



Original Article

Effects of Routine Physical Therapy with and without Pilates-based Core Stability Exercises on Gait, Function and Balance in Patients with Multiple Sclerosis

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ABSTRACT

Background: In multiple sclerosis, the immune system erroneously assaults and harms the protective myelin and this can cause a variety of symptoms such as muscle weakness, coordination difficulties, vision disturbances and chronic pain. **Objective:** To determine the effects of routine physical therapy with and without Pilates-based core stability exercises on gait, function and balance in ambulant multiple sclerosis. **Methods:** A randomized controlled trial was conducted at the Afeera Saleem Physiotherapy Clinic in Gujranwala, Pakistan and completed within nine months, after the approval of the synopsis. The sample size for this study was calculated to be 74 with 37 individuals in each group, using non-probability purposive sampling for the selection of sample. Patients with multiple sclerosis, meeting the McDonald's criteria, aged 18 years or over, able to walk independently with or without assistive devices such as a walking stick or orthotic brace and both males and females were included. Patients having pathology or recent injury of the lower extremity, lumbar radiculopathy, systematic diseases, congenital deformity or having scores less than 6 on the truncated mental test were excluded. The qualitative data was presented as frequency and percentages. **Results:** This showed that there was a statistically significant difference in mean ranks between the Pilates group and routine physical therapy group at the post-intervention and follow-up time points (p-value 0.000). The Pilates group had a higher mean rank on the functional reach test measure at these time points compared to the routine physical therapy group at the post-intervention level, the mean ranks at the follow-up level, the mean ranks for the timed up and go test were 20.57 for the Pilates group and 54.43 for routine group, a p-value of 0.000, indicating a statistically significant difference between the two groups mean rank of 22.62 for the Pilates group and a mean rank of 52.38 for the routine physical therapy group (p-value 0.000). **Conclusion:** The results of this study suggest that the Pilates intervention was effective in improving timed up-and-go tests and expanded disability status scale scores for individuals with multiple sclerosis as compared to the routine physical therapy intervention.

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INTRODUCTION

Multiple sclerosis (MS) is a chronic autoimmune disease that distresses the central nervous system, which includes the brain and spinal cord. In MS, the immune system erroneously assaults and damages the protective covering that surrounds nerve fibers called myelin. This damage can cause a variety of symptoms, such as muscle weakness, coordination problems, vision disturbances, and chronic pain. Multiple sclerosis is considered a rare disease, with an estimated prevalence of around 2.5 million cases worldwide.¹ The prevalence of MS can vary depending on the population and region studied. It's expected that nearly 400,000 people in the United States have MS, with new cases diagnosed every week.² It is characteristically diagnosed between the ages of 20 and 40 but can be diagnosed at any age. The prevalence of MS also tends to be higher in regions further away from the equator. The particular source of MS is not fully understood, but it is thought to be an autoimmune disorder. Multiple sclerosis is a disorder that impairs a person's ability to operate in their lower extremities, which leads to a reduction in balance.³

Multiple sclerosis is a neurological condition that makes it difficult for a person to walk normally, maintain their balance, and walk at a normal speed.⁴ The Pilates exercise routine is beneficial in that it helps to develop the core muscles; however, there is inadequate evidence to support the assertion that this is the case.⁵ A study published in 2022 found that a combination of routine physical therapy and Pilates-based core stability exercises improved gait, function, and balance in ambulant individuals with MS. The study included a group of participants who received routine physical therapy and a group who acknowledged routine physical therapy plus Pilates-based core stability exercises. Both groups showed improvements in gait, function

and balance, but the group that received the additional pilates-based exercises showed greater improvements.⁶ Arik et al. 2022 conducted a study and found that pilates exercises may be a non-compulsory way for enlightening balance in Multiple sclerosis patients, according to the study's results; nevertheless, further research is required to determine if it is more beneficial than other physiotherapy methods.⁷ According to the findings of the research, Pilates is beneficial for improving one's cognitive skills as well as balance, locomotion, physical-functional conditions (muscle strength, core stability, aerobic capacity, and body composition), and body structure. There was no discernible improvement in either the level of weariness or the quality of life or psychological function. On average, there was a degree of commitment to the Pilates intervention that was more than 80%.⁵ A randomized control trial was conducted by Güngör et al., in 2022 core stability found that the patients with multiple sclerosis benefited from this treatment in terms of increased lower limb strength and improved postural stability.⁸

