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Systematic Review

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The Effects of Acupuncture in Patients with Multiple Sclerosis: A Systematic Review

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Abstract

Background: Multiple Sclerosis (MS) is an autoimmune disorder that affects the nervous system affecting all aspects of patients' lives. Researchers found effects of acupuncture on different aspects of MS related complications such as fatigue, spasticity, pain, and overall quality of life. This systematic review was conducted to assess the impact of acupuncture on different complication of MS as well as quality of life.

Methods: An independent and systematic search across PubMed, Scopus, EMBASE, and Web of Science was carried out. Additionally, the gray literature, including references from the selected studies and conference abstracts published up until October were examined.

Results: The literature search identified 1,877 articles, and after removing duplicates, 1,062 remained. Finally, a total of 18 studies were included in the systematic review. The studies included were published between 1974-2023 and the sample size ranged between 1-108. Four of six studied including Randomized Controlled Trial (RCTs) found that acupuncture in cases who completed the study was effective in pain management, symptomatic relief for spasticity, MS-related fatigue and enhanced patients' quality of life.

Conclusion: Acupuncture can be effective in treating some MS related complications such as fatigue, disability and quality of life.

Keywords: Acupuncture therapy, Autoimmune diseases, Gray literature, Humans, Multiple sclerosis, Pain management, Quality of life, Sample size

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Introduction

Multiple Sclerosis (MS) is a complex and chronic autoimmune disorder that primarily affects the central Nervous System (CNS). The disease is characterized by inflammation, demyelination, and subsequent neurodegeneration, which disrupt the normal transmission of nerve impulses throughout the body (1). As MS progresses, patients face a wide range of symptoms that vary in severity and presentation, profoundly affecting their physical, psychological, social, and economic well-being.

Psychological complications are a significant concern for MS patients, with common issues including chronic fatigue, depression, anxiety, cognitive dysfunction, and sleep disturbances (2,3). Fatigue, for example, is one of the most disabling symptoms and is reported by over 80% of MS patients, leading to considerable impairment in daily functioning. Depression and anxiety are also prevalent, affecting both the emotional stability and social interactions of patients, while cognitive decline further compromises their ability to manage daily life (2,3).

On the physical side, MS patients frequently experience symptoms such as neuropathic pain, spasticity, muscle weakness, gait imbalance, and bladder dysfunction (4-7). Spasticity, or the involuntary stiffness and muscle spasms, can significantly impair mobility, while neuropathic pain is often persistent and difficult to manage. Lower urinary tract symptoms, including incontinence and frequent urination, add another layer of complexity to patient care (4-7). These physical and psychological burdens, along with the progressive nature of the disease, lead to a profound reduction in quality of life, often rendering patients unable to perform basic daily activities or maintain employment (8).

Current treatment approaches for MS focus primarily on Disease-Modifying Therapies (DMTs) that aim to reduce the frequency of relapses and slow the progression of the disease. However, these treatments are not without limitations. They can have significant side effects, and many patients do not experience sufficient symptom relief from conventional pharmacological approaches. Consequently, patients often turn to Complementary and Alternative Medicine (CAM) therapies in search of more holistic and effective treatments. Among these alternatives, acupuncture has gained considerable attention (9,10). Acupuncture, a traditional Chinese medical practice that involves the insertion of fine needles into specific points on the body, has been widely used for the management of pain and various chronic conditions (11). A systematic review by Arjeh *et al* evaluated various complementary and alternative therapies, including acupuncture, and highlighted its potential benefits in improving MS-related symptoms such as fatigue, pain, and quality of life (12). Also, a review of multiple studies indicated that acupuncture might improve MS-related symptoms such as fatigue, spasticity, and pain, thereby enhancing patients' quality of life. However, the review also highlighted that many studies suffered from poor design and lack of statistical rigor, underscoring the need for more robust research in this area (13). These findings suggest that acupuncture could be a beneficial complementary therapy for managing certain MS symptoms, though further well-designed studies are necessary to confirm its efficacy.

