



# EFFECT OF BODY WEIGHT SUPPORT TREADMILL TRAINING ON BALANCE IN STROKE INDIVIDUALS

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## **ABSTRACT**

**OBJECTIVE** – To evaluate the effect of body weight support treadmill training on balance in stroke individuals.

## **METHOD** –

A scoping review of observational, experimental, randomized control trials were performed. Google Scholar, EBSCO host and PubMed were searched using terms balance and body support treadmill training and stroke. The PRISMA-Scoping review checklist and preferred reporting items used to analyze each report's section.

**RESULT** – A total of 67 studies were selected, of which 14 were published between 2010-2023 were included in the study.

**CONCLUSION**- This review suggests that body weight support treadmill training is effective on balance in stroke individuals.

**KEYWORD**- Stroke, body weight support treadmill, balance

## **Introduction**

A stroke is a brain attack (cerebrovascular accident, or CVA) where brain cells die due to an excess (hemorrhagic) or a lack (ischemic) of blood. A person who has suffered a stroke may show several cognitive and motor deficits. On the other hand, motor deficits may include reduced movement and sensation, muscular weakness, hemiplegia or hemiparesis, balance issues, and problems with walking independently, among many

others [1]. Patients with extensive instances of falling had poor balance and walking ability [2]. Balance is diminished in patients with hemiplegia and hemiparesis. Balance impairments increase fall risk, resulting in high economic costs and social problems. Balance problems in hemiparetic patients after stroke can be caused by different impairments in the physiological systems involved in postural control, including sensory afferents, movement strategies, biomechanical constraints, cognitive processing, and perception of verticality [3].

Body Weight Supported Treadmill (BWST) is a well-established neurorehabilitation tool, provide stroke survivors with confidence in starting rehabilitation early after surgery or trauma to regain balance and locomotion <sup>[4]</sup>. In addition, BWS reduces lower extremity load, thus facilitating step initiation shown promise in providing improvements in motor function, locomotion ability, and balance in stroke survivors <sup>[5]</sup>. This study demonstrates that combined training has considerable effects on balance, mobility, and fear of falling parameters, while lower frequency of isolated BWSTT is as much effective as higher frequency of conventional training in ambulatory post-stroke patients <sup>[6]</sup>.

Hence, the objective of this review was to investigate whether BWSTT has a significant effect on balance at different stages of recovery in stroke individuals.

## **METHODS**

**AIM-** the present study aims to review the effect of body weight support treadmill training on balance in stroke individuals.

### **Search strategies**

Searches for relevant studies were conducted in the databases Google Scholar, EBSCO, PubMed. Terms used in bibliographical searches included stroke AND body-weight-supported treadmill training AND balance among others.

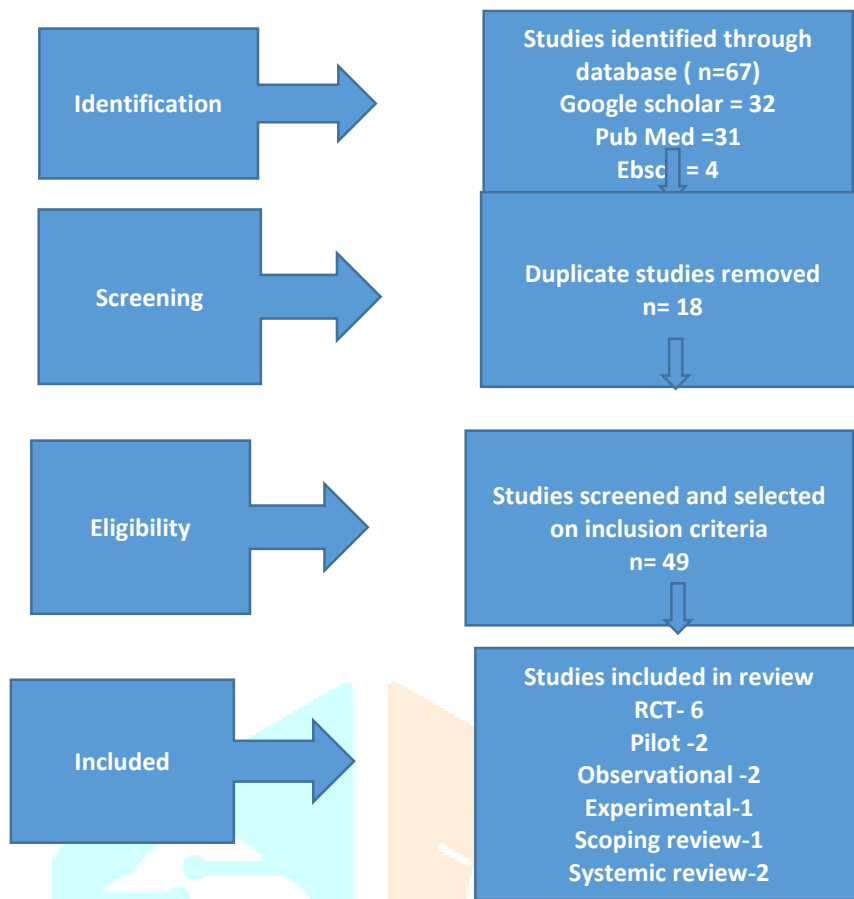
Hence, all studies using Experimental, RCT, systemic and scoping reviews, pilot study related to balance, body-weight-supported treadmill were included.

