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INPLASY

Efficacy of plyometric training on power, muscle strength and speed in physical education students without regular training. A Randomized controlled-trial systematic review

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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 26 January 2025 and was last updated on 26 January 2025.

INTRODUCTION

Review question / Objective What evidence is there on the effectiveness of plyometric training on power, muscular strength and speed in physical education students without regular training?

Rationale Plyometric training, based on the stretch-shortening cycle (SCC), is effective for developing power, muscular strength and speed. In untrained populations, it promotes significant neuromuscular adaptations, improving physical performance even in beginners. Plyometric training is safe and efficient for enhancing physical capabilities.

Condition being studied Analysis of strength, lower extremities power and rate of force development in Physical education students without regular training.

METHODS

Search strategy Electronic databases (Cochrane, Embase, Medline (PubMed), Scopus, SPORTDiscus, and Web of Science) were searched for relevant publications. Keywords and synonyms were entered in various combinations in all fields: (Plyometric training) AND (children) OR (adolescent).

Participant or population Physical education students without regular training.

Intervention Incorporated plyometric training processes during physical education classes.

Comparator Experimental versus control groups.

Study designs to be included Randomized controlled-trials.

Eligibility criteria Physical education students aged between 12 and 16, with no gender restrictions. Training programs with plyometric intervention in the physical education process; 3) a control group and an experimental group; 4) a performance measure (speed, strength, power, coordination). Only original, peer-reviewed, randomized controlled studies written in English were considered.Retrospective studies, prospective studies, studies for which only the abstract was available, case reports, special communications, letters to the editor, invited comments, errata, overtraining studies and patents were excluded.

Information sources Electronic databases, (Cochrane ,Embase ,Medline(PubMed),,Scopus, SPORTDiscus, and Web of Science) were searched for relevant publications.

Main outcome(s) Plyometric training in untrained individuals has proven effective in improving muscular power, strength, and speed. Studies report moderate gains in jump height, maximal strength, and reductions in sprint times, primarily attributed to enhanced neuromuscular efficiency during initial adaptations. Programs lasting 4 to 12 weeks, with 2 to 3 sessions per week, have been shown to be the most effective, yielding significant progress in beginners due to rapid neural adaptations. Therefore, plyometric training is a valuable method for enhancing physical performance in untrained populations.

Additional outcome(s) Plyometric training in untrained individuals promotes significant gains in explosive strength, muscular power, and speed. Studies show improvements in neuromuscular coordination, motor unit recruitment, and the efficiency of the stretch-shortening cycle (SSC). Structured programs result in increases in jump height and enhanced dynamic balance, also contributing to injury prevention. Low-intensity training with gradual progression is effective in maximizing adaptations while minimizing the risk of fatigue or injury.

Quality assessment / Risk of bias analysis The Physiotherapy Evidence Database (PEDro) scale was used to assess the methodological quality of the randomized controlled trials included in this systematic review and meta-analysis. The scale evaluates the internal validity of the studies on a scale from 0 (low methodological quality) to 10 (high methodological quality). Eleven items are assessed on the scale, with criterion 1 not being included in the final score. Points for items 2 to 11 were awarded only when a criterion was clearly satisfied.

Strategy of data synthesis The data synthesis strategy to assess the effectiveness of plyometric training in untrained individuals, which shows modest to moderate improvements in muscular power, strength, and speed, will be structured rigorously. Initially, randomized controlled trials (RCTs) investigating the effects of plyometric training on untrained populations with specific data on muscular power, strength, and speed will be included. Studies with trained populations or those without complete baseline and follow-up data will be excluded. Data extraction will focus on dependent variables such as muscular power (e.g., jump height), muscular strength (e.g., maximal strength), and speed (measured by sprint times). Effect sizes (ES) will be calculated using Hedge's g based on means and standard deviations obtained for both plyometric training and control groups. For statistical analysis, a random- effects model will be applied to account for differences between studies, reflecting variations in training protocols and population characteristics. The ES will be calculated for each dependent variable, with 95% confidence intervals, and the results will be interpreted using the following scale: 0.6–1.2 (moderate effect), 1.2– 2.0 (large effect), 2.0–4.0 (very large effect), and values greater than 4.0 (extremely large effect). Heterogeneity will be assessed using the I^2 statistic, with higher values indicating greater variation across studies. Additionally, the risk of bias will be assessed using the Egger's test, and the "trim and fill" method will be applied if publication bias is detected. All analyses will be performed using the Comprehensive MetaAnalysis software (version 2; Biostat, Englewood, NJ, USA).

Subgroup analysis Adolescent.

Sensitivity analysis The risk of bias was explored using the extended Egger's test (38). When bias was present, the trim and f ill method was applied (39), in which case L0 was assumed as the default estimator for missing studies (40).

Language restriction English.

Country(ies) involved Portugal.

Keywords Plyometric training, Power, Muscle strength, Speed, Physical education students, Without regular training, Randomized controlled trial, Systematic review.

Contributions of each author

Author 1 - Guilherme Ferreira - FMC lead the project, wrote and revised the original manuscript and RRC analyzed and interpreted the data, wrote the statistical report and revised the original manuscript.
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