Studies show that 2.7-21% of MS patients use acupuncture as a complementary treatment to manage their symptoms (9,10). These patients report improvements in symptoms such as fatigue, spasticity, pain, and overall quality of life, although the exact mechanisms by which acupuncture works in MS remain unclear (14).

A recent systematic review and meta-analysis by Haider *et al* assessed the effectiveness of acupuncture in mitigating fatigue among MS patients, concluding that acupuncture has potential benefits in reducing fatigue (15). However, their review focused primarily on fatigue, leaving other common MS complications such as spasticity, pain, and overall quality of life less thoroughly examined.

The present systematic review aims to build upon these findings by evaluating not only the effects of acupuncture on fatigue, but also its broader impact on spasticity, pain, gait, bladder dysfunction, and overall quality of life. By addressing a wider range of symptoms, this review seeks to provide a more comprehensive understanding of acupuncture's role in managing MS-related complications.

Need for the study

As in introduction explain, despite growing interest in

acupuncture as a therapeutic option for MS patients, there remains a lack of comprehensive reviews synthesizing the evidence on its effectiveness in managing MS-related complications.

Therefore, the primary aim of this systematic review is to evaluate the effects of acupuncture on different complications associated with MS, as well as its overall impact on patients' quality of life. By consolidating the available evidence, this review seeks to fill the existing gaps in the literature and provide a clearer understanding of acupuncture's role in the management of MS. Such insights are crucial for determining whether acupuncture could serve as a viable non-pharmacological intervention to improve patient outcomes.

Materials and Methods

This manuscript is a systematic review of previously published studies, and no new experiments or human participants were involved. All original studies included in the review were assumed to have followed ethical guidelines as per the standards of their respective publications.

Literature search

To ensure a comprehensive understanding of the effects of acupuncture on MS complications, four major electronic databases: PubMed, Scopus, EMBASE, and Web of Science were systematically searched. The search covered all relevant studies published from database inception up to October 2023. In addition to the formal databases, the gray literature, which included manual searches of conference proceedings, dissertations, and references listed in the selected articles were also explored. The aim was to capture all pertinent studies, regardless of their publication status, to minimize the risk of publication bias.

Inclusion and exclusion criteria

All study designs that reported the effects of acupuncture on MS-related complications were included. These studies included Randomized Controlled Trials (RCTs), cohort studies, case-control studies, cross-sectional studies, case series, and case reports. No restrictions were placed on the language of the publication to ensure broad coverage of relevant literature. However, the following were excluded:

- Studies that did not report clinical outcomes related to MS complications
- Articles that focused solely on other forms of traditional Chinese medicine or complementary therapies without specifying acupuncture
- Reviews, commentaries, editorials, and other secondary sources that did not provide primary clinical data

Search strategy

The search strategy combined both MeSH terms and free-text keywords to ensure a broad capture of relevant studies. Search strings that included synonyms and variations of terms related to both MS and acupuncture were also explored. Specifically, the following terms and combinations were used:

"Multiple Sclerosis" OR "MS" OR "Relapsing-Remitting Multiple Sclerosis" OR ("Multiple Sclerosis" AND "Relapsing-Remitting") OR "Chronic Progressive Multiple Sclerosis" OR ("Multiple Sclerosis" AND "Chronic-Progressive") OR "demyelinating diseases" OR "demyelinating disorders" OR (autoimmune AND demyelinating) OR "autoimmune demyelinating disease" OR (autoimmune AND cerebral) OR (autoimmune AND "spinal cord") OR (autoimmune AND "central nervous system") OR (autoimmune AND "peripheral nervous system") OR "demyelination" OR (autoimmune AND demyelination)AND("acupuncture" OR "Acupuncture" OR "acupuncture therapy" OR "Acupuncture Therapy" OR "acupuncture trends" OR "pharmacopuncture").