### **Screening and data extraction**

Those publications that satisfy the inclusion criteria were selected for initial screening. Titles and abstracts were read to identify relevant publications and the references for which were screened to find additional relevant studies. The following criteria:

1. Adult patients with stroke more than 6months.
2. Outcome variables were parameters of balance are:  
Berg Balance Scale (BBS)  
Fugl-Meyer assessment scale (FMS)  
Timed Up and Go Test  
Rivermead Mobility Index (RMI)  
MMSE [mini mental state examination]

From these 67 papers were selected as possibly relevant. After a full evaluation, 18 duplicate studies were removed and the remaining 49 studies were then entered into the screening process. The author analyzed each study that had previously done. In final results, we found fourteen studies met all inclusion criteria and review goals. Seen in (Figure.1).



**FIG.1:** Flow diagram of the search process in the scoping review.

### Ethical consideration

This study didn't require to be investigated or approved by an institutional review board since the scoping review entirely included summary or statistics from previously published research.

### RESULTS

After assessing the eligibility of articles based on the title, abstract, and full text, 14 articles were selected. All included studies were published from 2010-2023.

Author /year	Participants	Study Design	Assessment tools	Analysis
Suparna et al,2021 <sup>[7]</sup>	on 30 ambulatory chronic stroke patients having post stroke duration of six months or more.	Randomized control trial	Timed Up and Go test Cadence 10 meter Walk Test Berg Balance Scale.	BWSTT offers improvement in gait, in terms of walking speed, dynamic balance, posture control, that is significantly more than that of conventional gait training, as found in this study.
Xiao-Ming Yu et al,2020 <sup>[5]</sup>	Seventy-one stroke survivors with hemiplegia were randomly allocated to the control group (N= 35) or the BWS-TC group	Randomized control trial	Berg Balance Scale Fugl-Meyer assessment scale	Tai-Chi and BWSTT training on balance control and walking function enhance dynamic balance and walking function in stroke survivors.

	(N= 36).			
Rüstem Mustafaoğlu et al,2018 <sup>[6]</sup>	a total of 45 post-stroke patients were randomly assigned to combined training group (CombTG), conventional training group (CTG), and BWSTT group (BWSTTG)	Randomized control trial	Berg Balance Scale Timed Up and Go Test Rivermead Mobility Index Stair Climbing Test	BWSTT is as much effective as higher frequency of conventional training in ambulatory post-stroke patients.
Ken-Wei Chang et al,2021 <sup>[8]</sup>	On 16 chronic stroke for more than six months, whose level of Brunnstrom stage is greater than IV and who are able to walk more than eleven meters with or without assistive devices were recruited.	A pilot study	Berg Balance Scale Timed Up and Go test 10-Meter Walk Test 6-Minute Walk Test pulmonary function test	The 30 min of walking backward on a treadmill three times a week for four weeks increased balance, speed of walking and cardiopulmonary fitness.
Byung Joon Lee et al, 2013 <sup>[9]</sup>	twenty-six stroke patients (20 men and 6 women) participated in this study and randomly divided into two groups: the experimental group (body weight supported treadmill training group, n=14) and control group (treadmill group, n=12).	Randomized control trial	Berg Balance Scale (BBS)	Intensive gait training with Body Weight Support Treadmill Training may improve gait and balance in subacute stroke.
Erik Chumacero-Polanco et al,2018 <sup>[10]</sup>		A systematic review	Berg balance scale (BBS) timed-up-and-go test (TUGT) 6minWT	BWS-TWT increases WS, cadence, balance, and endurance of stroke survivors at any stage poststroke.

