

Research Paper

Effectiveness Yoga Exercises on General Health of Patients With Multiple Sclerosis: A Single-subject Study

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ABSTRACT

Background and Objective: Multiple sclerosis (MS) is among the most prevalent autoimmune diseases, with a rising incidence worldwide. This study aimed to examine the impact of a course of yoga practice on the general health of individuals with MS.

Materials & Methods: This single-subject study involved four participants and utilized the ABAB design, where “A” represented the baseline phase and “B” denoted the intervention phase. Data were collected using the public health questionnaire, visual analysis and the calculation of mean and percentage changes within and between phases for data analysis.

Results: Participant R experienced a 55% improvement in general health, participant M showed a 43% enhancement, participant F demonstrated a 13.11% increase and participant A exhibited a 43.75% boost.

Conclusion: Yoga exercises can enhance general health by influencing the muscular and nervous systems, hormones, and neurotransmitters.

Keywords: Yoga, Multiple sclerosis (MS), General health

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Introduction

Multiple sclerosis (MS) is a chronic, progressive, and autoimmune neurological disorder affecting the central nervous system [1]. It stands as one of the most prevalent autoimmune diseases, with its incidence on the rise globally. The symptoms of the disease can vary based on the type of nerves involved [2]. There appears to be a bidirectional relationship between this physical ailment and psychological disorders. We present the collection of these psychological disorders as public health, effective in three areas: Physical, mental and social health [3].

Given the absence of definitive treatment for MS and the bothersome side effects associated with drug therapies [4], yoga enhances mental and physical well-being through physical exercises, breathing techniques and meditation as a form of mental intervention in the body [5]. Yoga stands out as a cost-effective and secure complementary treatment approach that has gained widespread recognition globally, offering high accessibility [6].

Nevertheless, despite numerous experimental studies investigating the impact of yoga on MS-related complications, there are limited single-subject studies. A significant challenge in experimental research is the necessity of a large subject pool, which can be uneconomical in terms of expenses and time. Moreover, in this approach, individual differences may influence research outcomes, leading to difficulties distinguishing between individual variances and independent variables from the test results. However, in single-subject studies, each participant serves as their control, maintaining a consistent experimental environment and conducting multiple and continuous measurements of the dependent variable. This method ensures that changes experienced by each subject during the study are not conflated with group effects [7]. Additionally, single-subject studies closely resemble real-world treatment scenarios.

Materials and Methods

This single-subject study employed an ABAB design, with A representing the non-intervention phase and B representing the intervention phase. The study population consisted of women with MS from Borujerd City, selected through convenience and voluntary sampling methods based on prior research and reputable research methodology texts, like “experimental psychology: Principles and practices [7].” Initially, a statistical sample of seven women aged 30 to 45 years with MS was chosen;

however, the sample size was reduced to four individuals due to constraints related to cooperation and availability of companions.

The inclusion criteria comprised a confirmed diagnosis by a specialist physician, literacy in reading and writing, aged between 30 and 45 years and no prior history of yoga practice. The exclusion criteria involved non-participation in yoga classes for any reason and engagement in multiple other sports simultaneously.

Data were gathered through the general health questionnaire (GHQ). Taqavi assessed the GHQ’s validity using test re-test, halving reliability coefficient, and the Cronbach α , yielding reliability coefficients of 0.70, 0.93 and 0.90, respectively. The 28-item GHQ was deemed suitable for implementation in psychological and clinical research [8]. Responses were rated on a 4-point Likert scale ranging from 0 to 3, with lower scores indicating better general health.

The research procedure was elucidated to the participants upon obtaining permissions and approvals. The research period was segmented into four ABAB phases to monitor and assess individual changes, with tests conducted and recorded every four days. Phase A involved no intervention for 16 days, while phase B encompassed a 24-day intervention where participants engaged in yoga training sessions. Following 21 test sessions for each participant, the sampling phase concluded, leading to the subsequent step of diagram creation and initiation of research hypothesis analysis. To maintain participant confidentiality, subjects were introduced using the pseudonyms R, F, M and A.

Results

The collected data were presented in tables and graphs to assess the impact of yoga practice on the general health of MS patients.

Based on Figure 1 and Table 1, subject R’s average general health score during the first to fourth phases of the intervention was 17.8, 13.2, 14.33 and 8, respectively. This finding signifies a 25.84% increase in the second phase, an 8.56% decrease in the third phase (without intervention), and a 44.17% increase in the fourth phase compared to the preceding phases. Overall, subject R’s general health improved by 55% throughout the study.

For subject M, the average general health score from the initial to the final phase of the intervention was 14, 7.4, 12 and 8, respectively. This finding indicates a

Table 1. Mean scores of the GHQ

Phase	Mean			
	Participant			
	R	M	F	A
No intervention phase (A)	17.8	14	36.25	16
Intervention phase (B)	13.2	7.4	30.8	12.33
No intervention phase (A)	14.33	12	41.75	13
Intervention phase (B)	8	8	31.5	9

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47.14% increase in the first phase, a 62.16% decrease in the third phase and a 33.33% increase in the fourth phase. Subject M’s general health improved by 42.85% during the study.

Subject F’s average general health score during the first to fourth phases of the intervention was 36.25, 30.8, 41.75 and 31.5, respectively. This reflects a 15.03% increase in the second phase, a 35.55% decrease in the third phase and a 24.55% increase in the fourth phase. Overall, subject F’s general health improved by 13.1% in this study.