The search was independently conducted by two researchers. Titles, abstracts, and full texts of potentially relevant studies were screened according to the inclusion criteria. Discrepancies in article selection were resolved through consensus or by consulting a third reviewer.

Data extraction

A standardized data extraction form was also explored to ensure the consistent collection of relevant information from each study. The following variables were extracted:

- First author's name
- Year of publication

- Country of origin
- Study design (*e.g.*, RCT, cohort study, case series)
- Sample size and characteristics (*e.g.*, mean age, gender distribution)
- Detailed description of the acupuncture intervention (*e.g.*, type, frequency, duration)
- Control or comparator groups (if applicable)
- Outcomes measured (*e.g.*, fatigue, spasticity, pain, quality of life)
- Key findings related to MS-related complications
- Follow-up period (if applicable)

For randomized controlled trials, information on randomization methods, blinding, and the handling of missing data to assess methodological quality was also extracted. For non-randomized studies, potential confounders and efforts to minimize selection bias was focused upon.

Risk of bias assessment

To assess the risk of bias in included studies, the Cochrane Collaboration's Risk of Bias Tool for randomized controlled trials was utilized (16). This tool assesses seven key domains, including:

1. Random sequence generation (selection bias)
2. Allocation concealment (selection bias)

Blinding of participants and personnel (performance bias)

3. Blinding of outcome assessment (detection bias)
4. Incomplete outcome data (attrition bias)
5. Selective reporting (reporting bias)
6. Other potential sources of bias

For non-randomized studies, the Newcastle-Ottawa Scale (NOS) to evaluate the study quality was employed. This scale assesses three broad domains: selection of study groups, comparability between groups, and the ascertainment of either the exposure (for case-control studies) or the outcome of interest (for cohort studies). Each study was independently assessed by two researchers, with disagreements resolved through discussion.

Statistical analysis

All statistical analyses were performed using STATA software (Version 14.0; StataCorp LP, College Station, TX, USA). A random-effects model was employed to account for between-study variability, which was anticipated due to differences in study design, participant characteristics, and acupuncture interventions. The primary outcome of interest was the improvement in MS-related complications, such as fatigue, spasticity, pain, and quality of life, following acupuncture treatment.

Initially, a meta-analysis using Standardized Mean Differences (SMDs) with 95% confidence intervals (CIs) for continuous outcomes was planned to be performed. However, due to significant heterogeneity in study designs, sample sizes, intervention protocols, and outcome measures, a pooled statistical analysis was deemed inappropriate. Instead, a structured narrative synthesis to systematically summarize the findings was conducted. Spasticity was analyzed as a dichotomous variable ('improved' *vs*. 'not improved') because many included studies reported outcomes in binary terms rather than using continuous scales. The heterogeneity in measurement tools, such as variations in the use of the Ashworth Scale or subjective patient-reported outcomes, further supported the decision to use this classification. To assess the degree of heterogeneity between studies, the I^2 statistic was calculated. An I^2 value greater than 50% indicated substantial heterogeneity. In cases of high heterogeneity, subgroup analyses based on factors such as study design, duration of acupuncture treatment, and geographical location of the study was performed.

In addition, sensitivity analyses was conducted by excluding studies with high risk of bias to determine the robustness of the pooled estimates. Where appropriate, publication bias was assessed using funnel plots and Egger's test.

Ethical approval

Since this study was based on published literature, no ethical approval was required. However, the authors adhered to standard practices for systematic reviews and meta-analyses, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines throughout the research process.

