

# INPLASY PROTOCOL

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**Support:** None.

**Review Stage at time of this submission:** Data analysis.

**Conflicts of interest:**  
None declared.

## INTRODUCTION

**Review question / Objective:** To determine the effects of maturation stage (eg, classified in the same intervention protocol as early-, and late-mature) on linear sprinting speed adaptations to plyometric

## EFFECTS OF MATURATION STAGE ON SPRINTING SPEED ADAPTATIONS TO PLYOMETRIC JUMP TRAINING IN YOUTH MALE TEAM SPORTS PLAYERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Review question / Objective:** To determine the effects of maturation stage (eg, classified in the same intervention protocol as early-, and late-mature) on linear sprinting speed adaptations to plyometric jump training (PJT) in youth (aged <18 years) male team sports players.

**Condition being studied:** Healthy youth (aged <18 years for the case of mean value for the group) male team sport athletes classified in the same intervention protocol as early-, and late-mature based on Tanner stage or peak height velocity (Mirwald formula) or Fels method (radiography-based method). The athletes must be part of a competitive team sport and not part of a physical education programme.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 01 April 2022 and was last updated on 01 April 2022 (registration number INPLASY202240006).

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stage or peak height velocity (Mirwald formula) or Fels method (radiography-based method). The athletes must be part of a competitive team sport and not part of a physical education programme.

## METHODS

**Search strategy:** Tree text terms and Boolean operators (i.e., AND/OR) were applied in the sections of title or abstract, using no filters or limits to conduct the search. The following general search strategy was conducted: (“team sport\*” OR “soccer” OR “football\*” OR “rugby” OR “futsal” OR “basketball” OR “volleyball” OR “handball” OR “korfbal” OR “baseball” OR “softball” OR “polo” OR “hockey” OR “cricket” OR “lacross” OR “dodgeball” OR “netball” OR “ultimate frisbee”) AND (“plyometric\*” OR “ballistic” OR “stretch-shortening cycle” OR “reactive strength” OR “jump”) AND (“sprint\*” OR “speed” OR “velocity”) AND (male OR men).

**Participant or population:** Healthy youth (aged <18 years for the case of mean value for the group) male team sport athletes classified in the same intervention protocol as early-, and late-mature based on Tanner stage or peak height velocity (Mirwald formula) or Fels method (radiography-based method). The athletes must be part of a competitive team sport and not part of a physical education programme.

**Intervention:** Plyometric jump training (eg, bilateral and/or unilateral, loaded and/or unloaded) with a minimum of 4 weeks duration.

**Comparator:** At least two maturation stages. Athletes non-exposed to plyometric jump training either passive (non-dedicated intervention, only field-based regular training) or active (alternative training method)

**Study designs to be included:** Randomized controlled and/or parallel trials.

**Eligibility criteria:** The eligibility criteria were defined based on PICOS. Articles were restricted to those written in

Portuguese, Spanish, and English languages, and published as original articles in peer-review journals, with no restrictions regarding publication date, and no filters applied.

**Information sources:** The search for the current systematic review will be conducted in the following databases: EMBASE, PubMed, Scopus, SPORTDiscus and Web of Science. Searches were conducted on December 02, 2021. After the conclusion of the automatic search, a manual search was performed using the reference list of the included articles and also searching in systematic reviews conducted in similar topics. Systematic reviews will be searched in the same databases with the terms “systematic review” OR “reviews” after the regular search strategy. Additionally, we also asked two external experts in plyometric training (with Ph.D. and with publications in indexed journals) for checking the inclusion list of articles and to identify possible articles missing in the list. The experts were found and included based on Expertscape rank for “Plyometric+training” that can be found in the link: <https://www.expertscape.com/ex/plyometric+exercise>.

**Main outcome(s):** Pre-post intervention values of sprinting speed (eg, time measured by photocells and/or optical systems; maximal sprint speed measured by radar gun and/or optical systems) in linear speed test trajectories.

**Quality assessment / Risk of bias analysis:** The risk of assessment was assessed using the Physiotherapy Evidence Database scale (PEDro) which was developed for randomized-controlled trials [49]. The PEDro scale consists in an eleven-items assessment tool, in which the score of 1 means “yes” and 0 means “no”. The final score consists in the sum of scores from item 2 to item 11. The item one “eligibility criteria were specified” is not considered for the final score calculation. The PEDro scale was independently used by two of the co-authors (AFS and FMC) to assess and classify the included articles. After the independent assessment, the two

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lists were compared and discussed with a third author (HS) aiming to solve possible disagreements by discussion.

**Strategy of data synthesis:** A previous established method was followed [19,34], which the analyze and interpretation of results were only accompanied in the case of at least three studies provided baseline and follow-up data for the same measure. To estimate the effect size (ES; Hedge's g) for each outcome measure in the maturation groups, pre-training and post-training mean and standard deviations (SD) for dependent variables were used. Data were standardized using post-intervention SD values. The random-effects model was used to account for differences between studies that might impact the PJT-based effect [50,51]. The ES values undertaken 95% confidence intervals (CI). Estimated ES were interpreted as followed: 0.6–1.2, moderate; >1.2–2.0, large; >2.0–4.0, very large; >4.0, extremely large [52]. Heterogeneity was measured using the I<sup>2</sup> statistic, being considered as i) low, with values of 75% [53]. The risk of bias was investigated using the extended Egger's test [54]. When it was present, the trim and fill method was used [55], in which case L0 characterizes the default estimator for missing studies [56]. All analyses were conducted using the Comprehensive Meta-Analysis software (version 2; Biostat, Englewood, NJ, USA). Statistical significance was fixed at  $p \leq 0.05$ . Moderators related with training frequency, training type, or team sport can be considered in case of two or more studies.

**Subgroup analysis:** Youth male sports team players.

**Sensitivity analysis:** Heterogeneity was measured using the I<sup>2</sup> statistic, being considered as i) low, with values of 75%.

**Language:** Portuguese, Spanish and English.

**Country(ies) involved:** Portugal.

**Keywords:** Plyometric exercise; team sports; athletic performance; youth sports; puberty.

**Contributions of each author:**

Author 1 - Ana Silva.

Author 2 - Rodrigo Ramirez-Campillo.

Author 3 - Halil Ibrahim Ceylan.

Author 4 - Hugo Sarmento.

Author 5 - Filipe Clemente.