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Fear of falling, not falls, impacts leisure-time physical activity in people with multiple sclerosis

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ABSTRACT

Background: There is a consensus that physical activity is imperative for people with MS (PwMS). However, regardless of the benefits, many PwMS do not participate in any meaningful physical activity.
Aim: To examine the relationship between leisure-time physical activity with clinical characteristics and common symptoms in PwMS.
Methods: The sample included 190 PwMS (107 women), mean age 40.8 (S.D = 13.1) and mean disease duration of 6.4 (SD = 8.3) years since diagnosis. Outcome measures included the Godin Leisure-Time Exercise Questionnaire (GLTEQ), Four Square Step Test (FSST), 2-Minute Walk test (2 mWT), Timed Up and Go test (TUG), Timed 25-Foot Walk test (T25FW), fall status, Falls Efficacy Scale International (FES-I), Modified Fatigue Impact Scale (MFIS), walking speed and the Multiple Sclerosis Walking Scale self-reported questionnaire (MSWS-12).
Results: Eighty-six PwMS were classified as active (GLTEQ = 31.6 (S.D = 16.7); 104 were insufficiently active (GLTEQ = 3.0 (S.D = 4.3). Insufficiently active PwMS demonstrated a slower walking speed, elevated fatigue, more concerns of falling and additional walking difficulties compared to active PwMS. Non-significant differences between groups were observed in the TUG, 2 mWT, FSST, T25FWT and fall status. According to the linear regression, by utilizing the FES-I we observed a 12.2% variance related to leisure-time physical activity. The independent variables: EDSS, MSWS-12, fatigue and walking speed were non-significant.
Significance: The present findings highlight the impact of concern of falling on physical activity in PwMS. This knowledge may represent an opportunity to improve care and enhance physical activity in the MS population.

1. Introduction

Multiple sclerosis (MS) is a demyelinating disease of the central nervous system (CNS) [1] with an estimated prevalence of 1 per 1000 persons afflicted in the United States [2,3]. The disease process produces a diversity of neuropathological changes in the CNS [1,4], typically affecting a wide range of neurological functions including mobility, cognition, vision, muscle strength, coordination and sensation.

There is a consensus that physical activity is imperative for people with MS (PwMS). Emerging evidence has demonstrated that physical activity can improve walking performance, balance, cognition, fatigue, depression and quality of life in PwMS [5]. Moreover, Barry et al.'s stacking data revealed that physical activity and exercise are potential immunomodulatory therapies targeting innate signaling mechanisms, modulating MS symptom development and progression [6]. However, regardless of the benefits, up to 78% of PwMS do not participate in any meaningful physical activity [7]. Interestingly, the number of inactive PwMS is in contrast to the fact that most PwMS believe that their health and function will improve if they would participate in physical activities [8].

Several studies have typified particular barriers of physical activity participation in the MS population, i.e., mobility difficulties, fatigue, pain, heat sensitivity, low self-efficacy, energy deficits and environment [9]. However, to date, the definite contribution of each factor is still unclear. Recently, Casey et al. examined a battery of psychosocial constructs associated with physical activity participation in PwMS and found that goal setting and self-efficacy were moderately associated with participation in physical activity [10]. Nevertheless, the authors

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emphasized the need to continue and expand the research on physical participation barriers in PwMS by investigating combinations of subjective and objective factors related to MS.

Amassing new information on this topic can be beneficial. Firstly, it will help clarify why most PwMS are physically inactive. Secondly, it might help in improving current physical activity programs in the MS population which may be achieved by combining or modifying new and traditional components into the program. Moreover, it might also refine assessment strategies and enhance the success of these programs. Therefore, the objective of this study was to examine the relationship between leisure-time physical activity, clinical characteristics and common symptomatic measures in PwMS, including falls and concerns of falling.

2. Methods

2.1. Study design and participants

The current study design was cross-sectional. Retrospective data collected from the Multiple Sclerosis Center, Sheba Medical Center, Tel Hashomer, Israel's computerized database were evaluated. The database is a population-based registry documenting demographic and clinical data of all PwMS followed at the Center. Since the establishment of the Sheba MS Center, an electronic record-keeping system has archived patients' demographic, clinical and imaging data and updated often by the Center's medical staff during each clinic visit. Patients' computerized files include demographic data, medical history, electrophysiological and neuroimaging test results, dates of steroid injections, immunomodulatory and other drug treatments. Walking and balance performance (via clinical tests and instrumented equipment), cognitive function, MRI imaging, blood tests, evoked potentials, treatment response and gene expression data are recorded as well. Mobility assessment including questionnaires relating to falls and constructs are part of the routine patient evaluations at the MS Center.

