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Connection of therapeutic exercises for the activity of daily living and quality of life of patients with multiple sclerosis

A Literature Review

Metropolia University of Applied Sciences

Bachelor of Health Care

Physiotherapy

Bachelor's Thesis

Date 08.12.2022

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Title	Connection of therapeutic exercises for the activity of daily living and quality of life of patients with multiple sclerosis
Number of Pages	23 pages
Date	08 December 2022
Degree	Bachelor of Health Care
Degree Programme	Physiotherapy
Specialization option	Physiotherapy
Instructors	Sanna Garam, Senior Lecturer Heini Maisala-McDonnell, Senior Lecturer
<p>Multiple sclerosis is a progressive chronic disease of the brain and spinal cord. It is considered to be an autoimmune-mediated disease of the central nervous system, which causes chronic inflammation, primary demyelination of nerves, and axonal damage. Rehabilitation programs aim to progress function, well-being, and quality of life for people with multiple sclerosis. The therapeutic exercises involve movements prescribed to correct impairments such as muscle weakness, spasms, spasticity, imbalance, restore musculoskeletal as well as maintain a state of well-being.</p> <p>This bachelor's thesis aims to assess the connection between aerobic, strengthening, and balance exercises to the activity of daily living and the quality of life of patients with multiple sclerosis.</p> <p>The method used for this thesis was based on a modified literature review. A systematic search was conducted in PubMed, Science Direct, Research Gate, and manual search. Six randomized controlled trials and systematic review articles were selected for the literature review to fulfill the inclusion criteria.</p> <p>The results confirm that the connection of therapeutic exercises such as strengthening, aerobic, and balance exercises are beneficial for the activity of daily living and quality of life of patients with multiple sclerosis. Exercises are beneficial rehabilitation approach for people with multiple sclerosis to manage symptoms, restore function, optimize quality of life, promote wellness, and boost participation in activities of daily living.</p>	
Keywords	multiple sclerosis, therapeutic exercises, strengthening, aerobics, balance, the activity of daily living, quality of life

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1 Introduction

Multiple sclerosis (MS) is a progressive chronic disease of the brain and spinal cord. It is an autoimmune-mediated disease of the central nervous system, which causes chronic inflammation, primary demyelination of nerves, and axonal damage. (Tobin 2021.) Multiple sclerosis can cause everlasting damage or deterioration of the nerves of the patient (Höftberger et al. 2014).

The most common demyelinating illness is multiple sclerosis, with prevalence rates that range greatly, from high levels in North America and Europe (>100/100,000 people) to low levels in Eastern Asia and sub-Saharan Africa (2/100,000 people). Multiple sclerosis is expected to affect 2.8 million individuals globally (35.9 per 100,000 population). Multiple sclerosis prevalence has increased in every world region since 2013 but gaps in prevalence estimates persist. The pooled incidence rate across 75 reporting countries is 2.1 per 100,000 persons/year, and the mean age of diagnosis is 32 years. (Leray, Moreau, Fromont & Edan 2016.)

Compared to men, women are more likely to continue having multiple sclerosis. Multiple sclerosis has considerable societal costs due to its long duration, early loss of productivity, need for assistance with everyday tasks, usage of immunomodulatory therapies, and multidisciplinary medical care. For both sexes and in all nations, the age range of 35 to 64 has shown the highest prevalence rates. (Walton et al. 2020.)

Rehabilitation programs are aimed at improving the quality of life for people with multiple sclerosis. Many rehabilitation techniques can be used to treat multiple sclerosis. With the aid of physiotherapy intervention and guidance soon after diagnosis, it is possible to lessen handicaps, maximize the potential for independence, increase employment, and lessen the disease's influence on health and quality of life issues. Therapeutic exercises are made to rectify deficiencies, regain skeletal and muscular function, and keep a person in good health. Patients with multiple sclerosis may benefit from physical activity as a form of rehabilitation. In multiple sclerosis patients, a supervised and customized exercise program may enhance fitness, functional capacity, and quality of life. (Amatya, Khan & Galea 2019.)

