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Research Article

The Effect of a Structured Physiotherapy Program on Anxiety, Physical Activity Levels, and Kinesiophobia in Patients with Multiple Sclerosis

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Abstract

Objectives: Reduced physical activity and kinesiophobia may further impair quality of life and functional independence in individuals with MS. The aim of this study is to investigate the effects of a structured physiotherapy program on anxiety, depression, gait speed, kinesiophobia, and quality of life in individuals with MS.
Methods: This prospective clinical study included 25 ambulatory individuals. All participants completed a 10-week rehabilitation program consisting of 30 supervised sessions. Assessments performed before and after treatment included the Multiple Sclerosis Quality of Life Scale (MSQoL-54), Timed 25-Foot Walk Test (T25FW), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Tampa Scale for Kinesiophobia (TSK), International Physical Activity Questionnaire–Short Form (IPAQ-SF), and Expanded Disability Status Scale (EDSS).
Results: Significant improvements were observed in anxiety and depression scores following rehabilitation ($p<0.05$). The pain subscale of MSQoL-54 also improved significantly. No significant changes were observed in other subscale scores. However, no statistically significant changes were found in T25FW, TSK, or EDSS scores.
Conclusion: Structured rehabilitation programs may improve psychological symptoms and certain aspects of quality of life in individuals with MS. Additionally, no significant improvement was observed in walking speed, kinesiophobia, and disability levels. Further studies could be conducted to determine the effectiveness of longer-term, structured physiotherapy programs or studies incorporating different therapy methods.
Keywords: Kinesiophobia, multiple sclerosis, physiotherapy

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Multiple sclerosis (MS) is a chronic, inflammatory, and degenerative disease affecting the central nervous system. Typically emerging in young adulthood, this disease leads to impairments in motor, sensory, cognitive, and psychological functions, significantly affecting individuals' quality of life. During the clinical course of MS, psychological symptoms such as anxiety and depression are frequently observed alongside physical disability. These psychological conditions complicate disease management and negatively affect individuals' social, occupational, and personal lives.[1]

The prevalence of depression and anxiety in individuals with MS is higher than in the general population. Studies have shown that approximately 30–50% of MS patients

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experience depression, while 20–40% experience anxiety. These psychological disorders may arise not only from the direct effects of the disease but also from the stress and uncertainty associated with coping with a chronic illness.[2] Furthermore, depression and anxiety may lead to decreased quality of life, reduced treatment adherence, and increased social isolation in MS patients. In individuals with chronic diseases, disease-specific barriers related to disease type, stage of progression, and functional limitations exist in addition to barriers commonly observed in the general population.[3] Fear of movement in MS patients represents a barrier not only to regular physical activity but also to the maintenance of normal daily habits, thereby negatively affecting quality of life and biopsychosocial well-being.[4]

Quality of life (QoL) is a multidimensional concept encompassing an individual's physical health, psychological state, social relationships, and interaction with environmental factors. In patients with MS, quality of life is influenced not only by physical symptoms but also by psychological and social factors.[5] Depression and anxiety are among the primary psychological factors negatively affecting quality of life. Therefore, it is important that MS treatment addresses not only physical symptoms but also the psychological state of patients.[6]

Considering the high prevalence of psychological symptoms such as depression and anxiety in MS patients and their negative impact on QoL, it is of great importance that rehabilitation programs focus on these areas. The existing literature suggests that psychological interventions and physical activity can improve psychological well-being and enhance quality of life in patients with MS.[6,7] But the effect of a structured physiotherapy program on all areas of anxiety, depression, kinesiophobia, and physical activity has not been investigated in patients with MS.

The aim of this study is to investigate the effects of a structured physiotherapy program on anxiety, physical activity levels, kinesiophobia, depression, gait speed, and quality of life in individuals with MS.

Materials and Methods

Study Design

This study was conducted as a prospective, quantitative clinical study. The study was carried out in Marmara University Hospital Physical Medicine and Rehabilitation Clinic between July 2025 and January 2026. All patients were informed in detail about the treatment before participating in the study, and written informed consent was obtained. The study protocol was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Marmara University Faculty of Medicine Clinical Research Ethics Committee (Approval No: 09.2025.25-05.12).

Participants

A total of 30 patients who had been diagnosed with multiple sclerosis for more than one year and met the inclusion criteria were initially included in the study. Due to the withdrawal of 5 patients during the treatment period, 25 patients were included in the final analysis. Two patients left the study because they experienced an attack, and three patients left because they discontinued treatment (Fig. 1).

