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Protocol: Effects of plyometric training on physical performance and injury-related indicators in male senior soccer players: a systematic review and meta-analysis.

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202610047

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 January 2026 and was last updated on 15 January 2026.

INTRODUCTION

Review question / Objective P (Population): Male soccer players (≥18 years old) competing at the national level. I (Intervention): Structured plyometric training programs (PJT – plyometric jump training) lasting ≥8 weeks. C (Comparator): Passive control group. O (Outcomes): Primary — jump performance (countermovement jump and squat jump; CMJ/SJ), speed (5–30 m), change of direction (e.g., 505 test). Secondary — strength/power (e.g., isokinetic peak torque), repeated sprint ability, locomotor metrics (HSR – high-speed running), injury incidence, and neuromuscular markers.

Study objective
Quantify the effects of plyometric training (PJT) on performance outcomes in soccer players. Compare effects across subgroups (age, sex, competitive level, duration/frequency/volume, exercise type, and training surface). Explore the impact of plyometric training (PJT) on injury incidence and neuromuscular markers. Rate the certainty of the evidence for each outcome using the GRADE approach (Grading of Recommendations, Assessment, Development and Evaluations).

Rationale Plyometric jump training (PJT) is widely used in soccer to improve reactive strength and neuromuscular efficiency, leading to gains in jumping performance, sprint speed, and match-related actions. However, the literature shows considerable variation in protocols (volume, frequency, surface, unilateral vs. bilateral) and contexts (male players, aged ≥18 years, competing at the national level), which justifies an updated quantitative synthesis that also considers safety (injury outcomes) and potential effect moderators.

Condition being studied Physical performance and injury-related outcomes in male senior (≥18 years) soccer players exposed to plyometric jump training (PJT).

METHODS

Search strategy ((soccer[Title/Abstract] OR football[Title/Abstract])
AND (plyometric*[Title/Abstract] OR "plyometric jump training"[Title/Abstract] OR "plyometric training"[Title/Abstract]
OR "jump training"[Title/Abstract] OR "drop jump"[Title/Abstract] OR "depth jump"[Title/Abstract]
OR bounding[Title/Abstract] OR "hurdle jump"[Title/Abstract] OR "stretch-shortening cycle"[Title/Abstract]))
NOT (futsal[Title/Abstract] OR "beach soccer"[Title/Abstract]).

Participant or population Male soccer players (≥18 years old) competing at the national level.

Intervention Structured plyometric training programs (PJT – plyometric jump training) lasting ≥8 weeks.

Comparator (i) passive control groups (no additional training beyond the participants' usual soccer practice and match participation), (ii) active control groups (usual soccer training with an alternative conditioning program not primarily plyometric, e.g., strength/resistance, sprint, balance, core, or technical training), and/or (iii) other exercise interventions used to contrast the effects of plyometric jump training (PJT). Where applicable, studies comparing different PJT prescriptions (e.g., volume, frequency, surface, unilateral vs. bilateral emphasis) will also be considered, provided a clearly defined comparator group is available.

Study designs to be included Primary — jump performance (countermovement jump and squat jump; CMJ/SJ), speed (5–30 m), change of direction (e.g., 505 test). Secondary — strength/power (e.g., isokinetic peak torque), repeated sprint ability, locomotor metrics (HSR – high-speed running), injury incidence, and neuromuscular markers.

Eligibility criteria Sample: male soccer players (age ≥ 18 years; national competitive level).
Intervention: plyometric training (PJT) ≥ 4 weeks, delivered either as a standalone program or integrated into regular training.
Comparator: passive/active control or another physical training intervention.
Study design: randomized controlled trials (RCTs), quasi-experimental studies, non-randomized controlled studies, and pre–post studies with a control group.
Outcomes: at least one primary outcome.
Publication: original, peer-reviewed studies, full text available, in English or Portuguese.

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

Main outcome(s) Vertical jump performance assessed by countermovement jump (CMJ) and squat jump (SJ), extracted as jump height (cm) and/or power output (W or $W \cdot kg^{-1}$) when reported.
Linear sprint performance over 5 m, 10 m, 20 m and 30 m, extracted as time (s).
Change-of-direction (COD) performance, primarily assessed by the 505 test and/or T-test, extracted as time (s).

Additional outcome(s) Strength and power outcomes, such as isokinetic peak torque and other strength/power measures (e.g., 1RM, if reported).
Repeated-sprint ability (RSA) outcomes (e.g., best time, mean time, total time, fatigue index), as reported.
Locomotor indicators, especially high-speed running (HSR) variables (e.g., HSR distance, number of high-speed runs/actions), according to each study's definition and threshold.
Injury outcomes, including injury incidence/rate, time-loss injuries, and days lost, as reported.
Neuromuscular markers (e.g., reactive strength measures such as RSI, if available).

Data management All records will be exported to a reference manager (e.g., Zotero/EndNote/Mendeley) for storage and duplicate removal, then imported into a screening tool (e.g., Rayyan) for study selection by two independent reviewers. Data extraction will be performed using a standardized, pilot-tested form and stored in a version-controlled spreadsheet (e.g., Excel/Google Sheets). Disagreements will be resolved by consensus or a third reviewer. An audit trail will be kept (exclusion reasons, data conversions, author contact), and all materials (searches, screening logs, extraction sheets, RoB files) will be archived and shared as supplementary files when feasible.