This bachelor's thesis aims to see the association of therapeutic exercises for the activities of everyday living and the quality of life of patients with multiple sclerosis.

2 Literature review

The rehabilitation of people with multiple sclerosis of a sequence of review papers, exercise therapy, and physical activity have been revealed to be generally beneficial to those with multiple sclerosis who are not suffering a relapse, as well as having positive effects on health-based quality of life in those with a mild to moderate disability. Balance and movement have been demonstrated to benefit through physiotherapy. The effectiveness of physical therapy wanes as the severity of the condition increases. While some studies have presented their findings in terms of the severity of the disabilities, none have distinguished between progressive multiple sclerosis and relapsing-remitting multiple sclerosis. (Campbell, Coulter, Mattison, Miller, McFadyen & Paul 2016.) The risk of losing important abilities or independence should be considered early in the rehabilitation process. The benefits of rehabilitation interventions are higher in the earlier stages of multiple sclerosis due to the failure of adaptive compensatory tools. Despite the progression of the disease, inpatient and outpatient rehabilitation is beneficial in reducing disability, and improving participation, and quality of life. Specific interventions can improve physical and cognitive performance. (Beer, Khan & Kesselring 2012.)

2.1 Types of multiple sclerosis

Multiple sclerosis affects each patient differently. In some cases, patients may be mildly affected, on the other hand, some patients may suffer from several impairments, such as losing their ability to write, speak or walk. There are four courses of multiple sclerosis that are defined. Relapsing-remitting multiple sclerosis is the most common type of multiple sclerosis which statistics show that 90% of patients will have a relapsing-remitting course of the disease. This variant of multiple sclerosis is categorized by the onset of neurological symptoms over hours to days. If the relapsing-remitting condition variate to a point where there are no discernible relapses and remissions; the course of the disease has transitioned to secondary progressive multiple sclerosis. In secondary progressive multiple sclerosis, symptoms collect and worsen without any remission. (McNamara 2022.)

Primary progressive multiple sclerosis is the third type of multiple sclerosis, and this form of multiple sclerosis progresses gradually yet steadily from the time of its onset. Indications stay at the same level of intensity without declining, and there are no remission periods. Patients with primary progressive multiple sclerosis experience a continuous worsening of their condition. (Weatherspoon 2019.) Benign multiple sclerosis is a minor course where an individual will have a slight disease after having multiple sclerosis for around 15 years. This

happens in about 5-10% of patients. Benign multiple sclerosis cannot be shown at the time of diagnosis or even after a few years of multiple sclerosis. (McNamara 2022.)

2.2 Therapeutic exercise

Physiotherapists play a vital role in the management of multiple sclerosis throughout the disease course such as a diagnosis, during and after relapses, during periods of progression as well as periods of stability, and when the disease becomes more advanced (Rohrig 2018). Physiotherapy for multiple sclerosis contains exercises to strengthen the muscles and develop patients' gait patterns and improve balance and coordination. Physiotherapy treatments also include stretches to aid to maintain movement and reduce muscle spasticity. Studies show that engaging in early physiotherapy can be supportive even in the earliest phases of multiple sclerosis. It can help patients to learn how to care for and handle their changing bodies, reduce aggravating symptoms, improve strength and stamina, and regain abilities after disease relapse. (Weatherspoon 2019.)

Exercise therapy is one of the greatest and most well-researched rehabilitation strategies for multiple sclerosis patients, and it impacts a variety of impacts on symptoms. Exercise therapy includes a variety of exercise methods, including resistance training and endurance training, all of which are suitable for multiple sclerosis patients to use. Exercise can alter a wide range of functional and health-related factors as well as the diversity of symptoms displayed by multiple sclerosis patients. Investigations on the positive effects of exercise on weariness, balance, walking, cognition, and quality of life have been the main topics of both original and review studies. Two of the main disabilities in multiple sclerosis are loss of balance and walking ability, which result in diminished autonomy and heightened fatigue perception and disease severity in patients. (Riemenschneider, Hvid, Stenger & Dalgas 2018.)