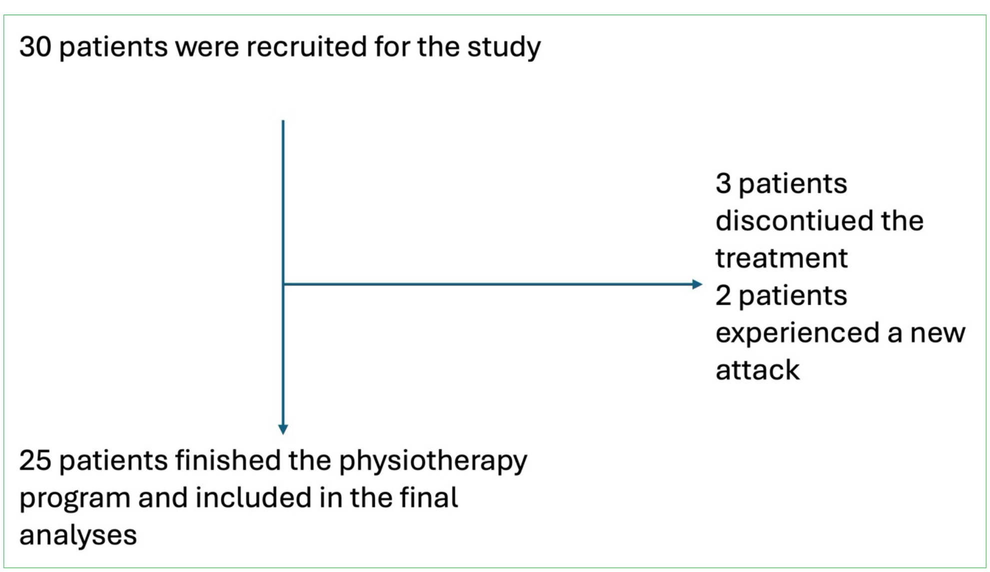

Figure 1. Flow diagram of patient recruitment and inclusion in the final analysis.

Inclusion Criteria

1. Age between 18–65 years
2. Being followed for at least one year with a diagnosis of multiple sclerosis
3. EDSS score below 7
4. Ability to ambulate

Exclusion Criteria

1. Non-ambulatory status
2. Presence of another neurological disease in addition to multiple sclerosis
3. Presence of severe physical, emotional, or cognitive impairment that could significantly interfere with the evaluation
4. History of surgery within the past year

Assessment Methods

Patients' demographic data and medical histories were recorded in the patient follow-up form.

After clinical evaluation, patients who were found eligible for the study underwent the predetermined rehabilitation program. Evaluation and questionnaire results were recorded both at baseline and after the completion of the 30-session rehabilitation program. To ensure standardization, all assessments were conducted by the same researcher.

The following assessment tools were used:

- Multiple Sclerosis Quality of Life Scale (MSQoL-54)
- Timed 25-Foot Walk Test (T25FW)
- Beck Anxiety Inventory (BAI)
- Beck Depression Inventory (BDI)
- Tampa Scale for Kinesiophobia (TSK)
- International Physical Activity Questionnaire–Short Form (IPAQ-SF)
- Expanded Disability Status Scale (EDSS)

Assessments

Multiple Sclerosis Quality of Life Scale

The Multiple Sclerosis Quality of Life Scale (MSQoL-54) questionnaire was used to assess quality of life. MSQoL-54 consists of two main composite scores (physical health and mental health), 12 subscales, and 2 independent items. Additionally, four MS-specific domains are included: cognitive function, health distress, sexual function, and overall quality of life. Scores range from 0 to 100, with higher scores indicating better quality of life.[8]

Timed 25-Foot Walk Test

This test measures lower extremity function. Patients are asked to walk a predetermined distance, and the time taken to complete the walk in both directions is recorded. The average of the two measurements is used.[9]

Beck Anxiety Inventory

The Beck Anxiety Inventory consists of 21 items, each scored on a 4-point Likert scale (0–3), ranging from "not at all" to "severely." Total scores range from 0 to 63, with higher scores indicating greater anxiety severity. Scores are categorized as follows: 8–15 mild anxiety, 16–25 moderate anxiety, and 26–63 severe anxiety.[10]

Beck Depression Inventory

The Beck Depression Inventory consists of 21 items, each scored between 0 and 3. Total scores range from 0 to 63. Scores are interpreted as follows: 0–9 minimal, 10–16 mild, 17–29 moderate, and 30–63 severe depressive symptoms. A score of 17 or above indicates the presence of depression.[11,12]

