

# Research

## Personalized Yoga Therapy for Multiple Sclerosis: Effect on Symptom Management and Quality of Life

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### Abstract

This study aimed to assess the feasibility of personalized yoga therapy intervention in a private setting and its effect on quality of life (QOL), sleep quality, and symptom relief among patients with multiple sclerosis (MS). A single-group pre- and post-experimental study was conducted among 10 members of the Multiple Sclerosis Society of India between December 2017 and April 2018. At baseline and during follow-up, QOL, sleep quality, symptoms, and pain were assessed using the Multiple Sclerosis Quality of Life, Pittsburgh Sleep Quality Index, MS Symptom Checklist, and visual analogue scale, respectively. The intervention comprised 12 private customized yoga sessions of 1 hour duration and three group sessions, all spread over 3 months. Patient feedback and direct observations by the yoga therapist were documented at each session. Ten patients (seven female, three male, age 31–52 years) were enrolled in the yoga intervention; seven completed 8–12 sessions, and three completed fewer than 5 sessions. Therapist-to-patient ratio was 1:2. All domains except sexual function showed clinically significant improvement in QOL scores. Statistically significant improvement was found in social function ( $p = 0.014$ ) and change in health status ( $p = 0.029$ ) scores after the intervention. Although there was improvement in pain and sleep quality, these changes were not statistically significant. Patients reported improvement in symptoms with practice of yoga alongside lifestyle changes. The study supports the feasibility of this 3-month yoga intervention for patients with MS. Studies with larger sample sizes are required to confirm our findings. Vasudevan et al. *Int J Yoga Therapy* 2021(31). doi: 10.17761/2021-D-19-00037.

**Keywords:** therapeutic yoga, multiple sclerosis (MS), MS symptom management, asana for MS, pranayama

### Introduction

Multiple sclerosis (MS) is a chronic inflammatory demyelinating disease that affects the central nervous system and leads to varying levels of disability in affected individuals. The disease, once considered rare, is being increasingly diagnosed in India with improvements in diagnostic modalities and availability of neurologists. Although community-based estimates are not available, the prevalence from hospital-based studies is reportedly as high as 7–10 per 100,000 population, nearly 180,000 patients in absolute numbers. Onset of disease typically occurs in young adults aged 20–40 years and is more prevalent in females than in males. The disease has complex pathophysiology; hence, there is always unpredictability and variation in individuals in disease progression, severity, and signs and symptoms,<sup>1</sup> which affects quality of life (QOL).<sup>2</sup> Fatigue, asthenia, balance and mobility loss, depression, and decreased cognitive function are common problems experienced by MS patients.<sup>3</sup> Symptomatic management of the condition with medication has short-term benefits. Evidence for long-term benefits is lacking, and adverse effects are reported.<sup>4,5</sup>

Of foremost importance in patients with MS is enhancing physical function and QOL, as there is no cure. Many patients use unconventional treatments or complementary and alternative medicine (CAM) that includes physical interventions, therapies, and diets. Physical interventions that have shown improved symptomatic management are acupuncture, chiropractic medicine, cooling therapy, dental amalgam removal, Feldenkrais, guided imagery and relaxation, hyperbaric oxygen, magnetic field therapy, massage, neural therapy, reflexology, tai chi, and yoga.<sup>6</sup> Regarding the efficacy of CAM, 67.1% patients reported improvement.<sup>7</sup> Evidence is accumulating that CAM treatments are beneficial for patients with MS.

Studies have reported that MS patients showed positive responses to yoga therapy and that it is safe and feasible.<sup>8,9</sup> Although yoga may be considered to address pain, mental health, fatigue, spasticity, balance, bladder control, and sexual function,<sup>10</sup> a meta-analysis concluded that yoga improved only mood and perceived fatigue but not muscle function, cognitive function, or health-related QOL. The studies included small numbers of patients with MS and hence could not allow in-depth assessment of muscle function, cognitive function, and other parameters. As yoga was not associated with severe adverse events, the meta-analysis recommended that its practice in patients with MS need not be discouraged. Yoga studies with patients with MS used group sessions, and the types of yoga were Raja Yoga, Hatha Yoga, Iyengar Yoga, Chair Yoga, Sivananda Yoga, or type left to the teacher (combination of postures from different schools).