Subject A’s average general health score from the first to the fourth phase of the intervention was 16, 12.33, 13 and 9, respectively. This result indicates a 22.93% increase in the second phase, a 5.43% decrease in the third phase, and a 30.76% increase in the fourth phase. Over-

all, subject A’s general health improved by 43.75% in this research.

Overall, the results demonstrated an enhancement in general health across all intervention phases. Notably, in the third phase, general health declined for all subjects except subject F. Conversely, the improvement in general health during the third phase, compared to the first phase, indicated the stability of the initial intervention period. Ultimately, there was an enhancement in the general health of all subjects by the conclusion of the research.

The outcomes of the Friedman test revealed a significant variance among the phases without intervention, the initial intervention phase, the subsequent phase without intervention, and the subsequent intervention phase (Friedman $\chi^2=9.99$, $P\leq 0.019$), highlighting a notable

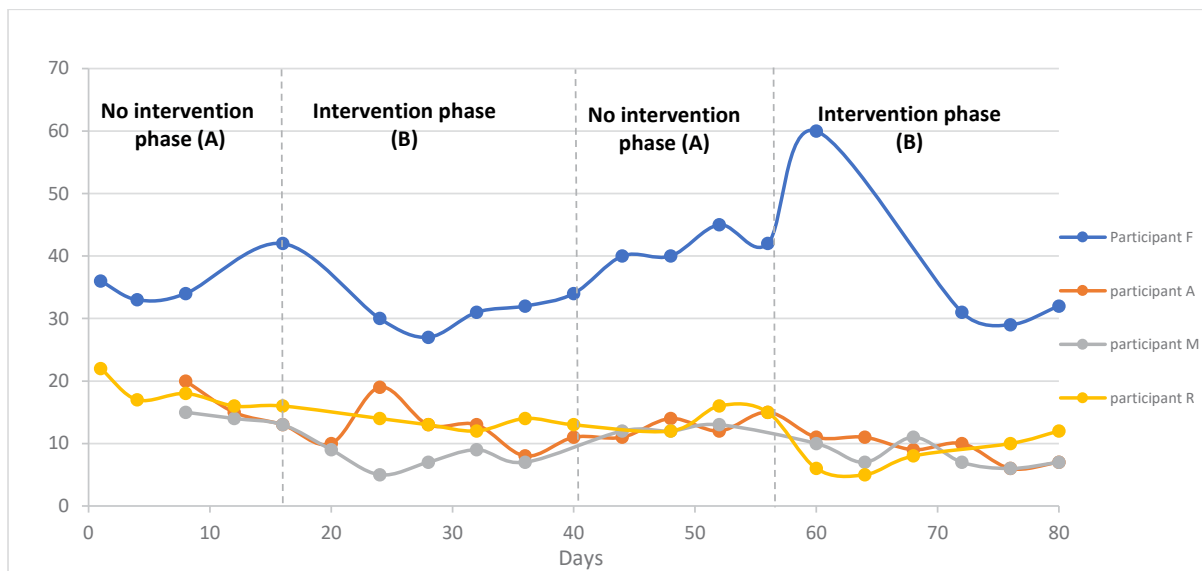


Figure 1. Scores of the GHQ

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distinction between the study stages. Furthermore, the Wilcoxon's matched-pairs signed-rank test illustrated a significant difference between the phases without intervention and the initial intervention phase ($Z=2.03$, $P\leq 0.042$), as well as between the phases without intervention and the subsequent intervention phase ($Z=2.04$, $P\leq 0.041$).

Discussion

Yoga exercises can enhance the management of physical functions, increase physical stability and body resistance, and influence the overall sense of bodily health by boosting adaptability in mental, nervous, immune, and cognitive systems. Additionally, yoga aids in regulating the autonomic nervous system, further enhancing physical stability, body resistance, and immune system function [9]. Furthermore, yoga exercises improve the quality of life for MS patients by decreasing fatigue levels and enhancing sleep quality. Meditation can decrease activation in the prefrontal cortex, amygdala and hippocampus when exposed to pain stimuli. This reduced activation may result in a more neutral perception of pain, ultimately elevating physical health and quality of life [10]. Depression correlates with reduced brain-derived neurotrophic factor (BDNF) levels and elevated cortisol levels. Yoga proves effective in elevating BDNF levels and lowering cortisol levels.

Consequently, yoga, either alone or in combination with medications, may be effective in ameliorating symptoms of depression. Moreover, increased BDNF levels can significantly impact neuroplastic function [11]. As per the monoamine hypothesis, an imbalance in dopamine and serotonin hormones can also contribute to depression. Recent studies indicate that yoga exercises can elevate dopamine levels by 65% [12]. Breathing techniques like Brahmari aid in balancing the autonomic nervous system by diminishing sympathetic activity and enhancing parasympathetic output. This balance can assist in alleviating negative emotions such as stress, depression, and anxiety [13].

The limitations of this research encompass challenges related to questionnaire completion due to frequent testing, restricted participant access, cooperation issues, and subjects' reluctance to engage in non-intervention periods, potentially resulting in the resurgence of physical and psychological complications. Despite these limitations, the strengths of this study offer hope that this methodology can be employed for a more comprehensive exploration of the trajectory and evolution of variable changes.

Conclusion

Yoga exercises can enhance general health by influencing the muscular and nervous systems, hormones, and neurotransmitters.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of [Islamic Azad University, Borujerd Branch](#) (Code: IRCT20230508058119N1). Ethical considerations encompassed obtaining written consent, ensuring candidates the confidentiality of their personal information and characteristics.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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