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# Non-pharmacological Management of Multiple Sclerosis: The Role of Sport and Rehabilitation

**Maria Wieczorek**

Medical University of Warsaw

Żwirki i Wigury 61, 02-091, Warsaw, Poland

wieczorekmarialucja@gmail.com

ORCID: 0009-0000-9951-7509

**Weronika Górska**

Medical University of Warsaw

Żwirki i Wigury 61, 02-091, Warsaw, Poland

weronika.maslow@gmail.com

ORCID: 0009-0005-3155-9573

**Weronika Plichtowicz**
Medical University of Warsaw
Żwirki i Wigury 61, 02-091, Warsaw, Poland
plichtowicz.w@gmail.com
ORCID: 0009-0009-7713-8597

**Lena Jaworowicz**
Medical University of Warsaw
Żwirki i Wigury 61, 02-091, Warsaw, Poland
lena.jaworowicz@gmail.com
ORCID: 0009-0008-4210-7216

## ABSTRACT

**Introduction:** Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system that primarily affects young adults. This study aimed to review the current evidence on the role of exercise and rehabilitation in managing MS symptoms and improving patients' quality of life.

**Materials and Methods**: A comprehensive literature search was conducted using Google Scholar and PubMed databases. The search included articles published from 2005 onwards. Keywords used in the search included "multiple sclerosis", "rehabilitation", "sport" and "therapy." Abstracts were initially screened to identify potentially relevant studies. Subsequently, each selected publication underwent thorough analysis.

**Objectives:** The aim of this review was to collect and synthesize available information on the role of physical exercise, sports, and rehabilitation in patients with multiple sclerosis.

**Results:** The findings highlight the significant benefits of regular physical activity and exercise for MS patients. Various forms of exercise, including aerobic training, resistance training, and water-based activities, have been shown to improve balance, mobility, fatigue levels, and overall quality of life. Emerging rehabilitation technologies, including transcranial magnetic stimulation, virtual reality, and telerehabilitation, have further expanded treatment options for MS patients.

**Conclusions:** Exercise and rehabilitation play crucial roles in managing MS symptoms and improving patients' functional outcomes. While the evidence supports these multifaceted

approaches, further research with larger cohorts is needed to establish their long-term effectiveness and refine personalized treatment protocols for MS management.
**Keywords:** Multiple sclerosis, rehabilitation, physical activity, exercise therapy, non-pharmacological management, fatigue, mobility, balance

## 1.Introduction

Multiple sclerosis (MS) is one of the leading causes of neurological disability in young adults. Characterized by inflammation, demyelination, and neurodegeneration, MS presents with a wide range of symptoms. Common symptoms include fatigue, which can be severe and debilitating, as well as vision problems such as blurred or double vision, and optic neuritis. Many patients experience sensory disturbances like numbness, tingling, or pain in various parts of the body, along with mobility issues including muscle weakness, spasticity, and difficulties with balance and coordination. Cognitive symptoms, affecting memory, concentration, and information processing, bladder and bowel dysfunction, sexual problems, and mood changes such as depression are also frequently reported [1,2]. The disease course varies among individuals, with some experiencing relapsing-remitting patterns while others progress to more severe disability. MS is classified into several types based on its progression: relapsing-remitting MS (RRMS), the most common type, characterized by clearly defined attacks of worsening neurological function followed by periods of partial or complete remission. Primary progressive MS (PPMS), marked by a gradual decline in neurological function without relapses or remissions. Secondary progressive MS (SPMS), initially presents as RRMS but transitions into a progressive decline in function over time. Progressive-relapsing MS (PRMS), a rare form where progressive worsening occurs with acute relapses but without periods of full remission [3,4]

Given the complexity of the disease, multidisciplinary management incorporating both pharmacological and non-pharmacological approaches is essential. Recent studies emphasize the importance of personalized rehabilitation programs that integrate physical therapy,

cognitive training, and lifestyle modifications to optimize functional outcomes and improve patient quality of life [5, 6].

**Epidemiology**

The global prevalence of MS has significantly increased in recent years. As of 2020, approximately 2.8 million people worldwide are estimated to have MS, corresponding to a global prevalence of 35.9 per-100,000 individuals. The pooled incidence rate across 75 reporting countries is 2.1 per-100,000 persons/year. The mean age of diagnosis is 32 years [7]. MS is more common in females than in males, with a ratio ranging from 2:1 to 3:1.
The highest prevalence is typically observed in the 45- to 64-year-old age group [7, 8].

## 2.Physical activity

Recent research underscores the benefits of physical activity in MS patients. A systematic review and meta-analysis demonstrated that exercise improves balance, walking ability, endurance, fatigue levels, and quality of life. Various forms of exercise, including aerobic training, resistance training, and multi-component training, have been investigated for their effects on MS symptoms [9].

Aerobic activities such as cycling, walking, and swimming improve cardiovascular health, enhance respiratory function, and help manage fatigue in MS patients. Studies suggest that moderate-intensity training, performed at least three times per week, can improve endurance, reduce systemic inflammation through modulation of cytokine levels, and enhance overall quality of life [10,11].

