

A Literature Review on Effectiveness of Balance Training in Diabetic Neuropathy Patients

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Abstract: Background: One of the frequently occurring complications of diabetes mellitus is peripheral neuropathy that is related to the condition which is predominantly more in the elderly patients with poor balance, falling anxiety and falls. The prevalence of diabetes is relatively high, and neuropathy affects one-third of people with diabetes. Additionally, one third of those who have diabetic peripheral neuropathy can cause balance issues as well as gait problems. The severity of the disease and inadequate glycemic management increases the risk of developing DPN. About 30% of DPN clients experiences the muscle wasting, loss of ankle reflexes, diminished gait, impaired balance and lack of coordination control and risk of falls. Aim: The purpose of this study is to examine the pertinent literature regarding the efficacy of balance training for individuals with Diabetic neuropathy. Search Method: A literature review using the meta-analyses (PRISMA), focusing on period of 2010-2021, was undertaken. Databases used for searching the articles are pub Med, research gate, Google scholar. Selection Criteria: The selection criterion consists of articles having the keywords Diabetic neuropathy (DN), berg balance scale, balance training, type 2 Diabetes mellitus and glycemic control, falls. Results: Total of 10 Articles were selected according to inclusion criteria and these studies showed that balance training is effective in Diabetic neuropathy. Conclusion: After conducting a literature review, this study found that a particular exercise training program (Balance training) was effective in Diabetic neuropathy by improving balance and reduction of falls of risk.

Keywords: DN, type 2 DM, Diabetes mellitus, bergs balance scale, balance training, glycemic control, falls.

1. Introduction

Diabetes mellitus is a highly prevalent chronic disease that impacts a significant number of people, and its global prevalence is on the rise (1). Metabolic diseases categorized by high levels of blood sugar (hyperglycemia) resulting from irregularities in insulin secretion, function, or both, are referred to as diabetes. (2). The International Diabetes Federation reports that around 425 million adults between the ages of 20 to 79 have diabetes, and this number is estimated to increase by an additional 200 million by the year 2040 (3). Compared to individuals who live independently in the community, those with diabetic neuropathy experience a relatively lower incidence of falls and related injuries (4).

Type 2 diabetes and its consequences, peripheral neuropathy, impact a vast population (WHO 1999) peripheral neuropathy causes sensory and motor impairments, which often result in mobility dysfunction and changes in gait patterns. Walking and balance are both necessary for independence in daily activities (5). In the elderly population, falls are frequently attributed to diabetic neuropathy. Diabetes-related peripheral neuropathy frequently causes balance disorders and dramatically reduced sensations in the feet, decreasing their capacity to maintain their balance effectively (6).

If any disruption or deficits occurs in the sensorimotor system can cause a loss of balance, which can lead to injury (7). Proprioception and Somato sensory inputs from the foot are important factors of motor control during balance and walking (8). Balance can be categorized as either static or dynamic which is typically understood to be the capacity of

the body to keep its centre of gravity within its base of support. Training for balance is a multifaceted and dynamic form of exercise that can decrease the likelihood of falling and improve overall quality of life (9). There are numerous treatment approaches for diabetic neuropathy that emphasizes on balance training and gait, such as the functional strengthening workouts for the gait and balance, total body vibration, and biodex stability system (10).

Need of the Study:

- It is characterized by several clinical symptoms which includes cardiovascular, neuromuscular, orthopedic, fear of falling. The most frequent cause of type 2 diabetes mellitus, which negatively impacts balance and increases the likelihood of falling.
- This study aims to evaluate the effectiveness of existing literature on the subject through a comprehensive review of balance training exercise for Diabetic neuropathy.

Study Objective:

The objective is to assess a literature review concerning the efficacy of balance training exercises in individuals with Diabetic neuropathy.

2. Materials and Methods

Study Design: A literature review was conducted by searching cross-referenced databases and utilizing the Recommended reporting guidelines for Systematic Reviews and Meta-Analyses (PRISMA) on the following platforms: PubMed, Google Scholar, and ResearchGate.

