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INTRODUCTION

Review question / Objective This systematic review aims to investigate match physical performance outcomes following hamstring muscle injury in professional football players, with particular attention to changes in global positioning system (GPS) derived external load metrics before and after return to play (RTP). Additionally, the review seeks to explore contextual and injury-related factors that may influence post-injury match performance, such as injury characteristics (e.g., location, severity, time to RTP), and player characteristics. To this end, the proposed systematic review will address the following question:

How does match physical performance change after RTP following hamstring muscle injury in professional football players, as measured by GPS-derived metrics, and which contextual factors may influence these outcomes?

Rationale Non-contact hamstring muscle injuries are among the most common time-loss injuries in professional football, representing a substantial burden for players and teams due to their high incidence and recurrence rates 1–3. These injuries frequently result in reduced training and match availability and may negatively affect players' ability to meet the physical demands of competition after RTP 3,4.

In recent years, the widespread use of GPS and tracking technologies in professional football has

Impact of Non-contact Hamstring Muscle Injuries on Match Performance Outcomes in Professional Football Players: A Study Protocol for a Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Data extraction.

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 10 February 2026 and was last updated on 10 February 2026.

enabled objective monitoring of match physical performance and external load during competition, providing valuable information on players' locomotor demands before and after injury 5–7. Metrics such as total distance covered, relative distance, high-speed running distance, sprint distance, and accelerations and decelerations are commonly used to evaluate match performance following RTP 8.

Despite the increasing availability of GPS-derived performance data in professional football, evidence regarding how hamstring muscle injuries affect match physical performance after RTP remains fragmented and inconsistent across studies 3,7. Differences in injury definitions, RTP criteria, observation periods, and performance metrics contribute to heterogeneity in the literature and limit the ability to draw clear conclusions about post-injury performance recovery 3.

Furthermore, injury-related and contextual factors, such as injury severity, time-loss duration, playing position, and match exposure following RTP, may influence performance outcomes but have not been systematically synthesised 3,7,9–11.

A comprehensive synthesis of the available evidence is therefore needed to clarify the impact of hamstring muscle injuries on match physical performance after RTP in professional football players and to identify contextual factors that may explain variability in performance recovery. Improving this understanding may help inform RTP decision-making, performance monitoring strategies, and load-management practices in professional football 3.

Condition being studied The present systematic review will address the impact of hamstring muscle injuries on match physical performance in professional football players following RTP. Hamstring muscle injuries represent one of the most common time-loss injuries in football and may affect players' ability to reproduce pre-injury locomotor demands during competition 3,10,12,13.

This review will focus on post-injury match performance assessed through GPS and tracking-derived external load metrics, including total distance covered, relative distance, high-speed running distance, sprint distance, and the number of accelerations and decelerations. Performance outcomes will be examined by comparing pre-injury and post-return-to-play match data when available.

Additionally, injury-related and contextual factors that may influence post-injury performance will be considered, including injury severity, time-loss duration, return-to-play timing, playing position, competitive level, and player characteristics.

METHODS

Search strategy PubMed (soccer[Title/Abstract] OR football[Title/Abstract]) AND (hamstring[Title/Abstract] OR "hamstring injur*" [Title/Abstract] OR "hamstring strain*" [Title/Abstract] OR "muscle strain*" [Title/Abstract] OR "muscle injur*" [Title/Abstract]) AND ("return to play" [Title/Abstract] OR "return to sport" [Title/Abstract] OR RTP [Title/Abstract] OR RTS [Title/Abstract] OR reinjur* [Title/Abstract] OR recurrence [Title/Abstract] OR recovery [Title/Abstract]) AND (performance [Title/Abstract] OR sprint* [Title/Abstract] OR speed [Title/Abstract] OR "high-speed running" [Title/Abstract] OR "running demands" [Title/Abstract] OR "match performance" [Title/Abstract] OR "physical test*" [Title/Abstract]) NOT ("review" [Title/Abstract]) Scopus (TITLE-ABS-KEY(soccer) OR TITLE-ABS-KEY(football)) AND (TITLE-ABS-KEY(hamstring) OR TITLE-ABS-KEY("hamstring injur*") OR TITLE-ABS-KEY("hamstring strain*") OR TITLE-ABS-KEY("muscle strain*") OR TITLE-ABS-KEY("muscle injur*")) AND (TITLE-ABS-KEY("return to play") OR TITLE-ABS-KEY("return to sport") OR TITLE-ABS-KEY(RTP) OR TITLE-ABS-KEY(RTS) OR TITLE-ABS-KEY(reinjur*) OR TITLE-ABS-KEY(recurrence) OR TITLE-ABS-KEY(recovery)) AND (TITLE-ABS-KEY(performance) OR TITLE-ABS-KEY(sprint*) OR TITLE-ABS-KEY(speed) OR TITLE-ABS-KEY("high-speed running") OR TITLE-ABS-KEY("running demands") OR TITLE-ABS-KEY("match performance") OR TITLE-ABS-KEY("physical test*")) AND NOT (TITLE-ABS-KEY(review)) Embase ((TI(soccer) OR AB(soccer)) OR (TI(football) OR AB(football))) AND ((TI(hamstring) OR AB(hamstring)) OR (TI("hamstring injur*") OR AB("hamstring injur*")) OR (TI("hamstring strain*") OR AB("hamstring strain*")) OR (TI("muscle strain*") OR AB("muscle strain*")) OR (TI("muscle injur*") OR AB("muscle injur*")) AND ((TI("return to play") OR AB("return to play")) OR (TI("return to sport") OR AB("return to sport")) OR (TI(RTP) OR AB(RTP)) OR (TI(RTS) OR AB(RTS)) OR (TI(reinjur*) OR AB(reinjur*)) OR (TI(recurrence) OR AB(recurrence) OR (TI(recovery) OR AB(recovery))) AND ((TI(performance) OR AB(performance)) OR (TI(sprint*) OR AB(sprint*)) OR (TI(speed) OR AB(speed)) OR (TI("high-speed running") OR AB("high-speed running")) OR (TI("running demands") OR AB("running demands")) OR (TI("match performance") OR AB("match performance")) OR (TI("physical test*") OR AB("physical test*")))) NOT (TI(review) OR AB(review)) SPORT Discus (soccer:ti,ab,kw OR football:ti,ab,kw) AND (hamstring:ti,ab,kw OR 'hamstring injur*':ti,ab,kw OR 'hamstring strain*':ti,ab,kw OR 'muscle strain*':ti,ab,kw OR