Mechanistically, aerobic exercise exerts beneficial effects by upregulating brain-derived neurotrophic factors (BDNF), which play a pivotal role in synaptic plasticity, neurogenesis, and myelin repair [12]. Furthermore, stimulates mitochondrial biogenesis in skeletal muscle, increasing energy efficiency and reducing exercise-induced fatigue. Additionally, aerobic has been shown to attenuate oxidative stress markers, thereby preserving neuronal function and reducing neurodegeneration in MS patients [11].

Progressive resistance training (PRT) enhances muscle strength, which is crucial for mobility and reducing fall risk. PRT involves systematic overloading of muscles through weight-bearing

or resistance exercises, leading to hypertrophy and neuromuscular adaptations[13,14].It also modulates inflammatory responses by reducing levels of pro-inflammatory cytokines while increasing anti-inflammatory mediators[15].

Fast-velocity concentric resistance training has shown promising results in improving muscle strength, walking speed, and reducing fatigue. It involves performing resistance exercises with rapid concentric contractions, optimizing neuromuscular activation and enhancing power output. Studies suggest that this type of activity can counteract the effects of muscle atrophy and contribute to the preservation of neuromuscular integrity in progressive MS cases [16]

Water-based exercises have been found to be effective in reducing fatigue, improving mobility, and enhancing muscle coordination in MS patients [17]. The buoyancy of water reduces the impact on joints and muscles, allowing for greater freedom of movement without exacerbating symptoms [18].

## 3.Rehabilitation

Rehabilitation encompasses a comprehensive, multidisciplinary approach aimed at addressing the diverse and evolving needs of MS patients. It integrates various modalities, including physical therapy, occupational therapy, speech therapy, and psychological support, to enhance mobility, cognitive function, communication, and overall quality of life [19,20].

Physical therapy plays a critical role in improving mobility, strength, coordination, and endurance. Techniques such as task-specific training, electrical stimulation, and robotic-assisted therapy are used to enhance functional movement [21]. Treadmill training may be an effective form of task-specific training for improving mobility in individuals with Parkinson's disease and multiple sclerosis. Analysis of 16 studies showed that treadmill training improved comfortable gait speed in people with Parkinson's disease and multiple sclerosis, as well as increased step length and walking endurance. Although the results are promising, the authors note that sample sizes in the analyzed studies were small, so conclusions should be interpreted with caution [22].

Occupational therapy (OT) helps MS patients maintain their ability to perform daily activities by focusing on energy conservation strategies, adaptive equipment use, and fine motor skill improvement. It also addresses workplace adaptations to sustain employment [20].

MS can impact speech and swallowing functions. Speech and language therapy (SLT**)** interventions include exercises to strengthen the oropharyngeal muscles, compensatory strategies for dysphagia, and cognitive-linguistic training to assist with communication difficulties. A pilot double-blinded randomized controlled trial demonstrated that Traditional dysphagia therapy (TDT) significantly improved swallowing function. The TDT program included sensorimotor exercises and swallowing maneuvers [23].

Neuropsychological rehabilitation programs are essential for addressing memory, executive function, and processing speed deficits common in MS. Cognitive training, compensatory strategies, and mindfulness-based interventions are often utilized [21,24].

MS-related spasticity is managed through a combination of stretching exercises, neuromuscular re-education, and modalities such as transcutaneous electrical nerve stimulation (TENS) or botulinum toxin injections [25].

Comprehensive rehabilitation programs are personalized to address the progressive nature of MS and maximize patient independence, social participation, and overall well-being.

## 4. Conclusions

The findings of this review highlight the significant role of exercise and rehabilitation in managing multiple sclerosis (MS). The multifaceted approach, combining physical activity and comprehensive rehabilitation programs, show promise in addressing various MS symptoms and improving patients' quality of life.

The benefits of exercise, including aerobic and resistance training, are well-documented, with improvements noted in balance, mobility, and fatigue levels. The underlying mechanisms, such as enhanced neuroplasticity and reduced inflammation, provide a strong physiological basis for these interventions.

Comprehensive rehabilitation programs, integrating physical, occupational, and speech therapies, offer a holistic approach to MS management. The positive outcomes in areas such as gait improvement, daily activity maintenance, and cognitive function underscore the importance of these interventions.

However, it is crucial to acknowledge the limitations of the current research. Many studies have small sample sizes, which may affect the generalizability of results. Future research should focus on larger cohorts and longer-term follow-ups to establish the sustained efficacy of these interventions.

Additionally, personalized approaches tailored to individual patient needs and disease progression should be further explored. This could lead to more targeted and effective rehabilitation strategies for MS patients.

**Disclosure**

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Methodology: Maria Wieczorek, Weronika Górska
Check: Lena Jaworowicz, Weronika Plichtowicz
Formal analysis: Maria Wieczorek
Investigation: Weronika Plichtowicz, Weronika Górska, Maria Wieczorek
Resources: Weronika Górska
Data curation: Lena Jaworowicz
Writing - rough preparation: Lena Jaworowicz, Weronika Górska
Writing - review and editing: Maria Wieczorek
Visualization: Weronika Plichtowicz
Supervision: Maria Wieczorek

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