Clinical Neurology and Neurosurgery 138 (2015) 20–24

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Determinants of physical activity in minimally impaired people with multiple sclerosis

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ARTICLE INFO

Article history:
Received 5 November 2014
Received in revised form 9 July 2015
Accepted 24 July 2015
Available online 29 July 2015

Keywords:
Multiple sclerosis
Minimally impaired
Physical activity
Accelerometer
Walking

ABSTRACT

Objective: Despite the commonly known benefits of physical activity, evidence shows that people with multiple sclerosis (pwMS) are relatively inactive. There are several studies about factors affecting physical activity in pwMS. However, these factors have not investigated in minimally impaired pwMS who do not have remarkable symptoms and walking disturbance. The objective was to determine factors affecting physical activity in minimally impaired pwMS.
Patients and Methods: We recruited 52 minimally impaired pwMS and measured physical activity with Godin Leisure-Time Exercise Questionnaire (GLTEQ) and an accelerometer used for the 7-day period. Demographic data were recorded. Walking (speed, endurance, dexterity, and quality), fatigue, depression, and quality of life were measured.
Methods: We recruited 52 minimally impaired pwMS and measured physical activity with Godin Leisure-Time Exercise Questionnaire (GLTEQ) and an accelerometer used for the 7-day period. Demographic data were recorded. Walking (speed, endurance, dexterity, and quality), fatigue, depression, and quality of life were measured.
Results: The walking speed assessed by the Timed 25-Foot Walk and gender were found the determinants of physical activity level assessed by the GLTEQ and accelerometer, respectively. Walking (speed, endurance, and dexterity), gender, employment status, and quality of life were associated with physical activity. Either female or unemployed participants had significantly less physical activity. There were no significant difference between physical activity levels and the other subgroups.
Conclusion: Either to be a female or to have slower walking speed was associated with less physical activity. Strategies to improve walking should be focused on female pwMS with minimal impairment.

1. Introduction

Multiple sclerosis (MS) is a chronic inflammatory demyelinating central nervous system disease that typically strikes adults, especially women [1]. MS affects mainly working-age individuals, obstructing their and their families' personal and professional life [2]. Walking function is one of the most valuable across levels of disability among people with MS (pwMS), and walking impairment is very challenging and prevalent [3]. The prevalence and impact of walking limitations in MS typically worsen across levels of accumulating disability. Walking limitations have negative consequences for participatory outcomes such as activities of daily living, quality of life, and employment. Both physical and psychological factors have a negative impact on physical activity in pwMS.

There is evidence for the benefits and safety of physical activity among pwMS [4]. Despite the commonly known benefits of exercise and physical activity, evidence shows that pwMS are relatively inactive yet physical activity may be even more important in a population facing functional deterioration [5]. There are several studies about factors affecting physical activity in pwMS [6–10]. The levels of disability of pwMS in these studies have a wide range. According to the findings of these studies, walking is impaired with disability progression while physical activity is decreasing. However, it is not clear why minimally impaired pwMS have less physical activity due to the knowledge of pwMS with Expanded Disability Status Scale (EDSS) scores below 4.0 do not have remarkable symptoms and walking disturbance [11]. It motivated us to conduct this study to investigate for variables that can be determinants of physical activity in minimally impaired pwMS.

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http://dx.doi.org/10.1016/j.clineuro.2015.07.018
0303-8467/

2. Patients and methods

2.1. Participants

The study was approved by the Ethics Committee of Dokuz Eylul University (Approval number: 2013/03-27) and all participants provided informed consent before participating in the study. The study design was cross-sectional. The recruitment period was between January 2013 and June 2013. The minimum required sample size was calculated 30 based on effect size = 0.32, $\alpha = 0.05$, power = 0.90 and number of predictors = 14 with G*Power (Version 3.1.9.2). This effect size was selected according to the results of a similar study [12]. We recruited randomly 52 pwMS (43 relapsing-remitting MS and 9 clinically isolated syndrome) from the university MS clinic. The inclusion criteria were a definite diagnosis of MS according to the McDonald criteria [13], the EDSS score between 0 and 3.5, attack free period for at least one month, and age more than 18 years. The exclusion criteria were to have other disorders which affect the gait, pregnancy and severe cognitive dysfunction.

2.2. Data collection

The demographic data were collected through face-to-face interviews. Age, gender, weight, height, body mass index (BMI), disease duration, and employment and marital status were recorded.

All the participants underwent the neurological examination by the same neurologist for generating an EDSS score. The EDSS is a 10-point scale of disease severity ranging from 0 (no disability) to 10 (death from MS) [11]. In the low range, 0–3.5, it is based on the modest-to-moderate change in one or more of the functional systems. Above 4.0, scoring is based primarily on gait dysfunction. Only pwMS with EDSS scores from 0 to 3.5 participated in the study.

