

Exercise as Medicine in Multiple Sclerosis— Moving Beyond Compensatory Benefits

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Many studies have shown that physical exercise improves multiple sclerosis (MS) symptoms, including cognition, fatigue, bowel and bladder function, depression, and overall quality of life. However, the pathophysiologic mechanisms responsible for these symptomatic changes remain elusive. Exercise offers a likely path for addressing progressive MS, nervous system repair, and as a wellness approach for people with MS. We as a community need to work toward gaining information to establish an evidence-based exercise prescription for people living with MS.

Keywords

Physical activity, training, aerobic exercise, strength training, plasticity, rehabilitation, recovery

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The importance of exercise for symptom management in multiple sclerosis (MS) has gained increasing momentum over the last 25 years. It was not so long ago that patients with MS were advised to avoid exercise. Studies in the 1970s showed evidence suggesting that increasing body temperature when exercising caused variable changes in motor function for people with MS.¹ However, in 1996, Petajan and colleagues² highlighted the benefits of exercise, showing evidence that aerobic training improved cardiovascular fitness, bowel and bladder function, fatigue, depression, and increased participation in social activities. Since then many studies have described symptomatic benefits gained when using different exercise modalities.^{3–7} Frohman and colleagues⁸ described how aquatic exercise provides a unique and beneficial medium for patients with MS due to water's buoyant effects and the thermodynamic, or heat dissipating, benefits associated with exercising in cool water. A study by Wiens and colleagues⁹ showed that 12 weeks of music therapy improved expiratory muscle strength by training participants with MS to breathe diaphragmatically and coordinate breath with speech. One study showed that benefits from exercise could be gained in as little as 8 weeks with supervised strength training.¹⁰ It is important to emphasize that MS symptoms are often improved when people exercise.

Given these positive changes in MS symptoms it is unfortunate that our understanding of the pathophysiologic pathways that can explain the positive effects of exercise remains unclear. Exercise is used often in MS clinical care; however, the focus is on its compensatory benefits without regard to its potential restorative benefits. We need answers to questions such as: Does physical exercise improve MS symptoms via synaptic changes at the axon? Does exercise effect cortical reorganization in MS? Are metabolic changes the important element, or does exercise simply improve co-morbidities (e.g., weight loss), thereby indirectly affecting secondary complications such as pain? Evaluating the link between symptoms and brain and spinal cord pathology in people with MS has been done almost exclusively using imaging technology. There is evidence that specific areas of the brain and spinal cord correlate with behavioral outcome measures such as strength, fatigue, and cognition.^{11–13} Yet it has proved difficult to move past descriptions of correlational relationships. Rodent experimental autoimmune encephalomyelitis models offer another avenue to evaluate mechanism and behavior. One study in mice showed that voluntary wheel running (i.e., aerobic exercise) significantly attenuated the magnitude of axonal loss when compared to a nonrunning condition,¹⁴ and showed an overall reduction in oxidative stress.^{15,16} Evidence from other pathologies should also be considered, and if relevant, pursued in MS. Jakowec and colleagues¹⁷ showed that motor recovery in patients with Parkinson's disease is enhanced when cognitive circuits are engaged; they emphasized that, to be most effective, exercise must be of high intensity, challenging, specific to the motor circuits affected, and engaging to the individual. Exercise as medicine has caught on in the

public health domain and marketing worlds. But one size does not fit all. Not every person in the exercise studies previously described improved from the same intervention or to the same degree. Why is that? Sound exercise prescription relies on clearly identifying symptoms, understanding the indications for the intervention, and providing the appropriate intensity, frequency, and duration.

In summary, exercise has limited risks and can be a user-friendly, cost-effective, and self-motivated moderator of ongoing disease with the potential for restorative and preventative outcomes. Exercise is well accepted in the MS community as a critical component of a healthy lifestyle. The National

Multiple Sclerosis Society (NMSS) recognizes the need for a comprehensive approach when addressing MS symptoms and supports the framework that exercise is a viable treatment in this complex disease. Taking this support one step further, the NMSS convened a Wellness Research Working Group of scientists and patients whose mission is to consolidate evidence supporting a wellness lifestyle, including exercise, with a goal of providing practical recommendations for people living with MS.¹⁸ Exercise offers a promising path for addressing progressive MS, nervous system repair, wellness, and lifestyle. The scientific community, along with the NMSS and others, must continue to work toward gaining information to establish an evidence-based exercise prescription for people living with MS. □

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