Juchul Cho et al 2015 <sup>[11]</sup>	Twenty stroke patients who volunteered to participate in this study were randomly assign to either the BWSTT combined with ball-kicking (BWSTT-BK; 10 participants) group or the BWSTT group (10 participants).	Randomized control trial	Berg Balance Scale (BBS) Timed Up and Go Test (TUG)	BWSTT-BK results in more favourable outcomes for stroke patients. Therefore, BWSTT-BK may be useful for the recovery of gait ability of stroke patients.
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## DISCUSSION

The purpose of this review was to investigate the effectiveness of BWSTT on balance in stroke patients. Fourteen studies were included, indicating that only a small number of topic have been published. As the date of publishing ranged from 2010 to 2023, it shown that there have been effect of BWSTT in terms of improving dynamic balance and postural control, lower extremity mobility which has decreased fear of fall among stroke individuals. This may involve improvements in muscle strength, coordination, proprioception, and motor control<sup>[7,12]</sup>.

Some discussions focus on comparing BWSTT with other balance training interventions, such as conventional physical therapy or overground walking training. While BWSTT may offer unique benefits, its comparative effectiveness in improving balance relative to other interventions requires further investigation. BWSTT often incorporates sensory integration by combining visual, vestibular, and proprioceptive feedback. This integrated sensory input can help stroke patients relearn balance strategies and improve postural control<sup>[13,14]</sup>.

While many studies reported immediate post-intervention improvements in balance, few explored the sustainability of these gains over the long term. Future research should focus on evaluating the durability of balance improvements following BWSTT and identify strategies to maintain functional gains in stroke survivors.

## LIMITATIONS

There weren't many relevant research only few studies were present in database. There is lack of follow-up in studies so we obtained no information about long-term effects. Thus, we suggest looking into more studies in the future that concentrate more on BWSTT along with balance.

## CONCLUSION

Evidence supporting the effectiveness of BWSTT in enhancing balance at any post-stroke stage can be found in this scoping review. This therapy can be prescribed by therapists at any point after a stroke, but patients who have significant difficulties sitting, standing, and walking such as those who are in the acute phase of recovery may benefit from it more. Additional research is needed to determine appropriate dosing regimens, long-term effects, and potential combinations with therapies.

