

University of South Dakota

USD RED

---

Physical Therapy Student Research Projects

Physical Therapy Research

---

2023

## The effects of balance exercises on lower extremity injury prevention: a systematic review

Madason Gene Leif SPT

*University of South Dakota, Madason.tessier@coyotes.usd.edu*

Bailey James Neises SPT

*University of South Dakota, Bailey.neises@coyotes.usd.edu*

Zach Thomas Sebern SPT

*University of South Dakota, Zachary.sebern@coyotes.usd.edu*

Ryan John Hanks SPT

*University of South Dakota, Ryan.hanks@coyotes.usd.edu*

Follow this and additional works at: <https://red.library.usd.edu/pt-studentprojects>



Part of the [Physical Therapy Commons](#)

---

### Recommended Citation

Leif, Madason Gene SPT; Neises, Bailey James SPT; Sebern, Zach Thomas SPT; and Hanks, Ryan John SPT, "The effects of balance exercises on lower extremity injury prevention: a systematic review" (2023). *Physical Therapy Student Research Projects*. 19. <https://red.library.usd.edu/pt-studentprojects/19>

This Poster is brought to you for free and open access by the Physical Therapy Research at USD RED. It has been accepted for inclusion in Physical Therapy Student Research Projects by an authorized administrator of USD RED. For more information, please contact [dloftus@usd.edu](mailto:dloftus@usd.edu).

# The effects of balance exercises on lower extremity injury prevention: a systematic review

Madason Leif, SPT; Ryan Hanks, SPT; Zach Sebern, SPT; Bailey Neises, SPT  
 Research Advisors: Dr. Hanz Tao, PT, DPT; Dr. Kory Zimney, PT, DPT, PhD

## Study Design

- Systematic Review

## Purpose

- To investigate which specific types of balance training were used in effective injury prevention programs.

## Background

- Non-contact lower extremity (LE) sports injuries are very common in young adults.
- Studies have been done to identify and predict risk factors for non-contact sport related injuries.
- Comprehensive sports injury prevention programs have been proven to reduce LE injury in teams participating in them.
- Comprehensive = core and LE strength, agility, balance and plyometrics

## Methods

- Databases used: SPORTDiscus & PubMed
  - Search terms: perturbation training OR reactive stepping OR reactive balance OR postural balance AND injury prevention in sports
- Inclusion criteria
  - RCT, peer-reviewed, past 10 years, English, and full text
- Exclusion criteria
  - UE injury, non sports related injury, contact injury, overuse running injury, participant age outside 10-30, previous LE injury, currently participating in injury rehab.
- Quality assessment of studies
  - Studies found in PEDro database
    - 0-10 scale
- Outcome measures include maintaining single leg balance under various conditions

