

Pilates exercise training Vs physical therapy for improving walking and balance in people with multiple sclerosis: A randomized controlled trial

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Abstract - Background: The capacity of individuals with multiple sclerosis to walk and maintain balance was tested in a randomised control trial to compare the benefits of a Pilates exercise programme to traditional physical therapy sessions. **Method:** Before and after the training, participants were tested on their walking speed, balance, trust in their own equilibrium, lung capacity, and mental acuity. **Results:** The Pilates and home exercise groups did not vary from one another on measures of walking speed ($p=0.096$), perceived walking ability ($p=0.165$), or fear of falling ($p=0.385$). **Conclusion:** Pilates has the potential to improve mobility and stability for persons living with multiple sclerosis. There is no evidence that this technique is more effective than conventional physical therapy.

Keywords - Pilates exercise training, Physical therapy, Improving walking, Multiple sclerosis, Randomized controlled trial

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INTRODUCTION

Inflammatory and myelin-free lesions develop all across the central nervous system in people with multiple sclerosis, an inflammatory illness. There is presently no treatment for it, and it has an unpredictable and worsening clinical course [1].

Living with multiple sclerosis (MS) can be challenging and overwhelming. The symptoms of this neurological disorder, which can include movement difficulties, balance problems, numbness, and fatigue, can make everyday life difficult and uncomfortable. Fortunately, there are several treatment options to choose from. Two of the most popular treatments are Pilates exercise training and physical therapy. In this article, we'll take an in-depth look at the differences between Pilates exercise training and physical therapy, as well as the effectiveness of each in improving walking and balance in people with MS.

The cause of the condition known as multiple sclerosis is unknown. Researchers [2] speculate that an autoimmune process, the genesis of which is unclear, is exacerbated by the interplay of many genetic susceptibility factors and environmental variables.

The majority of lesions are located in the brain and spinal cord. Demyelinated plaques, which are a kind of

myelin loss lesion, have a negligible impact on astrocytes and axons. White periventricular matter in the brain, cerebellum, and spinal cord are often affected by the lesions [2].

The location of the demyelinating lesions is connected to the symptoms, however the symptoms may not always show in the clinic in the same manner. Primary, secondary, and tertiary lesions are the three classifications [3].

Conspicuous neurological impairments are the most prominent indicators of CNS injury (ataxia, spasticity, tremor, paresthesias, etc.). Constraints, ulcers, urinary tract infections, and other complications are all examples of secondary symptoms. Tertiary symptoms, often known as impairments, are the mental, social, and financial consequences of the disease.

To put it simply, spasticity is a condition of movement characterised by involuntary muscular tension in a small number of muscles. In turn, this causes the muscles to atrophy and become less pliable, making it difficult to move and do daily duties. It may cause discomfort or perhaps serious disability if left untreated. Joint contractures may be avoided with a combination of passive, aided, and

free joint mobilisations (depending on the degree of dysfunction) and stretching exercises. Other physical therapies include cryotherapy and electrical stimulation [4].

Tiredness is the state of being unable to muster the mental or physical energy to go on with one's usual activities. Tiredness is a common symptom of multiple sclerosis [5].

Research shows that almost half of individuals in a hot environment had severe fatigue and other neurological issues. Fever may be particularly problematic when combined with environmental heat or strenuous physical exertion, both of which can increase core body temperature. Temperature control is the best treatment for MS [6].

Neurological issues that only last a short time are known as paroxysmal phenomena. The paroxysmal phenomenon can cause a wide variety of symptoms, including pain disorders like trigeminal neuralgia, sensitivity deficits like paresthesias, pruritus, and the of erhermitte sign, visual problems like diplopia and the Unthoff sign, motor problems like a sudden loss of strength and tonic spasms, and coordination issues like stuttering and stumbling (paroxysmal ataxia, dysarthria). Multiple sclerosis patients report discomfort between 30% and 60% of the time. Sports performance may help you manage your discomfort till you can stand again.