Results

Study selection

Figure 1 visually represents the systematic approach taken to ensure a comprehensive and unbiased selection of studies for the review. The flowchart

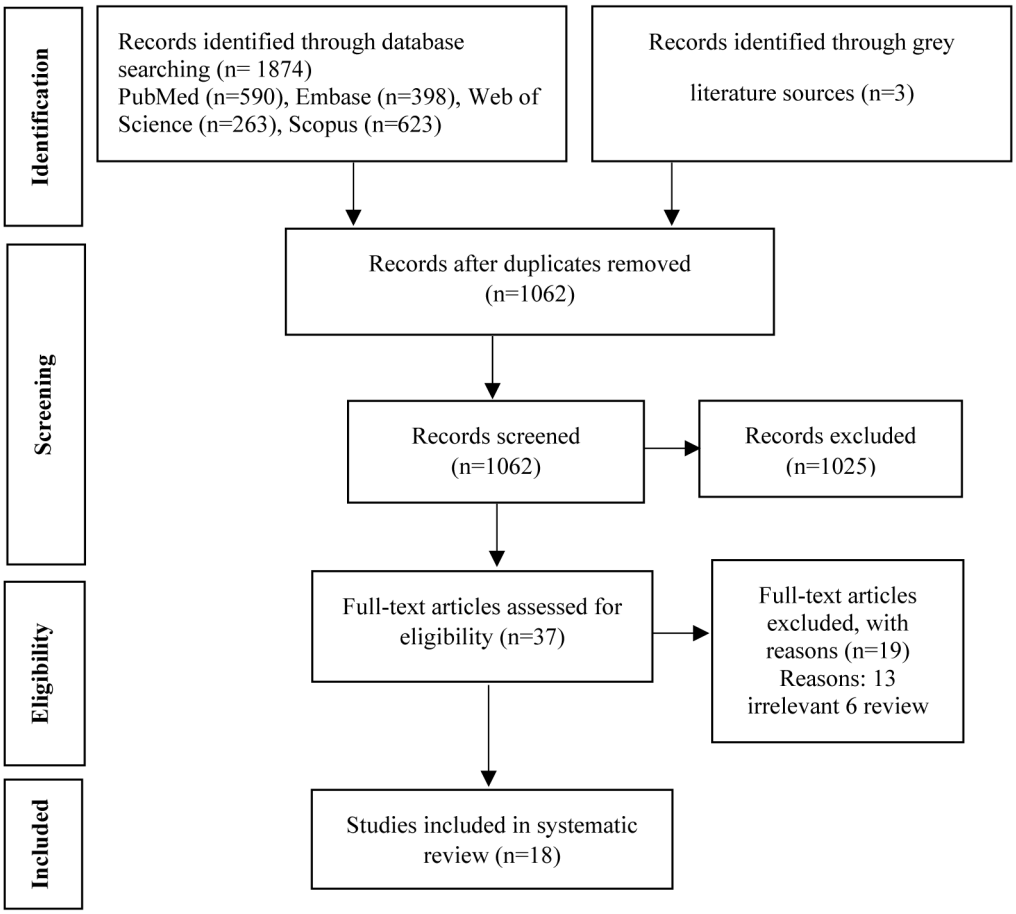


Figure 1. The flow chart of studies inclusion.

outlines the process of identifying, screening, and selecting studies for inclusion in the systematic review (Figure 1).

The studies included were published between 1974-2023 and the sample size ranged between 1-108. Two studies evaluated the effects of acupuncture on gait, and found positive effects, while two other studies reported positive effects on bladder symptoms. Improvement in fatigue symptom was found in five studies, and pain improvement in two studies (Table 1).

Table 1 summarizes the characteristics and outcomes of the RCTs included in the systematic review. Each study's key features, such as study design, participant demographics, interventions, outcome measures, and main findings, are crucial for evaluating the overall effectiveness of the interventions studied. The quality assessment of the included RCT studies is summarized in table 2.

Other included studies in this systematic review have explored the potential benefits of acupuncture in managing MS symptoms, focusing on fatigue, pain, spasticity, bladder dysfunction, and mobility issues. While most of these studies report positive outcomes, many are limited by small sample sizes, lack of control groups, or methodological constraints, emphasizing the need for more rigorous trials.