2.2.1 Aerobic exercises

The form of periodic, regulated physical activity known as aerobic exercise requires for the body's metabolic system to use oxygen as a source of energy. Different types of aerobic exercise are performed, but they all have a minimum and maximum heart rate of 70 to 80% of a person's age. Cardiopulmonary exercise, which involves modest energy expenditure over a long period, is regarded as the cornerstone of endurance training. (Cena 2021.) In multiple sclerosis patients, cardiovascular fitness, mood, and quality of life are improved by low to moderate-intensity aerobic exercise. Many people with multiple sclerosis can safely participate in this type of exercise. Patients with multiple sclerosis have been demonstrated to improve their cardiorespiratory fitness to the fullest within a short period, for example, 4 weeks of aerobic training. Cardiorespiratory exercise training in multiple sclerosis is related to increased maximal oxygen consumption (VO₂ Max) and dealing capacity, respiratory function, and reduction of fatigue. (Heine et al. 2015.)

In multiple sclerosis patients with mild to moderate disability, aerobic exercise training with low to moderate intensity may result in the addition of aerobic fitness and the elimination of fatigue. Resistance exercise can aid people with multiple sclerosis to adapt favorably, which can reduce fatigue and improve ambulation. Stretching your muscles is a flexibility workout that can reduce spasticity and prevent more uncomfortable spasms. Exercises that improve balance are good for lowering the fall rate. There are some broad prescriptions for exercise for people with multiple sclerosis. The purpose of the customized workout plan should be to increase strength, endurance, balance, coordination, and fatigue reduction. For those with multiple sclerosis, an exercise is a powerful form of therapy. A personalized training plan under supervision can increase fitness, functional capacity, and quality of life in multiple sclerosis patients. (Halabchi, Alizade, Sahraian & Abolhasani 2017.)

2.2.2 Strengthening exercises

Strength training also known as resistance exercise, increases muscle strength by making muscles work against a weight or force. Anaerobic exercise is resistance training. Utilizing free weights, weight machines, resistance bands, and your body weight are some of the several techniques of strength training. In multiple sclerosis patients, mild-to-moderate resistance exercise training increases physical capacities like peak oxygen consumption and maximal tolerated strength. Additionally, multiple sclerosis patients' physiological capabilities, strength, and quality of life are all improved by HIIT paired with resistance training.

(Zaenker et al. 2006.) A study that was done aiming at the effects of exercise training on physical fitness, mobility, fatigue, and health-related quality of life in adults with multiple sclerosis shows that among those with mild to moderate disability from multiple sclerosis, exercise training is effective for improving both aerobic capacity and muscular strength. It shows the major improvements in patients' fatigue, muscle strength, aerobic capacity as well their day-to-day activities in multiple sclerosis patients. (Latimer-Cheung et al. 2013.)

Grazioli et al. (2019) state that the study supports the use of resistance and aerobic exercise training to accomplish functional and psychological therapy goals and support the beneficial benefits of physical activity on individuals with multiple sclerosis. The study assessed how a 12-week combined training intervention affected individuals with multiple sclerosis' balance, walking capacity, sense of weariness, quality of life, and disease severity.

It suggests that multiple sclerosis patients undergo fitness training since it can aid in the long-term management of the condition by reducing fatigue and disease severity. If it is possible, the patient should be started early on in the course of the illness to alleviate its symptoms and impairments which have a huge impact on the patient's overall day-to-day activities. The results of the study support the use of a combination of resistance and aerobic exercise training to achieve functional and psychological therapeutic outcomes in patients with multiple sclerosis. (Grazioli et al. 2019.)

2.2.3 Balance exercises

A study was done by Paltamaa et al. (2012) to assess the effects of physiotherapy interventions on balance in people with multiple sclerosis, using randomized controlled trials of physiotherapy interventions in people with multiple sclerosis. The study proves balance exercises in patients with multiple sclerosis have significant progression. Study shows that at the end of the rehabilitation program patient's shows improvement in their balance and their overall daily activities. (Paltamaa, Sjögren, Peurala & Heinonen 2012.) According to a study done by Tramontano et al. (2018) aiming to find out the positive effects of balance rehabilitation on people with multiple sclerosis. His study shows that balance rehabilitation can decrease the level of disability and increase the quality of life of patients with multiple sclerosis. Also, participants have improved their stability and balance which help with their day-to-day activities as well as decreased fatigue levels.