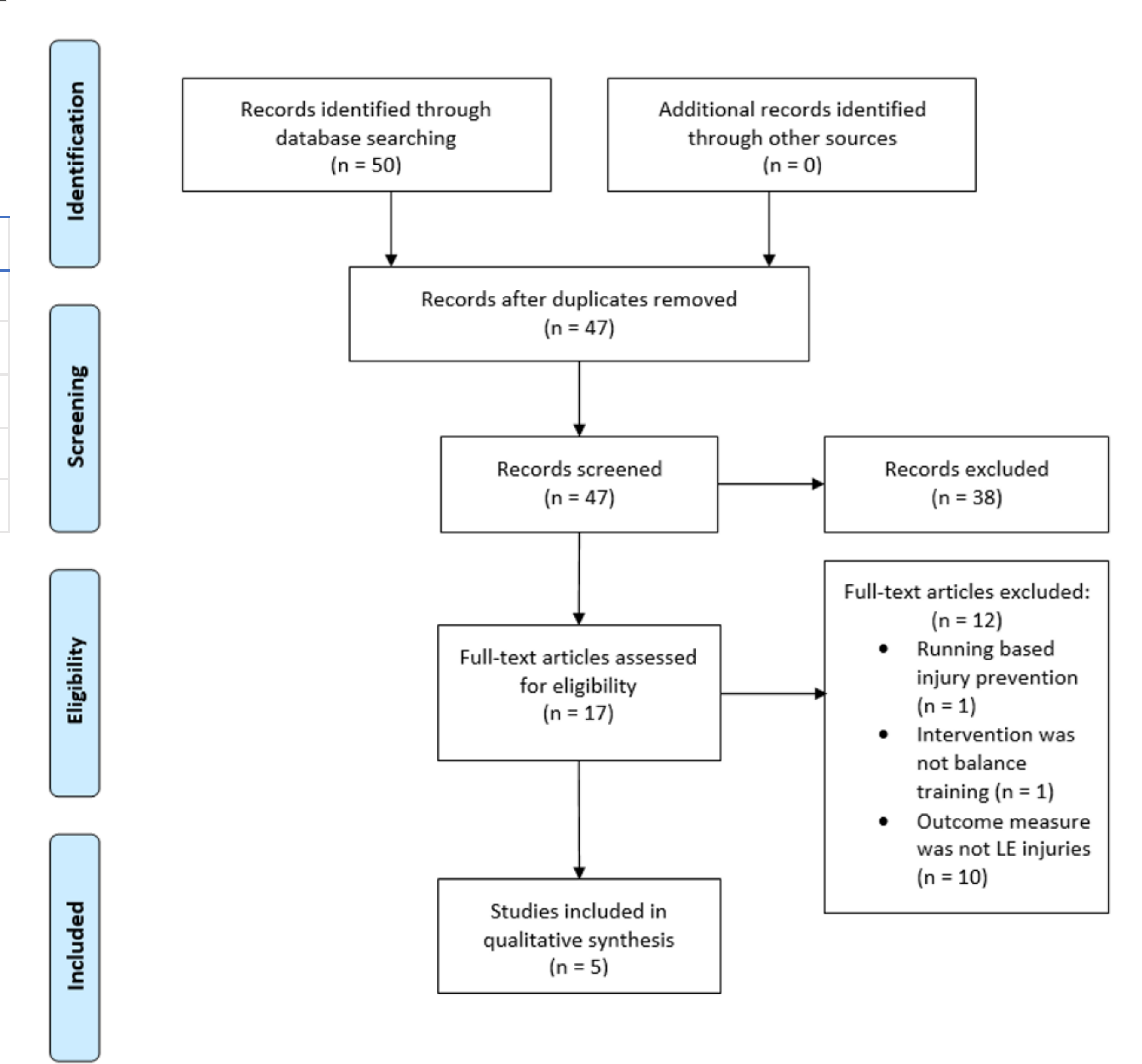
## Data Analysis

**Table 2. PEDro scores of studies Included for review**

Study	PEDro Score
Hisop et al. <sup>10</sup>	5
Steffen et al. <sup>11</sup>	5
Owen et al. <sup>12</sup>	5
Bonato et al. <sup>13</sup>	4
Halvarsson et al. <sup>14</sup>	8

- Average PEDro score: 5.4/10
- “Fair” quality

## Results



**Table 1. Characteristics of studies included for review.**

Study details		Participants		Intervention				Outcome (LE injuries)	
Study	Quality (PEDro)	Characteristics	n	Intervention	Frequency	Duration	Control	Follow-up	
Hislop et al. <sup>10</sup>	5 (Fair)	School rugby players aged 14-18	2,452	<ul style="list-style-type: none"> <li>• SLB perturbation training</li> <li>• SLB dynamic with moving BOS</li> <li>• SLB firm surface</li> </ul>	2-3 sessions a week	4 months	Regular warm-up	The intervention group (n=1,325) did not have a significant difference in LE injury risk (IRR=1.10; 90% CI 0.7–1.72) compared to the control group (n=1,127).  Intervention teams completing 3+ sessions a week (n=12) had a significant decrease in LE injury risk (IRR=.30, 90% CI 0.10-0.92) compared to the control group (n=51).	
Steffen et al. <sup>11</sup>	5 (Fair)	Female soccer players aged 13-18 who played on U16 and U18 club teams	226	<ul style="list-style-type: none"> <li>• SLB firm surface</li> <li>• SLB on alternating surface</li> <li>• SLB dynamic</li> <li>• SLB w/ psychomotor attentional focus</li> <li>• SLB perturbation training</li> </ul>	2-3 sessions a week	4 months	FIFA 11+ without proper coach and player training & low adherence group	The players that participated in 2.2+ sessions a week (n=73) had a significant decrease in LE injury risk (IRR=0.32; 95% CI 0.11–0.95) compared to the control group (n=75).  The player focused group (n=78) did not have a significant difference in LE injury risk (IRR= .83; 95% CI 0.33–2.08) compared to the control group (n=78).	
Owen et al. <sup>12</sup>	5 (Fair)	Elite male pro soccer players in Scottish Premier League	26	<ul style="list-style-type: none"> <li>• SLB on alternating surface</li> </ul>	2 sessions a week	58 sessions	Regular warm-up	The intervention group sustained a higher number of injuries (n=88) compared to the control group (n=72); however, no levels of significance were found between them (p=0.21).	
Bonato et al. <sup>13</sup>	4 (Fair)	Women's basketball players	160	<ul style="list-style-type: none"> <li>• SLB dynamic with moving BOS</li> </ul>	4 sessions a week	8 months	Regular warm-up	The intervention group (n=32) had significantly fewer injuries and significant differences in knee sprain injuries & ACL lesions (95% CI 0.37-1.13) compared to the control group (n=79).	
Halvarsson et al. <sup>14</sup>	8 (Good)	Elite orienteers	62	<ul style="list-style-type: none"> <li>• SLB on firm surface</li> <li>• SLB dynamic with moving BOS</li> </ul>	4 sessions a week (but significance found with 2 or more sessions a week)	4 months	Regular warm-up	The intervention group (n=30) did not show a significant difference in substantial injured orienteers (OR 0.50; 95% CI 0.19-1.34) and number of substantial injuries (OR=0.46; 95% CI 0.18-1.13) compared to control (n=32).  The intervention group that participated in 2+ sessions a week (n=19) showed a significant difference in substantial injured orienteers (OR=0.25; 95% CI 0.06-0.97), 65% reduced injury risk and number of substantial injuries (OR=0.26; 95% CI 0.07-0.92), 64% reduced injury risk compared to the control group.	