Pilates is an exercise method that targets the whole body by performing movement sequences. By strengthening core muscles and stretching supple fascia, Pilates improves awareness of one's body's structural makeup and how muscles work. During these routines, you'll learn to focus on maintaining a strong core while you move.

Hence, MS sufferers may benefit from Pilates since strengthening the core may alleviate problems with balance and movement. The developer of these routines said that harmony between the two was essential for optimal health. And his "method of motion control," which he dubbed "Contrology," was patented, too. All you need is a yoga mat and the floor for these moves. There is a chain of machines that may be used, each with its own set of components like springs, pulleys, and so on.

Focusing on breathing, control, fluidity, centre, focus, and precision may help you achieve a state of muscular equilibrium.

Physically, Pilates is challenging. A wide range of muscle groups, from the deep core muscles to the superficial limb muscles, are used. The mind and body are working together. This method lends credence to the theory that one might improve their energy centre to increase their overall vitality. A person's "centre of force" consists of their glutes, their lower back, and their abdominal muscles. By reinforcing certain areas, we can "work the energy from the inside out," so

reducing inhibitions on the remainder of the body's range of motion. The objective is to achieve muscular balance, which may be achieved by lengthening underdeveloped muscles and strengthening overdeveloped ones. Without putting stress on the spine or joints, this improves core strength and mobility [7-10].

Multiple Sclerosis

A chronic inflammatory disease that attacks the central nervous system, multiple sclerosis (MS) affects the immune system. It may be identified by neurological symptoms that recur and disappear as well as a progressive loss of function over time. When the immune system isn't working correctly, the myelin sheath, axons, and oligodendrocytes get irritated and damaged.

MS affects around 1 million people in the United States and is often discovered in people between the ages of 20 and 50. Very young children and elderly people are less likely to be impacted by it. Compared to those who were born male, people who were born female had a higher risk of developing MS. MS was long considered to predominantly impact Caucasians, yet a current study reveals that the incidence among African Americans is larger than previously assumed [11].

The likelihood of acquiring MS may be impacted by a person's genes and environment, even though there is no recognised cause for the disease.

Pilates Exercises

Body-Mind Pilates exercises are among the workouts that emphasise controlled movement, posture, and breathing. Pilates, which is pronounced "puh-lah-teez," is a kind of exercise that employs controlled movements on a mat or with apparatus to tone and strengthen the body and support both physical and mental wellness. It mixes movements from the East (Hatha-Yoga) with those from the West (proper breathing, relaxation, movement directed by the mind, precision, and the body centre as the primary energy point) (endurance training, stabilisation – classical ballet). Crews asserts that the exercise method he describes is intended to develop every muscle in the body, but it really focuses mostly on conscious engagement on deep muscular systems. To stabilise motion, these structures must operate properly [12].

Physical Therapy

Pilates exercise training is a form of exercise that focuses on strengthening the body's core muscles. It was developed by Joseph Pilates in the early 20th century and is now a popular form of exercise for people with MS. Pilates exercise training focuses on improving posture, flexibility, balance, and

coordination. It also incorporates stretching and breathing exercises to help relax the body [13].

Physical therapy is more focused on restoring movement and function. It uses a variety of exercises and equipment to help improve strength, flexibility, balance, and coordination. Physical therapy can also help reduce pain and improve quality of life.

A recent study conducted by the National Institutes of Health (NIH) sought to compare the effectiveness of Pilates exercise training and physical therapy in improving walking and balance in people with MS. The study used an intelligent ensemble based system for detecting, which incorporated the user's input. The study involved 89 participants with MS who were randomly assigned to either a Pilates exercise training group or a physical therapy group. The participants underwent 24 sessions of either Pilates exercise training or physical therapy over the course of 12 weeks.

At the end of the study, the results showed that both Pilates exercise training and physical therapy were effective in improving walking and balance in people with MS. However, the study found that Pilates exercise training was slightly more effective than physical therapy in improving walking and balance [14].

