



Review Article

Guidelines for Home-Based Physical Activities during COVID-19 Quarantine for People with Multiple Sclerosis: A Narrative Review

Hamid Mahdavi Mohtasham^{1*}, MSc; Shahnaz Shahrbanian², PhD; Majid Mahdavi Mohtasham³, MSc

¹Department of Sports Medicine, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

²Department of Sport Science, Faculty of Humanities, Tarbiat Modares University, Tehran, Iran

³Department of Computer Science, Islamic Azad University Kermanshah Branch, Kermanshah, Iran

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ABSTRACT

Background: COVID-19 seems to have a major impact on physical activity behaviors, especially for people with Multiple Sclerosis (MS) who have health conditions.

Methods: This study was a narrative review. Six databases, namely PubMed, ISI Web of Knowledge, Scopus, Google Scholar, Science Direct, and ProQuest, were search for relevant published studies.

Results: Healthcare providers and organizations advise people to stay at home, but this does not mean that they should be inactive. Self-isolation has an adverse effect on behavior activities and mental health in people with MS. Physical activity can act as medicine for people with MS, as it helps reduce stress, anxiety, and fatigue while improving balance, muscle strength, flexibility, and quality of life.

Conclusion: People with MS are recommended to perform activities such as whole-body chair exercises with moderate intensity at least 150 minutes per week according to the level of the individual's ability.

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Introduction

The novel coronavirus disease 2019 (COVID-19), identified in December 2019 in Wuhan, China, is an infectious disease which leads to mild to moderate respiratory illness. According to the World Health Organization (WHO), COVID-19 is a pandemic. To protect against contracting the virus, people should stay at home and isolate themselves, but such practices could adversely affect people's physical activity behaviors [1].

Multiple sclerosis (MS) is an autoimmune disease of the central nervous system (CNS) which leads to physical or cognitive disabilities [2]. The exact cause behind MS is still unknown, but there is increasing evidence suggesting that a combination of genetic and environmental factors

may increase the risk of developing this disease [3]. Genetic factors include genetics, smoking, and obesity, and environmental factors include climate, certain autoimmune diseases such as type 1 diabetes, certain infections such as coronavirus and human herpesvirus 6 (HHV-6), age, and gender [2, 3]. MS is common in women, and onset can vary from childhood to adult life; around an age of 20-40 is most frequently seen [4]. MS symptoms comprise muscle stiffness, spasms, weakness, fatigue, walking and balance dysfunction, depression and anxiety, and problems with mobility [3]. Because of these disabilities, people with MS are less active than healthy adults [5], which can affect their quality of life (QOL) [2].

People with MS are a vulnerable group during COVID-19 pandemic [6]. To reduce the risk of catching COVID-19, the authorities have recommended that people with MS should self-isolate as much as possible [6]. However, studies have shown that isolation can reduce health-related quality of life (HRQOL) in up to

*Corresponding author: Hamid Mahdavi Mohtasham, MSc; Department of Sports Medicine, School of Medicine, Shahid Beheshti University of Medical Sciences, Yaman st, Shahid Chamran Highway, P.O. Box: 19857-17443, Tehran, Iran. Tel: +98 21 22605090
Email: hamidmahdavi@sbmu.ac.ir

70% of MS sufferers [7]. COVID-19 has adverse effects such as anxiety on the mental health of healthy adults [8], and its effects could be much worse for people with MS.

The WHO state that physical activity is important for health and well-being during self-quarantine [9]. There is no original study or clinical trial on how exercise can protect people with MS against COVID-19, but there are plenty of studies on the effects of exercise on respiratory illness [10, 11] and how exercise improves immune system function [12].

Upper respiratory tract infection (URTI) is caused by various pathogens such as coronavirus and influenza, which involves the nose, sinuses, pharynx, or larynx [13]. It is believed that moderate-intensity exercise such as aerobic activity can help the immune system deal with pathogens to reduce the risk of the infection severity (32-41%), frequency (43-46%), and symptomatology (34-41%) [11].

It is acknowledged that reducing stress levels, getting adequate sleep, and eating a balanced diet strengthen the immune system. Studies have also shown that exercise makes the body resistant to diseases such as colds and flu [10, 11]. The J-shape model describes the relationship between exercise intensity and the risk of catching URTI. The model showed that moderate-intensity exercise may lower the risk of URTI, while high-intensity exercise may increase the risk [14]. Hence, moderate-intensity exercise could enhance immune function, decreasing the risk of respiratory infections.