'muscle injur*':ti,ab,kw) AND ('return to play':ti,ab,kw OR 'return to sport':ti,ab,kw OR rtp:ti,ab,kw OR rts:ti,ab,kw OR reinjur*:ti,ab,kw OR recurrence:ti,ab,kw OR recovery:ti,ab,kw) AND (performance:ti,ab,kw OR sprint*:ti,ab,kw OR speed:ti,ab,kw OR 'high-speed running':ti,ab,kw OR 'running demands':ti,ab,kw OR 'match performance':ti,ab,kw OR 'physical test*':ti,ab,kw) NOT review:ti,ab,kw
 Web of Science (TS=(soccer OR football)) AND (TS=(hamstring OR "hamstring injur*" OR "hamstring strain*" OR "muscle strain*" OR "muscle injur*")) AND (TS=("return to play" OR "return to sport" OR RTP OR RTS OR reinjur* OR recurrence OR recovery)) AND (TS=(performance OR sprint* OR speed OR "high-speed running" OR "running demands" OR "match performance" OR "physical test*")) NOT (TS=(review)).

Participant or population The present systematic review will include professional football (soccer) players.

Intervention Intervention: Return to sport and recovery.

Comparator Comparison: Pre- and post-match.

Study designs to be included Study: Longitudinal studies.

Eligibility criteria Based on the PICOS strategy (15), it will be as follows:

- Population: Professional football players with hamstring muscle injury.
- Intervention: Return to sport and recovery.
- Comparison: Pre- and post-match
- Outcome. Match performance outcomes.
- Study: Longitudinal studies.

Exclusion criteria:

- Articles are written in another languages than English.
- Articles that are reviews or transversal studies.
- Articles were excluded if another football code instead of soccer was investigated.
- Articles were excluded if not include hamstring muscle injuries.
- Articles were excluded if not include pre- and post-match performance outcomes.
- Articles were excluded if not include professional players
- Articles were excluded if not include official match data.

Information sources The databases that will be used in the present systematic review will be PubMed, Scopus, Embase, SPORTDiscus and Web of Science. Additionally, a complementary

manual search will be performed on the references list from the systematic review on the topic to avoid missing potential eligible articles.

Main outcome(s) The main outcomes of the review will be match performance metrics derived from GPS and tracking systems before and after hamstring muscle injury, focusing on external load variables such as total distance covered, relative distance (m·min⁻¹), high-speed running distance, sprint distance, number of accelerations and decelerations, and player load. Additionally, match participation variables, including minutes played and match exposure following return to play, will be considered when available.

Performance outcomes will be extracted according to the definitions and measurement methods reported in each study. When multiple measurement approaches are reported for the same outcome (e.g., different speed thresholds for high-speed running), the metric most consistently reported across the included studies will be selected to ensure comparability in the quantitative synthesis.

Additional outcome(s) Players' characteristics will be extracted to explore their potential role as contextual and moderating factors influencing post-injury match performance outcomes. The contextual variables of interest will include sex, age, playing position, previous hamstring muscle injury history, football experience, body mass index, injury severity (e.g., time-loss duration), and return-to-play time when reported. Additionally, baseline physical performance indicators (e.g., pre-injury match performance or fitness measures) will be recorded when available.

If other relevant contextual variables are identified during the review process (e.g., competitive level, match congestion, or rehabilitation duration), these will be incorporated and reported in the final manuscript.

Data management A specific codebook will be created for the systematic review, registering a) study characteristics (e.g., country, publication year, study design, competitive level); b) sample characteristics (e.g., number of players, sex, age, playing position); c) injury-related characteristics (e.g., hamstring injury definition, injury severity, time-loss duration, return-to-play criteria, pre-injury and post-injury observation periods); d) match performance outcomes derived from GPS and tracking systems, including external load variables such as total distance covered, high-speed running distance, sprint distance, number of accelerations and decelerations, player load, and other reported locomotor metrics collected in pre-

and post-injury matches; e) risk of bias and methodological quality assessment of the included studies.

Quality assessment / Risk of bias analysis The risk of bias of the included studies will be assessed independently by two reviewers using the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool, which is recommended for observational comparative studies 14. The assessment will consider bias due to confounding, selection of participants, classification of exposure, deviations from intended exposure, missing data, outcome measurement, and selection of reported results. Disagreements between reviewers will be resolved through discussion or consultation with a third reviewer. Additionally, the overall certainty of the evidence for each outcome will be evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach 15.

Strategy of data synthesis Descriptive statistics and frequency distributions of the outcomes will be reported.

Subgroup analysis Not applicable.

Sensitivity analysis Not applicable.

Country(ies) involved All the authors involved in the review are from Spain and Brazil.

Keywords Hamstring injury, external load, match performance, return-to-sport, soccer.

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