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Accentuated Eccentric Loading in Lower-Body Resistance Training: A Systematic Review of Acute and Long-Term Effects on Strength, Power, and Speed Outcomes

INPLASY202560101

doi: 10.37766/inplasy2025.6.0101

Received: 25 June 2025

Published: 25 June 2025

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ADMINISTRATIVE INFORMATION

Support - This systematic review with narrative synthesis has not received financial support from any organization or sponsor.

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

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202560101

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 25 June 2025 and was last updated on 25 June 2025.

INTRODUCTION

Review question / Objective To evaluate the acute and chronic effects of accentuated eccentric loading (AEL) training on lower-limb strength, explosive performance, and sprint ability in healthy adults, and to identify optimal loading parameters and training designs.

Rationale Accentuated eccentric loading (AEL) has gained attention as a strategy to enhance strength and neuromuscular performance by exploiting the muscle's greater force-producing potential during lengthening. However, findings are inconsistent across studies due to variation in protocol, population, and load prescription. This review aims to synthesize current evidence, clarify training outcomes, and support evidence-based programming.

Condition being studied Lower-limb strength, power, and speed performance in healthy individuals.

METHODS

Search strategy Databases: PubMed, Web of Science, Scopus, Embase, SPORTDiscus.Search terms include: "accentuated eccentric loading", "eccentric overload", "resistance training", "muscle power", "jump performance", "sprint performance", "lower limb".

Participant or population Healthy adults (age 18–50), including recreationally active individuals and athletes.

Intervention Accentuated eccentric loading (AEL) training where eccentric load exceeds concentric load, using devices such as weight releasers, motorized resistance, or manual assistance.

Comparator Traditional resistance training with equal concentric-eccentric load, or control condition with no intervention.

Study designs to be included RCTs, crossover trials, repeated-measures designs, non-randomized controlled trials.

Eligibility criteria Exclusion of studies involving injured populations, animal models, or lacking relevant outcome data.

Information sources Electronic databases (PubMed, Scopus, etc.), trial registers, manual reference list screening.

Main outcome(s) Lower-limb strength (e.g., 1RM squat)
Explosive performance (e.g., vertical jump, CMJ peak power)
Speed performance (e.g., sprint times)
Effect sizes: SMD or WMD with 95% confidence intervals.

Additional outcome(s) Neuromuscular fatigue (e.g., CMJ decrement)
RFD, EMG changes
Muscle hypertrophy
Adherence and adverse events.

Data management All retrieved records will be imported into EndNote for de-duplication and screened via Rayyan. Extracted data will be managed in Excel and cross-checked by two reviewers.

Quality assessment / Risk of bias analysis Risk of bias will be assessed using Downs and Black checklist for RCTs andnon-randomized studies. Two reviewers will independently assess quality.

Strategy of data synthesis Random-effects meta-analysis will be conducted where appropriate. Heterogeneity will be assessed with I^2. Narrative synthesis will be used when pooling is not feasible.

Subgroup analysis N/A.

Sensitivity analysis N/A.

Language restriction English only.

Country(ies) involved China.

Keywords Eccentric loading; resistance training; lower-limb strength; muscle power; sprint; healthy adults.

Contributions of each author

Author 1 - JH Zhong - Zhong JH drafted the protocol and led the design of the search strategy and data synthesis framework.
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Author 2 - TW Yu - Yu TW conducted preliminary literature screening and contributed to the methodological design.
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