Tampa Scale for Kinesiophobia

The Tampa Scale for Kinesiophobia is a 17-item questionnaire used to assess fear of movement and re-injury after an initial event. It uses a 4-point Likert scale (1=strongly disagree, 4=strongly agree). After reverse scoring of items 4, 8, 12, and 16, the total score ranges from 17 to 68. A score of 37 or higher indicates a high level of kinesiophobia.[13]

International Physical Activity Questionnaire–Short Form (IPAQ-SF)

IPAQ-SF evaluates time spent sitting, walking, and engaging in moderate and vigorous physical activities during the past week. Energy expenditure is calculated as MET-minutes/week. Based on the total score, ≤600 MET-min/week indicates inactive, 600–3000 indicates moderately active, and ≥3000 indicates sufficiently active.[14]

Expanded Disability Status Scale (EDSS)

EDSS ranges from 0 (normal neurological examination) to 10 (death due to MS). It evaluates eight functional systems affected by MS, with scoring based on the level of impairment.[15,16]

Treatment Protocol

Rehabilitation Program

All patients participated in a rehabilitation program consisting of 30 sessions over 10 weeks, performed three times per week, each lasting 40 minutes (5 minutes warm-up, 30 minutes exercise, 5 minutes cool-down), under the supervision of a physiotherapist. All exercises were administered by the same physiotherapist. Patients were instructed not to receive additional MS-related treatment from other centers during the study period.

Breathing exercises were performed at the beginning of each session and between exercises to facilitate relaxation and transition.

1. Inhale through the nose for 4 seconds, hold for 4 seconds, and exhale through the nose for 8 seconds.

Flexibility exercises aimed to improve or maintain the range of motion in muscles and joints. Exercises were performed for the quadratus lumborum, hamstrings, and piriformis muscles.

2. Quadratus Lumborum Stretch: While lying in the supine position, the patient is rotated to the right and left sides with assistance from the physiotherapist.
3. Hamstring Stretch: While lying supine, the patient's leg is raised straight with assistance from the physiotherapist. Repeated for both extremities.
4. Piriformis Stretch: While lying supine with knees flexed, one leg is placed over the other. The patient supports the lower leg with their arms, and the knees are brought toward the abdomen with assistance. Repeated for both extremities.

Strengthening exercises were performed to improve muscle strength. In patients who could not actively complete the range of motion during strengthening exercises, the exercises were performed actively assisted with the help of a physiotherapist. In patients who could actively complete the range of motion, the exercises were performed using resistance bands of different colors according to their tolerance level.

5. Gluteus Maximus and Medius Strengthening: Performed in standing, moving the leg backward and laterally.
6. Iliopsoas Strengthening: While lying supine, one leg is stabilized while the other is pulled toward the abdomen.
7. Hamstring Strengthening: While lying prone, knee flexion and extension are performed.
8. Gastrocnemius Strengthening: While lying supine, ankle plantarflexion is performed.
9. Tibialis Anterior Strengthening: While lying supine, ankle dorsiflexion is performed.

Balance exercises were included due to postural instability and fall risk in MS patients. Exercises were selected and administered taking into account the participants' balance levels.

10. Tandem stance (eyes open and closed, 5–10 seconds)
11. Single-leg stance (eyes open and closed, 5–10 seconds)
12. Tandem stance (eyes open and closed, 5–10 seconds)

    All exercises were performed under physiotherapist supervision for safety.

The exercise program was designed based on common problems observed in individuals with MS. The number of repetitions was individualized, and additional rest was provided for participants experiencing fatigue. Participants were asked to rate their perceived exertion during sessions using the Modified Borg Scale (0=very, very light; 10 = very, very hard). A rest break was given when the patient's fatigue level reached 5.

Statistical Analysis

Based on a previous meta-analysis reporting a pooled standardized mean difference, with an average change rate of 0.16±0.3 in anxiety scores, it was calculated that 25 patients should be included in the study to achieve 80% power, with a margin of error of 0.05. Considering a 20% dropout rate, the goal was to invite a total of 30 patients to the study.[7]

Statistical analyses were performed using SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±standard deviation (SD), whereas categorical variables were presented as frequency and percentage values.

The distribution of data was assessed using visual (histograms and probability plots) and analytical methods. Pre- and post-treatment comparisons were performed using paired-samples t-tests for normally distributed variables. Changes in physical activity levels between baseline and post-rehabilitation assessments were evaluated using the Wilcoxon signed-rank test, as IPAQ-SF categories (low, moderate, and high physical activity) represent paired ordinal data. Categorical variables were presented as frequencies and percentages.