Physical therapy uses both passive methods and therapeutic activities to strengthen the spine and other parts of the body. In addition to evaluating the child's trunk, arms, and legs for strength and range of motion, a physical therapist spends their time getting to know the parents of each new child [15, 16]. Through the use of well planned exercises, physical therapy may help a lot of kids.

By exercise, a child's muscles may get stronger and their range of motion can be improved. Some kids discover that physical activity improves their ability to keep their balance. Your child may do exercises on their own or with help from a physical therapist [17]. Active therapy, sometimes referred to as therapeutic exercise, includes stretching and posture correction and works to strengthen your back and reduce your risk of further damage. A physical therapist may be able to extend your child's arm or leg to enable better use of it. The use of heat or cold, ultrasound, electrical stimulation, and joint mobilisation are examples of passive approaches [18]. Children may get help from a physical therapist in methods more than just exercise. Take whirlpool baths in warm water with spinning currents to relieve your stiff and sore joints. Both an ice pack and a heating pad may ease pain and swelling. Massage is a different way to help too tense muscles relax. Physical therapists often work with kids to help them feel better, become stronger, and go back to utilising as much of their bodies as they can.

Physical therapy seeks to help kids with their gross motor skills, which include things like walking, running, crawling, and jumping and use the large muscles in the body. The physical therapist may demonstrate and go through strategies to help your child improve their gross motor skills by maintaining frequent communication with parents and teachers. Some of the exercises and activities that families began with their child at home must be continued. This is essential if things are to get better [19]. If physical therapy only applied at home and at school, where children spend the most of their time, once a week or once a month, it wouldn't be very beneficial [20].

METHODS

The study's methodology was developed in accordance with all CONSORT recommendations. A randomized controlled study was place in the Kingdom of Saudi Arabia. Throughout the course of their regular clinical examinations, patients were made aware of the research and given the opportunity to participate. A neurologist, physiotherapist, and psychologist all helped decide who may participate in the research. Participants were selected at random after meeting the study's inclusion criteria.

In all, 45 people living with MS with disability scores below 6.0 were enlisted. G*Power was used to determine the optimal sample size in advance. Using an alpha error probability of 0.05, an effect size of 0.61, and a power of 80%, the a priori sample size was calculated to be 18 individuals per group.

Participants had to be above 18 years old, able to walk 100 meters unassisted, have a confirmed diagnosis of MS according to the updated McDonald criteria (10), and be ready to take part. Exclusion criteria included current or recent participation in a core stability-based exercise program, relapse within 3 months, orthopedic disorders that could negatively affect gait and balance, cardiopulmonary problems that could affect exercising, diagnosed psychiatric problems or cognitive decline that render the patient incapable of performing tests and exercise training, and any neurological disease other than MS.

Randomization and allocation

Participants who met the study's inclusion criteria and gave their informed consent were randomly divided into two groups, one for each sex and one for each EDSS.

Intervention Programs

The abdominal draw-in movement and fundamental concepts like concentration, breathing, and knowing where your rib cage, shoulder, head, and neck are were introduced in the first session. The physiotherapist encouraged the patients to maintain neutral spine and pelvic alignment, activate the

transverse abdominal muscle, and breathe deeply during all exercises. The members of the control group were given standardized written homework to complete at home three times each week for a total of eight weeks. Designed to enhance spinal column flexibility, upper and lower limb strength, trunk and pelvic stability, and balance, these exercises represented standard therapeutic practice. Pilates exercises were performed in a different order from those performed at home. The schedule included a warm-up, the main event, and a wind-down. The exercises progressed by having the subject do more reps in different postures with less assistance. Participants were reminded through phone calls and handed printed brochures at the beginning, middle, and end of the study (weeks 3, 4, and 6).

