INPLASY

Monitoring Match Load in Women's Indoor Team Sports with Unlimited Substitutions: A Systematic Review of External and Internal Load

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Azevedo, R; Ribeiro, J; Travassos, B; Lopes, A; Valente-dos-Santos, J.

Corresponding author:
Ricardo Azevedo

p5917@ulusofona.pt

Author Affiliation:
University Lusófona, Faculty of Physical Education and Sport, Lisbon, Portugal.

ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 5 March 2026 and was last updated on 5 March 2026.

INTRODUCTION

Review question / Objective This systematic review aims to describe the methods used to monitor match load in women indoor team sports with unlimited substitutions, with a focus on understanding players performance.

Rationale A better understanding of the match in women's indoor sports is vital to define appropriate strategies that may contribute to enhance performance, accelerate recovery (by reducing fatigue), and reduce injury risk (by controlling the impact of match loads). In indoor team sports with unlimited substitutions, the intermittent nature of play and frequent changes in player participation create unique challenges for match load monitoring. In general, previous research showed that almost of monitoring strategies are supported by wearable technology incorporating local positioning systems (LPS), inertial measurement units (IMU) and accelerometers, as well as the heart rate monitors, biomarkers (lactate, creatine kinase (CK) and pH), rating of perceived exertion (RPE), and wellbeing questionnaires (fatigue, stress, mood, and recovery scales).

A recent scoping review on training load monitoring using wearable technology (2015–2020) showed that only 16.2% of studies involved women athletes, compared to 80.6% involving males (Benson et al., 2020. Workload a-WEAR-ness: Monitoring Workload in Team Sports With Wearable Technology. A Scoping Review. Journal of Orthopaedic and Sports Physical Therapy, 50(10), 549-563). This highlights a significant gender gap in the literature, with the strategies for measuring performance in women team sports being based on evidence from male populations, despite physiological and contextual differences. These differences affect how match should be monitored. Women experience hormonal fluctuations which influence fatigue, recovery, and performance capacity (Beato et al., 2024. Monitoring Readiness to Tain and Perform in FemaleFootball: Current Evidence and Recomendations for Practioners. International

Journal of Sport Physiolgy and Perfomance, 19(3), 223-231). Studies in basketball and futsal also highlight that women typically exhibit different internal and external load patterns, such as lower high-intensity distances but higher relative effort (McFadden et al., 2020. Comparison of Internal and External Training Loads in Male and Female Collegiate Soccer Players During Practices vs. Games. Journal of Strength and Conditioning Research, 34(4), 969-974). Contextually, female athletes often face reduced access to technology, staffing, and structured monitoring practices (Emmonds et al., 2019. The Challenge of Applying and Undertaking Research in Female Sport. Sports Medicine - Open, 5(1), 51). Therefore, monitoring in women's team sports must be adjusted to reflect their specific physiological responses and support structures.

Condition being studied Load monitoring in women indoor team sports with unlimited substitutions.

METHODS

Search strategy A bibliographic search was carried out of studies published in the PubMed, Scopus, Web of Science and SPORTDiscus databases. The search was built using women's sport and synonyms as search terms. Booleans were added to optimise the search. The following keywords were used: (female OR women OR girls) AND (indoor OR futsal OR basketball OR handball OR "ice hockey" OR "roller hockey") AND ("match load" OR workload OR "match monitoring" OR "match intensity" OR "match volume" OR "match demands" OR match* OR game OR "external load" OR "internal load" OR perform*). The search was restricted from 2005 to January 2026.

Participant or population Female athletes, federated or registered with official sports organizations, engaged in competitive practice of indoor team sports that allow unlimited substitutions during play.

Intervention This review will include studies that monitor match load in women athletes from indoor team sports. Studies that report both training and match load will be included only if match load data are reported separately.

Comparator None.

Study designs to be included Observational studies (cross-sectional, longitudinal, cohort or case-control) evaluating match load (internal and/or external) in women's indoor sports, published in peer-reviewed journals. Studies may also include performance-related outcomes (e.g., physical, technical, or tactical indicators) or contextual variables (e.g., opposition level, match location), provided there is no experimental manipulation (e.g., match intervention or randomized controlled trial).

Eligibility criteria Peer-reviewed journals were included, written in English, Portuguese or Spanish, which investigated indoor team sports with unlimited substitutions, evaluating match load (external and internal load), using objective and/or subjective monitoring methods (speed, total distance, sprints, accelerations and decelerations, heart rate, PSE, biomarkers (lactate, CK and pH) and wellness questionnaire, if they analysed official matches regulated by a recognized competition authority (e.g., national federations, confederations, or university leagues). Studies were excluded if they: inaccessible studies, focused on adapted sports, whose populations were physical education school contexts, had limited substitutions, did not indicate any match-related indicators, if they're not official matches, systematic reviews or scoping reviews, samples that include participants of both genders and if include both indoor and outdoor sports.