3 Aim and methods

3.1 Aim

This bachelor's thesis aims to assess the connection between therapeutic exercises for the activity of daily living and the quality of life of patients with multiple sclerosis. In this bachelor's thesis, we investigated how aerobic, strengthening, and balance exercises are connected with the activity of daily living and the quality of life of patients with multiple sclerosis.

3.2 Search strategy

Data collection was done using randomized controlled trials and systematic review studies. This bachelor's thesis, the modified literature review, was carried out on publications that were published after 2010. The thesis was done with the newest research articles as the therapeutic exercises for multiple sclerosis have improved with time, and to maintain the quality of the research. Inclusion and exclusion criteria are summarized in table 1. Searches were conducted using PubMed, Science Direct, Research gate, and manual search. The following search words were used; "physical therapy", "physiotherapy", "therapeutic exercises", "multiple sclerosis", MS, "activity of daily living", ADL, "balance training", balance, "aerobic exercise", "quality of life", "strength training", "functional ability", "systematic reviews", "randomized controlled trial", RCT. The flowchart of the bachelor's thesis is presented in figure 1

Table 1. Inclusion and Exclusion criteria used in the bachelor's thesis

	Inclusion criteria	Exclusion criteria
Publication date	After the year 2010	Before the year 2010
Publication language	English	Articles that are not in English
Method	Randomized controlled trials, systematic review	Other publications than randomized controlled trial methods and systematic reviews
Contents	Multiple sclerosis, the activity of daily living, quality of life, therapeutic exercises, aerobic, strengthening, and balance exercises.	Articles not related to multiple sclerosis, the activity of daily living, quality of life, therapeutic exercises, aerobic, strengthening, and balance exercises.