Limitations in yoga-related literature include the predominance of group sessions without a control group and insufficient description of the yoga intervention, partly due to its subjective nature. Also, previous studies do not mention modification or customization of yoga practices based on the individual patient. Therefore, the present study aimed to assess the feasibility of personalized yoga therapy intervention in the lineage of T. Krishnamacharya, in a private setting with a 1:2 ratio of therapists to patients. Patients with MS were given customized, need-based modifications in their yoga practices, and effects of the intervention on QOL, sleep quality, and symptom relief were assessed. The approach taken was individual-centric rather than disease-centric.

## Methods

A single-group pre- and post-experimental design was adopted for the present study. The study was carried out among the members of the Multiple Sclerosis Society of India (MSSI), Hyderabad Chapter, between December 2017 and April 2018. MSSI is a registered voluntary, non-profit organization established in 1985 and affiliated with the Multiple Sclerosis International Federation, United Kingdom. The organization offers guidance and medical and financial support to patients with MS.

During monthly MSSI support group meetings, information about the study was shared with patients and caregivers. Posters with information on yoga therapy classes were displayed on the bulletin board at MSSI in Hyderabad. The yoga therapists evaluated patients who consented to participate for eligibility to be enrolled in the study.

The inclusion criteria were ability to communicate in Telugu, Hindi, or English; ability to ambulate without the assistance of another person for a minimum of 25 feet; no

practice of yoga in the last 6 months; and consent from a neurologist to practice yoga. The exclusion criterion was presence of any serious medical conditions in the last 8 weeks.

A structured proforma was used to gather information on sociodemographic details, medical history, and symptoms. Clinical details such as MS and relapse history and current complaints were collected from medical records and clinical interview. The *panchamaya* (five sheaths) model was used as a holistic framework to understand the individual on the five levels of *annamaya* (physical), *pranamaya* (physiological), *manomaya* (knowledge and thoughts), *vijnanamaya* (inner will and ability to discriminate), and *anandamaya* (sense of joy, contentment). This framework was used so that every aspect of the individual was studied, understood, and used for the intervention. A thorough assessment was done using observation (*darshanam*) and interview (*prashnam*) to elicit information relating to these aspects. QOL, sleep quality, symptoms, and pain were assessed using the Multiple Sclerosis Quality of Life (MSQOL)-54,<sup>11</sup> Pittsburgh Sleep Quality Index, MS Symptom Checklist, and visual analogue scale, respectively. All tools were administered at baseline and at the end of the intervention. In addition, feedback on changes in symptoms and practice adherence was collected during each session. Yoga therapists collected the data and administered the psychometric tools.

## Framework for Personalized Yoga Intervention

An individualized yoga therapy module based on the Krishnamacharya tradition was developed by a group of IAYT-certified yoga therapists to meet the patients' needs and capabilities. Conscious breathing and its application in *asana* (physical postures) is the main tool for practice, as breath has the power to influence the body and the mind simultaneously.

The information gathered about the patient was organized using the following framework from Patanjali's Yoga Sutras (Chapter 2) to understand suffering (*duhkham*) as well as its manifestation, causes, goals, and means to overcome it.

- *Heyam*: immediate symptoms/issues bothering the person; the effect they have on the individual's life, work, roles they play, etc.; other health concerns and how much they bother the individual
- *Hetu*: possible causes and factors such as triggers, aggravating factors, diet, lifestyle, personality of the individual, and context
- *Hanam*: short-term goals of bringing symptom relief and improving the individual's sense of well-being and long-term goals of strengthening and empowering the person from within

- *Upayam*: what to avoid; tools to address short-term goals, address/eliminate contributing factors, and prepare the person for long-term goals

