

Effect of Foot Reflexology on Patients With Multiple Sclerosis: A Systematic Review of Current Evidence

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ABSTRACT

BACKGROUND: Individuals with multiple sclerosis (MS) commonly experience fatigue, discomfort, sleep problems, anxiety, and reduced quality of life. Studies have shown that foot reflexology can help relieve these symptoms. The objective of this current study is to systematically review the effects of foot reflexology on patients with MS.

METHODS: We conducted a systematic review of published literature in many databases, including PubMed, EMBASE, and Cochrane Library, from January 1, 2000, to January 27, 2022. With language restrictions, we included randomized controlled trials of foot reflexology interventions for MS that had any clinical or psychological symptom measurements as outcomes. The Cochrane risk-of-bias tool was used to assess evidence quality. Two authors independently screened titles and abstracts. Potential eligible articles were retrieved for full-text review. A third author checked for excluded records. All discrepancies were resolved through a discussion among the 4 reviewing authors.

RESULTS: A total of 154 studies were identified; 9 studies with 545 MS patients were included in this review. The most frequently reported findings of foot reflexology intervention in individuals with MS were reductions in fatigue, pain, muscle spasms, stiffness, and psychological symptoms and improvement in bowel and bladder functions and quality of life.

CONCLUSIONS: The findings suggest that foot reflexology could be a safe and effective modality to reduce the physical and psychological symptoms and also improve the quality of life for individuals with MS; however, well-designed, large-scale trials are required to confirm the effect.

Int J MS Care. 2024;26(2):43-48. doi:10.7224/1537-2073.2022-093

Multiple sclerosis (MS) is a chronic neurological condition characterized by demyelination of nerve cells in the central nervous system resulting in motor, sensory, cognitive, behavioral, and communication problems.¹ Globally, about 2.8 million individuals have MS and women are twice as likely to be diagnosed.² Multiple sclerosis affects individuals in their early adult life and has a huge impact on function, finances, and quality of life.³ Physical impairment (eg, weakness, stiffness, sensory dysfunction, vision loss), exhaustion, pain, incontinence, cognitive problems (eg, memory, attention, executive dysfunction), and psychological problems⁴ are a few of the multiple functional abnormalities that MS causes. Around 10% to 15% of individuals may have adverse effects from pharmacological treatments or find them ineffective.⁴ Persistent symptoms, perceived lack of effectiveness, and adverse reactions to immune-modulating treatments may lead to increased interest in complementary and alternative medicine therapy such as acupuncture, yoga, heliotherapy, exercise, and reflexology, which are also commonly used to improve quality of life and manage symptoms.⁴

Reflexology is a common therapy from complementary and alternative medicine.⁵ It works on the theory that certain reflex points on the palms and soles correspond to internal organs and glands.⁶ Previous studies have found that foot reflexology is effectively used in the management of various symptoms, including fatigue, stress, bowel and bladder dysfunction, and pain, and also improved sleep and quality of life in individuals with MS.^{6,7} There is no previous review showing the effect of foot reflexology on individuals with MS; therefore, we aimed to review the effect of foot reflexology on subjective and objective outcomes in this cohort.

