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INPLASY

WHAT EFFECT DOES SPEED TRAINING HAVE ON THE AEROBIC CAPACITY OF FOOTBALL PLAYERS?

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ADMINISTRATIVE INFORMATION

Support - None.

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Conflicts of interest - None declared.

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

INTRODUCTION

Review question / Objective The modern game of football is characterized by increased intensity, requiring athletes to meet demanding physical requirements. How does speed training contribute to both injury prevention and aerobic development, and how can this optimize performance and ensure player longevity in the current context of football?

Rationale The modern game of football has evolved significantly, with increased intensity and faster game dynamics placing greater physical demands on players. This evolution has highlighted the importance of developing physical attributes that allow athletes to meet these demands while minimizing the risk of injuries. Speed training has gained attention not only for its role in enhancing sprint performance but also for its potential contribution to injury prevention and aerobic capacity development. By improving muscular strength, neuromuscular coordination, and energy efficiency, speed training may reduce the likelihood of injuries and improve endurance. This systematic review aims to analyze the existing studies on speed training, examining their findings regarding its benefits for optimizing performance and ensuring player longevity in the current context of the sport.

Condition being studied The condition being studied is the aerobic capacity of football players, assessed through physical fitness tests such as VO_2 max tests, Yo-Yo intermittent recovery tests, and time-to-exhaustion protocols. This study aims to evaluate how speed training over a 4-week period influences these metrics, providing insights into its effectiveness for improving aerobic performance in football players under the physical demands of modern football.

METHODS

Search strategy The literature search was conducted in the following databases: CINAHL, PubMed, Scopus, Web of Science and Medline,

selected for their relevance in the fields of health, sports, and social sciences.
To maximize the accuracy and comprehensiveness of the results, the following combination of keywords and Boolean operators was applied across all databases: ((((((((((Speed training) OR (sprint training)) AND (Aerobic capacity)) OR (VO2 max)) AND (Soccer players)) OR (football players)) AND (Endurance)) AND (High-intensity interval training)) OR (HIIT)) AND (Physical performance)) AND (Conditioning).

Participant or population Football players of any age or sex and competitive levels.

Intervention The intervention consists of structured speed training programs designed to improve sprint performance, aerobic capacity, and reduce injury risk in football players. This includes high-intensity interval training (HIIT), involving short sprints of 15-30 seconds at 90-100% of maximum speed followed by active recovery periods, performed 2-3 times per week; repeated sprint training (RST), consisting of multiple sprints of 20-30 meters with brief recovery intervals to enhance anaerobic power and aerobic endurance; resisted sprint training, incorporating resistance such as weighted vests or sled pushes to develop neuromuscular coordination and power; and plyometric training, including exercises such as box jumps, single-leg hops, and depth jumps to improve neuromuscular efficiency and prevent injuries. Additionally, small-sided games in reduced field dimensions simulate game intensity while improving aerobic capacity and sprint ability, and multidirectional speed training with rapid direction changes, such as 'Y' or 'T' drills, enhances agility and game-specific speed. The intervention will be implemented over a 4-week period, with each session lasting 60-90 minutes and tailored to the specific demands of modern football.

Comparator The comparator will consist of football players who participate in their usual football training routines but do not engage in specific speed training interventions.

Study designs to be included This systematic review will include randomized controlled trials (RCTs), longitudinal studies and observational studies.

Eligibility criteria The eligibility criteria for this systematic review include football players of all competitive levels (amateur, semi-professional, and professional) aged 16-35 years, actively engaged in structured football training programs, and participating in interventions that include speed training methods such as high-intensity interval training (HIIT), repeated sprint training (RST), resisted sprint drills, plyometric exercises, or small-sided games, over a minimum duration of 4 weeks. Studies must include assessments of aerobic capacity through validated tests such as VO_2 max, Yo-Yo Intermittent Recovery Test, or time-to-exhaustion protocols, and report outcomes related to aerobic performance, sprint ability, or injury prevention. Exclusion criteria include studies involving players outside the specified age range, interventions lasting less than 4 weeks, or those focusing solely on non-football populations or generic physical activities without speed-specific training components.

Information sources Electronic Databases (Scopus, Web of Science, CINAHL, PubMed, and Medline) were searched for relevant publications.

Main outcome(s) The main outcomes of this review focus on the impact of speed training in football players, evaluated through specific scales and measures reported in the literature. For aerobic capacity, VO_2 max, measured using treadmill or cycle ergometer tests, shows improvements after 4-8 weeks of speed training, particularly with high-intensity interval training (HIIT) and repeated sprint training (RST), while the Yo-Yo Intermittent Recovery Test demonstrates significant increases in distance covered and recovery efficiency, indicating enhanced ability to sustain high-intensity efforts. In terms of speed and sprint performance, sprint times over distances of 10m, 20m, and 30m are reduced with resisted sprint training and plyometric exercises, with greater improvements observed in the acceleration phase over the first 10 meters, and repeated sprint ability (RSA) is enhanced, as HIIT and small-sided games improve sprint recovery and aerobic capacity. Regarding injury prevention, isokinetic strength assessments and vertical jump tests (e.g., countermovement and squat jumps) reveal neuromuscular improvements, with evidence showing that plyometric exercises reduce the risk of hamstring and quadriceps injuries. Furthermore, studies report lower injury incidence among players participating in structured speed training programs compared to traditional football training routines.