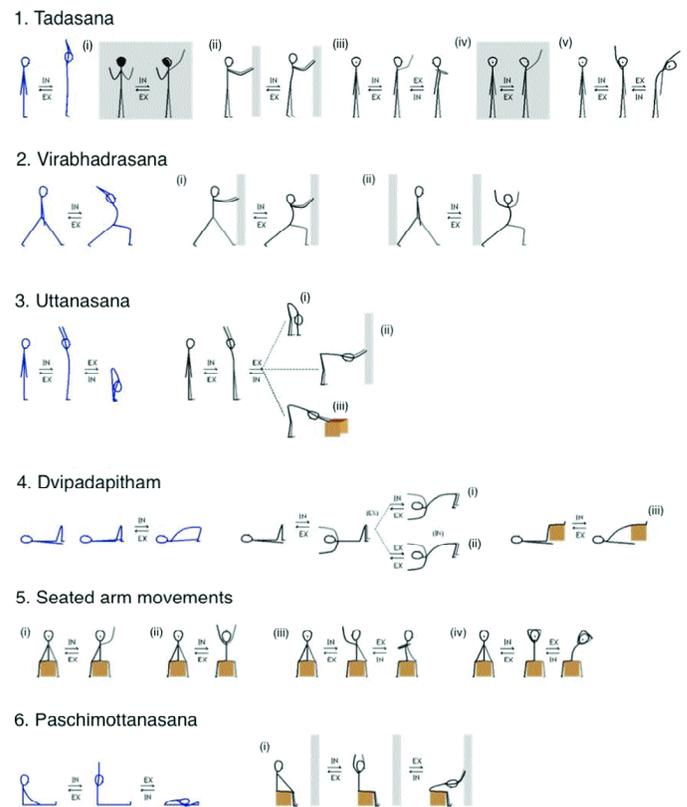
At each stage, tools and techniques (asana, *pranayama* [breathwork], meditation) were chosen based on the functions to be achieved, which were then customized for the individual and taught as a practice sequence. This method of sequencing practices that are goal-oriented using appropriate preparatory postures, counter-postures, and adequate rest periods where required is a unique feature of the Krishnamacharya tradition of yoga.

The intervention of 12 private hour-long sessions, spread over 3 months, was conducted by yoga therapists with experience in managing patients. In addition, a total of three group sessions were conducted to introduce patients to the basic philosophy of yoga, general guidelines of yogic practice, diet, sleep, lifestyle modifications, and the role of breathing and its effect on the mind in healing. Each group session lasted for 90–100 minutes, including asana (45 minutes), pranayama (20 minutes), guided meditation (15 minutes), and discussion (15–20 minutes). Both individual and group sessions were scheduled on weekends. The weekly 60-minute individual yoga sessions included breathing practices (pranayama, 15 minutes), postures with conscious breathing (asana, 30 minutes), meditation (5 minutes), and deep relaxation (10 minutes). The length of the practice was defined by the number of breath cycles; an average practice included 80–100 breaths. Patients were expected to do the practice at home and to come back for the weekly reviews. Based on the capability of the individual, the practice position could be seated (chair or ground), lying down (supine and/or prone), or standing, with movement being dynamic, static (and determined by the number of breaths), or both. The pranayama, asana, and other tools were modified for each patient from time to time based on their changing abilities and needs, with a focus on the current symptoms. Postures were retained for a few weeks to enable reaching mobility/flexibility goals. The yoga practice was pictured on a handout given to patients after each session.

The commonly used asana were *tadasana* (mountain pose), *virabhadrasana* (warrior) I, *uttanasana* (standing forward bend), *dvipadapitham* (or *setu bandhasana*, bridge), and *jathara parivrtti* (supine straight-leg twist). Pranayama techniques were *sitali* (cooling breath) or *sitkari* (hissing breath) and using sounds such as OM, humming, chants, or prayers as preferred by the patients. Additional tools used were visualizations in asana and pranayama, *nyasam* (finger movement coordinated with breathing), and relaxation practice. Practices were not restricted to the yoga mat, but intertwined in patients' daily lives, for example, seated arm and leg movements and pranayama while at work. Some of the customizations used were keeping the feet apart (moun-

tain, forward bend, bridge), bending the knees (mountain, warrior I, forward bend, supine twist), support from a wall or chair (mountain, warrior I, forward bend, bridge), moving one arm at a time (mountain, warrior I), otherwise altered arm movements (mountain, warrior I, forward bend, bridge), and moving into the posture on exhalation instead of inhalation (bridge). The modifications made for the six most common postures used are presented in Figure 1.

**Figure 1.** Framework for Personalized Yoga Interventions in MS Patients\*



\*For all postures except No. 5, the classical version is shown at the far left, with possible modifications to the right.

Nine patients were given both morning and evening practices, and one patient was given only evening practice due to his work schedule. Evening practices were focused on relaxation. Three patients who worked for long hours in their jobs (shopkeeping, IT, tailoring) were asked to take breaks during their work and do 3–4 asana with breathing.

The following lifestyle changes were suggested for patients: going to bed on time, waking up a few minutes earlier, drinking less water before sleeping, making time for family, getting involved in household chores (for male patients), and eating home-cooked food regularly. Dietary suggestions were offered based on ayurvedic principles, such as avoiding foods that increase heat (chicken, spice, curd/yogurt) and foods that are heavy to digest such as oily, fried food. Patients were advised to include plant-based

fiber throughout the year and cooling foods during summer.

