



Comprehensive Rehabilitation in Adults with Diabetic Peripheral Neuropathy: A Literature Review on Frequency, Intensity, and Duration Parameters

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Abstract

Background: Diabetic Peripheral Neuropathy (DPN) raises the risk of falls by causing sensory loss, balance problems, and motor issues. Rehabilitation programs that focus on balance, strength, gait, and sensorimotor training are widely used. Still, there is little agreement on the best frequency, intensity, and duration for these programs.

Objective: To synthesize available evidence on rehabilitation dosage parameters (frequency, intensity, and duration) from randomized controlled trials investigating comprehensive rehabilitation programs for adults with DPN and their effects on balance and fall risk.

Methods: A structured synthesis was conducted, drawing on randomized controlled trials and systematic reviews. Studies were analyzed for duration, frequency, supervision, adherence, and outcomes related to balance, gait, and fall incidence.

Results: Program durations varied from 4 to 52 weeks, but most participants completed 8 to 12 weeks of rehabilitation. Training usually took place 2 to 3 times per week, and sometimes up to 5 times in more intensive programs. Session lengths and intensity were not always reported, but when they were, sessions lasted 30 to 60 minutes. Programs lasting 8 to 12 weeks with at least 2 sessions per week led to clear improvements in balance and gait. However, only a few studies showed a real decrease in the number of falls.

Conclusion: Research shows that rehabilitation programs lasting 8 to 12 weeks with 2 to 3 sessions per week help improve balance and gait in adults with DPN. While these programs have positive effects, there is no standard way to report how hard the exercises should be. Studies use different measures, such as heart rate percentage, perceived effort, or resistance levels. Future research should focus on measuring and standardizing exercise intensity to find the best approach for preventing falls.

Keywords: Diabetic Peripheral Neuropathy; Rehabilitation; Exercise Dosage; Balance Training; Fall Prevention; Frequency; Intensity; Duration

Abbreviations

DPN: Diabetic Peripheral Neuropathy; RCTs: Randomized Controlled Trials; RPE: Rating of Perceived Exertion.

Introduction

Diabetic Peripheral Neuropathy (DPN) is a common complication of diabetes, affecting up to half of people with

long-term diabetes. It causes a gradual loss of nerve function, especially in the hands and feet, leading to poor balance, weak muscles, and trouble staying steady. Because of this, DPN increases the risk of falls and movement problems in adults. Rehabilitation programs that focus on balance, strength, walking, and sensorimotor skills are now a key part of managing these issues [1].

Several randomized controlled trials (RCTs) have shown that structured exercise programs can improve balance, walking speed, and movement in adults with DPN. However, studies differ on the best amount of exercise, including how often, how hard, and how long sessions should be. These details are important for putting research into practice and making sure patients stick with the programs.

Previous systematic reviews have shown that multimodal rehabilitation programs significantly improve functional outcomes in DPN; however, there is no consensus on the optimal prescription parameters. This review aims to synthesize data from recent RCTs and systematic reviews to identify the most effective frequency, intensity, and duration parameters of comprehensive rehabilitation for adults with DPN [2].

Methods

A structured literature search was conducted using PubMed, Scopus, ScienceDirect, and Google Scholar databases from 2015 to 2025. Search terms included "Diabetic Peripheral Neuropathy," "Rehabilitation," "Exercise therapy," "Balance training," "Fall risk," and "Frequency Intensity Duration." Randomized controlled trials (RCTs), meta-analyses, and systematic reviews examining multimodal rehabilitation interventions in adults with DPN were included. Studies involving pharmacological or surgical interventions without rehabilitation components were excluded [3].

Data extracted included intervention duration, weekly frequency, session length, supervision level, intensity

measures, and key outcomes such as balance, gait, and fall risk. The methodological quality of included RCTs was cross verified using the PEDro scale, and results were synthesized narratively, given heterogeneity in outcome measures [4].