Quality assessment / Risk of bias analysis Two independent reviewers will assess methodological quality and risk of bias for all included studies. Disagreements will be resolved through discussion, and, if necessary, by a third reviewer.
Randomized controlled trials (RCTs): risk of bias will be evaluated using the Cochrane Risk of Bias tool 2 (RoB 2), covering the following domains: (1)

bias arising from the randomization process, (2) bias due to deviations from intended interventions, (3) bias due to missing outcome data, (4) bias in measurement of the outcome, and (5) bias in selection of the reported result. Each study will be classified as low risk, some concerns, or high risk of bias.
Non-randomized and quasi-experimental studies: risk of bias will be evaluated using ROBINS-I (Risk Of Bias In Non-randomized Studies of Interventions), including the domains: (1) bias due to confounding, (2) bias in selection of participants into the study, (3) bias in classification of interventions, (4) bias due to deviations from intended interventions, (5) bias due to missing data, (6) bias in measurement of outcomes, and (7) bias in selection of the reported result. Each study will be judged as low, moderate, serious, or critical risk of bias.
Overall certainty of evidence for each main outcome will be assessed using the GRADE approach, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias.

Strategy of data synthesis All records will be exported to a reference manager (e.g., Zotero/EndNote/Mendeley) for storage and duplicate removal, then imported into a screening tool (e.g., Rayyan) for study selection by two independent reviewers. Data extraction will be performed using a standardized, pilot-tested form and stored in a version-controlled spreadsheet (e.g., Excel/Google Sheets). Disagreements will be resolved by consensus or a third reviewer. An audit trail will be kept (exclusion reasons, data conversions, author contact), and all materials (searches, screening logs, extraction sheets, RoB files) will be archived and shared as supplementary files when feasible.

Subgroup analysis Where data are sufficiently homogeneous, a meta-analysis will be conducted. Continuous outcomes (e.g., CMJ/SJ height or power, sprint times 5–30 m, change-of-direction tests such as 505) will be pooled using standardized mean differences (Hedges' g) with 95% confidence intervals, applying a random-effects model. If studies report the same scale/unit consistently, mean differences will be used instead. For dichotomous outcomes (e.g., injury incidence), effect sizes will be expressed as risk ratio (RR) or odds ratio (OR) with 95% confidence intervals, using random-effects models.
Statistical heterogeneity will be assessed using I^2 and τ^2. Prespecified subgroup analyses will be performed where possible to explore moderators, including: intervention duration (e.g., 4–7 vs ≥8 weeks), weekly frequency (1 vs 2 vs ≥3 sessions/week), training volume/intensity indicators (when reported), exercise type (unilateral vs bilateral), training surface (grass vs hard vs sand/other), and competitive level/context. Sensitivity analyses will be conducted by excluding studies at high risk of bias and by testing the influence of individual studies (leave-one-out), when feasible.
If meta-analysis is not appropriate due to high heterogeneity, insufficient comparable data, or inconsistent reporting, results will be synthesized narratively, structured by outcome category and intervention characteristics, and summarized in tables. Publication bias will be explored using funnel plots and Egger's test when at least 10 studies are included in a meta-analysis. Certainty of evidence for each main outcome will be assessed using GRADE.

Sensitivity analysis Sensitivity analyses will be conducted to test the robustness of the main findings. Where feasible, meta-analyses will be repeated under the following conditions:
Risk of bias: excluding studies rated as high risk of bias (RoB 2) or serious/critical risk (ROBINS-I).
Study design: including randomized controlled trials only (excluding non-randomized/quasi-experimental studies).
Statistical model: comparing pooled effects using random-effects versus fixed-effect models.
Effect size metric/data handling: excluding studies where outcome data required imputation or conversion (e.g., SD estimated from SE/CI/IQR; extraction from figures), to evaluate the impact of derived estimates.
Influential studies/outliers: conducting leave-one-out analyses (removing one study at a time) and, where applicable, excluding clear outliers identified through standardized residuals and influence diagnostics.
Comparator type (if mixed comparators are included): restricting analyses to passive control groups only versus broader comparators (active control/usual training), depending on the final eligibility criteria and the number of available studies.
Sensitivity analyses will be performed only when there are sufficient studies for the outcome (ideally ≥3). Any meaningful changes in magnitude, direction, or statistical significance will be reported and discussed as part of the interpretation of results.

Language restriction English.

Country(ies) involved Portugal.

Keywords Soccer; Plyometric Jump Training; Jump Training; Sprint; Change of Direction; Countermovement Jump; Squat Jump; Injury

Incidence; Neuromuscular Performance; Adult Male.

Contributions of each author

Author 1 - Marcos Neto - MN led the project, developed and registered the INPLASY protocol, defined the research question (PICO), eligibility criteria and outcomes, drafted and revised the original manuscript, and will coordinate the screening process, data extraction, risk of bias assessment, and overall data synthesis.
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Author 2 - Paulo Malico-Sousa - Run the data search, performed the metodological assessment, conducted the data extraction, wrote and revised the original manuscript.
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Author 5 - Raynier Montoro - RRC analyzed and interpreted the data, wrote tthe statistical report, wrote ans revised the original manuscript.
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