\*PEDro = Physiotherapy Evidence Database; FIFA = Fédération Internationale de Football Association; LE = lower extremity; SLB = single leg balance; BOS = base of support; IRR = incidence rate ratio; CI = confidence interval; OR = odds ratio; ACL = anterior cruciate ligament

## Conclusion

- There is a lack of research on balance interventions as a stand alone injury prevention method in sports.
- Current research is primarily focused on comprehensive injury prevention programs.
- 4 studies found that dynamic single leg balance interventions proved to be effective at decreasing LE injuries in athletes
- Dynamic single leg balance and adherence to an injury prevention program were found to be most important for injury prevention.
- Firm surface training had a negative effect on injury prevention.

## Limitations

- Significant heterogeneity exists in current studies between populations studied, outcome measures, and exercise prescription, so it is difficult to make direct comparisons with synthesis of findings

## Clinical Relevance

- Although there have not been specific balance exercises or programs identified, **increased adherence rates** to an injury prevention program that includes dynamic neuromuscular training showed lower prevalence of non-contact LE injury rates.
- Future research should be dedicated towards identifying which specific neuromuscular exercise/modality have the greatest impact on reducing LE injuries in an athletic population.

## References

- Leufstaller A, Rajabi R, Minoonejad H, Rahbei P. Efficacy of perturbation-enhanced neuromuscular training on hamstring and quadriceps onset time, activation and knee flexion during a tuck-jump task. *Int J Sports Phys Ther*. 2019;14(2):214-227. doi:10.26603/ijsp.190214.
- Reid PJ, Oliver JL, De Ste Croix MB, Meyer GD, Lloyd RS. Neuromuscular risk factors for knee and ankle ligament injuries in male youth soccer players. *Sports Med*. 2016;46(8):1059-1066. doi:10.1007/s00291-016-0479-x.
- Trojan TL, McKee DR. Single leg balance test to identify risk of ankle sprains. *Br J Sports Med*. 2006;40(7):619-623. doi:10.1136/bmj.2005.024356.
- Dingemans B, Malfait F, Nijss S, et al. Postural stability during single-leg stance: a preliminary evaluation of noncontact lower extremity injury risk. *J Orthop Sports Phys Ther*. 2016;46(8):650-657. doi:10.2519/jospt.2016.6278.
- Bizzini M, Jung A, Dvorak J. The "11+": a complete warm-up programme to prevent injuries in young female footballers: cluster randomised controlled trial. *Br Med J*. 2009;338(7686):95-99. doi:10.1136/bmj.e2660.
- Salgard T, Myklebust G, Steffen K, et al. Comprehensive warm-up programme to prevent injuries in young female footballers: cluster randomised controlled trial. *Br Med J*. 2009;338(7686):95-99. doi:10.1136/bmj.e2660.
- Salgard T, Brad FA, De Lira DM, Machado BAB, Carneiro RFF, Colavolpe PO. The FIFA 11+ injury prevention program for soccer players: a systematic review. *BMC Sports Sci Med Rehabil*. 2017;9(1). doi:10.1186/s13047-017-0083-z.
- Montan N. The PEDro scale is a valid measure of the methodological quality of clinical trials: a demographic study. *Am J Physiother*. 2000;55(2):129-133. doi:10.1016/0004-6514(09)70043-1.
- Hislop MD, Siskes KA, Williams S, et al. Reducing musculoskeletal injury and concussion risk in schoolboy rugby players with a pre-activity movement control exercise programme: a cluster randomised controlled trial. *Br J Sports Med*. 2017;51(15):1140-1146. doi:10.1136/bjsports-2016-097434.
- Steffen K, Emery CA, Romiti M, et al. High adherence to a neuromuscular injury prevention programme (FIFA 11+) improves functional balance and reduces injury risk in Canadian youth female football players: a cluster randomised trial. *Br J Sports Med*. 2013;47(12):794-802. doi:10.1136/bjsports-2012-091886.
- Owen AL, Wong DP, Deldal A, Paul DJ, Ohtani E, Collic S. Effect of an injury prevention program on muscle injuries in elite professional soccer. *J Strength Cond Res*. 2013;27(12):3275-3285. doi:10.1519/JSC.0b013e318290a3a.
- Bonato M, Benis R, La Torre A. Neuromuscular training reduces lower limb injuries in elite female basketball players. A cluster randomized controlled trial. *Scand J Med Sci Sports*. 2018;28(4):1451-1460. doi:10.1111/sms.13034.
- Halvarsson B, von Rosen P. Could a specific exercise programme prevent injury in elite orienteers? A randomised controlled trial. *Phys Ther Sport*. 2019;40:177-183. doi:10.1016/j.pt.2019.09.010.