A p value of <0.05 was considered statistically significant.

Results

Data from 25 patients were analyzed. The mean age of the patients was 47.36±10.58. Twenty-one of the patients (80.8%) were female. Detailed demographic data are given in Table 1.

When the patients' initial evaluations were compared with the final evaluations, the patients' MSQoL pain subscale improved significantly, from a mean score of 7.08±2.94 to 8.08±2.96 (p=0.04). There were no other significant changes in QoL. The results of QoL assessments are summarized in Table 2.

According to the IPAQ-SF classification, at baseline, 15 patients (60.0%) had low physical activity levels, 9 (36.0%) had

Table 1. Demographic properties of the patients.

	Mean ±SD		Min- Max
Age (year)	47.36 ± 10.58		22-66
Body-mass index (kg/m2)	25.5±4.59		18.70-33.30
Disease duration (years)	16.64±6.52		3-31
Gender	Female 21 (80.8%)		Male 4 (19.2%)
Disease subtype (percent)	RRMS 17 (65%)	PPMS 6	SPMS 2
Presence of walking aid (percent)	None 18 (72%)	Cane 3 (12%)	Walker 4 (16%)
Medications used by the patients (percent)	Ocrelizumab, n=18 (72.0%) Fingolimod, n=2 (8.0%) Fampridine, n=1 (4.0%) Teriflunomide, n=1 (4.0%) Cladribine, n=1 (4.0%) Ozanimod, n=1 (4.0%) Tolebrutinib, n=1 (4.0%)		

SD: Standard deviation; RRMS: Relapsing remitting multiple sclerosis; PPMS: Primary progressive multiple sclerosis; SPMS: Secondary progressive multiple sclerosis.

moderate physical activity levels, and 1 (4.0%) had high physical activity levels. Following the rehabilitation program, the number of patients with low physical activity levels decreased to 10 (40.0%), while the number of patients with moderate and high physical activity levels increased to 12 (48.0%) and 3 (12.0%), respectively. Wilcoxon signed-rank analysis demonstrated a significant improvement in physical activity levels after rehabilitation compared with baseline (W=12.0, p=0.035).

Patients' anxiety and depression levels also showed significant improvement, documented by Beck Depression and Anxiety Scales. The mean Beck Depression Scale score

Table 2. Change in multiple sclerosis quality of life scale (MSQoL) scores

	Mean Before treatment (SD)	Mean After Treatment (SD)	p	%95 Confidence Interval
MSQoL physical function	8.33 (4.92)	9.49 (5.38)	0.10	-2.57 – 0.26
MSQoL rol limitations-physical	5.40 (5.34)	4.92 (5.47)	0.65	-1.69 – 2.65
MSQoL pain	**7.08 (2.95)**	**8.08 (2.96)**	**0.04**	**-1.98 – -0.01**
MSQoL energy	5.07 (3.06)	5.34 (2.95)	0.42	-0.96 – 0.42
MSQoL social function	7.96 (2.98)	7.32 (3.05)	0.24	-0.47 – 1.75
MSQoL health perceptions	8.67 (3.99)	9.25 (3.47)	0.33	-1.78 – 0.62
MSQoL health distress	5.57 (3.85)	5.90 (3.63)	0.47	-1.27 – 0.61
MSQoL sexual function	5.65 (2.53)	5.63 (2.36)	0.87	-0.32 – 0.38
MSQOL BFS	53.65 (21.39)	55.55 (21.94)	0.44	-6.91 – 3.12
MSQoL role limitations-emotional	11.20 (10.07)	9.92 (11.38)	0.597	-3.64 – 6.20
MSQoL Emotional well-being	17.59 (4.76)	17.08 (5.58)	0.567	-1.30 – 2.32
MSQoL health distress	7.08 (4.91)	7.50 (4.62)	0.474	-1.61 – 0.77
MSQoL cognitive function	9.57 (4.32)	9.45 (3.62)	0.841	-1.10 – 1.34
MSQoL Overall quality of life	10.55 (3.27)	11.00 (4.11)	0.531	-1.92 – 1.02
MSQoL BMLS	54.92 (20.70)	54.95 (22.93)	0.993	-8.55 – 8.47

Significant changes are marked in bold.

improved from 13.56±10.34 to 10.48±9.69 (p=0.02). The mean Beck Anxiety score changed from 17.32±9.68 to 14.92±12.21 (p=0.04). There were no significant changes in the 25FWT, Tampa Scale for Kinesiophobia, or EDSS levels of the patients. These findings are summarized in Table 3.