There are not a lot of studies that have been done to appraise the effectiveness of pilates exercises on the function, gait, and balance of people who have multiple sclerosis. The management of MS typically involves a combination of approaches, including There are several medications available to help manage the symptoms of MS, including disease-modifying therapies that can slow the advancement of the disease and symptomatic treatments that can help alleviate specific symptoms such as fatigue, spasticity, and spasms.⁹ Physical therapy, occupational and speech therapy can help to advance mobility, coordination and general functioning for people with MS.¹⁰ Assistive devices such as canes, walkers, and other assistive devices can help to advance mobility and independence for people with MS.¹¹ There is a lack of

studies assessing the long-term effects of such interventions, and research on the best dosage, intensity, frequency and specific Pilates exercises that are most appropriate for people with MS is lacking.

METHODS

The study was a randomized controlled trial (RCT) conducted to explore the effect of routine physical therapy with and without Pilates-based core stability exercises on gait, function, and balance in ambulant individuals with multiple sclerosis. Fish and bowl methods were used to randomly select the patients in this study. The study was conducted at the Afeera Saleem Physiotherapy Clinic in Gujranwala, Pakistan, and lasted for nine months, starting after obtaining ethical approval for the study. The sample size for this study was calculated to be 31 individuals in each group, with an additional 20% dropout rate taken into account, resulting in a total of 37 individuals in each group. The study used a non-probability purposive sampling technique to select the sample.

Patients with multiple sclerosis, meeting the McDonald's criteria, aged eighteen years or over, able to walk independently with or without assistive devices such as a walking stick or orthotic brace, and both genders were included. The exclusion criteria for the study included pathology or recent injury of the lower extremity, lumbar radiculopathy, systematic diseases, congenital deformity, relapse in the preceding three months, medical conditions contra-indicating involvement in core stability exercises, scores less than six on the truncated mental test, current or fresh participation in core stability exercises, current involvement in another interventional research study. This study was double-blinded as the assessor and the patients in both groups were unaware of the groups they were allocated to make sure that study is unbiased. The study was measured through the