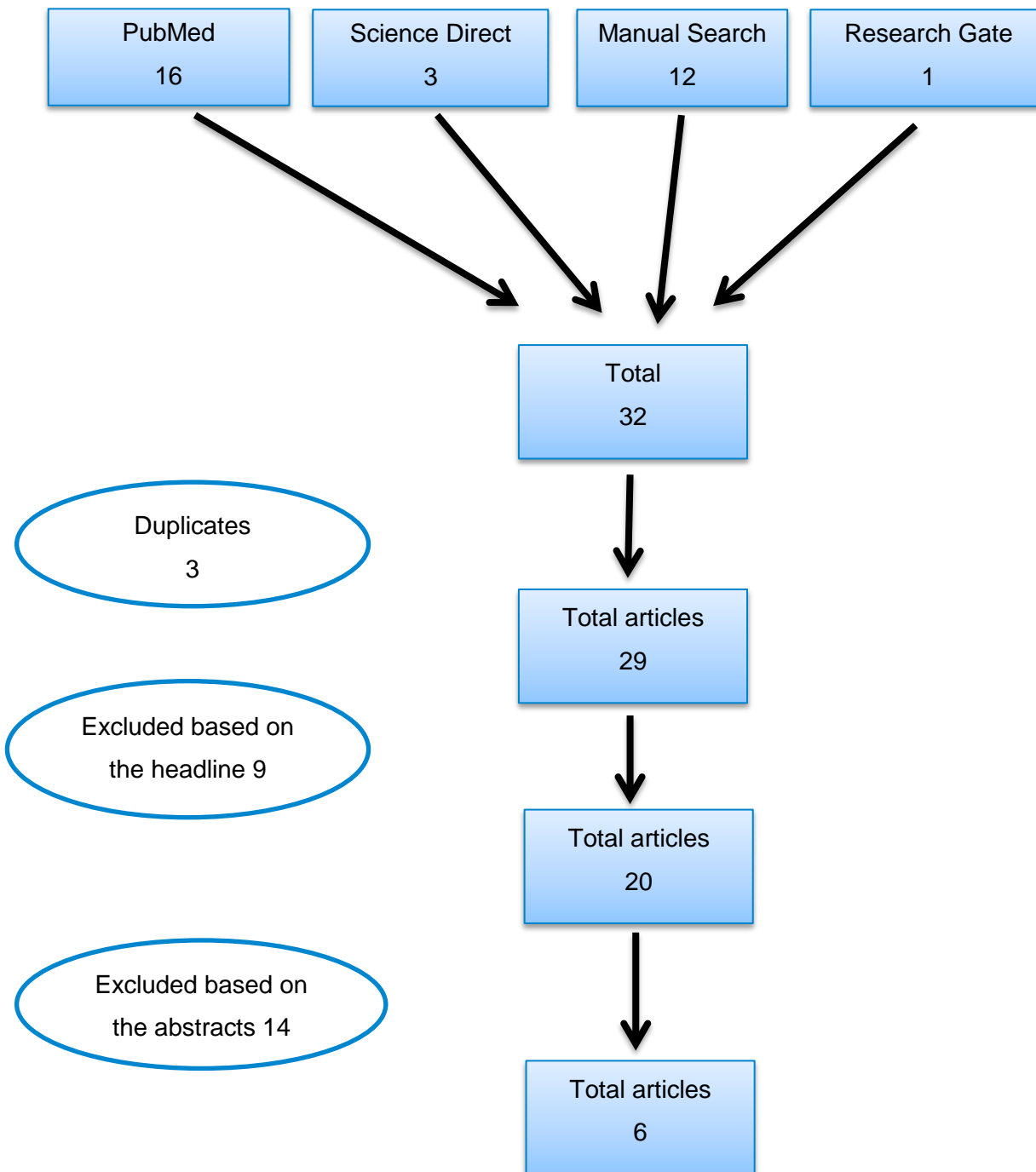


Figure 1. The flowchart of the bachelor's thesis

For this bachelor's thesis, the selection was able to identify 32 articles by searching the database. After the removal of 3 duplicates, a total of 29 records were selected for screening. Out of 29, 9 articles were excluded after reading headlines and 20 articles were selected. Out of 20 studies, 14 were excluded based on abstracts. Out of the 20 remaining articles assessed, only 6 articles were considered eligible. (figure 1)

4 Results

Finally, six research articles were selected for the thesis and all the articles are randomized controlled trials and systematic reviews according to the inclusion and exclusion criteria.

Table 2. Results and conclusions of the final six articles.

Authors, Year, and place	Purpose of the study	Methods	Participants	Intervention	Results and conclusion
Campbell et al. 2017	To assess the efficacy of physiotherapy interventions, including aerobic exercises, and resistance training for the rehabilitation of people with multiple sclerosis	A systematic review and meta-analysis of randomized controlled trials	The research was taken from five databases and reference lists of relevant articles including thirteen studies (described by 15 articles).	Randomized controlled trials which included participants with multiple sclerosis and investigated a physiotherapy intervention or an intervention containing a physiotherapy element were included.	Physiotherapy interventions such as aerobic exercises and resistance training help to reduce complications of multiple sclerosis. Such as improving the fitness level, functional capacity, level of independency muscle strength as well as activities of daily living.

Heine et al. 2015	To estimate the effectiveness of aerobic training on multiple sclerosis-related fatigues and societal participation in ambulant patients with severe MS-related fatigue.	A randomized controlled trial	Patients (N = 90) with severe MS-related fatigue.	Patients were allocated to 16-week Aerobic training or control intervention. The study was done using a multicenter, single-blinded, randomized controlled trial with five repeated measurements over the course of 12 months.	Exercise therapy can be prescribed to people with MS without harm. Exercise therapy, and particularly endurance, mixed, or other training, may reduce Self-reported fatigue and helps to improve the quality of life of patients with multiple sclerosis.
Latimer-Cheung et al. 2013	To find out the evidence of effects of aerobic and strengthening exercise training on physical fitness, mobility, fatigue, the activity of daily living, and overall quality of life	A systematic review	People with multiple sclerosis and 54 studies were included in the review.	The extracted data were analyzed using a descriptive approach. There was strong evidence that exercise performed 2 times per week at a moderate intensity increases aerobic capacity and muscular strength.	Among those with mild to moderate disability from multiple sclerosis, exercise training is effective for proving both aerobic capacity and muscular strength. Exercise can improve mobility, reduce fatigue, and improve day-to-day activities as well as the quality of life.