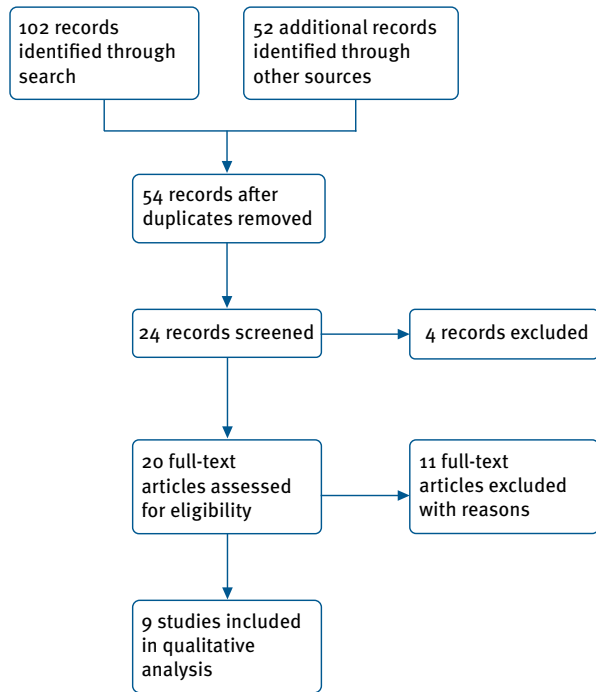
METHODS

Our systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses reporting guidelines (FIGURE 1).

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Note: Supplementary material for this article is available online at IJMSC.org.

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FIGURE 1. Flow Diagram of Preferred Reporting Items Obtained by Systematic Reviews and Meta-Analyses

Search Strategy

PubMed, EMBASE, Cochrane Library, Google Scholar, Scopus, and Web of Science were searched from inception to January 27, 2022 for the following keywords *multiple sclerosis AND foot reflexology OR zone therapy OR manual foot reflexology OR clinical foot reflexology OR reflexology*. In addition, the reference sections of all identified articles were manually searched and reviewed. The eligibility criteria were determined as per the Participants, Intervention, Control, Outcome, and Study (PICOS) framework. The study participants were individuals with MS (P). The studies examined and compared manual foot reflexology interventions with usual care, control, or placebo groups (I and C). The studies evaluated and compared at least 1 of the outcome measures (O). Only randomized control trials (RCTs), randomized crossover studies, cluster-randomized control trials, or quasi-experimental trials were included (S). Studies that included other interventions (eg, foot massage, acupuncture, auriculotherapy), were in languages other than English, and animal studies were excluded.

Study Selection Method

The studies were independently screened by 2 authors (BD, RP) for eligibility. In the first stage, titles and abstracts of studies were assessed; each author independently selected studies via the inclusion criteria and the remaining studies were selected through a full-text study. A third author (VMK) checked for excluded records. All discrepancies

were resolved through discussion between the 3 reviewing authors in the presence of a fourth review author (KM).

Data Extraction Method

Intervention details, outcome parameters, names of the authors, study design, and country and year of publications were independently extracted by 2 authors (CY, AA).

RESULTS

Included Studies

As shown in **TABLE**, the included research was done in Ireland (n = 1),⁸ the United Kingdom (n = 2),^{9,10} Iran (n = 5),^{6,11-14} and Turkey (n = 1).⁷ A total of 545 patients were enrolled in 9 trials, 8 RCTs^{6-9,11-14} and 1 crossover¹⁰ study. The duration of foot reflexology ranged from 30 minutes to 60 minutes per session for a duration of 4 weeks to 11 weeks. Four studies included only female participants^{6,11,12,14}; 5 studies had male and female participants.^{7-10,13}

Risk of Bias

The consensus of the Cochrane risk-of-bias tool is displayed in **FIGURES S1** and **S2**.

Random Sequence Generation

Eight studies^{6-9,11-14} had a computer-generated randomization, a random sectional allocation sequence, or used the sealed envelope approach, all of which have a minimal risk of bias; however, 1 study found that the development of random sequences carries a high risk of bias.¹⁰

Allocation Concealment

Six trials had unclear risks because how the data were obtained was not clear.^{6-9,11,13} Sequentially numbered, opaque, sealed envelope techniques were used in 3 trials, which were deemed to be low risk.^{10,12,14}

Blinding of Participants and Personnel

Two investigations revealed a substantial risk of bias due to a lack of blinding.^{6,10} Seven studies precisely defined the terms of various people who were blinded in the study and thus were found to have low risk.^{7-9,11-14}

Blinding of Outcome Assessment

Due to the author's involvement in data gathering, 5 studies were deemed high risk.^{6,7,10,12,14} Four trials were deemed low risk since they made it apparent that the expert analyzing the data was blind to group assignment and the intervention test.^{8,9,11,13}