Study Screening: In order to establish eligible criteria for the study, articles were carefully selected that met the following criteria: Randomized controlled trails and clinical trials.

Search Method and Eligibility Criteria: The Systemic search for articles in this review was based on a Google search, pub med and research gate. All databases used the term Diabetic neuropathy, berg balance scale, balance training, and hyperglycemia type 2. The abstracts of resulting studies were reviewed to identify studies relevant to the objective. Finally, 10 articles were selected accordance to their relevance.

Keywords: Keywords used in this article were diabetes mellitus, diabetic neuropathy, berg balance scale, balance, falls, glycemic control. According to the predefined selection and the rejection criteria and publication year, additional articles were finalized.

Inclusion Criteria:

- Articles which included DPN, Diabetic neuropathy and balance
- Articles containing balance training in rehabilitating the present Diabetic neuropathy were taken.
- Articles published from 2010 to 2021.
- Articles containing the complete text
- Only articles that were published in the English language.

Exclusion Criteria:

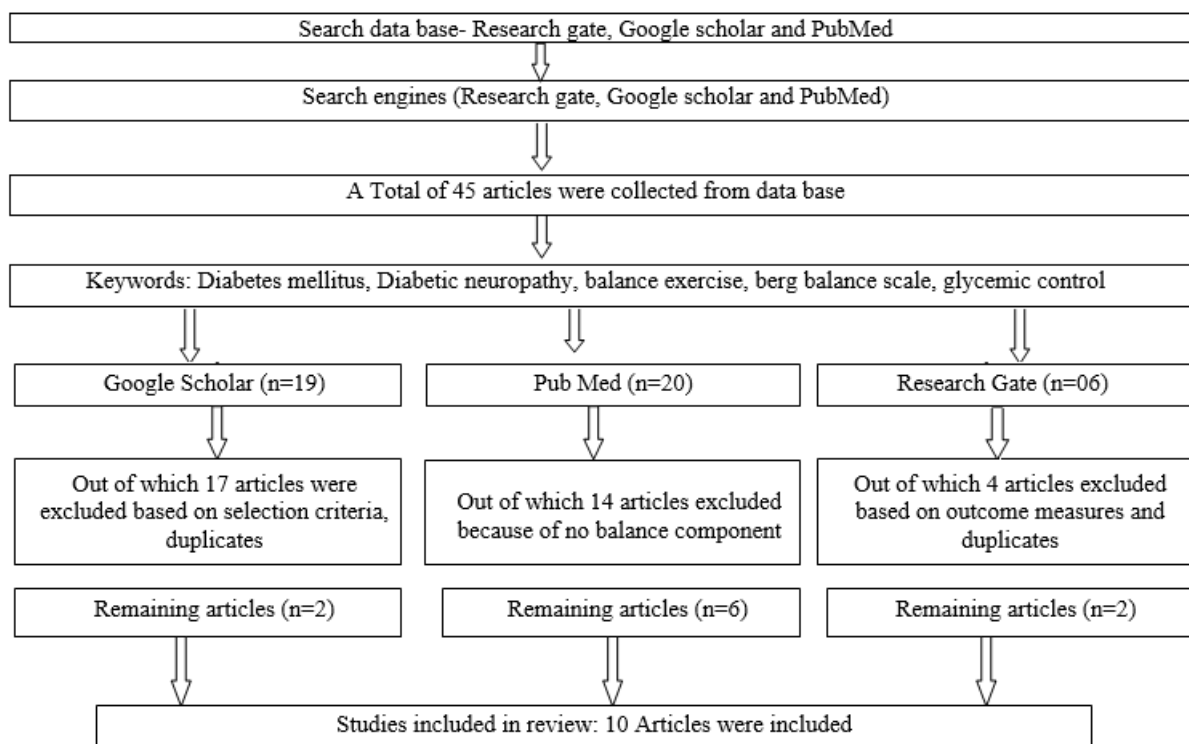
- Only Articles published prior to 2010
- Articles not containing the information relating to Diabetic neuropathy.
- Articles that mention any open wounds, malignancy, arthritis, illness were excluded.

