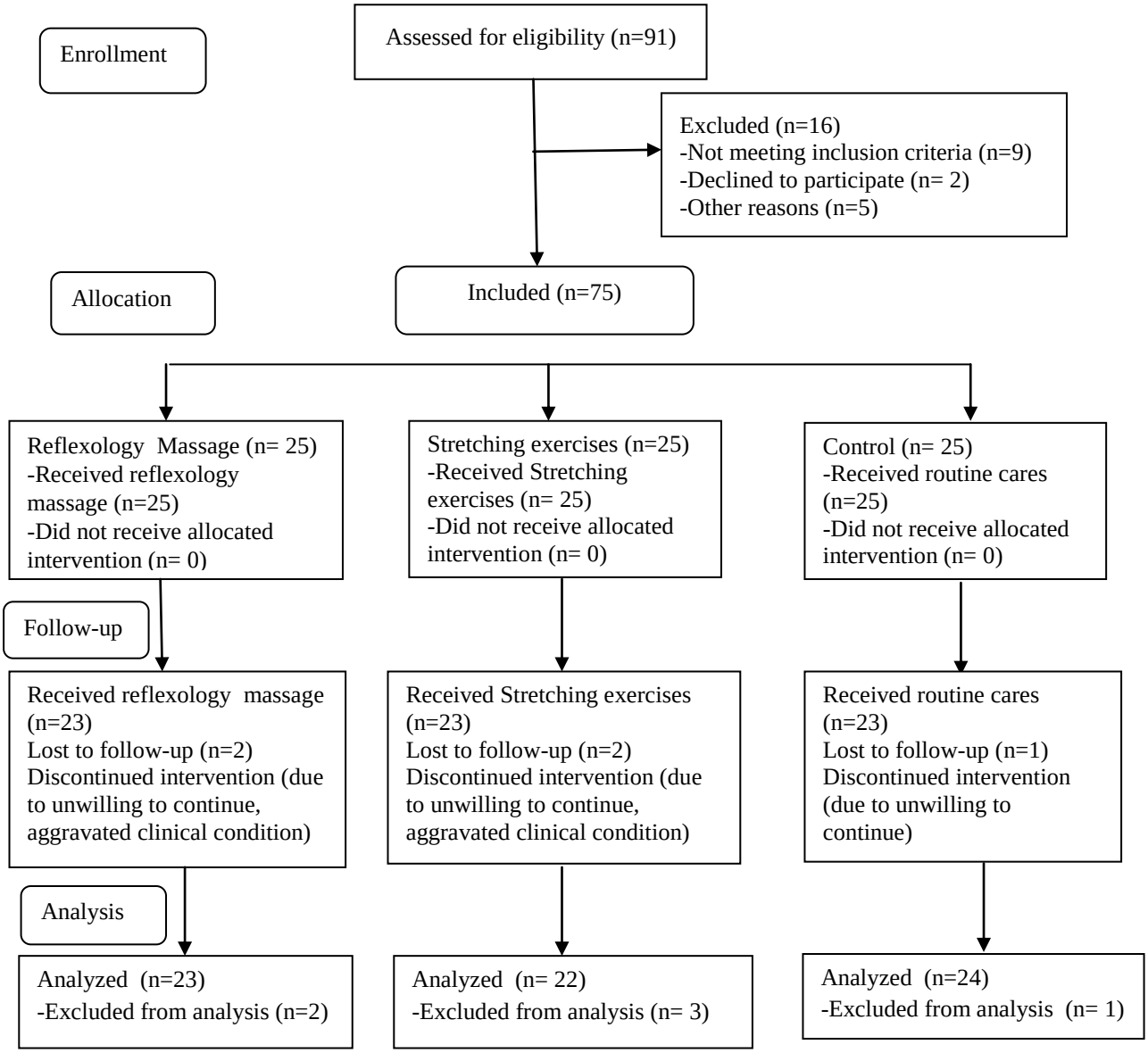

Figure 1. Flow diagram of the study process

The interventions were performed in each group over one month, three sessions per week (12 sessions in total), and 30 minutes per session. Sole reflexology intervention was performed based on the protocol in three stages: preparation (5 minutes), warming (10 minutes), and foot reflexology techniques (15 minutes). The reflex point started from the end of the first metatarsal phalangeal joint and reaches the heel (11). Preparing and warming up the feet include warming the feet by hands by performing specific movements, grabbing the sole and forefoot with two hands and creating backward bending movements, bending the foot sole, outward and inward rotation, and some heel movements. In order to stimulate the reflex points, massage was applied with hands fingers in the form of reciprocal movements by applying a pressure of about 0.5 cm (12). To perform sole reflexology massage, the patient was placed in a semi-sitting position with the head placed at an angle of15 to 30 degrees .The participants completed the fatigue multidimensional questionnaire at two times, i.e., one time on the day of onset of intervention and before intervention, and the other time on the last day, i.e., 10 minutes after the last session of the intervention. Stretching exercises consisted of 10 minutes of warm up at the beginning, 15 minutes of the desired stretching exercises, and then 5 minutes of cooling down (13). Moreover, the patients in the control group received only the routine treatment. The fatigue dimensions were assessed after the completion of the stretching exercises within 4 weeks (3 sessions per week). The data collector and statistical analyst were blinded to the patients in the three groups.

