INPLASY PROTOCOL

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None declared.

Effects of recreational small-sided soccer games on bone mineral density in untrained adults: A systematic review and meta-analysis of randomized-controlled trials

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Review question / Objective: **This systematic review with meta-analysis was conducted to assess the effects of small-sided soccer games (SSGs) training programs on bone mineral density (BMD) in untrained adults.**
Condition being studied: **Effects of SSG-based programmes with a minimum of 4 weeks of intervention and no restricted to frequency on bone mineral density.**
Information sources: **Electronic databases (Cochrane, Embase, Medline (PubMed), Scopus, SPORTDiscus, and Web of Science) were searched for relevant publications, from inception up to January 16, 2021.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 25 January 2021 and was last updated on 25 January 2021 (registration number INPLASY202110095).

INTRODUCTION

Review question / Objective: **This systematic review with meta-analysis was conducted to assess the effects of small-sided soccer games (SSGs) training programs on bone mineral density (BMD) in untrained adults.**

Rationale: **Bone mineral density (BMD) is one of the main outcomes for detecting the strength and health of the bones. Aiming to ensure better health of bone in adulthood,**

mechanical load, and strain promoted by exercise has been consistently suggested as one of the most effective non-pharmacological approaches. However, the type of exercise may differ in efficacy. Considering that practicing recreational soccer, namely, small-sided games (SSGs) is a popular approach made by adults, it is important to determine the impact of this type of exercise on BMD.

Condition being studied: Effects of SSG-based programmes with a minimum of 4 weeks of intervention and no restricted to frequency on bone mineral density.

METHODS

Search strategy: Electronic databases (Cochrane, Embase, Medline (PubMed), Scopus, SPORTDiscus, and Web of Science) were searched for relevant publications, from inception up to January 16, 2021. Keywords and synonyms were entered in various combinations in all fields: ("Soccer" OR "Football") AND ("soccer training" OR "football training" OR "soccer game*" OR "conditioned game*" OR "small-sided soccer game*" OR "small-sided and conditioned game*" OR "SSG") AND ("bone mineral density" OR "bone mass" OR "BMD"). Additionally, the reference lists of the included studies retrieved were manually searched to identify potentially eligible studies not captured by the electronic searches. Finally, an external expert was contacted to verify the final list of references included in this systematic review and to indicate if there was any study that was not detected through our search.

Participant or population: Untrained adults (>18 years old) from any sex, with or without a non-communicable disease.

Intervention: SSG-based programmes with a minimum of 4 weeks of intervention and no restricted to frequency.

Comparator: Passive or control groups no exposed to a specific pharmacological or diet-oriented plan.

Study designs to be included: Randomized controlled-trials.

Eligibility criteria: Inclusion criteria: (i) Untrained adults (>18 years old) from any sex, with or without a non-communicable disease. Adults were not exposed to specific pharmacological or diet-oriented plan; (ii) SSG-based programmes restricted to a minimum of 4 weeks (duration) and no restricted to frequency (number of sessions per week); (iii) Passive or active control groups; (iv) Pre-post intervention values of bone mineral density (BMD) measured in any body part; (v) Randomized controlled trials; (vi) Only original and full-text studies written in English. Exclusion criteria: (i) Trained adults, athletes, youth (above 18 years old). Participants were not exposed to specific pharmacological or diet-oriented plan; (ii) Other types of exercises; other type of SSGs; combined interventions (SSG and other type of exercise or intervention); or regular full-sized game (11 vs. 11); interventions with less than 4 weeks; (iii) Passive control with evidence of participation in structured exercise; (iv) Other outcomes no including bone mineral density (e.g., bone turnouver markers); no information pre-post intervention (e.g., follow-up excluded); (v) Non-randomized studies; (vi) Written in other language than English. Other article types than original (e.g., reviews, letters to editors, trial registrations, proposals for protocols, editorials, book chapters and conference abstracts).

Information sources: Electronic databases (Cochrane, Embase, Medline (PubMed), Scopus, SPORTDiscus, and Web of Science) were searched for relevant publications, from inception up to January 16, 2021.