Information sources PubMed, Scopus, Web of Science and Sportdiscus.

Main outcome(s) Monitoring strategies and performance-related measures associated with the external load (e.g. speed, total distance, sprints, accelerations and decelerations), internal load((e.g. HRmax, average HR, RPE/sRPE), biomarkers of fatigue and recovery (e.g., creatine kinase, hormonal markers) and wellness or recovery status indicators (e.g., wellness questionnaires, sleep quality, fatigue and readiness scales).

Additional outcome(s) Identification of strategies for competition and its integration to understand players performance and implications for injury risk management.

Data management Variables to be extracted: The first author (RLA) independently extracted the following information from the full-text articles included: (a) sample size and characteristics (i.e., age, matches and level of competition); (b) tools and methods used to monitor match load (i.e., GPS/LPS, IMU, heart rate monitors, subjective measures/scales) (c) type of variables used (i.e., TD, %HRmax, TD/%HRmax, wellness score); (d) main results and subsequently reviewed by other

author (JNR). All data was collected in Zotero and CADIMA.

Quality assessment / Risk of bias analysis For this systematic review, eligibility criteria were defined using the PICOSS framework, following PRISMA-P 2015 (Shamseer et al., 2015) and considering the PRISMA 2020 update (Page et al., 2021). The methodological quality of included studies was assessed with the critical review forms for quantitative studies proposed by Law et al. (1998), as recommended in sport-science systematic reviews (Sarmento et al., 2018). This tool comprises 16 items evaluating: clarity of purpose; relevance of background literature; appropriateness of study design; study sample; sample size justification; informed consent (if applicable); outcome measures (reliability and validity); detailed methods description; reporting of statistical significance; analysis methods; practical importance; reporting of dropouts (if applicable); appropriateness of conclusions; practical implications; and study limitations.
Each item was scored using a binary scale (1 = yes; 0 = no), except items related to informed consent and dropouts, which could also be rated as not applicable (n/a). Study quality was expressed as a percentage, calculated according to the approach described by Faber et al. (2016). The final quality index for each article was computed as the sum of item scores divided by the total number of items (16), and then converted to a percentage. Methodological quality was classified using the intervals proposed by Wierike et al. (2013): >75% = excellent; 51–75% = good; and ≤50% = poor methodological quality.
To enhance the reliability and objectivity of assessments (Anguera, 1999), a second researcher with scientific experience independently conducted the methodological appraisal. Additionally, risk of bias in non-randomised studies was evaluated using the RoBANS tool (Kim et al., 2013), which includes seven domains: selection of participants; exposure classification; confounding; outcomes; missing outcomes; statistical methods; and funding/conflicts of interest. Each domain was rated as Low risk, Unclear, or High risk. Risk of bias was assessed by two authors, and disagreements were resolved through discussion between reviewers or, when necessary, consultation with a third reviewer.

Strategy of data synthesis The following information was extracted from the included original articles: participant characteristics (e.g. age, gender, level of competition); condition (match); study type; internal measures; external measures.

Subgroup analysis None.

Sensitivity analysis None.

Language restriction English.

Country(ies) involved Portugal.

Other relevant information None.

Keywords Indoor Team Sport; Women's Sport; Workload; Monitoring; Substitutions.

Dissemination plans We plan to disseminate the results of this systematic review through several channels. First, we will submit the findings to a peer-reviewed journal specializing in sports science. Additionally, we aim to present the key results at one Sports Science Conference in 2026.

Contributions of each author

Author 1 - Ricardo Azevedo - Conceptualization, formal analysis, investigation, methodology, run the data search, analyzed and interpreted the data, writing – original draft, Writing – review & editing.
Email: p5719@ulusofona.pt
Author 2 - João Ribeiro - Conceptualization, formal analysis, investigation, methodology, run the data search, analyzed and interpreted the data, writing – original draft, Writing – review & editing.
Email: joaonunrib@gmail.com
Author 3 - Bruno Travassos - Methodology, Supervision, Writing – review & editing.
Email: bfrt@ubi.pt
Author 4 - António Lopes - Methodology, Supervision, Writing – review & editing.
Email: p3436@ulusofona.pt
Author 5 - João Valente-dos-Santos - Methodology, Supervision, Writing – review & editing.
Email: p5021@ulusofona.pt