Some case reports and observational studies demonstrated improvements in fatigue, spasticity, or quality of life following acupuncture treatment (*e.g.*, McGuire *et al*, Foroughipour *et al*, Tajik *et al*, Lau *et al*), while others reported less conclusive outcomes (*e.g.*, Foell *et al*, Spoerel *et al*). For example, McGuire presented a case in which a 50-year-old female MS patient experienced marked improvement in fatigue following seven sessions of acupuncture, measured by multiple fatigue scales (22). Similarly, Foroughipour et al found that 75% of participants in an observational study reported improvements in fatigue, especially those unresponsive to conventional medication (23). In contrast, Foell and Spoerel et al documented limited or inconsistent outcomes, with

Table 1. Findings of included RCTs

Author/ Publication Year/ Study/ design	Mean age F/M ratio Sample size	EDSS	Recurrence rate	Recurrence interval	Gait	Fatigue	Quality of life
Wang C. *et al* (17), 2017 RCT/full-text (in Chinese)	Experiment: 36±5/ Control: 34±6 Experiment: 15 F, 6 M / Control: 15 F, 6 M 42 (21 experiment and 21 controls)	Experiment group month 3:-0.14±0.3, *p< 0.05 month 6:-0.07±0.2, *p< 0.05 month 12:0.07±0.2, *p< 0.01 month 24:0.19±0.2, *p< 0.01 Control group month3:0.17±0.1 month6: 0.17±0.2 month12:0.33±0.2 month24: 0.52±0.4 * N.S. in all months	Experiment: before3.15±0.48 After0.43±0.44 *p<0.01 Control: Before3.09±0.40 After 0.76±0.49, *p<0.01	Experiment: 441.56±65.37 days Control: 382.78±59.33 days ** p<0.01	-	-	-
Donnellan P. *et al* (14), 2008 RCT/full-text	Experiment: 53±9 Control: 50±8 Experiment: 5 F, 2 M Control: 5 F, 2 M 14 [7 experiment (Chinese acupuncture) / 7 control (minimal acupuncture)]; secondary progressive multiple sclerosis	-	-	-	-	** Experiment: 0.5±1.1 N.S.	(MSIS-29 physical) Experiment: before 55.2±23.6, after 40.8± 28.0/control: before 57.7±23.8, after 43.9±17.4 (MSIS-29 psychological) Experiment: before 34.3± 23.7 after 28.2±24.5 / control: before 48.4±30, after 25.4±14* And ** N.S.
Criado M. *et al* (18), 2017 RCT/full-text	46.3±11.07 12 F, 8 M 20 experiment / 20 control)	-	-		(Based on T25FW(s)) Experiment: * p=0.000 Control: * N.S	-	-
Quispe-Cabanillas J. G. (19), 2012, RCT/ full-text	Experiment: 36.0±11.5 / Control: 40.1±9.1 Experiment: 14 F, 2 M/ Control: 13 F, 2 M 31 (16 Experiment / 15 Control)	** 6 months: decrease (p=0.055)	-	-	-	(Based on VAS)** decrease in VAS score 3 months: p=0.0143 6 months: p<0.0001	(Based on FAMS) Median (IQR)** Increase in FAMS total score 3 months: p=0.0026 6 months: p<0.0001
Khodaie F. *et al* (21), 2023 RCT/full text	Experiment: 39.9±9.55 Control: 36.2±9.47 Experiment: 25 F, 5 M Control: 25 F, 5 M 60(30 experiment, 30 control)	Experiment: 2.2±1.32 Control: 2.0±1.53 N.S.	-	-	-	(FSS) Before: Experiment: 5.2±1.23 Control: 5.1±1.23 After: Experiment: 3.2±1.25 Control: 4.3±1.41** p<0.05	(MSQOL-54) Before: Experiment: 47.1±16.49 Control: 46.8±15.61 After: Experiment: 65.4±15.94 Control: 56.4±17.4 ** p<0.01

Contd. table 1.