T helper (Th) cells play a significant role in the initiation and progression of MS. Th-2 cells reduce inflammation by specific cytokines such as interleukin (IL)-4 and IL-13, while Th-1 and Th-17 cells promote inflammation by a large number of cytokines such as interferon-gamma (IFN- γ), IL-17, IL-21, IL-22, and IL-26 [3]. One study indicated that IL-4, IL-10, c-reactive protein (CRP), and IFN-g are significantly reduced after progressive

resistance training [15]. In addition, a most recent study indicated that 8 weeks of combined exercise (aerobic and resistance training) in people with MS may decrease plasma and peripheral blood mononuclear cell (PBMC) IL-17 and IFN- γ production [16].

During the COVID-19 pandemic, gyms and healthcare-related centers have been closed, and people with MS cannot benefit from exercise, but they can perform physical activity and exercises at home. Therefore, this study purposed to determine a strategy for protecting people with MS against the COVID-19 pandemic and to propose a home-based exercise activity for people with MS during the COVID-19 quarantine period.

Methods

This narrative review of studies on the effects of exercise in people with MS was conducted to propose a guideline for people with MS during COVID-19 quarantine.

The databases of PubMed, ISI Web of Knowledge, Scopus, Google Scholar, Science Direct, and ProQuest were searched for the key words, people with MS, multiple sclerosis, immune system, COVID-19, coronavirus, exercise, home-based exercise, and physical activity. After eliminating all unrelated and repetitive articles, those articles that met the inclusion criteria and were written in English were selected (Figure 1).

Results

Various studies have been conducted on the different activities of people with MS, such as aerobic [17], resistance [17], yoga [18], and Pilates [19] exercises. MRI studies have shown that physical activity may have neuroprotective effects by increasing the cortical thickness in people with MS, which can, in turn, impact the progression of the disease [20]. According to meta-

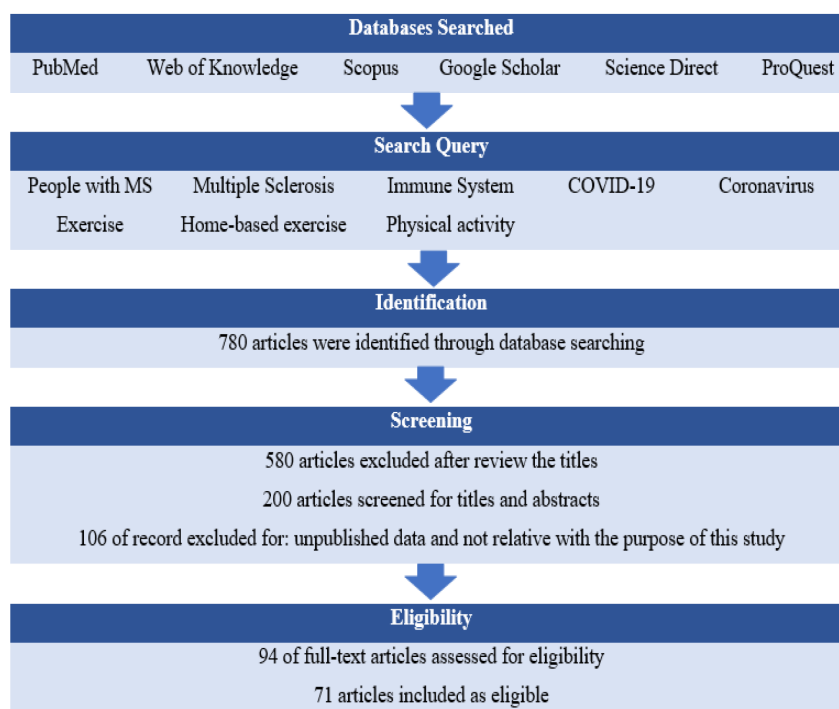


Figure 1: Search strategy diagram

analyses and systematic reviews of randomized controlled trials, exercise and physical activity can improve QOL [21] and impact overall immune function [22] in people with MS and serve as “medicine” [2]. Moreover, exercise can improve the mental health of people with MS [23].