In subgroup analyses, only the change in scores between the PPMS and RRMS groups was analyzed, since there were only two patients with SPMS in the study. The changes in depression scores and MSQoL energy subscales were significantly better in patients in the PPMS group compared with the RRMS group, while there were no significant differences between other parameters. All changes are summarized in Table 4.

Discussion

This study demonstrates that a physiotherapy program may be helpful for patients with MS in terms of depression, anxiety, and physical activity levels, while it does not affect kinesiophobia and can only minimally improve quality of life.

The demographic profile of our participants was comparable to that reported in previous studies.[12] In particular, male individuals and less common MS phenotypes are generally underrepresented in the literature, and the findings of this study should therefore be interpreted within this context. The physical and psychological characteristics of the patients

Table 3. Changes in anxiety, depression, kinesiophobia, and 25 feet walk test (25FWT) and EDSS scores before and after treatment.

Variable	Mean Before Treatment (SD)	Mean After Treatment (SD)	p	%95 Confidence interval
Beck anxiety	**17.32 (9.69)**	**14.92 (12.22)**	**0.04**	**0.15 – 4.95**
Beck depression	**13.56 (10.35)**	**10.48 (9.69)**	**0.02**	**0.42 – 5.74**
Tampa kinesiophobia scale	37.12 (5.30)	39.36 (6.72)	0.12	-5.13 – 0.65
25FWT	79.31 (99.21)	69.93 (78.45)	0.10	-2.20 – 20.96
EDSS	3.96 (1.62)	4.02 (1.69)	0.37	-0.20 – 0.08

Significant changes are marked in bold.

Table 4. Comparison of changes in QoL, 25 m walk test, depression and anxiety levels between patients with primary progressive multiple sclerosis (PPMS) and relapsing remitting multiple sclerosis (RRMS)

Variable	PPMS (n=17) Mean (SD)	RRMS (n=6) Mean (SD)	p	%95 Confidence interval
delta Tampa kinesiophobia scale	3.35 (7.21)	1.83 (4.7)	0.638	-8.14 – 5.10
delta Beck anxiety scale	1.17 (7.57)	-3.59 (5.73)	0.122	-1.39 – 10.90
delta Beck Depression scale	**-6.83 (6.85)**	**-0.76 (2.86)**	**0.006**	**-10.19 – -1.95**
delta 25fwt	-9.98 (11.26)	-10.37 (33.51)	0.979	-29.01 – 29.78
Delta MsQoL pain	0.83 (2.28)	0.60 (2.11)	0.831	-1.91 – 2.35
Delta MsQoL Physical function	2.27 (2.13)	0.40 (3.73)	0.263	-1.51 – 5.24
delta MsQoL Role limitations - physical	-1.00 (5.90)	0.00 (5.30)	0.703	-6.38 – 4.38
Delta MsQoL Energy	**1.92 (1.77)**	**-0.17 (1.34)**	**0.006**	**0.66 – 3.52**
delta MsQoL Social function	0.33 (2.34)	-0.82 (2.90)	0.390	-1.58 – 3.90
delta MsQoL Health perceptions	2.13 (2.45)	-0.20 (2.71)	0.079	-0.29 – 4.94
delta MsQoL Sexual function	-0.33 (0.70)	0.24 (0.62)	0.076	-1.20 – 0.06
delta MsQoL combined physical score	6.42 (6.77)	-0.25 (13.54)	0.265	-5.45 – 18.79
delta MsQoL Role limitations - emotional	0.00 (15.18)	-0.94 (11.27)	0.874	-11.22 – 13.10
Delta MsQoL Emotional well-being	**2.71 (4.50)**	**-1.16 (3.67)**	**0.048**	**0.03 – 7.70**
delta MsQoL Health distress	-0.23 (1.14)	0.37 (3.34)	0.673	-3.54 – 2.33
Delta MsQoL Cognitive function	1.25 (2.95)	-0.35 (3.02)	0.274	-1.37 – 4.57
delta MsQoL Overall quality of life	0.95 (5.58)	0.56 (2.72)	0.822	-3.18 – 3.96
delta MsQoL combined mental score	4.67 (18.89)	0.06 (22.21)	0.655	-16.58 – 25.81

Significant differences are marked in bold.

included in our study were largely consistent with those reported in previous studies. Differences between studies may be explained by variations in disease subtype, medication use, and emotional status. Overall, the clinical profile of the MS patients included in our study reflects findings commonly reported in the general MS population.

