

Footwear Science

ISSN: 1942-4280 (Print) 1942-4299 (Online) Journal homepage: www.tandfonline.com/journals/tfws20

Effect of weightlifting shoes on stability during barbell squat in high intensity cross training athletes

Giorgio Poletto, Eduardo Borsatto Gonçalves, Daiani de Campos, Eduardo Campos Martins, Joel Alvarez-Ruf & Heiliane de Brito Fontana

To cite this article: Giorgio Poletto, Eduardo Borsatto Gonçalves, Daiani de Campos, Eduardo Campos Martins, Joel Alvarez-Ruf & Heiliane de Brito Fontana (2025) Effect of weightlifting shoes on stability during barbell squat in high intensity cross training athletes, Footwear Science, 17:sup1, S38-S39, DOI: 10.1080/19424280.2025.2489698

To link to this article: https://doi.org/10.1080/19424280.2025.2489698

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Published online: 20 Jun 2025.

Submit your article to this journal

Article views: 874

View related articles

View Crossmark data

Citing articles: 2 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=tfws20

FOOTWEAR SCIENCE
2025, VOL. 17, NO. S1, S38–S39
https://doi.org/10.1080/19424280.2025.2489698

Taylor & Francis
Taylor & Francis Group

ABSTRACT

OPEN ACCESS Check for updates

Effect of weightlifting shoes on stability during barbell squat in high intensity cross training athletes

Giorgio Poletto[a], Eduardo Borsatto Gonçalves[a], Daiani de Campos[a], Eduardo Campos Martins[a], Joel Alvarez-Ruf[b,c] and Heiliane de Brito Fontana[a]

[a]BSiM-UFSC Musculoskeletal Biomechanics Research Group, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil; [b]Laboratorio de Cognición y Comportamiento Sensoriomotor, Universidad Metropolitana de Ciencias de la Educación, Santiago, Chile; [c]Laboratorio de Biomecánica Clínica, Facultad de Medicina Clínica, Universidad del Desarrollo, Santiago, Chile

ARTICLE HISTORY Received 13 January 2025; Accepted 1 April 2025
KEYWORDS Stability; balance; postural control; performance; mobility

Introduction

The use of weightlifting shoes with the aim of improving stability during high-intensity barbell squats is common. The shoes have a heel lift that favours ankle dorsiflexion range of motion while potentially reducing trunk range of motion and changing centre of pressure (CoP) dynamics (Legg et al., 2017).

Purpose of the study

The aim of this study was to investigate the effect of footwear on (CoP) displacement, velocity, and other nonlinear dynamics of the CoP during barbell squats at 50%, 70%, and 90% of their three-repetition maximum (50%3RM, 70%3RM, and 90%3RM) in competitive cross training athletes

Methods

An experimental, laboratory-based study with 3-dimensional movement analysis was conducted. Sixteen competitive athletes (8 females and 8 males; 27 ± 3 years; 72 ± 11 kg) performed barbell squats with three different loads (50%, 70%, and 90% of 3-repetition maximum [RM]) and two types of footwear (conventional shoes and weightlifting shoes). Kinematic and kinetic data were collected using eight infra-red cameras (Vicon Motion Systems) and two force plates (AMTI). The amplitude of centre of pressure displacement was calculated and expressed as a percentage of foot size. Peak trunk flexion angle, centre of pressure peak velocity (Vel-CoP) and amplitude of CoP displacement in the mediolateral and anteroposterior directions were verified for the concentric and eccentric phases (Hitting et al., 2016). Comparisons between shoes were drawn using Wilcoxon tests.

Results

We found a reduction in the amplitude of anteroposterior CoP displacement for the weightlifting shoes compared to conventional shoes during the concentric phase of the 90% 3-RM squat ($p = 0.025$, Figure 1). Additionally, we observed a reduction in the velocity of CoP displacement in the mediolateral direction for weightlifting shoes compared to conventional shoes during the concentric phase of the 90% 3RM squat ($p = 0.018$, Figure 2).