Home-Based Physical Activity

Although gyms are closed due to the pandemic, people with MS can benefit from performing physical activities at home. Every exercise can be performed at home except those that need particular equipment, such as weights. MS sufferers can also benefit from home equipment workouts such as TRX, resistance bands, ankle weights, etc. Sosnoff et al. studied adults with MS who performed 12 weeks of a group of exercises (stretching, core muscle strength, balance, and lower limb muscle strength); each session lasted 45-60 minutes, and each exercise was performed in sets of 8-10 repetitions [24]. Their results showed that that home-based exercises are safe, feasible, and effective for reducing physiological fall risk in older adults with MS [24].

Resistance Training. Studies have found that resistance training can improve muscle strength in people with MS [25]. Furthermore, resistance training can improve functional capacities such as gait, stair climbing, and chair transfer [25-27] and decrease fatigue [25] in people with MS. Most studies have focused on the lower extremities [25, 27], because strength deficit is more

frequently experienced in the lower extremities than in the upper extremities by people with MS [28]. DeBolt et al. showed that home-based resistance exercise can improve leg extensor power in people with MS. Their patients performed lower-extremity resistance training accompanied by a DVD 3 times per week for 8 weeks. The sessions consisted of 5-10 minutes warm-up, 25-30 minutes strengthening exercises, and 5-10 minutes whole-body stretching. The patients performed 3 sets of 8-12 repetitions of chair raises, forward lunges, step-ups, heel-toe raises, and leg curls. To increase the intensity, a vest, ankle weights, and a step were used [27].

Some studies conducted on upper extremity showed improvement in the upper extremity muscle strength (elbow flexors and extensors, shoulder abductors and adductors) [26].

Endurance Training. Many studies have investigated different kinds of endurance training, such as bicycle ergometry and treadmill walking [29-34]. Endurance training can be done at home on a chair in the sitting position such as seated knee lifts (Figure 2). The results of previous studies have indicated that endurance training with low to moderate intensity can improve the activities of daily living in people with MS with EDSS scores below 7. Studies have also shown that long-term endurance training can improve maximal aerobic capacity (Vo2max) [30].

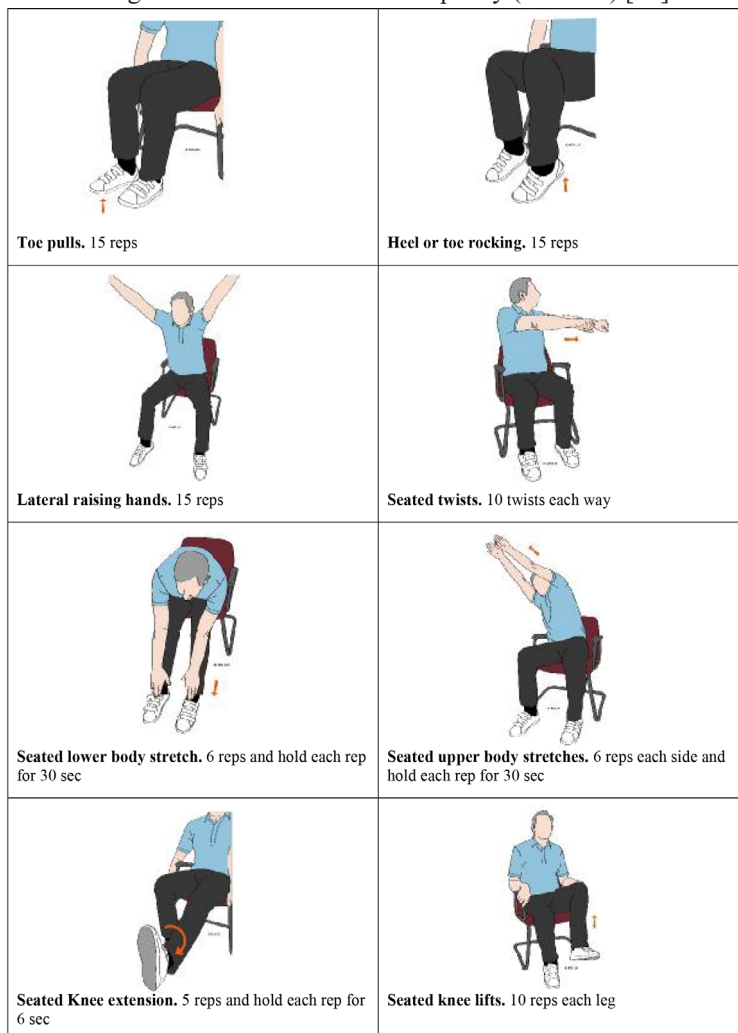


Figure 2: 5-minute whole-body workout on chair. Adapted from MS-UK (Multiple Sclerosis-United Kingdom) with permission. Reps: Repetitions