Main outcome(s): The bone mineral density (g.cm-2) was chosen as the main outcome for the following body regions: total body (or whole body), spine (or trunk or midriff), pelvis (or hips) and lower limb (leg, femur and tibia).

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 scores the internal study validity in a range of 0 (high risk of bias) to 10 (low risk of bias). Eleven items are measured in the scale. The criterion 1 is not included in the final score. Points for items 2 to 11 were only attributed when a criterion was clearly satisfied. Two of the authors (JRG and DC) independently scored the articles. Disagreements in the rating between both authors was resolved through discussion with a third author (HS). Aiming to control the risk of bias between authors, the Kappa correlation test was used to analyze the agreement level for the included studies. A minimum agreement level of k = 0.90 was established.

Strategy of data synthesis: Although two studies can be used in meta-analyses (Valentine, Pigott, & Rothstein, 2010), considering reduced sample sizes are common in the sports science literature (Abt et al., 2020), including in SSG studies (Zouhal et al., 2020), analysis and interpretation of results in this systematic review and meta-analysis were only conducted in the case of at least three studies provided baseline and follow-up data for the same measure. Pre-training and post-training means and standard deviations (SD) for dependent variables were used to calculate effect sizes (ES; Hedge's g) for each outcome measure in the SSG-based training and control groups. Data were standardized using post-intervention SD values. The random-effects model was used to account for differences between studies that might impact the SSG-based effect (Deeks, Higgins, & Altman, 2008; Kontopantelis, Springate, & Reeves, 2013). The ES values are presented with 95% confidence intervals (CI). Calculated ES were interpreted using the following scale: 0.6–1.2, moderate; >1.2–2.0, large; >2.0–4.0, very large; >4.0, extremely large (Hopkins, Marshall, Batterham, & Hanin, 2009). Heterogeneity was assessed using the I2 statistic, with values of 75% considered to represent low, moderate, and high levels of heterogeneity, respectively (J. P. T. Higgins & Thompson, 2002). The risk of bias was explored using the extended Egger's test (Egger, Smith, Schneider, & Minder, 1997). When bias was present, the trim and fill method was applied (Duval & Tweedie, 2000), in which case L0 was assumed as the default estimator for missing studies (Shi & Lin, 2019). All analyses were carried out using the Comprehensive Meta-Analysis software (version 2; Biostat, Englewood, NJ, USA). Statistical significance was set at p ≤0.05.

Subgroup analysis: Moderated analyses were planned to use a random-effects model and independently calculated single factor analysis. When possible, the median split technique was planned (Moran, Clark, Ramirez-Campillo, Davies, & Drury, 2019). Moderator analysis was considered for the sex of participants, length and weekly frequency of the interventions, initial BMD levels.

Sensitivity analysis: Heterogeneity was assessed using the I2 statistic, with values of 75% considered to represent low, moderate, and high levels of heterogeneity, respectively (J. P. T. Higgins & Thompson, 2002). The risk of bias was explored using the extended Egger's test (Egger, Smith, Schneider, & Minder, 1997). When bias was present, the trim and fill method was applied (Duval & Tweedie, 2000), in which case L0 was assumed as the default estimator for missing studies (Shi & Lin, 2019). All analyses were carried out using the Comprehensive Meta-Analysis software (version 2; Biostat, Englewood, NJ, USA). Statistical significance was set at p ≤0.05.

Language: English.

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

Keywords: sports; football; bone mass; recreational football; health promotion; human physical conditioning.

Contributions of each author:
Author 1 - Filipe Manuel Clemente - FMC lead the project, wrote and revised the original manuscript.

Author 2 - Rodrigo Ramirez-Campillo - RRC analyzed and interpreted the data, wrote the statistical report and revised the original manuscript.
Author 3 - Hugo Sarmento - Run the data search, performed the methodological assessment, conducted the data extraction, wrote and revised the original manuscript.
Author 4 - Daniel Castillo - Run the data search, performed the methodological assessment, conducted the data extraction, wrote and revised the original manuscript.
Author 5 - Javier Raya-González - Run the data search, performed the methodological assessment, conducted the data extraction, wrote and revised the original manuscript.
Author 6 - Thomas Rosemann - wrote and revised the original manuscript.
Author 7 - Beat Knechtle - wrote and revised the original manuscript.