

# INPLASY PROTOCOL

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**Support:** None.

**Review Stage at time of this submission:** Formal screening of search results against eligibility criteria.

## Conflicts of interest:

No conflicts of interest.

## Effects of strength training vs. stretching protocols on range of motion: A systematic review and meta-analysis

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**Review question / Objective:** The aim of this study was to systematically review and meta-analytically compare the effects of strength training (ST) compared to stretching or ST + stretching protocols on range of motion (ROM).

**Condition being studied:** Supervised strength training interventions (i.e., participants performed the exercise protocols under the supervision of a certified professional).

**Information sources:** Six electronic databases were used to search and retrieve the articles: Cochrane Library, EBSCO (including all its available databases), PubMed (including MEDLINE), Scielo, Scopus, and Web of Science (Core Collection).

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 September 2020 and was last updated on 04 October 2020 (registration number INPLASY202090098).

## INTRODUCTION

**Review question / Objective:** The aim of this study was to systematically review and meta-analytically compare the effects of strength training (ST) compared to

stretching or ST + stretching protocols on range of motion (ROM).

**Rationale:** Stretching protocols are unanimously accepted as improving range of motion (ROM). However, some evidence has suggested that strength training (ST)

may also improve ROM, mainly due to improvements in stretch-shortening cycles and agonist-antagonist coactivation. However, the effects of ST compared to stretching protocols on ROM remain unexplored.

**Condition being studied:** Supervised strength training interventions (i.e., participants performed the exercise protocols under the supervision of a certified professional).

## METHODS

**Search strategy:** The search was conducted in early-October 2020. Boolean operators were applied in our search strategy. Article title, abstract or keywords: (“strength training” OR “resistance training” OR “weight training” OR plyometric\* OR calisthenics) AND (“flexibility” OR “stretching”) AND “range of motion” AND “random\*”.

**Participant or population:** Participants with no restriction regarding their health, sex, age or training status.

**Intervention:** Supervised strength training interventions (i.e., participants performed the exercise protocols under the supervision of a certified professional).

**Comparator:** Comparators were supervised groups performing stretching or ST + stretching; stretching interventions were acceptable in the forms of static, dynamic and PNF.

**Study designs to be included:** Study design was limited to randomized and randomized-controlled (i.e. active controls) trials.

**Eligibility criteria:** Articles were eligible if they were published or in press in peer-reviewed journals, with no restrictions in language or publication date. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adopted (Moher, Liberati, Tetzlaff, & Altman, 2009). The P.I.C.O.S. approach was established as follows: (i) participants with

no restriction regarding their health, sex, age or training status; (ii) supervised strength training interventions (i.e., participants performed the exercise protocols under the supervision of a certified professional); ST were any interventions aiming to increase strength levels, either through resistance training, plyometrics or similar protocols and combinations of such protocols (Bompa & Buzzichelli, 2018); (iii) comparators were supervised groups performing stretching or ST + stretching; stretching interventions were acceptable in the forms of static, dynamic and PNF (ACSM, 2018) (iv) outcomes were limited to ROM assessed in any joint; and (v) study design was limited to randomized and randomized-controlled (i.e. active controls) trials (Hariton & Locascio, 2018).

**Information sources:** Six electronic databases were used to search and retrieve the articles: Cochrane Library, EBSCO (including all its available databases), PubMed (including MEDLINE), Scielo, Scopus, and Web of Science (Core Collection).

**Main outcome(s):** Outcomes were limited to ROM assessed in any joint.

**Quality assessment / Risk of bias analysis:** Risk of bias in individual studies and across studies was assessed using the Cochrane risk-of-bias tool for randomized trials (RoB 2) (Sterne et al., 2019).

**Strategy of data synthesis:** Data items were divided according to different topics: (i) Population: subjects, health status, sex/gender, age, training status and selection of subjects; (ii) Intervention and comparators: study length in weeks, weekly frequency of the sessions, weekly training volume in minutes, duration of the sessions in minutes, number of exercises per session, number of sets and repetitions per exercise, type of loads (e.g., % 1RM), full vs. partial ROM, existence of supervision and supervision ratio; (iii) ROM testing: joints that were tested and planes and positions of testing, mode of testing (i.e., active, passive, both), type and

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duration of warm-up, timing of testing (i.e., pre- and post-tests, intermediate tests, retention tests), which results were considered as valid for a given test (e.g., average of three measures), reporting of data reliability, number of testers and instructions provided during testing; (iv) Outcomes: average magnitude of changes in ROM for intervention and comparator groups, differences between groups.

**Subgroup analysis:** None.

**Sensibility analysis:** To chose later.

**Language:** English.

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

**Keywords:** systematic review; strength training; flexibility; stretching; range of motion.

**Contributions of each author:**

**Author 1 - José Afonso -** Conceptualization; Main writing and revision of the article.

**Author 2 - João Moscão -** Main writing and organization of the manuscript.

**Author 3 - Tiago Rocha -** Main writing and organization of the manuscript.

**Author 4 - Rodrigo Zacca -** Data collection process; Revision of the article.

**Author 5 - Alexandre Martins -** Data collection process and revision of the article.

**Author 6 - André Milheiro -** Data collection process and revision of the article.

**Author 7 - João Ferreira -** Data collection process and revision of the article.

**Author 8 - Rodrigo Ramirez-Campillo -** Data analysis and statistical report; revision of the article.

**Author 9 - Filipe Manuel Clemente -** Additional contributions to the introduction and discussion; data collection and revision of the article.