Virtual reality-based treadmill training (VR-TT) can be beneficial for people with MS. People with MS with mild to moderate disabilities received VR-TT three times per week for six weeks, and each session lasted 45 minutes. The results showed significant improvements in walking endurance and speed, cadence and stride length, lower limb joint ranges of motion, powers, and balance [35].

Core exercise. People with MS suffer from walking impairments, and trunk control is a prerequisite for walking. One study indicated that core and balance exercises, called Group Core DIST, performed for 60 minutes three times per week for 6 weeks could improve walking [36].

Pilates. Marques et al. reported the safety and efficiency of Pilates training as a method to improve QOL, cognition, physical performance, strength, balance, walking, and posture parameters in people with MS. The exercise group performed home-based training (chair raises, forward lunges, step-ups, heel-toe raises, and leg curls) 3 times per week for 8 weeks [19].

Yoga. Hasanpour-Dehkordi et al. indicated that yoga can increase lower extremity strength and balance. It can also decrease fatigue and pain in people with MS [37]. In their study, MS sufferers performed yoga exercises three sessions per week for 12 weeks, and each session lasted 60-70 minutes. Hatha yoga was performed in the study, which included postures, breathing, and meditation components. Each pose was held between 10-30 seconds, and the rest interval between poses was 30-60 seconds [37]. Yoga can help MS patients control their anxiety and stress, and it promotes social functioning. Hasanpour-

Dehkordi and Jivad found that yoga may improve QOL in people with MS. The study compared the effects of regular aerobic and yoga on QOL in people with MS. The patients performed yoga 3 sessions per week for 12 weeks [34].

Recommendations for Physical Activity

People with MS should perform physical activities at least 150 minutes per week (2-3 days per week) [38]. There are examples of exercises which they can do for different goals, such as balance exercises (standing and straight-line walking with as little assistance as possible), lower limb muscle strength exercises (squats and leg abductions with an exercise band), stretching exercises (ankle rotations, hamstring stretch, and inner groin stretch), and core muscle strength exercises (abdominal crunch and seated twist), or they can adapt the exercises to their own needs at the online source (Table 1).

People with MS can begin with one set of 8 repetitions per each task and progress to three sets of 8 repetitions. According to their ability, they can later change the exercise progression through lying, kneeling, sitting, or standing positions. Figure 2 presents a 5-minute whole-body workout on the chair proposed by MS-UK.

To have a successful workout, people with MS should remember to do a warm-up before and a cool-down after the workout. Moreover, they should not push their bodies hard. If they need to rest, they should do so without hesitation. In addition, people with MS should keep their body temperature low by staying hydrated-cold or exercising in a cool room.

Table 1: Guideline for home-based activities for patients with multiple sclerosis (MS) during COVID-19 quarantine