This review highlights several recurring methodological limitations across trials of rehabilitation interventions for adults with diabetic peripheral neuropathy (DPN). Most included studies were small and underpowered, limiting precision and increasing the risk of type II error. There was marked heterogeneity in intervention content and dosing (mode, frequency, intensity, and duration), and reporting of exercise intensity was often incomplete or non-standardized (e.g., absence of HRR, %HRmax, %1RM or explicit RPE ranges), which impedes reproducibility and dose-response interpretation. Outcome assessment varied widely studies used different neuropathy measures (symptom scales, nerve conduction studies, balance/gait tests), sometimes relying on subjective reports and many trials had only short follow-up periods, leaving the durability of effects unclear. Risk-of-bias concerns were common, including incomplete reporting of allocation concealment and limited use of blinded assessors. Finally, adherence and fidelity monitoring were inconsistently reported, and co-interventions were sometimes poorly controlled, reducing confidence in attributing observed effects solely to the tested rehabilitation protocols. These limitations reduce certainty in the pooled evidence and indicate a need for larger, better-reported trials with standardized dosing and outcomes [5,6].

Results

Across the analyzed studies, intervention duration ranged between 4 and 52 weeks. The most common duration was 8–12 weeks, with training frequencies between 2–3 sessions per week. Session duration typically spanned 30–60 minutes. Supervised programs showed better adherence and greater improvements in balance and gait measures compared to unsupervised home-based training. Where reported, intensity was based on percentage of maximum heart rate, RPE, or resistance training loads (Table 1).

Author (Year)	Duration (weeks)	Frequency (sessions/week)	Session Length	Supervision	Main Outcomes
Mueller et al. (2021)	12	3	60 min	Supervised	↑ Balance, gait speed, proprioception
Alissa et al. (2024)	8	2	45 min	Supervised	↓ Fall risk, ↑ postural control
Shipper et al. (2023)	10	3	45–60 min	Mixed	↑ Berg Balance, TUG improvement
Pakpattan et al. (2024)	8	3	30 min	Supervised	↑ Dynamic balance, muscle strength
Smith et al. (2020)	12	2–3	60 min	Home-based	↑ Gait velocity, no change in falls

Table 1: summarizes key RCTs on rehabilitation dosage in adults with DPN.

Discussion

This review identifies a consistent trend supporting comprehensive rehabilitation programs of 8–12 weeks duration, conducted 2–3 times per week, and lasting 30–60 minutes per session, as effective in improving balance and gait outcomes in adults with DPN. Where described, intensity was set using percentage of maximum heart rate, RPE, or resistance loads. Supervised sessions appear more effective than unsupervised interventions, emphasizing the role of professional guidance in enhancing safety, adherence, and progression.

Despite these findings, inconsistencies in intensity reporting remain a major limitation. Only a few studies objectively quantified workload using measures such as %HRmax, Rating of Perceived Exertion (RPE), or one-repetition maximum (1RM) for strength components. Future trials must standardize exercise intensity documentation to enable precise dose–response modeling.

While improvements in functional balance and mobility are robust, reductions in actual fall incidence are less consistently observed. This discrepancy likely reflects small sample sizes, short follow-up periods, and variability in how falls are monitored. Integrating sensor-based monitoring and long-term follow-up could help bridge this evidence gap.

Finally, individual tailoring based on neuropathy severity, comorbidities, and baseline functional capacity remains essential. A one-size-fits-all approach is unlikely to optimize outcomes.

Conclusion

Evidence supports the use of comprehensive rehabilitation programs for adults with Diabetic Peripheral

Neuropathy with the following parameters: program duration of 8–12 weeks, 2–3 sessions per week, and session lengths of 30–60 minutes at moderate intensity. These programs improve balance and gait and may reduce fall risk, though data on fall incidence remain inconclusive. Future research should emphasize standardized reporting of exercise intensity, longer-term follow-up, and integration of digital adherence tracking to establish optimal therapeutic dosing.

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