INPLASY

The Influence of Different Types of Running Shoes on Lower Limb Biomechanics in Fatigued Runners: A Systematic Review and Meta-Analysis

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Corresponding author:
Shiyang Yan

yanshiyangscu@126.com

Author Affiliation:
Sichuan University.

Yang, LM; Sun, BL; Zhao, YH; Yan, SY.

ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Formal screening of search results against eligibility criteria.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 September 2024 and was last updated on 19 September 2024.

INTRODUCTION

Review question / Objective Participants: The participants (both male and female) included in our meta-analysis were healthy adult distance runners without previous injuries or chronic diseases.
Intervention(s): Inclusion criteria: studies assessing the effect of footwear type (minimalist, conventional, traditional, motion control, stability, neutral or Advanced Footwear Technology)on the presence of altered running biomechanics in post-fatigue runners.
Comparator(s)/control: The intervention will be compared against a 'neutral shoe' condition. Neutral shoes should have the cushioning function of normal running shoes but without the motion control effects such as arch support and valgus reduction. Meanwhile, the combination of neutral shoes with arch support and orthotic insoles is considered to be motion control shoes. In studies including multiple conditions, the 'neutral shoe' condition will be used as the reference.
Main outcome(s): The biomechanical variables should include but not limited to the following: leg stiffness, joint angles, angular velocities, and hip, knee, and ankle moments in subjects fatigued from running.
Additional outcome(s): Tibial acceleration, step frequency.

Condition being studied Shoes are believed to have a significant effect on the biomechanics of a runner's movement, and different shoe designs can provide runners with a variety of running aids such as arch support, cushioning, muscle activation, and valgus control. Prolonged running or strenuous sprinting is associated with neuromuscular fatigue in runners, leading to decreased motor control of the lower limbs. Numerous studies have explored the effects of shoe structure on the angles, angular velocities, and moments of the hip, knee, and ankle joints before and after human fatigue. Therefore, the aim of this review is to synthesise the available evidence and analyse the effects of mainstream

footwear construction on the biomechanical alterations of movement following running fatigue.

METHODS

Search strategy A systematic search was executed by two independent reviewers with a well-developed search strategy on Ovid including (PubMed, Embase), Web of science (including Medline, Web of Science Core Collection, Preprint Citation Index, ProQuest), Cochrane library and CNKI, Wanfang, China Science and Technology Journal Databases.
No restriction of date. The English search terms were "(shoe* OR footwear) AND (fatigu* OR Lassitude) AND (run* OR jogging OR marathon OR long distance OR triathlon OR sprint* OR Trail OR gait movement* OR locomotion OR exercise* OR motor activity OR physical activity)" Inclusion of English and Chinese literature published in peer-reviewed journals.

Participant or population The participants (both male and female) included in our meta-analysis were healthy adult distance runners without previous injuries or chronic diseases.

Intervention Inclusion criteria: studies assessing the effect of footwear type (minimalist, conventional, traditional, motion control, stability, neutral or Advanced Footwear Technology)on the presence of altered running biomechanics in post-fatigue runners.

Comparator The intervention will be compared against a 'neutral shoe' condition. Neutral shoes should have the cushioning function of normal running shoes but without the motion control effects such as arch support and valgus reduction. Meanwhile, the combination of neutral shoes with arch support and orthotic insoles is considered to be motion control shoes. In studies including multiple conditions, the 'neutral shoe' condition will be used as the reference.

Study designs to be included Our meta-analysis included crossover experimental studies and randomized trials (RCTs), written in English and Chinese published before 27 July 2024.

Eligibility criteria Types of study to be included: Our meta-analysis included crossover experimental studies and randomized trials (RCTs), written in English and Chinese published in peer-reviewed journals before 27 July 2024.
The included articles should include not only the basic information of the subjects, but also their strike pattern and training summary/status, and preferably provide detailed information about the shoes (such as shoe category, weight, heel height, toe drop, sole hardness, bending stiffness, and testing methods, etc.). At the same time, the included articles should include detailed experimental design details (mode of data collection, running speed at the time of data collection, fatigue protocol, type of fatigue, venue at the time of the run).

Information sources We will include articles published in peer-reviewed journals and registered clinical trials. The electronic databases we searched include Ovid (with PubMed and Embase), Web of Science (including Medline, the Web of Science Core Collection, the Preprint Citation Index, and ProQuest), the Cochrane Library, CNKI, Wanfang, and the China Science and Technology Journal Databases.The electronic databases we searched, are Ovid including (PubMed, Embase), Web of science (including Medline, Web of Science Core Collection, Preprint Citation Index, ProQuest), Cochrane library and CNKI, Wanfang, China Science and Technology Journal Databases. If the data cannot be obtained separately from the entire text, we will contact the corresponding author; If no response is received within two weeks or data cannot be extracted, the study will be excluded.

Main outcome(s) The biomechanical variables should include but not limited to the following: leg stiffness, joint angles, angular velocities, and hip, knee, and ankle moments in subjects fatigued from running.

Additional outcome(s) Secondary Outcome: Tibial acceleration, step frequency.

Data management All study data will be extracted by one of the researchers and cross-checked by another researcher to ensure accuracy. The study authors will be contacted by email for any missing data, and a reminder email will be sent after one week if no response is received.
The data to be extracted will relate to:
Study aims and characteristics of the participants (sample size, gender, height, body mass, Foot strike pattern and training summary/status).
Interventions and comparisons (Shoe type, weight, heel height, toe drop, sole stiffness, bending stiffness).
Experimental design details (mode of data collection, running speed at the time of data collection, fatigue protocol, type of fatigue, venue at the time of the run).

Quality assessment / Risk of bias analysis Two examiners will independently assess the risk of

bias for all articles: randomised controlled trials using the Cochrane Risk of Bias Assessment Tool and cross-over experimental designs using the Physiotherapy Evidence Database scale (PEDro Scale). Disagreements between individual judgements will be resolved through discussion until an agreement can be reached. If an agreement cannot be reached, then a third person will be consulted.

Strategy of data synthesis We will initially compile and synthesize the data from the selected studies using a narrative synthesis. A summary of the participant characteristics, methodology and interventions will be presented in table format. For quantitative summary of the data, we will pool estimates when possible. Meta-analysis will be undertaken to explore heterogeneity if the number of studies pooled is sufficient. Data will be grouped and discussed according to kinematics outcomes (leg stiffness, hip, knee, and ankle angles, range of motion, angular velocity, moments, tibial acceleration, and step frequency).

Subgroup analysis Subgroup analyses will be performed separately with different comparators if the necessary data are available.

Sensitivity analysis Bias funnel plots were used to illustrate the relationship between intervention effect and SE in each intervention. Publication bias assessment was tested by the Egger's regression intercept. A p value of <0.1 (wo tailed) in the test indicated the presence of publication bias.

Country(ies) involved China.

Keywords Humans; Running; Shoes; Fatigue.

Contributions of each author

Author 1 - Luming Yang.
Email: ylmll1982@126.com
Author 2 - Bolin Sun.
Email: 310487235@qq.com
Author 3 - Yihong Zhao.
Email: 1216499940@qq.com
Author 4 - Shiyang Yan.
Email: yanshiyangscu@126.com