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Unilateral plyometric training effectively reduces lower limb asymmetry in athletes: A Meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

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 5 April 2025 and was last updated on 5 April 2025.

INTRODUCTION

Review question / Objective This meta-analysis aimed to evaluate PT and CT's effects on athletes' lower limb asymmetry.

Condition being studied Lower limb asymmetry in athletes is associated with impaired performance and elevated injury risk. Plyometric training (PT) and complex training (CT) are commonly used interventions for this problem, but existing evidence on their effectiveness remains inconsistent.

METHODS

Search strategy This meta-analysis was conducted in strict accordance with the PRISMA guidelines. Two independent reviewers searched the Web of Science, PubMed, ProQuest, Scopus, EBSCO CNKI, and Wanfang databases in a double-blinded manner. The databases were searched from inception to March 19, 2024. Boolean logic and truncation were used to develop the search strategies, as follows: ('asymmetr*') AND (' training' OR 'intervention' OR' strength' OR 'jump' OR' change of direction' OR 'single leg' OR' unilateral' OR 'bilateral' OR' plyometric' OR 'complex training') AND (' athletes' OR 'player'). To identify additional eligible studies, the reference lists of the included studies were also manually searched.

Participant or population Healthy athletes regularly participate in training and competition every week without any clinical symptoms or history of major lower limb injuries. Regardless of nationality, sex, age, sports, level and years of exercise, etc.

Intervention The experimental group adopts at least one PT or CT as the training method. If unilateral or bilateral action mode is used, such as unilateral PT, it is also allowed to be included

because it still belongs to the category of PT in essence.

Comparator The control group was allowed to be PT, CT, or routine training.

Study designs to be included Randomized controlled trial.

Eligibility criteria

Exclusion:

1) There is no report or insufficient data to support the calculation of lower limb asymmetry index.
2) Duplicate publications or studies that had inaccessible full text.
3) Reviews, conference papers and degree papers.

Information sources Two independent reviewers searched the Web of Science, PubMed, ProQuest, Scopus, EBSCO CNKI, and Wanfang databases in a double-blinded manner.The Web of Science, PubMed, ProQuest, Scopus, EBSCO CNKI, and Wanfang databases in a double-blinded manner.

Main outcome(s) At least one outcome index was lower limb asymmetry index before and after training, including single-leg countermovement jump (SLCMJ), single-leg broad jump (SLBJ) , single-leg horizontal triple jumps (SLH3J) or single-leg lateral jump (SLLJ).

Data management Endnote, Review Manager 5.3.

Quality assessment / Risk of bias analysis Two researchers independently assessed the risk of bias in the included studies using the Cochrane risk of bias tool. The risk of bias domains was assessed: random sequence generation, allocation concealment, blinding of participants and personnel, incomplete outcome data, selective reporting, and other biases. The risk of bias for each domain was divided into three levels: low risk of bias (meeting the low risk of 5 or more items), moderate risk of bias (meeting the low risk of 3-4 items), and high risk of bias (meeting the low risk of less than 3 items). As it is difficult to implement blinded exercise interventions, we considered the risk of bias regarding blinding to be unclear.

Strategy of data synthesis Review Manager 5.3 software was used for statistical analysis. The outcome indicators included in the literature are continuous variables assessed via different test methods. Since there are a variety of calculation formulas for limb asymmetry, such as (Nondominant limb/Dominant limb) x 100, different calculation methods may affect the results (Bishop et al., 2018). To address this heterogeneity, we referred to a previous meta-analysis on limb asymmetry (Bettariga et al., 2022) to extract pre-intervention asymmetry values (mean ± standard deviation) reported in the original literature. To quantify the extent of the effect of the training intervention on limb asymmetry, the effect size (Hedges 'g) was calculated as a standardized mean difference (SMD) and reported with a 95% confidence interval (95% CI). The function of SMD is to eliminate the inconsistency of calculation formulas and units between studies and make the results comparable. The specific calculation formula is:

Mean post and Mean pre represent the mean after and before the intervention, respectively, and SD pooled is the pooled standard deviation. The I^2 test was used to assess heterogeneity among the studies; if I^2 0.1, the degree of heterogeneity was low, and the fixed effects model was adopted. The random effects model was adopted if I^2< 50% and $P \leq 0.1$. Results were visualized using a forest plot. An SMD < 0.5 indicated a small effect, an SMD from 0.5-0.8 indicated a moderate effect, an SMD from 0.5-0.8 indicated a moderate effect, and an SMD ≥ 0.8 indicated a large effect. $P \leq 0.05$ was considered to indicate statistical significance.

Subgroup analysis 1.Unilateral and bilateral plyometric trainingcom and complex training.
2.countermovement jump , single-leg broad jump, single-leg horizontal triple jumps and single-leg lateral jump.

Sensitivity analysis The I^2 test was used to assess heterogeneity among the studies; if I^2 0.1, the degree of heterogeneity was low, and the fixed effects model was adopted. The random effects model was adopted if I^2< 50% and $P \leq 0.1$. Results were visualized using a forest plot. An SMD < 0.5 indicated a small effect, an SMD from 0.5-0.8 indicated a moderate effect, an SMD from 0.5-0.8 indicated a moderate effect, and an SMD ≥ 0.8 indicated a large effect. $P \leq 0.05$ was considered to indicate statistical significance.

Country(ies) involved China.

Keywords lower limb asymmetry, plyometric training, complex training, athletes, meta-analysis.

Contributions of each author

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