Multidimensional fatigue inventory (MFI) designed by Smith et al. was used to assess the fatigue dimensions. This inventory has 20 items with 5-point Likert scale in five subscales of general fatigue, physical fatigue, mental fatigue, reduced activity and reduced motivation. The scores range from 1 (*strongly agree*) to 5 (*strongly disagree*). Each dimension consists of 4 items. The total score of each dimension varied 5-20 and global scores range from 20-100. Higher scores indicate more fatigue. The patients with a global fatigue score of ≤ 50 were included in the study. The validity and reliability of the Persian version of this inventory has been confirmed in previous studies (14).
Data were analyzed using IBM SPSS Statistics (version 19) using descriptive and inferential statistics with 95% confidence interval (CI). The distribution of outcome variable was checked. Due to the normal distribution, the results of paired samples T test and one-way analysis of variance (ANOVA) were reported for intragroup and intergroup comparison, respectively. P<0.05 was considered statistically significant.

Ethical Consideration
The informed written consent was obtained after explaining the aim of the study. This study was confirmed by the research ethics committee (REC) of Yasuj University of Medical Sciences (YUMS) (IR.YUMS.REC.1395.151) and was registered in the Iranian Registry of Clinical Trials (IRCT) (IRCT2016112931166N1).

Results
Seventy and five RA patients were included in the present study; however, 69 (92%) participants completed the study. The participants' total mean of age was 44.6±10 years (range of 28-68 years). Moreover, 36 (52%) of the participants were male and the rest were female. There was no significant difference between the three groups in terms of demographic characteristics (p>0.05) (Table 1).

Table 1: The characteristics of participants in the three groups

Group Variable	Stretching exercises	Sole reflexology	Control	Total	p-value*	Statistic
Gender, n (%)						
Male	14 (56.0)	12 (48.0)	13 (52.0)	39 (52.0)	0.091	0.01
Female	11 (44.0)	13 (52.0)	12 (48.0)	36 (48.0)		
Place of residence, n (%)						
Urban	19 (76.0)	18 (72.0)	20 (80.0)	57 (76.0)	0.122	20.2
Rural	6 (24.0)	7 (28.0)	5 (20.0)	18 (24.0)		
Occupation, n(%)						
Worker	1 (4.0)	1 (4.0)	2 (8.0)	4 (5.3)		
Employed	5 (20.0)	7 (28.0)	6 (24.0)	18 (24.0)		
Non-govermental	8 (32.0)	5 (20.0)	5 (20.0)	18 (24.0)	0.184	28.02
Unemployed	3 (12.0)	4 (16.0)	5 (20.0)	12 (16.0)		
Housewife	7 (28.0)	7 (28.0)	6 (24.0)	20 (26.7)		
Student	1 (4.0)	1 (4.0)	1 (4.0)	3 (4.0)		
Education level, n(%)						
Elementary	9 (36.0)	2 (8.0)	7 (28.0)	19 (25.3)		
High school	4 (16.0)	4 (16.0)	5 (20.0)	13 (17.3)	0.385	5.3
Diploma	8 (32.0)	14 (56.0)	10 (40.0)	31 (41.3)		
Higher than diploma	4 (16.0)	5 (20.0)	3 (12.0)	12 (16.0)		
Marital status, n(%)						
Single	6 (24.0)	3 (12.0)	2 (8.0)	11 (14.7)	0.10	1.5
Married	19 (76.0)	22 (88.0)	23 (92.0)	64 (85.3)		

*paired samples t-test

The result of paired samples t-test for intragroup comparison showed that the participants in the two groups of sole reflexology and stretching exercises had significantly lower score of global fatigue and types of fatigue (except reduced motivation) in post interventions compared to before the interventions (p>0.05). However, the control group did not differ in terms of global fatigue and types of fatigue after the interventions (p>0.05) (Table 2). Intergroup comparison indicated that

the three groups did not differ in terms of global fatigue and types of fatigue before the interventions (p>0.05). The overall analysis of one-way ANOVA test for intergroup comparisons indicated significant differences among the three groups for global fatigue and types of fatigue (except reduced motivation) (p<0.001) (Table 2).

