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Effects of strength training on lower-limb explosive performance and dance-specific movement quality in dancers: A systematic review with implications for injury prevention

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ADMINISTRATIVE INFORMATION

Support - None.
Review Stage at time of this submission - Data analysis.
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 August 2025 and was last updated on 18 August 2026.

INTRODUCTION

Review question / Objective Objective: This systematic review examined the effects of strength training on lower-limb explosive performance and dance-specific movement quality in dancers, with implications for injury prevention.

Rationale Jumping ability is a fundamental component of both athletic performance and artistic expression in dancers and aesthetic sports practitioners (e.g., rhythmic gymnastics, figure skating, cheerleading, and artistic swimming). Superior jumping performance reflects lower-limb explosive power and neuromuscular coordination, directly affecting movement height, airtime, and aesthetic quality, thereby enhancing overall performance and competition scores. However, dancers and aesthetic athletes often exhibit insufficient physical conditioning, as training predominantly emphasizes technique and artistic performance, resulting in relatively underdeveloped lower-limb strength. Strength training has been widely shown to enhance vertical jump

performance and neuromuscular control in athletic populations. However, the evidence in dancers and aesthetic sports practitioners remains inconsistent, with some studies reporting significant improvements while others showing limited or modality-dependent effects. Furthermore, although dancers perform a high volume of repetitive jumping and landing movements that place substantial mechanical stress on the lower-extremity joints—with overuse injury prevalence estimated at 40%–84% in professional ballet dancers—the potential role of strength training in injury prevention within this population has not been systematically examined. Previous systematic reviews have focused on general physical fitness outcomes rather than specifically on jump performance or dance-specific movement quality. To our knowledge, no prior review has comprehensively synthesized evidence on the effects of strength training on jumping performance specifically in dancers and aesthetic sports practitioners, nor has it considered the broader implications for movement quality and injury prevention. Therefore, this systematic review

aimed to synthesize available empirical evidence on the effects of strength training on lower-limb explosive performance and jump-related outcomes in dancers and aesthetic sports practitioners, to clarify the current state of evidence, and to identify gaps that may inform future research and practice.

Condition being studied Condition being studied: Jump performance (e.g., vertical jump height, flight time) in dancers and aesthetic sports practitioners, with specific attention to the effects of strength training interventions.

METHODS

Search strategy A comprehensive literature search was conducted in PubMed, Web of Science Core Collection, Scopus, SPORTDiscus, and the Cochrane Library from inception to June 1, 2025. The search strategy combined terms related to the population (dancers and aesthetic sports practitioners), the intervention (strength or resistance training), and the outcome (jump performance), using both controlled vocabulary (e.g., MeSH terms in PubMed) and free-text keywords. The main search terms included dance, aesthetic sports, ballet, ballroom, jazz, rhythmic gymnastics, figure skater, artistic swimmer, artistic gymnast, strength training, weight training, resistance training, plyometric training, power training, jump, jump performance, vertical jump, explosive strength, and explosive power. These terms were combined using Boolean operators (AND/OR), and an example of the PubMed search string was: “((strength training OR weight training OR resistance training OR plyometric training OR power training)) AND ((jump OR jump* performance OR vertical jump OR explosive strength OR explosive power)) AND ((dance* OR aesthetic sports OR ballet OR ballroom OR jazz OR rhythmic gymnastics OR figure skater OR artistic swimmer OR artistic gymnast))”. In addition, Google Scholar was used for supplementary searches. Reference lists of the included studies and relevant reviews were also manually screened to identify additional eligible studies.

Participant or population Dancer and aesthetic sports practitioners.

Intervention Strength training interventions, including resistance training, plyometric training, weighted training, or core strength training, either alone or in combination with regular practice.

Comparator Control group performing regular dance or sport-specific training, general physical training, or no additional intervention.

Study designs to be included Randomized controlled trials (RCTs) or other controlled trials.

Eligibility criteria Eligible studies were randomized controlled trials or controlled trials involving dancers or aesthetic sports practitioners, in which strength training was applied as the primary intervention. Studies were required to report at least one objective jump performance outcome (e.g., vertical jump height, countermovement jump height, flight time). Full-text articles written in English or Chinese and providing sufficient data for analysis were included. Studies were excluded if they were non-controlled designs, reviews, conference abstracts, dissertations, or if the intervention effects of strength training could not be isolated.

Information sources A comprehensive literature search was conducted in PubMed, Web of Science Core Collection, Scopus, SPORTDiscus, and the Cochrane Library from inception to June 1, 2025. In addition, Google Scholar was used for supplementary searches. Reference lists of the included studies and relevant reviews were also manually screened to identify additional eligible studies.

Main outcome(s) Primary outcome(s): Jump performance, including (1) general jump tests (e.g., vertical jump height, countermovement jump, squat jump, flight time, jump power) and (2) sport-specific jump performance assessed through validated or standardized dance/aesthetic sports movements.

Additional Outcomes Adverse events and injury-related data (e.g., overuse injury prevalence, injury incidence, or training-related discomfort) reported in the included studies. These outcomes were not pre-specified as primary or secondary outcomes in the original protocol but were discussed in the review to provide contextual information on the safety and translational implications of strength training for dancers and aesthetic sports practitioners.

Quality assessment / Risk of bias analysis The risk of bias of randomised controlled trials (RCTs) was independently assessed by two reviewers (MA, SL) using the Cochrane Risk of Bias tool version 2 (RoB 2). For non-randomised studies of interventions (NRSIs), the Risk Of Bias In Non-randomised Studies of Interventions (ROBINS-I) tool was applied. Any disagreements between reviewers were resolved through discussion or consultation with a third reviewer (KGS) when necessary.

The overall certainty of the evidence for each outcome was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Given the inclusion of both RCTs and non-randomised controlled trials, the certainty of evidence started at high for RCTs and low for non-randomised studies and was subsequently downgraded or upgraded based on five domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. GRADE certainty levels were classified as high, moderate, low, or very low.

Strategy of data synthesis A synthesis will be conducted to integrate the findings. The synthesis will be structured by training modality to evaluate the effects of each training type on lower-limb explosive performance and dance-specific movement quality. In addition, the potential relationship between strength training-induced neuromuscular adaptations and injury prevention will be explored qualitatively, drawing on established biomechanical and physiological mechanisms reported in the literature.

Subgroup analysis None.

Sensitivity analysis Not applicable as a meta-analysis was not performed.

Country(ies) involved Malaysia and China.

Keywords Strength training, Jump performance, Dancers, Aesthetic sports, Systematic review, Meta-analysis.

Contributions of each author

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