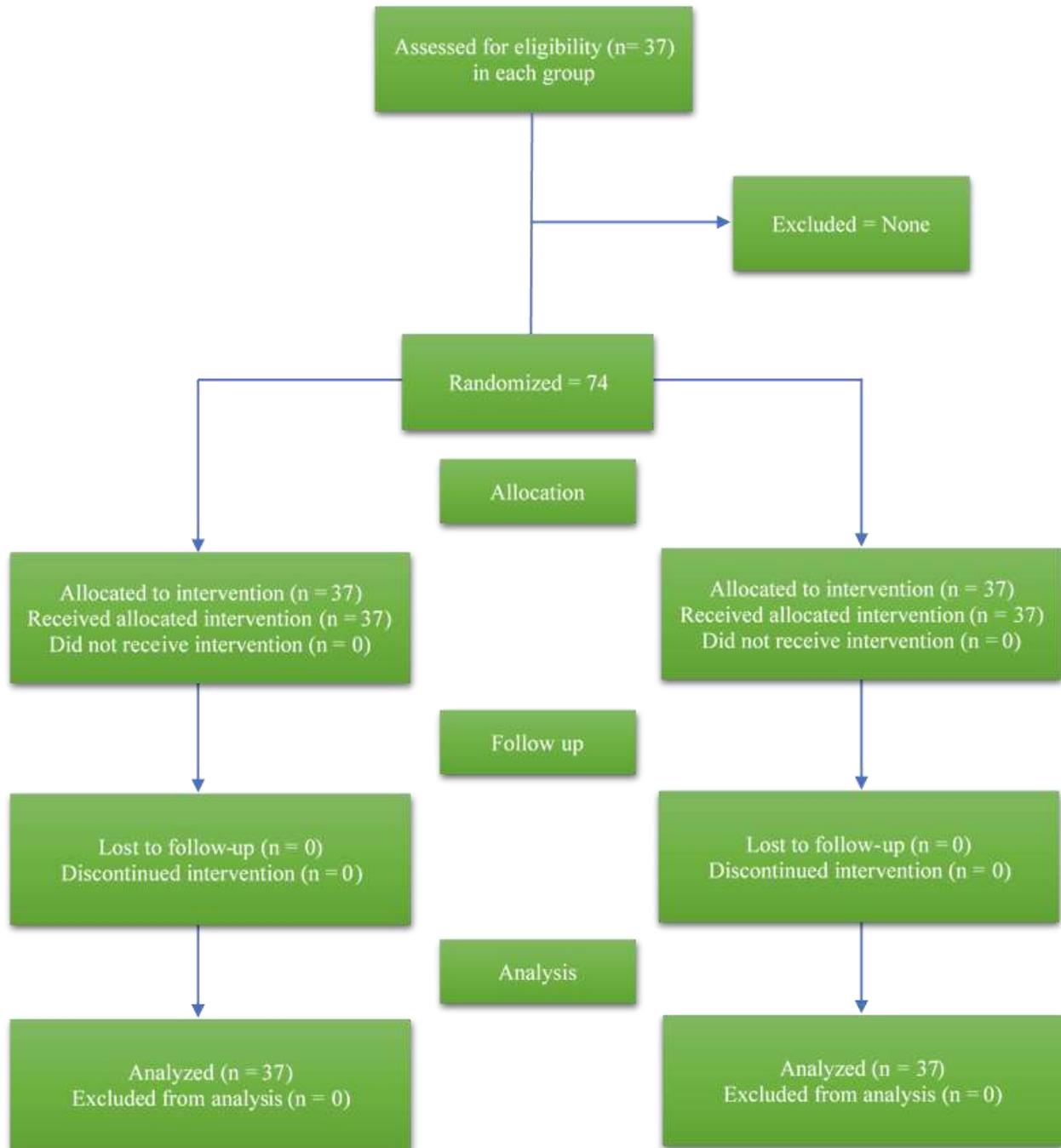
functional reach test (FRT) and the timed up-and-go test (TUG). The study was permitted by the institutional review board. The study was designed to provide insight into the efficiency of pilates-based core stability exercises as an adjunct to routine physical therapy (RPT) in the management of improving gait, function and balance in ambulant individuals with multiple sclerosis. The data was analyzed using SPSS version 25 and was presented as frequency, percentages and mean ranks.

RESULTS

These results show the gender distribution for two groups, Pilates and RPT in a study. In the Pilates group, 78.4% of the participants were male and 21.6% were female. In the RPT group, 94.6% of the participants were male and 5.4% were female. The mean age for the Pilates group was 12.64, with a standard deviation of 6.37. The mean age for the RPT group was 9.43, with a standard deviation of 2.10. This suggests that the Pilates group was slightly older on average compared to the RPT group.

The results indicated that there was a statistically significant difference in mean ranks between the Pilates group and the RPT group at the post-intervention and follow-up time points, as indicated by the p-value of 0.000. This suggests that the Pilates group had a higher mean rank on the FRT tool at these time points compared to the RPT group at the post-intervention level, the mean rank at the follow-up level, the mean rank for the TUG test was 20.57 for the Pilates group and 54.43 for the RPT, p-value of 0.000, signifying a statistically significant difference between the two groups mean rank of 22.62 for the Pilates group and a mean rank of 52.38 for the RPT group p-value was 0.000, indicating that the difference in EDSS scores between the two groups was statistically substantial. These results show the gender distribution for two

Figure 1: Consort Diagram



groups, Pilates and RPT, in a study. In the Pilates group, 78.4% of the participants were males and 21.6% were females while in the RPT group, 94.6% of the participants were males and 5.4% were females. The mean age for the Pilates group was 12.64, with a

standard deviation of 6.37. The mean age for the RPT group was 9.4324, with a standard deviation of 2.10. This suggests that the Pilates group was slightly older on average compared to the RPT group. The results indicate that there was a statistically

Table I: Demographics

Demographics		Pilates		RPT	
	Response	Frequency	Percent	Frequency	Percent
Gender	Male	29	78.4	35	94.6
	Female	8	21.6	2	5.4
Age	Mean, SD	12.64+6.37		9.43+2.10	