## REFERENCES

1. Chumacero-Polanco E, Yang J, James CR, Wu M. Body-Weight-Supported Treadmill Walking Training Improves Functional Walking and Balance in Stroke Survivors at Any Poststroke Stage: A Systematic Review. *Critical Reviews™ in Physical and Rehabilitation Medicine*. 2018;30(4).
2. Chang KW, Lin CM, Yen CW, Yang CC, Tanaka T, Guo LY. The effect of walking backward on a treadmill on balance, speed of walking and cardiopulmonary fitness for patients with chronic stroke: a pilot study. *International Journal of Environmental Research and Public Health*. 2021 Mar 1;18(5):2376.
3. Mahmoudi Z, Mohammadi R, Sadeghi T, Kalbasi G. The effects of electrical stimulation of lower extremity muscles on balance in stroke patients: a systematic review of literatures. *Journal of Stroke and Cerebrovascular Diseases*. 2021 Aug 1;30(8):105793.
4. Duncan PW, Sullivan KJ, Behrman AL, Azen SP, Wu SS, Nadeau SE, Dobkin BH, Rose DK, Tilson JK, Cen S, Hayden SK; LEAPS Investigative Team. Body-weight-supported treadmill rehabilitation after stroke. *N Engl J Med*. 2011 May 26;364(21):2026-36. doi: 10.1056/NEJMoa1010790. PMID: 21612471; PMCID: PMC3175688.
5. Yu XM, Jin XM, Lu Y, Gao Y, Xu HC, Xue X, Fang L, Hu J. Effects of body weight support-tai chi footwork training on balance control and walking function in stroke survivors with hemiplegia: a pilot randomized controlled trial. *Evidence-based Complementary and Alternative Medicine*. 2020 Oct;2020.
6. Mustafaoglu R, Erhan B, Yeldan İ, Ersöz Hüseyinsinoğlu B, Gündüz B, Razak Özdiñçler A. The effects of body weight-supported treadmill training on static and dynamic balance in stroke patients: A pilot, single-blind, randomized trial. *Turk J Phys Med Rehabil*. 2018 Aug 15;64(4):344-352. doi: 10.5606/tftrd.2018.2672. PMID: 31453532; PMCID: PMC6648026.
7. GanGoPadhyay S, Saha S, SenGuPta M, MAITY B, CHAKRABARTI D. Effect of Body Weight Support Treadmill Training on Gait Recovery, Lower Limb Function and Dynamic Balance in Patients with Chronic Stroke: A Randomised Controlled Trial. *Journal of Clinical & Diagnostic Research*. 2021 Oct 1;15(10).
8. Chang KW, Lin CM, Yen CW, Yang CC, Tanaka T, Guo LY. The effect of walking backward on a treadmill on balance, speed of walking and cardiopulmonary fitness for patients with chronic stroke: a pilot study. *International Journal of Environmental Research and Public Health*. 2021 Mar 1;18(5):2376.
9. Lee BJ, Lee HJ, Lee WH. The effects of intensive gait training with body weight support treadmill training on gait and balance in stroke disability patients: a randomized controlled trial. *Physical therapy rehabilitation science*. 2013 Dec 31;2(2):104-10.
10. Chumacero-Polanco E, Yang J, James CR, Wu M. Body-Weight-Supported Treadmill Walking Training Improves Functional Walking and Balance in Stroke Survivors at Any Poststroke Stage: A Systematic Review. *Critical Reviews™ in Physical and Rehabilitation Medicine*. 2018;30(4).
11. Cho J, Lee E, Lee S. Effects of body weight-supported treadmill training combined with ball-kicking on balance and gait of subacute stroke patients. *Physical therapy rehabilitation science*. 2015;4(2):738.
12. Mao YR, Lo WL, Lin Q, Li L, Xiao X, Raghavan P, Huang DF. The effect of body weight support treadmill training on gait recovery, proximal lower limb motor pattern, and balance in patients with subacute stroke. *BioMed research international*. 2015 Oct;2015.
13. Duncan PW, Sullivan KJ, Behrman AL, Azen SP, Wu SS, Nadeau SE, Dobkin BH, Rose DK, Tilson JK, Cen S, Hayden SK. Body-weight-supported treadmill rehabilitation after stroke. *New England Journal of Medicine*. 2011 May 26;364(21):2026-36.
14. Jang SH, Lee JH. Impact of sensory integration training on balance among stroke patients: Sensory integration training on balance among stroke patients. *Open Medicine*. 2016 Jan 1;11(1):330-5.
15. Cho KH, Lee WH. Effect of treadmill training based real-world video recording on balance and gait in chronic stroke patients: a randomized controlled trial. *Gait & posture*. 2014 Jan 1;39(1):523-8.
16. Duncan PW, Sullivan KJ, Behrman AL, Azen SP, Wu SS, Nadeau SE, Dobkin BH, Rose DK, Tilson JK, Cen S, Hayden SK. Body-weight-supported treadmill rehabilitation after stroke. *New England Journal of Medicine*. 2011 May 26;364(21):2026-36.
17. Sukonthamarn K, Rerkmoung S, Konjen N, Charoenlimprasert J, Sriaoum S. Effectiveness of Anti-Gravity Treadmill Training in Improving Walking Capacity and Balance in Hemiparetic Stroke Patients: A Randomized Controlled Trial. *Journal of the Medical Association of Thailand*. 2019 Sep 1;102(9).

18. Wang J, Zhao L, Gao Y, Liu C, Dong X, He X. The difference between the effectiveness of body-weight-supported treadmill training combined with functional electrical stimulation and sole body-weight-supported treadmill training for improving gait parameters in stroke patients: A systematic review and meta-analysis. *Frontiers in Neurology*. 2022 Nov 9;13:1003723.