- Articles not containing the information about balance training.
- Articles in other languages with no related title, or abstract and no related keywords are excluded.

3. Procedure

10 articles were chosen in compliance with the established criteria for selection and rejection of articles. All ten of these articles used the randomized control trails and clinical trials as their study designs. In order to do the necessary analyses of the articles, English language articles were chosen. English is the preferable language; the likelihood of an error in analyses of these articles can be reduced. Considering articles with non-English language might have resulted in improper understanding, interpretations, analyses and accurate information. Therefore, English language articles were chosen so that we can obtain relevant analyses, suitable interpretation, data analysis, and accurate information be stated in this review. For this review, articles that were published between the years of 2010-2021 were considered. Full text articles were chosen so that comprehensive information could be gathered from articles. Articles without the information about diabetic neuropathy, DM, berg balance scale, balance exercise were eliminated. Key words used for this study is Diabetes mellitus, Diabetic peripheral neuropathy, balance training, glycemic control, type 2 Diabetes. This study's scope pertains to evaluating the efficacy of balance exercises in the patients with diabetic neuropathy and hence articles containing no relevant data regarding the mentioned scope of this study were not considered.

Study Selection Strategy:



4. Results

The results of this review were that balance training shows a positive impact on enhancing balance and mitigating fall

risks in individuals with diabetic neuropathy. Most of the reviewed studies suggest that balance training was most effective in improving overall mobility and reduced risks of falls in diabetic neuropathy.

S.No	Authors	Year	Study Design	Sample Size	Conclusion
1.	Robin L.Kruse joseph W. Lemaster et al	2010	Randomized control trial	79	Participants balance and lower extremity strength were little impacted by the training regimen. Compared to the control group participants; increasing weight bearing activity had no effect on the rate of falling for intervention group. People with DPN+PN who are sedentary appear to be able to improve their exercise level without increasing their risk of falling.
2.	M. Mathivathan-i	2018	Randomized control trial	30	The study's conclusion suggests that Proprioceptive Neuromuscular Facilitation (PNF) is a more effective approach compared to simple balance training.
3.	Javeria Ghazal et al	2016	Randomized control trial	196	Balance exercises that are task oriented are beneficial at enhancing the dynamic, anticipatory and reactive balance. By improving balance results, task-oriented training mitigates the fall risk.
4.	Seyedeh hoda seyedizadeh et al	2020	Randomized controlled trails	24	These trainings have the potential that the combined aerobic resistance should be effective.
5.	Zahra Rojhani-shirazi et al	2016	Randomized control trial	60	Compared to frenkele training, Swiss ball exercises are preferred for patients with diabetic neuropathy in improvising balance.
6.	Bina eftekhar sadat et al	2015	Randomized control trail	44	The results shown that Balance training has the potential to enhance postural stability and balance in elderly individuals who have diabetic neuropathy.
7.	Sowjanya Maruboyina et al	2018	Randomized control trial	30	Patients with diabetic peripheral neuropathy can improve their balance more quickly using a stability disc than with a wobble board.
8.	Chang Ho song et al	2011	Randomized control trial	38	Balance exercise regimen enhances trunk proprioception along with balance. These findings indicated that Individuals with diabetic neuropathy can benefit from engaging in balance exercises.
9.	Mohammad akbari, Hassan Jaffari et al	2012	Clinical trail	20	The results demonstrate that balance training has the potential to enhance stability in patients with diabetic neuropathy.
10.	Steven J.brown et al	2015	Clinical trail	89	In individuals with DPN, they have shown clear deficits in dynamic sway while performing gait-related activities, which develop into increasing gait task makes it more obvious complexity.patients with DPN who experience balance issues may also experience a compensation strategy(increasing stance width) that is employed as a result of although it may actually raise the chance of falling, the perceived instability.