Incomplete Outcome Data

All studies gathered information on all outcomes. Low dropout rates made all of the studies appear to be low risk.⁶⁻¹⁴

Selective Reporting

Because the hypotheses of 2 studies were expressly stated in the introduction or abstract, they had low risks of bias.^{8,10} Seven studies had a risk that was unknown because their hypotheses were not stated clearly.^{6,7,9,11-14}

Other Bias

Five studies were low risk because they appeared to have no other sources of bias.^{5,8,9,11,13} Four studies were determined to be of unclear risk.^{7,10,12,14}

Intervention Results

Mackereth et al¹⁰ conducted a crossover trial to compare the effects of reflexology and progressive muscle relaxation training on psychological and physical outcomes for individuals with MS. The trial's group 1 (n = 27) received progressive muscle relaxation training during a 40-minute session held once a week for 6 weeks. This was followed by a 4-week washout period. The cohort then received a 40-minute reflexology session once a week for 6 weeks. Group 2 (n = 26) received the reverse for the same time periods: reflexology training, washout, then progressive muscle relaxation training. Results from the 36-Item Short Form Survey and State-Trait Anxiety Inventory, plus salivary cortisol systolic and diastolic blood pressure, and heart rate levels were collected from the 50 patients (25 patients in each group) who completed the study. The authors concurred that reflexology helped individuals with MS feel less stressed.

Hughes et al⁸ examined the role of foot reflexology on pain in individuals with MS. A double-blind, randomized, sham-controlled clinical trial was designed to compare the effect of foot reflexology with sham reflexology. A total of 71 individuals with MS were randomly allocated to a foot reflexology group (n = 35) and a control group (n = 36). The intervention group was given foot reflexology with pressure massage; the control group was given sham reflexology (ie, standard foot massage with little pressure) using grapeseed oil. Both groups received weekly 45-minute treatments for 10 consecutive weeks. In the control group, 2 participants withdrew during the intervention and 2 participants withdrew during the follow-up period. The visual analog scale (VAS; for pain and spasms), the McGill Pain Questionnaire, the Multiple Sclerosis Impact Scale-29 (MSIS-29), the Modified Fatigue Impact Scale, the Fatigue Severity Scale (FSS), the Beck Depression Inventory-II, and the Barthel Index for Activities of Daily Living were given to both groups before and after the intervention. Follow-ups were carried out at 16 weeks and 22 weeks. Significant reduction in pain was observed in both groups when compared to baseline. No statistically significant difference was observed between groups.

Miller et al⁹ studied the effects of foot reflexology on 20 individuals with MS with moderate to severe disability through a single-blinded, randomized, placebo-controlled trial. Participants in the intervention group received weekly foot reflexology for 8 weeks (1 hour/week) while the control group received lower leg and foot massage for the same duration and time period. Muscle stiffness/spasm, body pain, quality of sleep, and bladder and bowel function were measured and the MSIS-29 given at baseline, week 8, and 8 weeks after the intervention (week 16). There were no

PRACTICE POINTS



The minimal electrical activity along the sensory nerves generated during reflexology might be beneficial in reducing the symptoms associated with multiple sclerosis.

Foot reflexology is a noninvasive, economical, nonpharmacologic treatment option that may be beneficial for individuals with multiple sclerosis. ■

significant improvements in the MSIS-29 between the groups; however, moderate reductions were noted in muscle stiffness at 8 weeks in the reflexology group.

A single-blind, randomized clinical trial was conducted by Nazari et al¹¹ to compare relaxation and foot reflexology in women with MS and fatigue. Seventy-five women with MS participated in the study and they were divided into 3 equal groups: reflexology, relaxation, and control. The intervention group received a twice-weekly 40-minute reflexology session for 4 weeks; the relaxation group received relaxation training (ie, Jacobson, Benson techniques) on the same schedule; the control group received routine medical treatment. Fatigue was assessed via the FSS before, immediately after, and 2 months after the intervention. Results showed that, after the intervention in the reflexology group, mean FSS scores were lower than those in the relaxation and control groups.