Table II: FRT, TUG and EDSS at Post-Interventional Level

FRT, TUG and EDSS at Post Interventional Level	Pilates	RPT	p-value
	Mean Rank	Mean Rank	
FRT Level	50.72	24.28	0.000
TUG Level	20.57	54.43	0.000
Expanded Disability Status Scale (EDSS)	22.62	52.38	0.000

a significant difference in mean ranks between the Pilates group and the RPT group at the post-intervention and follow-up time points, as indicated by the p-value of 0.000. This suggests that the Pilates group had a higher mean rank on the FRT tool at these time points compared to the RPT group at the post-intervention level, the mean ranks at the follow-up level, the mean ranks for the TUG test were 20.57 for the Pilates group and 54.43 for the RPT, the p-value of 0.000, indicating a statistically significant difference between the two groups mean rank of 22.62 for the Pilates group and a mean rank of 52.38 for the RPT group p-value was 0.000, indicating that the difference in EDSS scores between the two groups was statistically significant (Table 2).

DISCUSSION

These results suggest that the use of Pilates exercises as part of a core stability training program can have a positive impact on gait, function, and balance in individuals with

multiple sclerosis who can walk. The study found that the Pilates group had significantly better scores on measures of gait, function, and balance compared to the control group who received only RPT at post-intervention and follow-up time points. The study also found that the Pilates group had significantly lower scores on the expanded disability status scale (EDSS), which is a commonly used measure of disability in multiple sclerosis. The study's results are consistent with previous research that has shown that core stability exercises can be beneficial for individuals with multiple sclerosis.

Pilates is the type of exercise that emphasizes core strength and stability, and it may be particularly well-suited for individuals with multiple sclerosis who have difficulty with balance and coordination.¹²⁻¹⁴ A small randomized controlled trial published in 2014 found that a 12-week Pilates-based exercise program significantly improved balance, leg

strength, and quality of life in people with multiple sclerosis compared to a control group who received no intervention.¹⁵ Another study published in 2012 found that a 12-week Pilates-based exercise program significantly improved mobility, balance, and fatigue in people with multiple sclerosis compared to a control group who received no intervention. On the other hand, other studies have found mixed results or no significant benefits of Pilates-based exercise programs in people with multiple sclerosis.¹⁶ These results suggest that there may be some differences in the demographic characteristics of the participants in the Pilates and RPT groups.

Specifically, the Pilates group had a higher proportion of females and was slightly older on average compared to the RPT group. It is significant to consider these differences when deducing the results of the study, as they may have had an impact on the outcomes. For example, if the treatment being studied (in this case, the Pilates or RPT interventions) is known to have different effects on men and women, or if the treatment is effective for different age groups, the gender and age distribution of the study participants may affect the overall results. Additionally, it is important to ensure that the sample is representative of the target population to increase the generalizability of the study's findings. These demographic findings were also consistent with previous literature.¹⁷ There are a few potential strengths of these findings. First, the study used multiple outcome measures (EDSS, TUG, and FRT) to evaluate the effect of the Pilates-based exercises on gait, parameters of gait, step length, stride length, foot angle, function, and balance, which provides a more comprehensive understanding of the impact of the intervention. Second, the study used a randomized controlled design, which increases the internal validity of the study by controlling for potential confounders. Third, the study

used a follow-up assessment, which allows for the evaluation of the long-term effects of the intervention. Finally, the study had a relatively large sample size, which increases the power of the study and the generalizability of the findings. Based on the results of this study, it appears that Pilates-based core stability exercises may harm gait, function, and balance in individuals with multiple sclerosis. However, the sample size of this study was small and the results may not be generalizable to a larger population.¹⁸

CONCLUSION

In supposition, the outcomes of this study propose that the Pilates intervention was effective in improving TUG and EDSS scores for individuals with multiple sclerosis, as compared to the RPT intervention. It is essential to note that the sample size for this study was comparatively smaller, and the results may not be generalizable to a larger population. Further research is needed to confirm and expand upon these findings.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

Funding: No funding source is involved.

Authors' contributions: All authors read and approved the final manuscript.

CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

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