Previous studies have consistently demonstrated that physical inactivity is one of the most important modifiable problems affecting individuals with MS and is closely associated with poorer quality of life, reduced functional independence, and increased psychological burden. Although different studies have used various instruments to evaluate physical activity, including self-reported questionnaires and objective activity monitoring, the overall conclusion has remained remarkably consistent: people with MS are generally less physically active than healthy individuals, even during the early stages of the disease. The baseline findings of our study are in agreement with these observations, as most participants demonstrated low physical activity levels before rehabilitation. Marck et al.[13] demonstrated that increased physical activity levels measured using the IPAQ were associated with significant improvements in quality of life. In contrast, Reguera-García et al.[14] reported that during the COVID-19 pandemic, 33.3% and 34.3% of MS patients demonstrated vigorous and moderate physical activity levels, respectively, according to the IPAQ-Short Form.[14] These findings are not consistent with the results of our study. The low physical activity levels observed in our participants may be related to fear of falling and fear of movement. Previous studies have suggested that this issue may be addressed through educational interventions aimed at improving coping strategies in patients with MS.

An interesting observation in the present study is that physical activity improved without parallel improvements in overall quality of life. Although this finding may initially appear contradictory, quality of life in MS is influenced by numerous physical, psychological, cognitive, and social determinants that cannot be fully modified within a relatively short rehabilitation program. Consequently, improvements in only one component, such as physical activity, may not immediately translate into higher overall quality-of-life scores. Longer follow-up periods may be necessary before behavioral changes become reflected in broader patient-reported outcome measures. Kubsik- Gidlewska et al.[16] demonstrated that exercise contributes not only to the physical abilities of MS patients but also to mood and attitudes toward exercise. Similarly, Grazioli et al.[17] reported that multicomponent exercise training improves quality of life, walking ability, and balance, while also reducing depression, fatigue, and disease severity in MS patients. Resistance and aerobic exercise have been identified as the most effective interventions for improving fatigue and quality of life, respectively. In this study, the results did not show a simultaneous increase in physical activity and quality of life with the application of a physiotherapy program. However, the long-term effects of such a program are still debatable due to the limited time frame of this study.[17]

There are reports suggesting that long-term and systematic physical activity may reduce relapse frequency and disease progression in some patients with MS. Despite the well-established beneficial effects of physical activity (PA) on functionality and quality of life in MS patients, several studies have demonstrated that PA levels in this population are generally lower than those observed in the healthy population.[18] Several exercise studies have demonstrated beneficial effects of rehabilitation on physical functioning, fatigue, mood, and health-related quality of life in MS. However, improvements across these domains are not necessarily expected to occur simultaneously. While some outcomes, such as psychological well-being or habitual physical activity, may respond within weeks, changes in walking performance, disability, or broader quality-of-life domains often require longer intervention periods or prolonged maintenance of an active lifestyle. Therefore, the absence of significant improvements in EDSS or T25FW in our study should not be interpreted as evidence that rehabilitation was ineffective. Rather, it may indicate that the duration of the intervention was sufficient to modify behavior and emotional status but insufficient to produce detectable neurological or functional changes.

In the 2012 study by Sandroff et al.[3], 77 individuals with MS and 77 matched healthy controls were included. Physical activity was assessed using the Godin Leisure-Time Exercise Questionnaire (GLTEQ), the International Physical Activity Questionnaire (IPAQ), accelerometer activity counts, daily step counts, and time spent in moderate-to-vigorous physical activity (MVPA). There were statistically significant differences between the groups in accelerometer activity counts, step counts, time spent in moderate-to-vigorous physical activity, GLTEQ scores, and IPAQ scores. Significant differences in free-living physical activity were identified between the MS and control groups across all five measures. Although the authors suggested that the degree of physical inactivity in minimally disabled MS patients may be lower than previously reported in the literature, inactivity levels remain concerning when considering the well-documented prevalence of physical inactivity in the general population. Similarly, the individuals included in our study also demonstrated low physical activity levels on average.