Nazari et al¹² conducted a similar trial in 2016. A single-blind, randomized, placebo-controlled trial followed the same outline (ie, 75 women with MS; 3 equal groups; same duration and pattern), but the Numeric Pain Rating Scale was used to assess pain before, immediately after, and 2 months after the intervention. Results showed that the pain severity decreased in the reflexology group when compared with the relaxation and control groups.

Mozhgan et al¹⁴ conducted another similar trial in 2017. A single-blind RCT followed the same outline (ie, 75 women with MS; 3 equal groups; same duration and pattern), but the Depression, Anxiety, and Stress Scale was given before, immediately after, and 2 months after the intervention. A mean reduction in anxiety, stress, and depression scores was noted immediately after the intervention in both the reflexology and relaxation groups when compared with the control group.

Nusrat et al⁶ also studied the role of foot reflexology in symptom relief in women with MS. The intervention group (n = 30) received 15 minutes of reflexology per foot 3 times

TABLE. Effect of Foot Reflexology on Individuals With Multiple Sclerosis

First author year country	Cohort	Duration and frequency	Outcomes
Mackereth 2009 ¹⁰ UK ^a	Individuals with MS N = 50	40 min weekly for 6 wk	STAI, SBP, HR, salivary cortisol level reduced significantly; SF-36 and DBP showed insignificant changes.
Hughes 2009 ⁸ Ireland	Individuals with MS R = 35 C = 36	45 min weekly for 10 wk	VAS score reduced significantly in reflexology group; McGill, FSS, MSIS-29, BI, and BDI showed significant changes in both reflexology and sham groups.
Miller 2013 ⁹ UK	Individuals with MS (moderate to severe disability) R = 10 C = 10	60 min weekly for 8 wk	No statistically significant differences in primary outcome (MSIS-29) and secondary outcomes (HADS, VAS) in severe disability.
Nazari 2015 ¹¹ Iran	Women with MS R = 25 Re = 25 C = 25	40 min twice weekly for 4 wk	Fatigue (FSS) significantly reduced in reflexology group vs relaxation and control groups.
Nazari 2016 ¹² Iran	Women with MS R = 25 Re = 25 C = 25	40 min twice weekly for 4 wk	NRS pain intensity score reduced significantly in reflexology group vs relaxation and control groups.
Soheili 2017 ¹⁴ Iran	Women with MS R = 25 Re = 25 C = 25	40 min twice weekly for 4 wk	DASS-21 score reduced in reflexology and relaxation groups more than in the control group.
Sajadi 2020 ¹³ Iran	Individuals with MS R = 33 C = 30	30-40 min twice weekly for 6 wk	CAS significantly improved but insignificant improvement in QOL for the reflexology group vs control group.
Ebrahimi 2020 ⁶ Iran	Individuals with MS R = 30 C = 30	30 min 3 times a week for 4 wk	FSS, SSI, and serum cortisol levels reduced significantly in reflexology group vs control group.
Doğan 2021 ⁷ Turkey	Individuals with MS R = 30 C = 30	30-40 min 3 times a week for 4 wk	Significant decrease in fatigue and VAS, combined physical and mental QOL improved in reflexology group vs control group.

BDI-II, Beck Depression Inventory-II; BI, Barthel Index for Activities of Daily Living; C, control group; CAS, Constipation Assessment Scale; DASS-21, Depression Anxiety Stress Scale-21; DBP, diastolic blood pressure; FSS, Fatigue Severity Scale; HADS, Hospital Anxiety and Depression Scale; HR, heart rate; McGill, McGill Pain Questionnaire; MFIS, Modified Fatigue Impact Scale; min, minute(s); MS, multiple sclerosis; MSIS-29, Multiple Sclerosis Impact Scale-29; NRS, Numeric Rating Scale; QOL, quality of life; R, reflexology group; RE, relaxation group; SBP, systolic blood pressure; SF-36, Short Form 36; SSI, Stress Symptoms Index; STAI, State Trait Anxiety Inventory; VAS, visual analog scale; wk, week(s).