Mode of Exercise	Guideline	General Goals	Example
Physical Activity	<ul style="list-style-type: none"> • Daily • 30 min in total 	<ul style="list-style-type: none"> • Improve daily activity • Increase energy expenditure 	<ul style="list-style-type: none"> • Cooking • Gardening • Household chores
Aerobic exercise	<ul style="list-style-type: none"> • 2–3x/week • 10–30 min (40%–60% MHR) (or 3 sets, 10 min) 	<ul style="list-style-type: none"> • Increase cardiovascular function • Improve endurance capacity • Reduce risk for coronary artery disease 	<ul style="list-style-type: none"> • Stationary bike • Chair aerobics • Water aerobics • Walking • Dancing
Resistance Training	<ul style="list-style-type: none"> • 2–3x/week • 1–3 sets for each exercise, • 8–15 repetitions (or 10 sets, 3 repetitions) • 5–10 exercises 	<ul style="list-style-type: none"> • Increase muscle strength and endurance • Reduce fatigue • Reduce spasticity • Equalize agonist/antagonist 	<ul style="list-style-type: none"> • Bodyweight • Resistance Band • Free weight • Weight Machines • Ball • Pilates
Flexibility (Stretching)	<ul style="list-style-type: none"> • Daily • 2–3 sets of each stretch • Hold 30–60 sec 	<ul style="list-style-type: none"> • Increase joint ROM • Reduce spasticity • Improve balance 	<ul style="list-style-type: none"> • Yoga • Tai Chi • Passive ROM • Active ROM
Neuromotor	<ul style="list-style-type: none"> • 3–6x/week • 20–60 minutes 	<ul style="list-style-type: none"> • Prevent falls • Improve balance • Improve coordination • Improve cognitive 	<ul style="list-style-type: none"> • Tai Chi • Virtual reality • Yoga
Core	<ul style="list-style-type: none"> • 2x/day • 4–5 repetitions • Holding each repetition 10–15 seconds 	<ul style="list-style-type: none"> • Prevent falls • Improve balance 	<ul style="list-style-type: none"> • Dead bug • Hollow hold • McGill curl-up • Side bridge • Bird dog
Postural	<ul style="list-style-type: none"> • Every 1–2 hours • Hold for 10–15 seconds 	<ul style="list-style-type: none"> • Improve gait • Prevent falls • Improve balance stability • Improve coordination • Reduce fatigue 	<ul style="list-style-type: none"> • Active weight shifting • Posture exercises such as Chin tuck and Pull shoulder blades back.
Breathing	<ul style="list-style-type: none"> • Every second day • 3 sets • 10 repetitions 	<ul style="list-style-type: none"> • Improve lung function • Reduce stress • Reduce anxiety 	<ul style="list-style-type: none"> • Square breathing (inhale, hold, exhale, and hold for 2 sec)

Discussion

It has been found that MS as an autoimmune disease could be affected by environmental factors such as COVID-19, which could further lead to an increased risk of developing it. According to the WHO, self-isolation is one of the protective measures against COVID-19 [1]. However, people with MS are less active than healthy adults, and self-isolation could affect their health [7]. Various studies have reported that exercise and physical activity play important roles in people with MS lives [2, 21, 23]. Therefore, people with MS should be active, especially during the pandemic, but the problem is that gyms are closed during COVID-19 quarantine.

People with MS can benefit from exercising at home. Studies have indicated that home-based exercise can improve physical and mental health in people with MS [24, 35, 36, 39]. People with MS can perform many types of physical activity at home, such as resistance training, aerobic exercise, Pilates, stretching, and virtual exercise, based on their ability.

Because of a lack of activity during the quarantine and safety concerns, resistance exercise may not be a good first choice for people with MS; after a couple weeks of performing other home-based physical activity, however, it might be good.

Aerobic exercise is fun, simple, and helps improve activities of daily living and preserve energy during the day in people with MS. Therefore, it might be a good choice for people with MS wanting to start exercising.

Some studies have investigated the efficiency of yoga in people with MS, but methodologically sound evidence was not found on the subject, and according to a systematic review and meta-analysis, it requires further study [18]. Researchers have stated, however, that people with MS who are not adherent to recommended exercise regimens might perform yoga as an alternative option [18].

Pilates is a type of exercise which can be performed at home and does not require special equipment. It can also improve physical function [19, 24, 36]. In addition to improving physical performance, Pilates also can improve mental health [40]. Pilates' breathing principles reduce sympathetic nerve activity and lead to improvement in serotonin system regulation [39]. The study results showed that two weekly sessions for eight weeks of home-based Pilates by DVD at home can improve the management of several mental health symptoms, such as anxiety, depression, and fatigue, among people with MS [39].

Conclusion

Although self-isolation has an adverse effect on behavior activities and mental health in people with MS, home-based activities provide an opportunity for them to stay healthy during the pandemic. People with MS should perform physical activities or exercises with moderate intensity at least 150 minutes per week. Furthermore, they should choose a favorable activity according to their ability level.

Acknowledgment

The figures used in this study were produced by MS-UK, and permission for use was granted subject to an appropriate acknowledgement given to MS-UK. For further exercises suitable for people living with MS, visit the MS-UK website.

Conflict of Interest: None declared.

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