However, the increase with the physiotherapy program is remarkable, and patients can be advised to adhere to such programs to increase physical activity and the additional benefits of this increase. An additional point worth considering is that increasing physical activity in individuals with MS may have benefits extending beyond simple improvements in exercise capacity. Participation in a structured rehabilitation program provides patients with regular supervision, individualized exercise progression, and continuous encouragement, all of which may enhance confidence in performing daily activities. This increased confidence may partially explain the improvement observed in physical activity levels despite the absence of measurable changes in disability or gait performance. It is possible that patients became more willing to engage in everyday activities because they perceived exercise as safe and manageable under professional guidance. Such behavioral adaptations may not be fully reflected by neurological disability scales but may nevertheless represent clinically meaningful outcomes. From a rehabilitation perspective, encouraging sustained participation in structured exercise programs may therefore contribute to maintaining an active lifestyle even before measurable functional gains become apparent.

In their 2023 study, Margoni et al.[19] suggested that MS diagnosis itself may represent a risk factor for the development of anxiety disorders, reporting that the prevalence of self-reported anxiety symptoms increased from 2.7% at disease onset to 6.2% at the time of diagnosis. In the cross-sectional study conducted by AlSaeed et al.[15] in Saudi Arabia, 323 MS patients were included. Anxiety and depression levels were evaluated using the Hospital Anxiety and Depression Scale (HADS). According to the results, 25.7% of patients demonstrated symptoms of anxiety, while 13.6% demonstrated symptoms of depression. The majority of patients had anxiety and depression scores within normal limits (57% and 70%, respectively). Although the mean depression score was within the normal range, the mean anxiety score corresponded to borderline anxiety symptoms. These findings suggest that MS patients may be more likely to experience anxiety than depression. The findings from this study are important in the sense that a structured physiotherapy program may aid in improving anxiety in patients with MS. In the meta-analysis conducted by Zhang et al.[20], the prevalence of anxiety in MS patients and the major risk factors contributing to anxiety development were evaluated. The authors estimated that approximately 36% of MS patients suffer from anxiety. Furthermore, age at assessment, female sex, living with family, psychiatric history, depression, adherence to MS medications, relapsing-remitting MS (RRMS), and baseline EDSS scores were identified as significant risk factors for anxiety in MS patients.

Considering the characteristics of the individuals included in our study, it may be stated that many participants belonged to these identified risk groups. In our study, anxiety and depression were evaluated using the Beck Anxiety Inventory and Beck Depression Inventory. Improvements in both anxiety and depression scores were observed following the rehabilitation program. These findings suggest that participation in a regular rehabilitation program may contribute to improvements in neuropsychiatric symptoms. The mechanisms underlying these psychological improvements are probably multifactorial. Besides the physiological effects of exercise on neuroplasticity and inflammatory pathways, regular rehabilitation may reduce emotional distress by improving self-efficacy, increasing social interaction, establishing daily routines, and providing continuous feedback from healthcare professionals. For many individuals with MS, participation in supervised rehabilitation also creates a sense of control over a disease that is otherwise characterized by unpredictability. Although these mechanisms were not specifically evaluated in the present study, they may explain why improvements in anxiety and depression were observed despite relatively stable disability scores. Future studies incorporating patient-reported measures of self-efficacy, exercise confidence, or perceived disease control may further clarify the pathways through which rehabilitation exerts its psychological benefits.

In the study conducted by Ruiz Sánchez et al.[21], which included 58 MS patients and 58 healthy controls, the TSK-11 questionnaire was used to evaluate fear of movement. According to the results, many MS patients were affected by kinesiophobia, and kinesiophobia levels were higher in MS patients compared with healthy controls. Further studies are needed to determine whether gait and balance impairments trigger fear of movement in MS patients and to evaluate the effectiveness of interventions aimed at reducing this fear. Similarly, in the study conducted by Wasiuk-Zowada et al.[18], 80 individuals with MS aged between 35 and 69 years were evaluated. The authors demonstrated that kinesiophobia is an important issue in MS patients and that low physical activity levels may represent one of its major determinants.

Mikuľáková et al.[22] reported in their cross-sectional study, which included 148 MS patients (105 women), that the mean kinesiophobia score was 39.27 points on the TSK scale. Higher levels of kinesiophobia were identified in 58.78% of participants, while lower levels were found in 41.22%. Additionally, 50% of participants reported moderate or severe anxiety. The authors identified three major independent predictors of kinesiophobia in patients with

MS: age, anxiety, and physical activity. Higher anxiety levels were associated with greater kinesiophobia, while lower physical activity levels measured using GLTEQ demonstrated the strongest association with kinesiophobia. Furthermore, older age was positively associated with fear of movement, whereas more physically active individuals reported lower levels of kinesiophobia. These findings are consistent with previous reports indicating that approximately 60% of MS patients demonstrate moderate-to-severe levels of kinesiophobia.