Physical activity was measured with a questionnaire and an accelerometer. The participants wore a Caltrac accelerometer (Muscle Dynamic Fitness Network, Torrance, CA, USA) on an elastic belt around the waist on the non-dominant hip during the waking hours, except while showering, bathing, and swimming, for a 7-day period. Waking hours were defined as the duration from the point of waking out of bed in the morning until the point of going to bed in the evening [14]. The Caltrac accelerometer is a light and pocket instrument that detects vertical movements with a built-in ceramic crystal which transfers kinetic acceleration into electrical impulses [15]. The Caltrac accelerometer estimates physical activity energy expenditure in kilocalories based on the user characteristics (i.e. age, height, weight, and gender). Although the Caltrac accelerometer stored the activity counts in a weekly basis, the participants recorded the counts in a log on a daily basis. The counts of 7 days in the log were summed and compared with the Caltrac information to ensure the data was true. Afterward the average of 1-day activity counts were calculated. There is evidence that accelerometers provide a valid and reliable measure of ambulatory physical activity in the pwMS [14,16] and healthy adults [17]. The Godin Leisure Time Exercise Questionnaire (GLTEQ) is a commonly used questionnaire to measure of usual physical activity in pwMS [16,18,19]. The GLTEQ is a two-part measure, but for this study, we only included the first part of the questionnaire. Because the second part contains a single item on number of days per week of physical activity that results in sweating and this sweat index has questionable validity in MS [20]. The first part contains three items that measure the frequency of strenuous, moderate, and mild physical activities for periods of more than 15 min during one's free time within a typical week. Weekly frequencies of strenuous, moderate and mild physical activity were multiplied by 9, 5 and 3 metabolic equivalents, respectively, and were summed to form a measure of the total leisure physical activity [21]. A cut point at 24 units was used to determine the activity level of the participants (i.e. 24 units or more: active – substantial benefits and 23 units or less: insufficiently active – less substantial or any benefits) [22].

Walking was assessed in multiple aspects included endurance, speed, dexterity and perceived quality. We measured walking endurance with the Six-Minute Walk Test (6MWT). The 6MWT has been used as a tool to measure walking endurance in MS population [23]. The test was performed on a level-surface hallway, controlled for possible obstacles and distractions. Standard instructions and testing guidelines were implemented [23,24]. Each participant was instructed to walk as far and as fast as possible for 6 min while traversing 30-meter intervals until the test was completed. Time was recorded using a standard stopwatch. Distance, in meters, was recorded. The walking speed was measured with the Timed 25-Foot Walk (T25FW) which was performed along a clearly marked 25-foot long path on a corridor that was clear of obstructions and foot traffic. We provided standardized instructions and emphasized walking as fast and as safely as possible [25]. The T25FW was performed twice, and the mean of the two trials was included for the analysis. The test is the first component of the MS Functional Composite which is widely used to determine the function in MS [26]. Walking ability is a complex motor task which includes sensorimotor functions, some of which are lower limb strength, spasticity and coordination, as well as balance. The Six Spot Step Test (SSST) was designed to measure these complex arrays of walking in pwMS [27]. Standard instructions and testing guidelines were implemented for the SSST [27]. The test contains a rectangular field with six circles on the floor following a criss-cross course. Five circles contain a block. The starting-point is the first circle, which does not contain a block. From there the patient walks to the other side of the field and kicks the blocks out of the five circles, as quickly as possible. The task is immediately administered again by having the patient walk back the same route. Both the dominant and non-dominant legs were tested twice (i.e. totally 4 trials). Perceived walking quality was measured with the 12-item Multiple Sclerosis Walking Scale (MSWS-12) which is a 12-item self-reported measure of the impact of MS on walking. It was developed using standard methods of test construction and then validated in community and hospital-residing samples of pwMS [28]. Lower scores indicate less perceived walking impairment.

We evaluated the psychological variables such as fatigue, depression, and quality of life. The Fatigue Impact Scale (FIS) is a widely used multidimensional scale measuring the physical, cognitive, and social effects of fatigue [29]. It comprises 40 questions and each question scores between 0 and 4, ranging from minimal to severe degrees. The validation of the Turkish version of the FIS was done on the pwMS [30]. The Beck Depression Inventory (BDI) is a widely used 21-items self-reported measure that assesses the presence and intensity of depressive symptoms reflecting the similar symptoms [31]. Each question has a set of at least four possible answer choices, ranging in intensity. The Multiple Sclerosis International Quality of Life (MusiQoL) questionnaire, a specific, self-administered, multidimensional questionnaire, was co-developed and initially validated in 15 countries including Turkey [32]. The MusiQoL questionnaire comprises 31 questions in 9 subscales: activities of daily living, psychological well-being, symptoms, relationships with friends, relationships with family, sentimental and sexual life, coping, rejection, and relationships with healthcare system. All 9 dimensions and the index score were linearly transformed and standardized on a 0–100 scale, where 0 indicates the worst possible level of quality of life and 100 indicates the best level.