Grazioli et al. 2019	To find out the effects of concurrent resistance training and aerobic exercise training on functional status in patients with multiple sclerosis.	A randomized controlled trial	Male or female; age, between 25 and 55 years; multiple sclerosis patients.	Study has evaluated using the effect of a 12-wk combined training intervention (resistance and aerobic exercise) on balance, walking ability, fatigue perception, quality of life, and severity of disease in patients with multiple sclerosis.	The study confirms the beneficial effects of physical activity in patients with multiple sclerosis and support the use of a combination of resistance and aerobic exercise training to achieve functional and psychological therapeutic outcomes to improve the quality of life of the patients.
Paltamaa et al. 2012	To determine the effects of physiotherapy interventions such as balance exercises, strengthening, and aerobic exercises on balance in people with multiple sclerosis.	A systematic review and meta analysis of randomized controlled trials	Randomized controlled trials of physiotherapy interventions in people with multiple sclerosis, with an outcome measure linked to the International Classification of functioning, disability and health.	Screening 233 full-text papers, 11 studies were included in a qualitative analysis and 7 in a meta-analysis.	Mild to moderately disabled people with multiple sclerosis can Greatly benefit from the effects of physical therapy on balance for their daily activities and improve their quality of life.

Tramontano et al. 2018	To find out the effects of balance rehabilitation and how it reduces the complications of the disease and how it improves the activity of daily living.	A preliminary randomized controlled trial	The experimental group (15 patients - 9F-; mean age 50.64±11.73) and the control group (15 patients -8F-; mean age 45.77±10.91).	All patients were evaluated before and after treatment with the expanded disability status scale, Barthel index Tinetti balance and gait scale, berg balance scale, fatigue severity scale, two-minute walking test, and timed 25-foot walk test.	Four weeks of Vestibular rehabilitation training results in less fatigue, improved balance, and performance of the activities of daily living in patients with severe multiple sclerosis.
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Six research articles were selected for the bachelor's thesis and all the articles are randomized controlled trials and systematic review studies according to the inclusion and exclusion criteria. For this thesis, four articles were taken from PubMed, one from Research gate, and one from Science direct.

According to Heine et al. (2015), aerobic exercises help to reduce complications of relapsing and remitting multiple sclerosis and enhance their quality of life by increasing their functional capacity and fitness levels. One article by Campbell et al. (2017) describes the effectiveness of physiotherapy interventions such as aerobic exercises and resistance training for the rehabilitation and activity of daily living of people with multiple sclerosis. Another two articles by Latimer-Cheung et al. (2013) and Grazioli et al. (2019) describe the exercise training on patient's quality of life and another one describes how aerobic and strength training combined with rehabilitation programs can be beneficial to patients with multiple sclerosis. Two articles by Tramontano et al. (2018) and Paltamaa et al. (2012) discussed balance rehabilitation and its importance to improve the quality of life and activity of daily living of multiple sclerosis patients.

Aerobic and strengthening exercises. Heine et al. (2015) describe about the exercise prescription for patients with relapsing and remitting multiple sclerosis and the importance of aerobic exercises. Impairments related to the disease process itself are irreversible by exercise, but impairments resulting from deconditioning are often can be reversible with exercise. Appropriate exercise can lead to significant improvements in different areas such as aerobic fitness, muscle strength, flexibility, stability, tiredness, cognition, quality of life, and respiratory function. Also, aerobic exercises are safe and tolerable for many individuals. Patients are shown to make favorable gains in cardiorespiratory fitness within a short term of exercise, for example, 4 weeks. During strength training, the patients use muscle contractions against a load for increasing muscle strength. After 16-week aerobic training or control intervention with an improvement of ≥ 8 exercise therapy, aerobic training, in particular, has proven efficacy in the treatment and prevention of physical deconditioning, mobility problems, secondary health risks, and potential disease progression.