Written informed consent was obtained from all patients. Adverse events were reported to the consultant for immediate remedy.

### Data Collection and Analysis

The data were entered using Microsoft Excel. Frequency and percentage were computed for sociodemographic data, attendance, and adherence. QOL scores were converted to a 0–100 scale and summarized using multiple domains as described in the MSQOL-54 tool; the higher the score, the better the QOL. Also, physical health composite score and mental health composite score were calculated based on the range of scores assigned to each item. Differences between baseline and postintervention in pain, QOL, symptoms, and sleep were analyzed using the Wilcoxon signed-rank test with a statistical software program (IBM SPSS Statistics for Windows, version 21.0). Changes in symptoms experienced by the patients were presented as narratives for each patient.

### Patients

Of the 18 patients registered with MSSSI, 8 patients could not be included (5 because of their medical conditions and 3 because of expected difficulty in spending time for the intervention). Ten patients (age range 31–52 years) were enrolled in the yoga intervention. The three male patients were working as a store manager, mechanic, and team lead in a software firm, respectively. Of the seven female patients, four were housewives, two were self-employed, and one was working in a software firm.

### MS History

Clinical manifestations reported by patients were loss of sensation in legs and/or arms (ranging from numbness to complete paralysis), impact on eyes (double vision, blurred vision, swaying effect, vertigo, loss of depth perception, eyeballs turned to one side or shaking of eyeballs), bladder dysfunction, shivering, and disorientation. Number of previous relapses reported ranged from 1–8; 60% of patients had 4 or fewer relapses, whereas 40% had 5–8 relapses. Number of years since the first MS attack ranged from 3–20: Three patients reported that their first attack happened fewer than 10 years ago, five reported that their first attack was 11–19 years ago, and two reported that their first attack was 20 or more years ago. Three patients had their most recent MS attack/relapse 6 months before the study, four had an attack less than 5 years before the study, and three had an attack between 5 and 10 years before the study. Stress in personal life and lifestyle were reported as precipitating factors for the first MS attacks.

Six patients were taking weekly MS medication (oral/injections). Other medications used were for acidity ( $n = 1$ ), urinary incontinence ( $n = 4$ ), bowel movement ( $n = 1$ ), anxiety ( $n = 4$ ), depression ( $n = 2$ ), sleep ( $n = 2$ ), and nutritional supplementation ( $n = 3$ ).

### Common Complaints Reported

The site of pain and stiffness varied from patient to patient, although five female patients had problems with memory, dizziness, balance, and mood swings. Low confidence and restricted social interaction were also noticed by the yoga therapists during the interactions between therapist and patient.

The following findings were recorded during the sessions.

#### *Annamaya (Physical Body)*

Tightness in the neck and upper back was observed in four patients. Stiffness in the neck was reported by two, low back pain by four, pain in the knees by two female patients, and restricted movement in the right shoulder and right leg with atrophy in the left leg by one male patient.

#### *Pranamaya (Energy Body)*

Breath was short and quick, with short inhalation and a strained exhalation. Average inhalation:exhalation ratio at the time of consultation was 3 s:3 s. Reported issues in this area were poor energy level, indigestion, incontinence, anger and frustration, burning sensation ( $n = 2$ ), and hot flashes ( $n = 1$ ). One female patient reported dizziness during the consultation process. Sleep was disturbed and poor in two patients.

#### *Manomaya, Vijnanamaya, and Anandamaya (Mental/Emotional Aspects)*

Anxiety, worry, low mood, sadness, agitation, suppression of emotions, anger, rage, helplessness, and distraction were some of the common complaints reported by patients. Some patients reported feelings of being a burden to the family, not being understood by family, and being victimized. One patient reported being relaxed and calm. Giving up on their interests and passions and having no interest in self-care were also reported.

### Results

Of the ten patients, seven completed 8–12 sessions and three completed fewer than 5 sessions. The most common complaints/symptoms were pain and low energy. Changes in energy level, sleep, urinary incontinence, and flexibility of the body, as well as partial improvement in pain, were reported from session 2 on. At the end of the intervention,

improvements were reported by patients and observed by therapists in breathing, pain, flexibility, balance, energy levels and stamina, digestion, sleep, bladder control, mood, attitude toward pain and condition, confidence, family relationships, interest in socializing, ability to identify stress triggers, and overall well-being. There were no changes in burning sensation, numbness, dizziness, depression, or memory loss. Three patients reported weight loss, and three others reported withdrawal of medication for acidity, urinary incontinence, pain, and inducing hunger. Patients adhered to suggested diet and lifestyle changes and reported changes in sleep, hunger, satiation, and general well-being. Gradually, the patients became more observant about their state of mind and altered their responses to daily situations. Male patients reported that their family observed changes in their mood and provided further support and encouragement. Patients reported that lifestyle changes helped them. No adverse results of yoga practice were noticed/reported. Narratives about the patients' symptoms and quality of life are presented in Appendix A.