Table 2. Comparison of patients' global fatigue and the types of fatigue

Fatigue type	Group time		Mean ± SD Control	Sole reflexology	Stretching exercises	Intergroup p-value*	f
General fatigue	Intragroup	Pre	15.95±2.40	15.90±2.38	16.45±2.24	0.675	0.39
		Post	15.74±2.59	14.36±2.88	10.33±1.65	0.001	31.72
		M. difference	0.21	1.54	6.12		
		Std. Error mean	0.41	0.59	0.52		
		P value**	0.603;(0.52)	0.016;(2.61)	0.001;(11.57)		
Physical fatigue	Intragroup	Pre	15.73±1.88	16.4±1.65	16.04±1.33	0.394	0.94
		Post	15.34±2.18	13 ±2.28	10.16±2.20	0.001	30.86
		M. difference	0.39	3.40	5.87		
		Std. Error mean	0.36	0.39	0.54		
		P value**	0.296;(1.07)	0.001;(8.67)	0.001;(10.82)		
Reduced motivation	Intragroup	Pre	15.34±2.6	16.09±2.52	16.41±2.08	0.306	1.20
		Post	15.26±2	15.95±1.98	16±1.47	0.307	1.20
		M. difference	0.86	0.13	0.41		
		Std. Error mean	0.16	0.2	0.48		
		P value**	0.604;(0.53)	0.504;(0.68)	0.403;(0.85)		
Reduced activity	Intragroup	Pre	15.21±1.97	16.27±2.51	16.12±1.77	0.192	1.69
		Post	15.13±2.24	14.25±3.40	10.16±1.99	0.001	24.50
		M. difference	0.86	2.01	5.95		
		Std. Error mean	0.14	0.56	0.56		
		P value**	0.539;(0.62)	0.001;(3.6)	0.001;(10.46)		
Mental fatigue	Intragroup	Pre	15.26±2.02	15.90±1.94	16.04±1.48	0.306	1.20
		Post	15.30±1.94	13±2.82	10.20±1.44	0.001	33.82
		M. difference	0.04	2.90	5.83		
		Std. Error mean	0.18	0.56	0.4		
		P value**	0.814;(-0.23)	0.001;(5.1)	0.001;(14.5)		
Global fatigue	Intragroup	Pre	76.43±8.17	80.72±8.61	81±7.30	0.104	2.344
		Post	76.82±7.43	68.72±8.59	50.95±5.73	0.001	77.28
		M. difference	0.39	12	30.04		
		Std. Error mean	0.89	1.49	1.55		
		P value**	0.663;(-0.43)	0.001;(8.01)	0.001;(19.34)		

*one-way ANOVA test; **paired samples t-test

Table 3. Post Hoc multiple comparisons using Bonferroni test for mean difference of fatigue types on post interventions

Types of fatigue	General fatigue			Physical fatigue			Reduced activity			Mental fatigue			Total fatigue		
Paired comparison: (I)group(J) group	Diff	Std. Err	p-value	Diff	Std. Err	p-value	Diff	Std. Err	p-value	Diff	Std. Err	p-value	Diff	Std. Err	p-value
Stretching exercises- Sole reflexology	-4.03	0.71	0.001	-2.83	0.67	0.001	-4.08	0.76	0.001	-2.79	0.63	0.001	-17.76	2.15	0.001
Stretching exercises-Control	-5.4	0.70	0.001	-5.18	0.66	0.001	-4.96	0.75	0.001	-5.09	0.62	0.001	-25.86	2.13	0.001
Sole reflexology -Control	-1.37	0.72	0.183	-2.34	0.66	0.003	-0.87	0.77	0.78	-2.3	0.63	0.002	-8.09	2.17	0.001

Since the overall analysis for post interventions was significant, multiple comparisons using Bonferroni test were performed. The significance levels showed that both the sole reflexology group and stretching exercises group significantly differed with the control group. Secondly, the sole reflexology group and stretching exercises differed from each other. In other words, the observed changes (improvement) of the participants' fatigue in the group which received stretching exercises were more than the group which received sole reflexology (Table 3).