5. Discussion

In diabetes, the nerves are frequently affected under condition of diabetic neuropathy, causing sensation loss or pain in the feet, legs, and hands. It can also affect balance and coordination, resulting in heightened fall risk. Evidence suggests that balance training is an effective approach to enhancing balance and reducing falls in patients with diabetic neuropathy. Balance training is a form of exercise that concentrates on enhancing the capacity to sustain balance and reducing falls in older adults and individuals with neurological conditions. When it comes to diabetic neuropathy, balance training can help in enhancing balance and reducing fall risk by addressing some physiological changes that occur in the nervous system. For example, studies have shown that diabetic neuropathy resulting in minimizing the number of nerve fibers and size in the feet and legs, which can affect sensations such as touch, temperature and proprioception.

Balance training can help counteract these changes by stimulating the nervous system and promoting the growth of new nerve fibers. Additionally, balance training can help improve muscle strength and flexibility, which can further enhance balance and stability. Physiologically, before balance training, diabetic neuropathy patients may show decreased nerve conduction velocity, impaired muscle

strength, reduced joint ROM, and decreased proprioception. However, after the balance training, there may be improvements in all the physiological aspects such as muscle strength, joint ROM and sensations etc. This can contribute to better balance and reduced fall risk in diabetic neuropathy patients.

Based on the studies reviewed, balance training shows markable effect on balance in individuals with peripheral diabetic neuropathies. The studies have reported significant improvements in balance measures such as BBS (berg balance scale) , TUG (timed up and go) test, postural sway after intervention of the balance training. Additionally, some studies have reported improvements in gait speed and stride length, suggesting a potential impact on mobility as well.

Many studies opted for composite intervention strategy that incorporated a range of exercises such as aerobic, strength training and progressive balance exercises. This integrated approach yielded significant improvements in balance metrics as compared to the group that received only balance exercises(13)(26). They reported that all the 29 patients completed their interventions with no adverse effects except one patient complains the calf pain. (13)

Mueller et al conducted a study comparing a group that engaged in weight bearing activities with another group that

didn't bear weight (26), while Kruse et al. compared a group that followed a program of exercises of balance, strengthening of leg along with self-monitored walking with a control group (13). Kruse and colleagues reported no adverse effects of exercises (13) while Mueller and colleagues reported calf pain in one patient (26)

One of the studies by Allet and his colleagues (2010) examined the efficacy of balance training program of 12 weeks on balance control along with gait performance in the diabetic neuropathy patients. The study found that balance training led to significant improvement in both gait speed along with balance control. The authors concluded that balance training can be effective intervention in enhancing the balance with minimizing fall risk in individuals with diabetic neuropathy. They have reported pain in Achilles tendon in two patients (27).

Rojhani-shirazi z et al. (2016) The study included 60 participants with type 2 diabetic peripheral neuropathy, were assigned randomly either to the Frenkel training group, Swiss ball training group or to comparison group focused on improving balance and stability using a Swiss ball., which measured the clinical balance measures before and after the 8 week exercise intervention. The authors concluded that exercises may have resulted in increased muscle strength and hypertrophy, as well as improved neuromuscular control and coordination, which contribute to improved balance measures in individuals with diabetic neuropathy and not reported adverse effects. (10)

According to prior research of rost and Robertson, concluded performing exercise that enhance balance, such as walking on tip toes, walking backwards (28), standing on one foot (29), walking on heels, side walking and climbing stairs can significantly improve balance and prevent falls among older adults (28) (29).

6. Conclusion

This literature review analyzed the efficacy of balance exercise training in Diabetic peripheral neuropathy and there is evidence of improvement in balance, mobility control and decreased in risk of falling. This study concluded that physical activity which included the balancing exercise reduced the imbalance in people affected with Diabetic neuropathy.