Details of the symptoms, goals, and changes (reported and observed) and number of sessions attended are presented in Table 1.

### Change in Quality of Life

The change in QOL in multiple domains is described in Table 2 and Figure 2. All domains except sexual function showed clinically significant improvement in QOL scores after the yoga intervention. There was a statistically significant improvement in social function scores after the intervention (median score of 54.4 vs. 87.5;  $p = 0.014$ ). Similarly, median QOL score on change in health status improved from 50.0 to 87.5, a statistically significant increase ( $p = 0.029$ ). Although not statistically significant, QOL scores in domains of physical health, role limitations due to physical problems, emotional well-being, and cognitive function improved after yoga.

Changes in physical health and mental health composite scores are described in Table 3. The physical health composite score improved from a median of 72.1 to 78.9; this increase was not statistically significant ( $p = 0.063$ ). Similarly, mental health scores improved from a median of 73.3 to 85.3 ( $p = 0.093$ ).

### Change in Pain Score and Sleep Quality

The median (interquartile range [IQR]) pain scores before and after yoga were 6.0 (4–8) and 4.5 (0–7), respectively. Although there was a decrease in pain scores, this was not statistically significant ( $p = 0.091$ ). Similarly, there was improvement in sleep quality, as the scores decreased from a median (IQR) of 8 (5–15) to 6 (5–11); the difference was not statistically significant ( $p = 0.061$ ).

## Discussion

Our study examined the effect of a yoga intervention on QOL, sleep quality, pain, and improvement in MS symptoms, with encouraging findings. There was improvement in almost all domains under QOL. There were statistically significant improvements in the social function and change in health status domains after the individualized yoga intervention. Although there were improvements in pain scores and sleep quality, the differences were not statistically significant. Patient narratives and therapist observations supported the quantitative findings. The improvements in social function were supported by the patients' narratives that they felt motivated and good after practice of yoga.

Trials done on MS have shown positive results with yoga interventions. Previous studies based on interventions involving yoga alone or as one of the components have shown significant improvement in QOL.<sup>9</sup> A study of an 8-week mindfulness-based intervention that used yoga movement, mindfulness meditation, and relaxing music included 22 MS patients and reported improvements in physical functioning and mental health scores.<sup>12</sup> A single-group pilot study was done in the United States on the effect of an 8-week yoga program for 14 patients with moderate MS-related disability.<sup>9</sup> The intervention had a positive effect on physical performance, mental function, and QOL. Our study findings are comparable to the above studies. A quasiexperimental study involving a yoga-based intervention and a control group also reported improvement in subscales of QOL.<sup>13</sup>

Our study findings contrast with the results of a three-arm randomized controlled trial evaluating the effects of two 12-week exercise training interventions—movement-to-music and adapted yoga—on physical and psychosocial outcomes.<sup>14</sup> That study found no significant differences between adapted yoga and control groups. The difference in findings could be due to methodological differences such as types of yoga involved and patient characteristics including disease severity. Similarly, a meta-analysis showed no significant effect of yoga on QOL, muscle function, or cognitive symptoms; the analysis also did not report any adverse effects, suggesting the possibility of yoga's efficacy given better experimental setups.<sup>15</sup> This uncertainty as to the effect of yoga on MS may be due to our lack of knowledge of the exact mechanism by which yoga affects physiology and functioning in MS patients.<sup>16</sup>

In the present study, physical improvements were reported and observed in breathing, pain, flexibility, balance, energy levels and stamina, digestion, sleep, and bladder control as the patients progressed during the yoga intervention. In support of this finding, yoga intervention has been beneficial in reducing fatigue<sup>17</sup> and improving QOL