Furthermore, weightlifting shoes significantly decreased the peak trunk flexion angle compared to conventional shoes at 70% of 3RM (mean difference = 1.47°, $p = 0.009$). All other comparisons did not yield significant effects for peak trunk flexion angle, centre of pressure peak velocities and displacements in the mediolateral and anteroposterior directions.

Discussion and conclusion

The main finding of this study was that weightlifting shoes reduced both the amplitude and velocity of CoP displacement compared to conventional shoes, particularly at high loads. Additionally, weightlifting shoes influenced the peak trunk flexion angle at a 70% 3RM load. These results suggest that

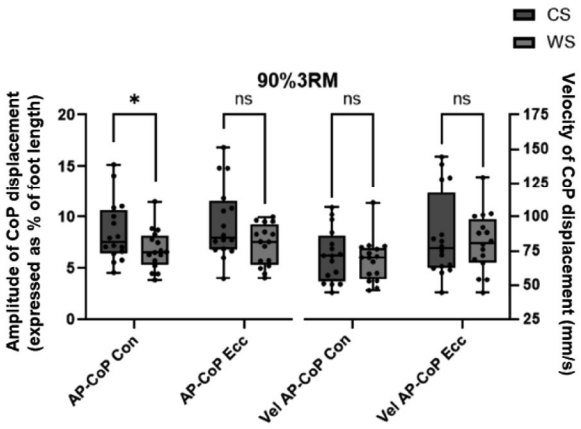


Figure 1. Anteroposterior Centre of Pressure (AP-CoP) displacement at 90% 3RM. The figure presents the amplitude of AP-CoP displacement (expressed as a % of foot length) and velocity of AP-CoP displacement (mm/s) during the concentric (Con) and eccentric (Ecc) phases. The whiskers on the boxes represent the minimum and maximum values.

CONTACT Giorgio Poletto giorgio.fisioterapia@gmail.com
© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

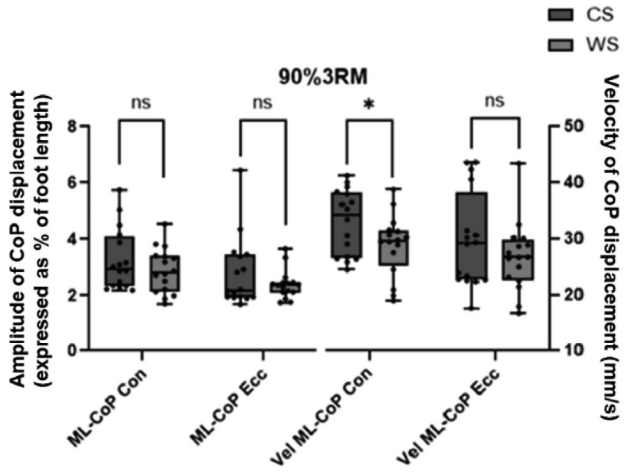


Figure 2. Mediolateral Centre of Pressure (ML-CoP) displacement at 90% 3RM. The figure presents the amplitude of ML-CoP displacement (expressed as a % of foot length) and velocity of ML-CoP displacement (mm/s) during the concentric (Con) and eccentric (Ecc) phases. The whiskers on the boxes represent the minimum and maximum values.

weightlifting shoes enhance stability during high-load barbell squats, potentially contributing to improved control, body alignment, and more efficient transfer of force in the squats. Further analyses, currently underway, will investigate changes in CoP dynamics in the frequency domain.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Hitting, J. W., Meir, R. A., Crowley-McHattan, Z. J., & Holding, R. C. (2016). Influence of Footwear type on barbell back squat using 50, 70 and 90% of one repetition maximum: A biomechanical analysis. *Journal of Strength and Conditioning Research*, *30*(4), 1085–1092. https://doi.org/10.1519/JSC.0000000000001180

Legg, H., Glaister, M., Cleather, D. J., & Goodwin, J. E. (2017). The effect of weightlifting shoes on the kinetics and kinematics of the back squat. *Journal of Sports Sciences*, *35*(5), 508–515. https://doi.org/10.1080/02640414.2016.1175652