Lynning M. *et al* (20), 2020 RCT/full text	Experiment 1: 46.5±10.2 Experiment 2: 46.8±10.8 Control: 49.2±9.6 Experiment 1: 15/8 Experiment 2: 16/5 Control : 17/5 66 (23 Experiment 1(real Acupuncture), 21 Experiment 2 (Sham Acupuncture), 22 control)	-	-	-	-	-	FAMS Median (IQR) Before: Experiment 1: 136 (114-147) Experiment 2: 112 (94-139) Control : 146 (124.5-160) After: Experiment 1: 131 (120-150) Experiment 2: 126.5 (104.5-145) Control : 143 (125-159)** N.S. in all months

*Within group difference, ** Between group difference.

N.S.: No Significant difference, EDSS: Expanded Disability Status Scale, MSIS-29: Multiple Sclerosis Impact Scale, T25-FW(s): Timed 25-Foot Walk, VAS: Visual Analog Scale, FAMS: Functional Assessment of Multiple Sclerosis, IQR: Interquartile R ange, FSS: Fatigue Severity Scale, MSQOL-54: Multiple Sclerosis Quality of Life-54.

Table 2. Quality assessment of included RCT studies

Author	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and researchers (Performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Wang *et al*	URB	URB	HRB	URB	URB	LRB
Donnellan *et al*	LRB	LRB	LRB	LRB	LRB	LRB
Criado *et al*	HRB	URB	HRB	URB	URB	LRB
Quispe-Cabanillas *et al*	LRB	LRB	LRB	LRB	LRB	LRB
Lynning *et al*	LRB	URB	LRB	LRB	LRB	LRB
Khodaie *et al*	LRB	LRB	LRB	LRB	LRB	LRB

Low Risk of Bias: LRB - Unclear Risk of Bias: URB - High Risk of Bias: HRB.

benefits observed in individual symptoms but lacking robust statistical analysis or long-term follow-up (24,25).

Likewise, studies such as those by Tajik et al, Becker *et al*, and Gunnersen *et al* indicated perceived improvements in pain relief, sleep quality, and general well-being; however, these studies lacked methodological rigor or control groups (26-28). Case reports like those of Soe *et al* suggested that acupuncture may reduce bladder-related complications in MS, though such findings require further validation (29). More recent observational studies, including Lau *et al* and Angel Ng *et al*, reinforced the potential of acupuncture in managing fatigue and cognitive symptoms (30,31), while Karpatkin *et al* and Miller provided early evidence of improved mobility and reduced spasticity through acupuncture (32,33). Nonetheless, the overall quality and consistency of evidence from non-randomized studies remain limited.

Discussion

The findings of this systematic review highlight the potential of acupuncture as a complementary

therapeutic intervention for MS, particularly in alleviating a range of debilitating symptoms, including fatigue, spasticity, pain, and overall quality of life. Several studies in this review reported improvements in fatigue, spasticity, and pain following acupuncture treatment. However, heterogeneity in study designs and outcome measures limited the ability to conduct a meta-analysis. Despite this limitation, the consistency of findings across various studies suggests that acupuncture may offer significant benefits for MS patients.

Several studies have investigated the effects of acupuncture on MS symptoms, with varying conclusions. A recent systematic review and meta-analysis by Haider *et al* focused primarily on fatigue and found that acupuncture may significantly reduce fatigue severity (15). However, their analysis did not extensively evaluate other MS-related complications such as spasticity, pain, and quality of life. The present systematic review expands on this by examining multiple outcomes, providing a broader understanding of acupuncture's therapeutic role. Additionally, previous systematic reviews have highlighted the need for more rigorous clinical trials, and present findings further support this recommendation.

Fatigue management

Fatigue is one of the most prevalent and disabling symptoms in MS, affecting up to 90% of patients (34). Acupuncture has been reported to modulate energy flow and neurotransmitter release, potentially addressing MS-related fatigue (21). In the context of Traditional Chinese Medicine (TCM), acupuncture is believed to regulate the flow of Qi (vital energy) along meridians in the body. Blockages or imbalances in this flow are thought to cause illness. Stimulating specific acupuncture points is intended to restore balance and promote healing. From a biomedical standpoint, this modulation of 'energy flow' may correspond to physiological mechanisms such as enhanced neurotransmitter release (*e.g*., serotonin, dopamine, endorphins), autonomic nervous system regulation, and improved microcirculation—all of which may contribute to symptom relief in MS (11,21).