Discussion

The purpose of the present study was to compare the effects of sole reflexology versus stretching exercises on the fatigue of RA patients. The results of the current research showed that both sole reflexology and stretching exercise had improved fatigue of RA patients. The results of the meta-analysis by Torres-Costoso et al. showed that combined exercise can reduce fatigue in multiple sclerosis (MS) patients (15). This finding is in agreement with the results of other studies, such as fatigue reduction in the study by Aslan et al. (16), physical fatigue and anxiety reduction and sleep quality improvement in MS patients in the Sajadi et al.'s study (17), improving respiratory symptoms in patients with asthma in the study by Sarikhani et al. (18) and pain relief following Swedish massage in the study by Sahraei et al. (19). The results of the study by Pazokian et al. also showed that exercise, either in the form of aerobic or stretching exercise has significant effects on reducing fatigue severity in MS patients, but aerobic exercise alonh with stretching exercise is more effective in reducing fatigue. In addition, stretching exercises, especially lower limb stretching exercise in these patients reduced muscle spasm and fatigue and increased flexibility (20). According to the results of Behboodi et al.'s research, aerobic exercises in the form of stretching exercises led to fatigue reduction in nurses working in neonatal intensive care unit (21).

Lactic acid accumulation is one of the most important mechanisms leading to fatigue. It is thus believed that lactic acid elimination is of significant importance for improvement of patients' fatigue. Massage affects the blood circulation and flushes out lactic acid, leading to fatigue and stress reduction (19), which is one of the most effective factors in the occurrence or exacerbation of symptoms in RA patients. Stretching exercise also increases the length of muscles, increases the blood supply to muscles, and facilitates the nutrients transfer to cells (23), causing fatigue reduction in patients.

As showed by the results of the present study, there was a significant fatigue difference between sole reflexology massage and stretching exercise groups after intervention, so that stretching exercise reduced fatigue in the studied subjects more than sole reflexology massage. The results of the study by Sadeghi et al. also showed that stretching exercise significantly reduces pain intensity in RA patients, but sole reflexology massage has no significant effect on pain reduction in these patients (24). Additionally, the results of the study by Hu et al. indicated that doing any exercise is better than no exercise for RA patients. However, they have not determined the exercise intensity, frequency, and period to achieve the better results (25). Moreover, the results of the research by Ducran et al. showed that an exercise program could cause a significant improvement in sleep quality and fatigue in RA patients (26).

As aforementioned, stretching exercise increases the length of muscles and blood supply to muscles, and facilitates the nutrients transfer to cells (23). On the other hand, strengthening the muscles around the joint and reducing the pressure applied on them are among other effects of stretching exercise (27), and this may be the reason for its greater effect on fatigue in the present study. Metin and Ozdemir's research which compared the effect of reflexology and aromatherapy, showed that reflexology reduces the pain and fatigue of patients with joint rheumatism earlier than aromatherapy (28). Also, Bakir et al. and Sarikhani et al. have shown that reflexology can reduce pain and breathing problems of patients (29,30). Reflexology activates the parasympathetic and then sends the neurotransmitter. In fact, it sends signals to the brain, internal organs, and bioelectrics throughout the body. The signals sent to the brain send alpha waves to the brain. Nerve impulses from reflexology are transmitted to the hypothalamus to produce corticotrophin-releasing factor (CRF). CRF stimulates the pituitary gland to increase production, so that the adrenal medulla produces endorphins. Endorphins released in the bloodstream can exert a natural analgesic effect on inflamed tissues, and as a result, reduce pain and reduce fatigue (31,32). Therefore, it can be said that both stretching exercise and sole reflexology massage can be considered as part of nursing care, although it would have been

better to have more emphasis on stretching exercises in counseling patients. Overall, it can be said that considering the importance of fatigue reduction in RA patients, educating methods which can help patients change their lifestyle and bring them the required power and ability to control the symptoms of the disease is among the most valuable health care services. Among the strengths of this research is to make attempts to enable RA patients to control and manage the symptoms of the disease. However, this study has some limitations, namely not investigating the long-term durability of the effect of the studied interventions. It is suggested that it be considered in the future studies.

Implications for practice

Considering the findings of the present study, sole reflexology massage and stretching exercise significantly affect the improvement of fatigue in RA patients, but fatigue attenuation variation was higher in stretching exercises than in sole reflexology massage. As the improvement of the symptoms is among the main objectives of this chronic disease, the health team members are suggested to consider the implementation of these techniques in the therapeutic and educational program of these patients. Moreover, they are suggested to avoid the rapid progress of the disease by emphasizing the continuity of the above-mentioned techniques implementation, and to promote the rehabilitation program at home as much as possible.

Acknowledgments

The authors are gratitude to the Vice Chancellor for Research and Technology of Yasuj University of Medical Sciences (YUMS) and also all the patients and nurses who helped us to conduct this study.

Conflicts of interest

The authors declared no conflict of interest.

Funding

This research didn't receive financial resources from any organization.

Authors' Contributions

Ardashir Afrasiabifar: design and analysis of the results, Majid Sadeghi: implementation of the interventions and data collection, Shahla Najafi Doulatabad: design and data collection. All authors contributed to the writing of the manuscript and discussed on the manuscript.

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