**Table 1.** Symptoms, Goals, and Changes Reported in MS Patients

<b>Patient (No. of Classes Attended)</b>	<b>Heyam (Symptoms)</b>	<b>Hanam (Goals)</b>	<b>Changes Reported by Patient (R) or Observed by Yoga Therapist (O)<sup>a</sup></b>
AM (10)	Burning sensation; numbness; poor sleep; fatigue; low energy; distracted; agitated	Improve sleep and energy level; calm mind	Improvement in energy (R-7); state of mind calmer (O-9)
HS (10)	Pain in chest, upper back, shoulders, left arm, and left knee; stiff hips; disturbed and poor sleep; urinary incontinence; stress	Relax neck, shoulder, and upper back area; improve flexibility in the upper body and hips, sleep, and bladder control; reduce stress	Improvement in pain in chest (R-2), upper back (R-4), shoulders (R-4), and left arm and knee (R-6); improvement in sleep (R-3) and urinary incontinence (R-3)
MK (12)	Heaviness and pain in calf muscles; discomfort in upper back, shoulders, and neck; constipation; low energy; mood swings; anger and irritability	Reduce pain and improve mobility in shoulder, neck area, and legs; improve energy and digestion; stabilize mood	Reduction in pain in calf muscles (R-7); better energy levels (R-4) and regularity of bowel movement (R-7); improvement in neck flexibility (O-4) and mood (O-4)
MT (4)	Pain in neck and low back; low energy levels and mood; dizziness when eyes are closed; depression; short-term memory loss; fear of falling; irritability and anger	Reduce pain in neck and lower back; improve balance and energy; enhance and stabilize mood	Improvement in mood (R-3)
MI (8)	Neck pain; tightness in legs; overall stiffness; inability to sleep; poor appetite; urinary incontinence; anger	Reduce neck pain; improve flexibility in spine and legs, sleep, digestion, and bladder control; calm mind	Improvement in sensation of hunger (R-2); reduction in neck pain (R-4), stiffness in legs (R-4), and frequency of anger outbursts (R-5); better bladder control (R-5); improvement in posture (O-3) and social interaction (O-5)
ND (12)	Pain in neck, shoulders, and upper back; knee locking; twitching in left cheek; numbness in right thigh; ringing in ears; urinary incontinence; poor memory; low energy; anger and rage	Reduce pain and improve flexibility in shoulder and upper back area; improve bladder control and energy levels; calm mind	Reduction in ringing in ears (R-2), pain in neck, shoulder and, upper back (R-4); improvement in energy levels (R-3); better bladder control (R-6) and memory (R-10)
NA (3)	Fatigue; mid-back and elbow pain; confusion and poor memory	Reduce pain and fatigue; improve mental state	Improvement in energy levels and reduction in fatigue (R-2)
SN (10)	Weakness in left leg; tingling sensation in abdomen; burning sensation in feet and palms; numbness in fingers, palms, toes, and soles of feet; restriction in right shoulder; “temper tantrums” (reported by patient)	Improve digestion, stability, balance, circulation, and mood	Improvement in strength in left leg (R-7); reduced numbness in fingers and palms (R-7) and toes and soles (R-10); improvement in flexibility in right shoulder (R+O-4); reduced frequency of temper tantrums (R-2); more social interaction (O-4); less fear of falling and better balance (O-7)
SG (11)	Pain in calf muscles, upper back, and neck; numbness in right arm; fatigue; light-headedness; imbalance; urinary incontinence; constipation; fear of falling; mood swings	Improve energy levels, bladder control, digestion, balance, and mood; reduce pain and tightness in legs, upper back, and neck	Improvement in bowel movement (R-6); reduction in pain in neck and upper back (R-7) and calf muscles (R-8); better social interaction (O-7)
TRK (4)	Urinary incontinence; anxiety; constipation; disturbed sleep	Improve bladder control, digestion, and sleep; reduce anxiety	Improvement in bladder control (R-3)

<sup>a</sup>Class number during which change(s) observed/reported given in parentheses