Outcome Measurements

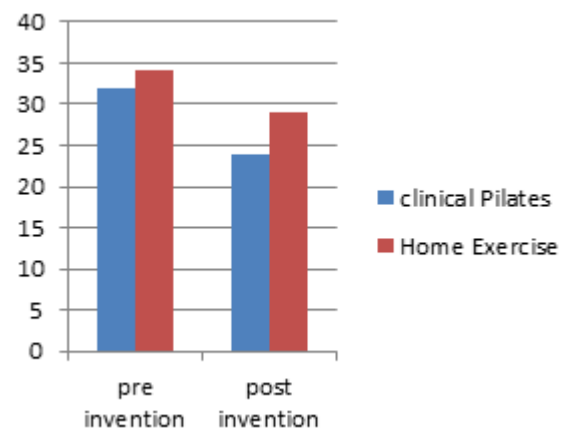
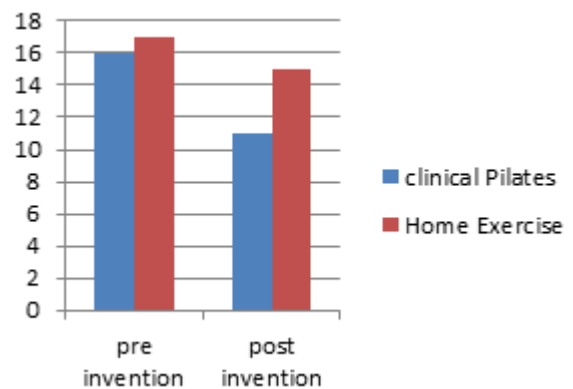
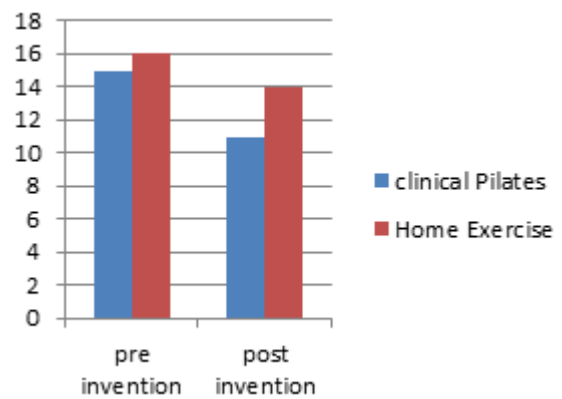
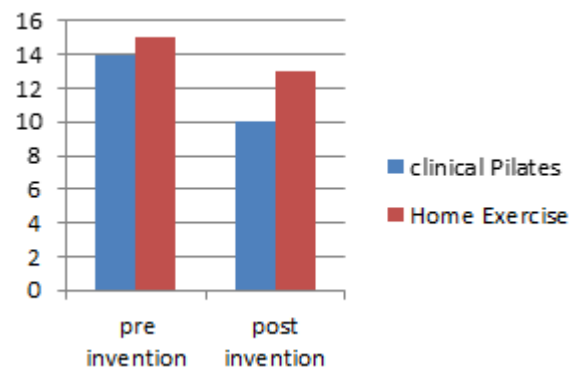
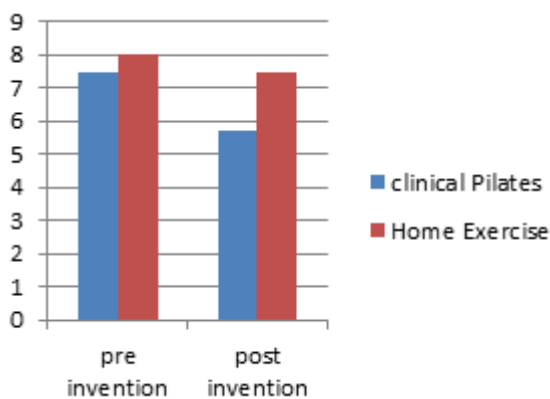
Both pre- and post-treatment assessments were conducted. A physiotherapist evaluated the patient's physical condition, while a psychologist evaluated the patient's mental health. Demographic and clinical information was collected, such as gender, age, height, weight, body mass index (BMI), and a 3-month fall history for MS patients.