This study did demonstrate a significant increase in physical activity and an improvement in anxiety, but this change was not reflected in kinesiophobia. The reason might be the limited time frame and the possibility of not overcoming kinesiophobia despite an increase in physical activity. Fear of falling, movement avoidance, fatigue-related avoidance behavior, and uncertainty regarding relapse might still cause kinesiophobia. This study also did not demonstrate any significant difference in change in Tampa kinesiophobia scores between different patient groups, but considering the limited size of our sample, kinesiophobia or change within this parameter may still be dependent on the disease subtype. The exact factors that influence kinesiophobia in patients with MS still need to be studied. Another possible explanation is that kinesiophobia may not improve at the same rate as anxiety or depression because it reflects a learned behavioral response rather than an isolated emotional symptom. Fear of movement often develops gradually following repeated experiences of imbalance, falls, excessive fatigue, or symptom worsening, and these experiences may reinforce long-term avoidance behaviors. Consequently, patients may become more physically active during supervised rehabilitation sessions while continuing to avoid movement in unsupervised daily environments. Therefore, future rehabilitation protocols for MS may benefit from combining exercise therapy with educational interventions, cognitive-behavioral approaches, motivational interviewing, or graded exposure techniques specifically targeting maladaptive beliefs related to movement. Such multidimensional rehabilitation strategies may prove more effective in reducing kinesiophobia than exercise interventions alone.

An important strength of the present study is the simultaneous evaluation of physical, psychological, and behavioral outcomes following the same rehabilitation program. While previous studies have frequently focused on individual outcomes such as quality of life, fatigue, or walking performance, fewer studies have examined anxiety, depression, physical activity, kinesiophobia, disability, and quality of life together within a single rehabilitation protocol. This comprehensive approach provides a broader understanding of the multidimensional effects of physiotherapy in people with MS and highlights that different clinical domains may respond differently to the same intervention.

Our study has several limitations. First, the absence of a control group prevents us from clearly distinguishing whether the results are due to the effect of physiotherapy or the effect of the time factor. Second, the fact that the participants belonged to different MS subtypes, the relatively small sample size, and the wide age range limit the generalizability of the findings. Furthermore, the inclusion of patients with different disease durations may have introduced clinical heterogeneity that could have influenced the observed outcomes. Additionally, the relatively short duration of the rehabilitation program and the lack of long-term follow-up assessments may have limited our ability to detect changes in disability, walking performance, and kinesiophobia. Future studies should address these limitations by including larger and more homogeneous patient populations with longer follow-up periods.

Conclusion

This study, conducted to examine the effect of a structured physical therapy and rehabilitation program on physical activity level, anxiety, and kinesiophobia, found a significant decrease in participants' anxiety and depression levels. Partial improvement was observed in participants' quality of life. However, no significant improvement was found in participants' walking speed, kinesiophobia, and disability levels. In conclusion, the structured physiotherapy program used in our study reduced neuropsychiatric symptoms but did not provide significant improvement in disability level, walking speed, and kinesiophobia parameters. Nevertheless, considering the progressive nature of the disease, we believe that the lack of significant deterioration in disability level, walking speed, and kinesiophobia parameters can also be considered a positive outcome.

List of Abbreviations

BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; EDSS, Expanded Disability Status Scale; EQ-5D-3L, EuroQOL Five-Dimensional Three-Level Questionnaire;; GLTEQ, Godin Leisure-Time Exercise Questionnaire; HADS, Hospital Anxiety and Depression Scale; IPAQ-SF, International Physical Activity Questionnaire–Short Form; MET, Metabolic Equivalent of Task; MS, Multiple Sclerosis; MSQoL-54, Multiple Sclerosis Quality of Life-54; MVPA, Moderate-to-Vigorous Physical Activity; PA, Physical Activity; PPMS, Primary Progressive Multiple Sclerosis; RRMS, Relapsing-Remitting Multiple Sclerosis; SD, Standard Deviation; SPMS, Secondary Progressive Multiple Sclerosis; T25FW, Timed 25-Foot Walk Test; TSK, Tampa Scale for Kinesiophobia

Disclosures

Ethics Committee Approval: Ethical approval was obtained from the Marmara University Faculty of Medicine Clinical Research Ethics Committee (Approval No: 09.2025.25-05.12).

Informed Consent All patients were informed in detail about the treatment before participating in the study, and written informed consent was obtained.

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