^aThis study was a crossover study; all the rest were randomized controlled trials.

a week for 4 weeks. The control group (n = 30) received the same duration and frequency of simple foot massage. Fatigue and stress were examined through serum cortisol levels and scores on the FSS and the Stress Symptoms Index at baseline, immediately after the intervention, and 1 month after the intervention. The foot reflexology group recorded lower levels of cortisol and fatigue than the control group.

Doğan et al⁷ conducted an RCT of how reflexology affected pain, fatigue, and quality of life in individuals with MS. The reflexology group (n = 33) had 3 sessions of reflexology a week for 12 weeks; the control group received usual care. Measurements, including the VAS, FSS, and the Multiple Sclerosis Quality of Life-54 (MSQOL-54) were taken at baseline, weekly, and monthly. The reflexology group had

a significant reduction of pain and fatigue and improved quality of life when compared with the control group.

Sajadi et al¹³ studied the effect of foot reflexology on constipation and quality of life in individuals with MS. A double-blind, randomized, controlled trial compared foot reflexology (n = 33) and control (n = 30) groups. The intervention group received a 30- to 40-minute session of reflexology per foot twice a week for 6 weeks; the control group received pressure-free foot massage for the same duration. The Constipation Assessment Scale (CAS) and Short Form 36 Quality of Life questionnaire (SF-36) were given before and after the intervention. After the intervention, CAS scores were statistically significant in the foot reflexology group; there was no significant difference in quality of life between the 2 groups.

Subjective Outcome Measures

Fatigue

Fatigue is a highly disabling symptom of MS, which often manifests as the first sign and remains throughout the disease course.¹¹ A total of 4 studies^{6-8,11} investigated the effect of reflexology on fatigue by using the Modified Fatigue Impact Scale and the FSS. Foot reflexology produced a significant reduction in fatigue compared with baseline.

Pain

The prevalence of pain among individuals with MS ranges from 40% to 80%.¹⁵ Four studies analyzed the effect of foot reflexology on the severity of pain in individuals with MS^{7-9,12} using a VAS and the Numeric Rating Scale. Foot reflexology resulted in a significant reduction in pain when compared with baseline.

Meta-Analysis

Four^{7-9,12} trials compared the variation in pain level between foot reflexology and control groups. The pooled effect (FIGURE S3) using a random-effects model showed that foot reflexology may have a positive role in pain management (standard mean difference [SMD] = -0.58, 95% CI [-1.22 to 0.005], $P = .004$; $I^2 = 77%$) but it is not statistically significant.

Quality of Life

Five studies reported the effects of foot reflexology on disease-specific quality of life as well as the day-to-day lives of individuals with MS using the SF-36, the MSIS-29, and the MSQOL-54 instruments.^{7-10,13} They all reported significant improvement in quality of life in the foot reflexology group.

Bowel and Bladder Function

Two studies reported on the effects of reflexology on constipation⁹ and bowel and bladder function.¹³ They used the CAS and a VAS for bladder and bowel function. Foot reflexology showed a significant reduction in constipation severity scores, whereas there was a moderate effect on bladder function and no effect on bowel function.

Muscle Stiffness, Muscle Spasm

Only 1 study⁹ reported a moderate effect on muscle stiffness using reflexology in individuals with MS. Severity of muscle stiffness was assessed via a VAS. Foot reflexology found no positive effect on muscle spasm in individuals with MS.

Sleep Quality

One study⁹ reported a moderate effect for foot reflexology on sleep quality in individuals with MS. Quality was assessed using a VAS.