The individualized rehabilitation program should be tailored to address a patient's main complaint or goal to improve strength, endurance, balance, coordination, fatigue, etc. It should consider a patient's baseline impairments and capabilities. Exercise prescription must include key components, such as frequency, duration, intensity, type of interventions, and precautions that therapists should consider. (Heine et al. 2015.)

According to Latimer-Cheung et al. (2013) and Grazioli et al. (2019), the findings of this study support the use of a mix of resistance and aerobic exercise training to achieve functional and psychological therapy objectives and confirm the positive effects of physical activity in multiple sclerosis patients and it shows that early rehabilitation will be more beneficial.

Balance exercises. According to Paltamaa et al. (2012) having balance exercises in the routine of rehabilitation, will be contributing in a significant manner to improving the overall quality of the activities of daily living of a person, diagnosed with multiple sclerosis. Another study done by Tramontano et al. (2018) aimed to find out the clinical effects of vestibular rehabilitation on balance skills and activity of daily living in highly disabled multiple sclerosis people. Thirty hospitalized participants with severe multiple sclerosis were evaluated before and after treatment with the Expanded Disability Status Scale, Barthel Index Tinetti Balance and Gait scale, Berg Balance Scale, Fatigue Severity Scale, Two Minute Walking Test, and Timed 25-foot walk test. Two follow-ups at 30 and 60 days after treatment, were carried out with Barthel Index. The findings show those four weeks of well-organized balance training rehabilitation programs can improve lots of benefits for patients with multiple sclerosis. Also, a balanced rehabilitation program can reduce the complications of the disease and can increase patients' level of stability which helps them to do their day-to-day activities well. (Tramontano et al. 2018.)

5 Discussion

The purpose of this bachelor's thesis was to evaluate the connection between therapeutic exercises for the activity of daily living and the quality of life of patients with multiple sclerosis. The useful effects of physical activity in patients with multiple sclerosis and support the use of a combination of resistance aerobic and balance exercise training to reach functional therapeutic outcomes are revealed to be effective with the results.

Exercise can be a beneficial rehabilitation strategy for people with multiple sclerosis to manage symptoms, restore function, optimize quality of life, promote wellness, and boost participation in activities of daily living. Exercise should be considered a safe and effective means of rehabilitation in multiple sclerosis patients. A supervised and individualized exercise program can improve physical fitness, functional capacity, quality of life, and modifiable impairments in multiple sclerosis patients. People with multiple sclerosis who are mild to moderately disabled can benefit significantly from physiotherapy effects on balance for their daily activities and improve quality of life. Aerobic training is generally safe and well tolerated in multiple sclerosis patients. They have been shown to make favorable gains in cardiorespiratory fitness. (Heine et al. 2015.)

Two studies by Grazioli et al. (2019) and Paltamaa et al. (2012) confirm the beneficial effects of physical activity in patients with multiple sclerosis and support the use of a combination of resistance and aerobic exercise training to achieve functional and psychological therapeutic outcomes, also exercise training are well tolerated by the patients and improved the quality of life of the patients as also reflected in the improvement in walking and balance ability as well as reduced depression. To obtain functional and psychological therapeutic goals, a combination of resistance and aerobic exercise training is supported by the positive benefits of physical activity on individuals with multiple sclerosis. Balance disorders are present in patients with multiple sclerosis and part of these disorders could be of vestibular origin. Balance rehabilitation found to be effective in improving balance in patients with central vestibular dysfunction. Training in vestibular rehabilitation assists people with severe multiple sclerosis to feel less fatigued and perform better in terms of balance and daily activities. According to Paltamaa et al. (2012) and Tramontano et al. (2018) having balance exercises in the routine of rehabilitation, will be contributing in a significant manner to improving the overall quality of the activities of daily living for those diagnosed with multiple sclerosis.

All the articles are randomized controlled trials and systematic review studies according to the inclusion and exclusion criteria. The selected six articles show the connection between therapeutic exercises for the quality of life and activity of daily living of patients with multiple sclerosis. This bachelor's thesis demonstrates how therapeutic exercises including strengthening, aerobic, and balancing training can enhance individuals with multiple sclerosis' capacities for daily living and quality of life.

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