

# INPLASY PROTOCOL

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**Corresponding author:**  
Dong Sun

sundong@nbu.edu.cn

**Author Affiliation:**  
Faculty of Sports Science,  
Ningbo University, Ningbo,  
China.

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**Conflicts of interest:**  
None declared.

## INTRODUCTION

**Review question / Objective:** This study focused on examining the effect of basic shoe constructions on running biomechanics and assessing the current state of sports shoe production in terms of injury and efficiency.

## The implications of sports biomechanics studies on the research and development of running shoes: A systematic review

Lin, S<sup>1</sup>; Song, Y<sup>2</sup>; Cen, X<sup>3</sup>; Bálint, K<sup>4</sup>; Fekete, G<sup>5</sup>; Sun, D<sup>6</sup>.

**Review question / Objective:** This study focused on examining the effect of basic shoe constructions on running biomechanics and assessing the current state of sports shoe production in terms of injury and efficiency.

**Condition being studied:** Although various sports sole constructions demonstrated marked changes in running biomechanical variables, few studies have yielded definitive findings on the mechanisms underlying soles features affecting running-related performance and injuries. To underpin modern sports shoe designs, this study focused on examining the effect of differing sole features on running biomechanics and assessing the current state of production of sports shoes in terms of injury and efficiency.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 August 2022 and was last updated on 30 August 2022 (registration number INPLASY202280107).

**Condition being studied:** Although various sports sole constructions demonstrated marked changes in running biomechanical variables, few studies have yielded definitive findings on the mechanisms underlying soles features affecting running-related performance and injuries. To underpin modern sports shoe designs, this study focused on examining the effect of

differing sole features on running biomechanics and assessing the current state of production of sports shoes in terms of injury and efficiency.

## METHODS

**Search strategy:** The following keyword combinations were used in a standardized electronic literature search process: “running shoes” OR “running footwear” AND (“midsole” OR “mid-sole stack height” OR “cushioning” OR “stiffness” OR “bending stiffness” OR “heel-to-toe drop” OR “shoe weight” OR “heel flare” OR “heel cup” OR “heel counter”) from January 1, 1980, to June 1, 2021, via the five electronic literature databases (Google Scholar, PubMed, ScienceDirect, Scopus, and Web of Science). A snowballing procedure was conducted to review the reference list and identify new papers.

**Participant or population:** Running shoe.

**Intervention:** Not applicable.

**Comparator:** Not applicable.

**Study designs to be included:** Original research from peer-reviewed English journals was included. Conference papers, review papers, master (doctoral) graduation papers, case studies, and non-full text articles were excluded.

**Eligibility criteria:** The research content must be related to the midsole (hardness, thickness, material), bend-ing stiffness, heel-to-toe drop, shoe mass, heel flare, and heel stabilizer (heel cup, heel counter) of running shoes. The research methods must involve the corresponding statistical analysis and offer quantitative results on the influences of shoe construction in biomechanical changes during running that are associated with performance and/or running injuries, non-biomechanical related studies were excluded.

**Information sources:** Papers published from January 1, 1980, to June 1, 2021, via the five electronic literature databases (Google Scholar, PubMed, ScienceDirect,

Scopus, and Web of Science) were included in this study.

**Main outcome(s):** The influences of shoe construction (midsole (hardness, thickness, material), bending stiffness, heel-to-toe drop, shoe mass, heel flare, and heel stabilizer (heel cup, heel counter)) in biomechanical changes during running that are associated with performance and/or running injuries.

**Data management:** All the articles included in this study were downloaded by the same author and imported into Mendeley Reference Management Software (Elsevier Ltd., Amsterdam, The Netherlands) for duplicate elimination, articles management, and citation.

**Quality assessment / Risk of bias analysis:** Cochrane Risk of Bias Assessment Tool was used to assess the risk of bias in each included study by two authors. Disagreements of quality assessment were resolved by the corresponding authors if happened. Seven domains were evaluated (random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other biases) and each domain has three grades, low risk of bias, unclear risk of bias, and high risk of bias.

**Strategy of data synthesis:** The other two authors conducted data extraction and analysis of the included literature, mainly including the first author’s name, research publication year, country, research design, athletic performance-related and/or injuries-related biomechanics variables, and the primary results. Disagreements regarding data extraction were resolved by the corresponding authors if they happened.

**Subgroup analysis:** Not applicable.

**Sensitivity analysis:** Not applicable.

**Language restriction:** Only English papers were considered in this study.

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**Country(ies) involved:** China, Hungary.

**Keywords:** running shoes; biomechanics; performance; injuries; development.

**Contributions of each author:**

**Author 1 - Shuangshuang Lin.**

**Email:** linshuangshuang@nbu.edu.cn

**Author 2 - Yang Song.**

**Email:** yang.song@uni-obuda.hu

**Author 3 - Xuanzhen Cen.**

**Email:** cenxuanzhen@outlook.com

**Author 4 - Kovács Bálint.**

**Email:** k.balint828@gmail.com

**Author 5 - Gusztáv Fekete.**

**Email:** fg@inf.elte.hu

**Author 6 - Dong Sun.**

**Email:** sundong@nbu.edu.cn