**Table 2.** Quality of Life (QOL) in MS Patients Before and After Yoga Intervention

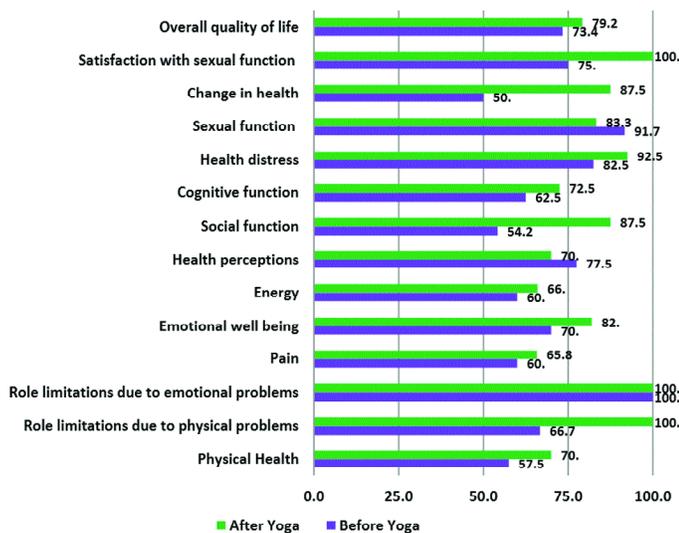
QOL Domain (MSQOL-54)	Before (n = 8)		After (n = 8)		p Value <sup>a</sup>
	Median	IQR	Median	IQR	
Physical health	57.5	40–80	70.0	48–80	0.178
Role limitations due to physical problems	66.7	33–100	100.0	67–100	0.085
Role limitations due to emotional problems	100.0	50–100	100.0	100–100	0.158
Pain	60.0	50–73	65.8	58–81	0.439
Emotional well-being	70.0	58–76	82.0	74–92	0.091
Energy	60.0	52–72	66.0	60–72	0.778
Health perceptions	77.5	55–83	70.0	60–88	0.674
Social function	54.2	50–79	87.5	83–96	0.014*
Cognitive function	62.5	40–80	72.5	63–88	0.067
Health distress	82.5	75–93	92.5	85–98	0.232
Sexual function (n = 7)	91.7	58–100	83.3	67–100	0.799
Change in health	50.0	38–75	87.5	75–100	0.029*
Satisfaction with sexual function (n = 7)	75.0	75–100	100.0	75–100	0.515
Overall QOL	73.4	64–83	79.2	70–87	0.723

<sup>a</sup>Based on Wilcoxon signed-rank test.

\*Statistically significant change.

QOL = quality of life; IQR = interquartile range.

**Figure 2.** Quality of Life in MS Patients Before and After Yoga Intervention



and physical pain management.<sup>18,19</sup> Guner and Inanici<sup>20</sup> have shown significant improvements in balance, walking speed, and step length, whereas hip flexor movements showed improvements that were not statistically significant after 12 weeks of yoga practice.

Patil and colleagues<sup>21</sup> affirmed that yoga has a positive effect on the symptoms of MS and helps in lifestyle management. The present study also showed clinically significant improvements in bladder control and digestion. Patients also reported improved confidence, family relationships, and social interaction, as found in other studies that have shown significant psychological affects of yoga.<sup>14,22</sup>

**Limitations**

Our study has the following limitations. First, the number of patients was too small to prove the effect of the yoga intervention. Although we were able to show improvements in the majority of the QOL domains, our study was underpowered to detect changes in QOL scores after the intervention. Second, the yoga intervention being customized to individual needs precludes standardization; in real-world practice, one-size-fits-all interventions may not be feasible or effective. Third, not all patients completed the intervention; only seven out of ten patients were able to attend the maximum number of sessions. Finally, some changes were subjectively self-reported by the patients. Hence, our study findings should be generalized with caution.

In our study, the yoga sessions were conducted by

**Table 3.** Composite Physical and Mental Health Scores in MS Patients Before and After Yoga Intervention

Composite Score (MSQOL-54)	Before (n = 8)		After (n = 8)		p Value <sup>a</sup>
	Median	IQR	Median	IQR	
Physical health composite score	72.1	57–80	78.9	69–81	0.063
Mental health composite score	73.3	65–85	85.3	84–88	0.093

<sup>a</sup>Based on Wilcoxon signed-rank test.

MSQOL = Multiple Sclerosis Quality of Life; IQR = interquartile range.

trained and experienced yoga therapists, which adds strength to the findings. As practices were progressively adapted to changing needs of the individual, a patient at any stage of MS progression was supported by appropriate practices, with the possibility of strengthening during remission periods. Also, we used a combination of quantitative and qualitative approaches to assess the feasibility and effect of the intervention. Direct observations by therapists at each session and perceptions of the patients after each session helped us to better customize the asana.