To evaluate the training's safety and acceptability, weekly phone calls were used to gather data on exercise-related adverse events (the number of participants who reported ill effects such extreme weariness, discomfort, dizziness, and falls as a consequence of exercise).

IBM SPSS Statistics for Windows was used to examine the data (version 24.0).

RESULTS

Forty-five people who may have participated in the research initially signed up. Withdrawals occurred in both groups (five from Clinical Pilates, four from the control). The final evaluations were completed by 35 people (n=17 in the Clinical Pilates group and n=18 in the control group) (Figure 1).



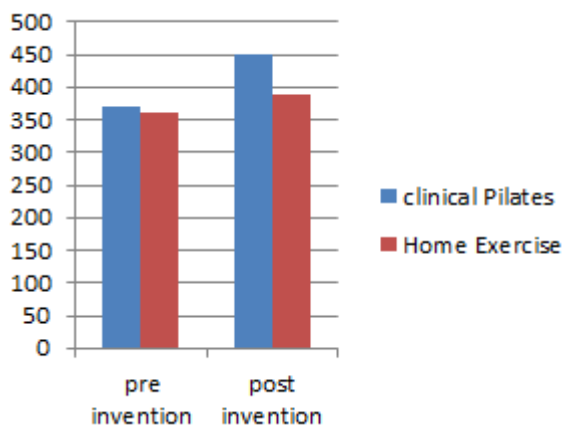


Figure 1: Comparison of pre- and post-intervention scores on outcome measures linked to walking for the Clinical Pilates and home exercise groups. Observable and quantifiable progress (SEM). *Statistically significant improvement.

Age, EDSS, illness duration, and body mass index showed no significant group differences ($p > 0.05$). From the outset, there was no statistically significant variation in the outcome measures (Table 1). Throughout the course of the research, just one participant in the home fitness program group reported falling.

Table 1: Demographics characteristics of the participants

Variable	All participants	Control (n=18)	Pilates (n=17)
Age (years)	45.45 (9.9)	48.24 (11.7)	42.5 (6.7)
Gender	23 females (69.7%) / 10 males (30.3%)	11 females (64.7%) / 6 males (35.3%)	12 females (75%) / 4 males (25%)
Body mass (kg)	26.39 (4.3)	26.5 (4.2)	26.28 (4.7)
Cerebellar	2.3 (1.1)	1.8 (1.0)	1.7 (0.8)
Disease duration (years)	12.59 (6.2)	9.83 (8.7)	11.84 (6.8)
EDSS	3.06 (1.6)	3.24 (1.7)	4.1 (1.1)
Height (cm)	1.65 (0.8)	1.66 (0.9)	1.65 (0.8)
Type of multiple sclerosis, n (%)			
Relapsing-remitting	28 (84.8)	14 (82.3)	14 (87.5)
Secondary progressive	5 (15.)	3 (17.64)	2 (12.5)

EDSS: Expanded Disability Status Scale

Controlling for baseline values, the Clinical Pilates group showed more improvement in walking and balance test scores (6-Minute Walk Test [6MWT], curl-up test [CT], limits of stability [LOS], overall postural stability [POS], mediolateral postural stability [MPS]) (Figures 1). Clinical Pilates led to significantly more gains in respiratory muscle strength and cognitive scores than did home exercise alone ($p < 0.05$) (Figures 2 and 3).