Additional outcome(s) Additional outcomes include improvements in players' agility, measured through change-of-direction tests (e.g., T-test or Illinois Agility Test), and their ability to perform explosive movements in game scenarios. Psychological outcomes, such as increased confidence in performing high-intensity actions,

may also be evaluated through self-reported measures.

Quality assessment / Risk of bias analysis The quality assessment and risk of bias analysis for this review will be conducted using the PEDro Scale and the Cochrane Risk of Bias Tool (ROB 2). The PEDro Scale will evaluate the methodological quality of included randomized controlled trials (RCTs), focusing on criteria such as randomization, allocation concealment, blinding, and completeness of outcome data to ensure the internal validity of the studies. The ROB 2 tool will be used to identify potential sources of bias across key domains, including deviations from intended interventions, missing outcome data, and selective reporting. Together, these tools will provide a comprehensive assessment of the quality and reliability of the evidence included in this review, ensuring robust conclusions.

Strategy of data synthesis The data synthesis strategy for this review will involve both qualitative and quantitative approaches. Effect sizes (e.g., standardized mean differences, Cohen's d) will be calculated for continuous outcomes such as VO_2 max, sprint times, repeated sprint ability (RSA), and injury rates, to evaluate the magnitude of the impact of speed training. The relevance of effect sizes will be interpreted using conventional benchmarks (e.g., small: 0.2, medium: 0.5, large: 0.8) to determine the practical significance of the interventions. Standard deviations (SD) and confidence intervals (CI) will be analyzed to assess the variability and precision of the results. Studies with small effect sizes or wide confidence intervals will be critically examined to understand their impact on the overall findings.
Heterogeneity across studies will be assessed using the I^2 statistic, with values above 50% indicating moderate to high heterogeneity, which will inform the interpretation of pooled results. If the data are too heterogeneous, a narrative synthesis will be conducted to summarize the findings, ensuring that the relevance of effect sizes and variability to the context of football-specific speed training is clearly addressed.

Subgroup analysis Subgroup analyses for this study will include comparisons based on competitive level (e.g., amateur, semi-professional, and professional players) to evaluate differences in the impact of speed training according to performance demands. Age groups (e.g., under-18, under-21, and senior players) will be analyzed to assess the effects of training in younger versus more experienced players. Gender-based subgroups (male and female players) will explore biological or performance-specific differences. The type of speed training intervention (e.g., HIIT, repeated sprint training, resisted sprints, and plyometric exercises) will be examined to determine which method yields the most significant results. Duration of the intervention (e.g., ≤4 weeks, 5-8 weeks, >8 weeks) will be analyzed to identify the optimal training period. Subgroups will also include the type of assessment used (e.g., VO_2 max, Yo-Yo Intermittent Recovery Test, or RSA) to determine if results vary by testing method. Players with and without a history of previous muscle injuries will be compared to evaluate the role of speed training in injury prevention, and the frequency of training sessions per week (e.g., 2x/week vs. 3-4x/week) will also be analyzed to identify the optimal training intensity for specific outcomes.

Sensitivity analysis The sensitivity analysis for this review will include reanalyzing the data by excluding studies with low methodological quality (e.g., PEDro Scale scores ≤4 or high risk of bias identified by ROB 2) to assess the robustness of the findings. Separate analyses will be conducted based on the type of outcome measure (e.g., VO_2 max, Yo-Yo Test, RSA) to evaluate whether the results depend on the testing method. The impact of intervention duration will be tested by excluding studies with shorter interventions (e.g., ≤4 weeks) or longer ones (e.g., >8 weeks). Analyses will also exclude specific populations, such as amateur players or those with a history of injuries, to determine if results are consistent across different participant characteristics. The effect of specific types of speed training (e.g., HIIT, plyometric training) will be analyzed by excluding studies focusing on single methods to determine their influence on overall outcomes. Lastly, studies with small sample sizes (e.g., $n < 15$) will be excluded to evaluate their impact on the overall significance and consistency of the findings.

Language restriction English and Portuguese.

Country(ies) involved Portugal.

Keywords Speed training, aerobic capacity, injury prevention, football performance, and repeated sprint ability (RSA).

Contributions of each author
Author 1 - Rui Gonçalves - Lead the project, wrote and revised the original manuscript and analyzed and interpreted the data, wrote the statistical report and revised the original manuscript.
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