## Conclusions

The study has practical implications in management of patients with MS. We recommend larger studies to confirm the findings from our study. Although the number of patients was small, almost all showed improvement with regard to symptom relief, sleep quality, and QOL. Hence, practice of yoga may be encouraged in addition to medical management for better QOL, which includes social and cognitive function and physical and mental health. Practices are simple, requiring minimal support from aids and props; nearly anybody can learn them and practice on their own at home, seeking help periodically from the therapist. This increases self-agency for patients, who will learn to be more self-reliant and confident.

Our study, based on individualized application of the tools of yoga, is ideally suited to MS, which is complex and demonstrates varied degrees and nature of disability progression. Furthermore, as the intervention is primarily breath-based, it brings about physical, physiological, mental, and emotional changes that are mediated by conscious breathing; these changes have a far-reaching effect on the individual's well-being and functional status. The sustainability of the yoga intervention for the long term could be high and the associated cost for practicing yoga is negligible. Yoga intervention for patients with MS is feasible. Seven out of ten patients included attended the majority of the sessions. The improvement seen in QOL, especially in social and cognitive function, was encouraging. Lifestyle modifications suggested as part of the intervention were found helpful by the patients, which suggests that yoga has several benefits in patients with MS and helps alleviate various physical, physiological, and psychological symptoms.

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## Conflict-of-Interest Statement

The authors have no conflicts of interest to declare.

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## **Appendix A.** Patient Symptoms and Salient Characteristics Observed by Yoga Therapists During the Intervention

**AM:** Participant had high heat in the palms and soles of feet as well as severe burning sensation in the body that caused her to use ice packs regularly. She had frequent bouts of fever, especially after her weekly MS medication. She was uncomfortable in forward-bending and supine asana, so her practice was predominantly seated, standing, and forward-bending postures without lowering the head. Walking on the toes and balancing postures improved her interest and attitude toward practice. She was the only participant with a long breath, so she was given pranayama ratios to further improve the quality of breath and focus and to calm the mind. Because of the heat and burning sensation, cooling techniques such as sitali with sound were given to her. Although she was motivated by practicing in a group, she was easily distracted and had poor adherence.

**HS:** Participant had limited mobility on the left side of the body due to a paralytic attack before MS, along with severe radiating pain in the chest, shoulders, mid-back, and head. She could not read or write in English, so practice was taught to her in Urdu; it was found later that she memorized the practice sheet. Adherence was high. Breath practice with niyasam was incorporated along with daily prayers. She was given both morning and evening practices along with a few conscious stretches with attention to breath and stretches at regular intervals during the day.

**MI:** Participant had frequent bouts of fever after taking his weekly MS medication. He could not read or write in English, so practice was taught to him in Urdu; it was found later that he memorized the practice sheet. Although attendance was erratic, his home practice was regular. Breath practice with niyasam was incorporated along with daily prayers. There was fear of pain and reluctance to try new postures; as he started observing positive changes, he was open to trying and had more interest in his practice.

**MK:** Participant was motivated by practicing in a group setting. He was able to do many postures. He was given morning and evening practices and stretches with attention to breath at regular intervals during the day. His attendance and adherence were high.

**MT:** Participant had severe dizziness in certain standing and lying positions that increased when eyes were closed. She was given postures with wall support and in a seated position and kept her eyes open during practice. She had challenges in comprehension, recollection, and adherence to practice. She discontinued after four sessions.

**ND:** Patient's main complaints were low confidence and a need to improve memory, tinnitus, urinary incontinence, and anger. She was initially irregular and sometimes skeptical about the practice but later attended regularly. She was easily distracted and found comfort in sharing. She was regular with her pranayama practice more than with asana practice.

**NA:** Participant was not motivated to do home practice and discontinued after three sessions.

**SN:** Participant had asymmetry in his body due to previous injuries (restriction in right shoulder, right leg shorter than left leg) and therefore had imbalance and used a cane to walk. He was given mainly asana in a seated position in the beginning of the intervention, and he progressed to asana standing, lying supine, and seated on the ground. Support was placed under his right leg to correct the imbalance in length of the legs. He was given morning and evening practices along with stretches with attention to breath at regular intervals during the day. His session attendance and adherence to home practice were high.

**SG:** Among the complaints listed, constipation caused the most distress to her. Practice was modified to address constipation along with other complaints. She reported that she referred back to certain techniques from her practice when she was stressed. She was motivated and interested in her practice, and adherence was high.

**TRK:** Participant had severe urinary incontinence, anxiety, constipation, disturbed sleep, and low confidence. She said that she found traveling out of her home very challenging. She was given morning practice and a relaxing evening practice. She had difficulty in understanding the practice. She discontinued after four classes.