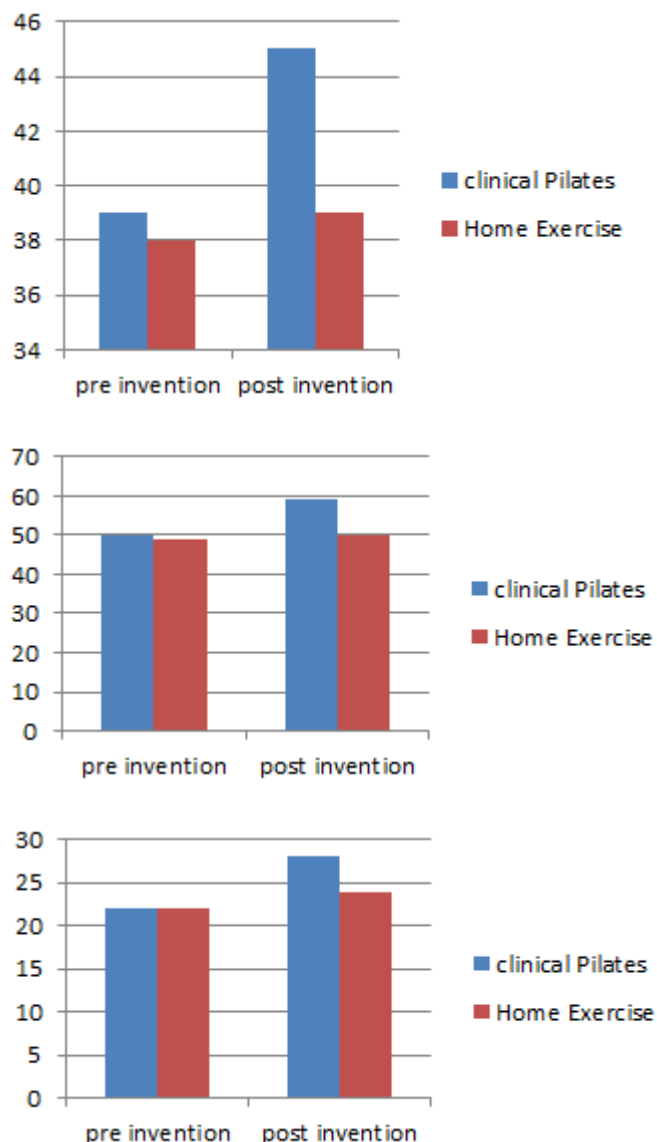


Figure 2: Comparison of pre- and post-intervention scores on cognitive outcome measures between the Clinical Pilates and home exercise groups. Standard deviation of the mean is shown by the error bars (SEM). * Observable and quantifiable progress.

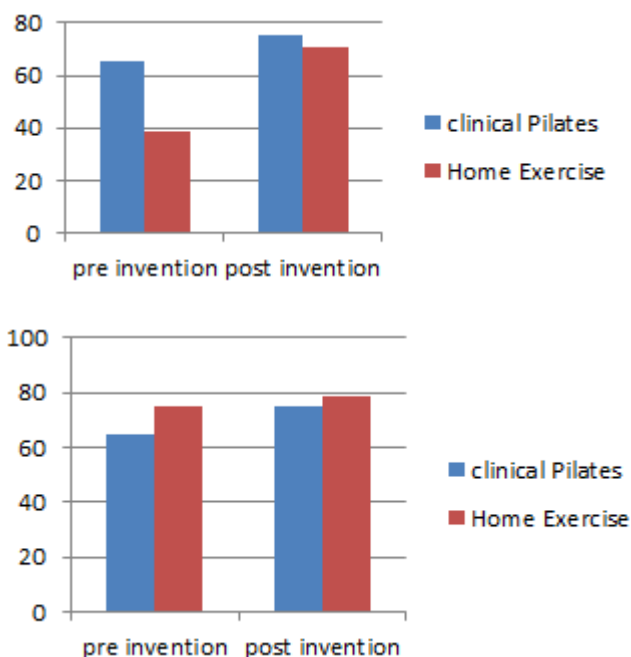


Figure 3: Comparison of pre- and post-intervention scores on outcome measures linked to respiratory muscle strength in the Clinical Pilates and home exercise groups. Standard deviation of the mean is shown by the error bars (SEM). * Observable and quantifiable progress.

CONCLUSION

This research concludes by offering an alternate rehabilitation approach for MS patients. Despite the lack of prospective randomized research employing Pilates for walking and balance rehabilitation in MS, this study shows that it is a viable therapeutic option. Yet, this approach is not noticeably superior to more conventional forms of physical therapy.

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