A computerized data collection tool was employed to select participants according to the following inclusion criteria: (1) a neurologist-confirmed diagnosis of definite MS according to the revised McDonald criteria [11]; (2) < 6.0 on the Expanded Disability Status Scale (EDSS) [12], equivalent to the ability of walking at least 100 m without a walking aid; (3) relapse-free for at least 90 days prior to testing; and (4) outcome measures assessed within a 3-month interval and no relapse. Exclusion criteria included: (1) orthopedic disorders that could negatively affect balance and walking; (2) pregnancy; (3) blurred vision; (4) cardiovascular disorders; (5) respiratory disorders; (6) taking steroids or fampridine.

The integrity of the data registry was evaluated by a computerized logic-algorithm-questioning process identifying data entry errors. The study was approved by the Sheba Institutional Review Board. All participants signed an informed consent form allowing the use of their data in the research project.

2.2. Godin leisure-time exercise questionnaire (GLTEQ)

The GLTEQ, a self-administered measuring tool for assessing physical activity [13], has been validated for use in PwMS [14]. It contains three items measuring the frequency of strenuous (e.g., jogging), moderate (e.g., fast walking) and mild (e.g., easy walking) exercise for periods of > 15 min during one's free time during a typical week. The weekly frequencies occurring over a 7-day period of strenuous, moderate, and mild activities are multiplied by 9, 5, and 3 metabolic equivalents, respectively, and summed to form a measure of total leisure activity. A recent review confirmed that the GLTEQ is an appropriate, simple and effective tool for describing patterns of physical activity, examining correlates and outcomes of physical activity participation and an advantageous primary outcome for measuring change in physical activity in response to an intervention in the MS population [15].

2.3. Four Square Step Test (FSST)

FSST measures dynamic balance and clinically assesses the person's ability to step over objects by walking forward, sideways and backwards. A square was formed by 4 canes resting flat on the floor. The participants were instructed to try and complete the sequence as fast as possible without touching the canes with both feet making contact with the floor in each square. If possible, they were to face forward during the entire sequence. One practice trial was allowed prior to administering the test. The participants performed two trials and the better time was used as the preferred score [16].

2.4. Two-minute Walk Test (2 mWT)

The participants were instructed to complete the test 'at their fastest speed' by walking up and down a 30-m hallway, circling cones at each end and covering as much distance as possible. Verbal encouragement was not offered. Distance was measured by specific marks along the corridor indicating every 30 cm. Steps taken during turning were not included in the measurement. Total distance in meters was subsequently registered. Walking improvement on the 2 mWT was indicated by positive score changes (in meters). The 2 mWT has been validated in people with cardiovascular and respiratory disease [17] and has been extensively used in neurorehabilitation trials in PwMS.

2.5. Timed Up and Go Test (TUG)

Participants were permitted to wear their usual footwear and any foot assistive device normally utilized. The starting point was determined after the subject was seated in a standard height chair, with his/her back flush against the chair and arms resting on the arm rests. He/she was then instructed to stand up, walk 3 m, turn around, walk back to the chair and sit down again. Timing began when the individual started to rise and ended when he/she returned to the chair and sat down. Walking improvement on the TUG was indicated by negative score changes (in seconds). Sebastiao et al. reported that the TUG was strongly associated with other valid measures of functional mobility in PwMS [18].

2.6. Timed 25-Foot Walk (T25FW)

The T25FW was performed on a clearly marked 25-foot long path, down a corridor cleared of obstructions and foot traffic. The corridor included sections for acceleration and deceleration. Standardized instructions were provided. Walking as fast and as safely as possible was emphasized. The T25FW was performed twice and the mean of the two trials was included in the analysis. Walking improvement on the T25FW was indicated by negative score changes (in seconds). The T25FW has been validated in MS as one of the three components of the Multiple Sclerosis Functional Composite [19].

2.7. Multiple Sclerosis Walking Scale (MSWS-12)

The MSWS-12 is a valid self-rated measure of walking ability in PwMS [20]. The questions focused on the patient's walking limitations (due to MS) during the past 2 weeks. Each item was scored on a 1–5 scale; the higher the score, the more perceived walking difficulties.

2.8. Modified Fatigue Impact Scale (MFIS)

The MFIS is a multidimensional 21-item questionnaire obtaining information as to the effects of fatigue within physical (9-items), psychosocial (2-items) and cognitive (10-items) domains over a four-week period. Participants rated the 21 items using a 5-point Likert-type scale,