Psychological Symptoms

Five studies^{6,8-10,14} reported on the impact of foot reflexology on psychological variables, including anxiety, stress, and depression, using the State Trait Anxiety Inventory; the Beck Depression Inventory-II; the Hospital Anxiety and Depression

scale; the Depression, Anxiety, and Stress 21-item scale; and the Stress Symptom Index for assessment. Foot reflexology was found to significantly reduce stress, anxiety, and depression in individuals with MS.

Physiological Outcomes

One study¹⁰ reported the effectiveness of foot reflexology on cardiac variables, notably heart rate and blood pressure. They found a moderate, nonsignificant reduction in systolic and diastolic blood pressure and heart rate.

Two studies examined the role of foot reflexology in salivary cortisol¹⁰ and serum cortisol⁶ levels in individuals with MS. When compared with baseline, those who received foot reflexology had significantly lower cortisol levels following the intervention.

DISCUSSION

Reflexology is the application of moderate pressure on the feet using a series of thumb and finger movements. Every physical area of the body is represented in a reflex area, from the head at the distal phalanx of the great toe to the pelvis at the calcaneum.¹⁶ Stimulating these areas enhances blood and energy circulation, promotes relaxation, and preserves balance,¹⁷ although the precise mechanism is unknown. We have 3 theories on why foot reflexology helps individuals with MS. (1) Reflexology creates electrochemical signals by activating neural pathways via the sensory stimuli, aiding analgesic effects with a release of endorphins.¹⁸ (2) Reflexology is believed to remove toxins from the body and impact the endocrine, immune, and neuropeptide systems. This positively affects the physiological and psychological parameters by stimulating the autonomous nervous system.⁷ (3) Significant improvement in quality of life could be attributed to the proprioceptors in the feet that correspond to parts of the body.¹⁹ Pressure is easily felt on the feet as they have a variety of sensory nerve receptors with unique anatomical and physiological characteristics.²⁰

In general, touch and foot reflexology generate pressure and trigger the sensory nerve endings (corpules). In the dermis and epidermis, corpules, tactile cutaneous mechanoreceptors (ie, Meissner, Ruffini, and Pacinian corpules), react to increased pressure and rapid vibration. They trigger action potential in the cells, discharging electrical current that gets transmitted via the sensory nerves to the brain for interpretation and resultant response via the motor nerves.²¹ Analgesic effects are achieved by pressure on specific reflex points, which effectively intercepts pain neural pathways via the gate control theory of pain mechanism.

In the 9 studies included in this review, foot reflexology had a positive effect on the physical and mental health and quality of life of individuals with MS. None of the interventions had treatment-related significant adverse events. Therapeutic responses to reflexology in individuals with MS vary from person to person because severity and

progression of disease are considerable¹³; however, the positive effects can be attributed to the type, depth, duration, and frequency of reflexology.

A strength of the present review is that, to the best of our knowledge, it is the first to analyze the scientific evidence available on the effects of foot reflexology on the physiological, psychological, and subjective changes associated with MS. Evidence shows that reflexology can have a variety of positive effects, specifically in the psychological domain. Limitations of this review include the fact that none of the studies had long-term follow-up. Future studies must explore long-term effects and prioritize high-quality study designs. Additional investigation into quantifiable physiological and biochemical characteristics are needed in order to address any beneficial effects of reflexology for individuals with MS.

CONCLUSIONS

Foot reflexology may be a safe and cost-effective intervention for individuals with MS as it has shown potential effectiveness in managing a range of physical and psychological symptoms experienced by individuals with MS. This systematic review aimed to provide a comprehensive summary of the effects of foot reflexology on the population. Drawing from the existing scientific literature, foot reflexology can effectively alleviate symptoms such as fatigue, stress, muscle spasms, depression, and anxiety. As a result, it contributes to improved sleep quality and overall quality of life. Thus, improvement was seen in both subjective and objective parameters; however, large-scale randomized studies with long-term follow-up are necessary to validate these effects. ■

FINANCIAL DISCLOSURES: The authors have no relevant financial disclosures.

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