Studies included in this review, such as those by Foroughipour *et al* and Lau *et al*, suggest that acupuncture may lead to clinically meaningful improvements in fatigue scores (23,30). These findings align with the results of Ng *et al*, who reported a substantial reduction in Modified Fatigue Impact Scale (MFIS) scores following an 8-week acupuncture intervention (31). However, differences in acupuncture techniques, session durations, and patient characteristics across studies indicate the need for standardized treatment protocols. Moreover, studies assessing long-term effects of acupuncture on fatigue are currently lacking, and future research should aim to address this gap.

Impact on spasticity and mobility

Spasticity is a major contributor to disability in MS patients, often leading to reduced mobility and quality of life (35). Acupuncture may offer relief by modulating neuromuscular function and reducing muscle stiffness (33). Miller *et al* and Spoerel et al reported improvements in spasticity among MS patients following acupuncture treatment, though these studies were limited by small sample sizes (25,33). Additionally, Karpatkin *et al* demonstrated improvements in gait function, suggesting that acupuncture may have a broader rehabilitative role in MS (32). However, given the heterogeneity in outcome assessment tools across studies, further research using standardized spasticity scales (*e.g*., the Modified Ashworth Scale) is warranted. Additionally, understanding the frequency and duration of acupuncture required for sustained improvements remains an open question, as different protocols may yield different outcomes.

Pain and quality of life

Pain is a frequently reported MS symptom, with prevalence rates ranging from 29-86% (36). This review identified multiple studies indicating that acupuncture may alleviate MS-related pain, with potential mechanisms involving endorphin release and neuroinflammation modulation. Ghajarzadeh *et al* and Junnilla et al documented reductions in pain intensity and medication use among acupuncture-treated patients (4,37). Additionally, studies such as those by Becker *et al* and Gunnersen *et al* emphasized improvements in overall well-being and quality of life, reinforcing the holistic benefits

of acupuncture (27,28). However, due to variability in pain measurement methods across studies, more rigorous trials with consistent outcome assessments are necessary. Another key area for future research is understanding whether the analgesic effects of acupuncture persist over extended periods or require repeated interventions for sustained relief.

Limitations and future directions

While this review provides valuable insights, several limitations should be acknowledged. The included studies exhibited substantial heterogeneity in treatment protocols, sample sizes, and outcome measures, limiting the ability to perform a meta-analysis. Additionally, some studies lacked robust blinding procedures, increasing the risk of performance bias. Future research should prioritize well-designed RCTs with larger sample sizes, standardized acupuncture protocols, and consistent follow-up periods to enhance comparability across studies. Moreover, exploring potential mechanisms of acupuncture through biomarker analysis and neuroimaging studies may further elucidate its therapeutic effects in MS. Another important consideration is the integration of acupuncture into conventional MS treatment plans, which could provide a more comprehensive approach to symptom management.

Conclusion

In summary, acupuncture appears to be a promising complementary therapy for MS, with potential benefits in managing fatigue, spasticity, pain, and quality of life. However, given the methodological limitations of the existing literature, further high-quality RCTs are needed to establish definitive conclusions. Acupuncture could serve as a valuable adjunctive treatment in the multidisciplinary management of MS, providing patients with an alternative, non-pharmacological approach to symptom relief. Future research should not only confirm acupuncture's efficacy but also explore optimal treatment protocols, long-term effects, and its role in integrative care approaches for MS patients.

Registration and protocol

The systematic review is not currently registered in any database. However, the authors are aware of the importance of registration and will consider doing so in the future.

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Conflicts of Interest

The authors declare no conflict of interest with any institution or individual.

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