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Characteristics of

Netball Match-Play:

Protocol for a

Systematic Review

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ABSTRACT

Introduction: Netball is a game that includes frequent, multidirectional, intermittent movement patterns during match-play. The particular rules and positions of netball impose unique external (e.g., distances covered, frequency and magnitude of accelerations/ decelerations, and changes of direction) and internal (e.g., heart rate, rate of perceived exertion) characteristics during match-play compared to other sports. The objective of this systematic review is to examine the internal and external characteristics during female netball match-play, as analysed through player tracking systems and notational video analysis.

Methods: The review will be reported according to the Preferred Reporting for Systematic Review and Meta-analysis (PRISMA) guidelines. Four databases (i.e., PubMed, Scopus, SPORTDiscus and Web of Science) will be searched. Two independent reviewers (NT and TDS) will initially screen the title and abstracts, following assessing the full text of remaining articles. Relevant data will be extracted, quality assessed, and presented in tabular form with a explanatory, chronological summary.

Dissemination: The systematic review will summarise the available literature pertaining to external and internal characteristics during netball match-play. The findings will direct the methodological considerations, future research, and evidence-based insights to optimise training, recovery, and performance strategies tailored to the unique demands of netball match-play. The authors aim to publish the review in a peer-reviewed journal.

1.0 INTRODUCTION

1.1 Background

Netball is a high-intensity, intermittent, court-based team sport played on a 15.25×30.5m court divided into thirds, consisting of four 15-minute quarters, with structured rest periods between quarters (England Netball, 2025). Seven players per team operate within strict positional restrictions, each fulfilling specific offensive and defensive tactical roles. Since its inclusion in the Commonwealth Games in 1998 and the establishment of the first semi-pro-fessional league in 2008 (ANZ Championship), netball has experienced a rise in global popular-ity and professionalism (Whitehead et al., 2021). This progression has stimulated increased research in applied sport science, yet understanding of netball match-play characteristics remains limited compared to more extensively studied sports such as soccer and rugby (Fox et al., 2013; Cormack et al., 2014).

A comprehensive understanding of internal and external characteristics during netball match-play is essential for optimising performance, monitoring training loads, mitigating injury risk, and managing fatigue (Bartlett et al., 2017; Heishman et al., 2018). External characteristics, otherwise known as external load, quantify the mechanical workload performed, such as distance covered, accelerations, decelerations, and changes of direction (Impellizzeri et al., 2019), whereas internal characteristics, also known as internal load, reflect the physiological and psychophysiological responses to external stimuli, including heart rate, oxygen consumption, and perceived exertion (Impellizzeri et al., 2019). While these concepts are widely used, debate persists regarding the validity of 'load' as a construct, with concerns about conflating distinct variables such as intensity, duration, and frequency (Staunton et al., 2022). Similarly, the reliance on accelerometer-derived metrics, such as PlayerLoad[™] (PL), raises questions about construct validity (Staunton et al., 2017; Renfree et al., 2022). Despite these conceptual inconsistencies, research on internal and external characteristics provides valuable insights into netball's physical

demands. However, much of this research has focused on outdoor sports utilising GPS technology (Benson et al., 2020), whereas indoor sports, including netball, require alternative tracking methods such as inertial measurement units and local positioning systems, which pose specific challenges (Simpson et al., 2020).

Netball match-play is characterised by frequent, unpredictable, multidirectional movements, rapid accelerations, decelerations, and high-impact jump-landings (Fox et al., 2013; Brooks et al., 2020). These movement demands are influenced by positional restrictions, the two-step rule upon ball reception, and the three-second passing requirement (World Netball, 2025). Unlike field-based sports such as soccer and rugby, netball's evenly distributed multidirectional demands contribute to unique movement patterns and subsequent biomechanical and physiological responses (Chandler et al., 2014; Simpson et al., 2020). However, the interaction between these movement patterns and the resultant internal and external characteristics remains poorly understood, with research in this area remaining fragmented. Additionally, given the broader underrepresentation of female athletes in sports science research (Smith et al., 2022), netball-specific findings are crucial for informing training, recovery, and injury mitigation strategies tailored to female athletes.

1.2 Objective

The objective of this systematic review is to examine the internal and external characteristics of female netball match-play. By synthesising current research, this review aims to provide a comprehensive understanding of netball's unique movement patterns and physiological responses, informing training methodologies, injury mitigation strategies, and performance optimisation approaches.

1.3 Review question

What are the internal and external characteristics of female netball match-play as assessed through player tracking systems and notational video analysis?

2.0 METHOD

The review will be reported according to the Preferred Reporting for Systematic Review and Meta-analysis (PRISMA) statement guidelines (Page et al., 2021).

2.1 Inclusion criteria

The population, exposure, comparison, outcomes, and study design (PECOS) framework will dictate the inclusion criteria, as recommended for systematic reviews examining cohort studies (Moola et al., 2017; Morgan et al., 2018).

2.1.1 Population

The population of interest is healthy, human, females (ages 16-40) who played competitive netball (i.e., organised netball match-play) at tiers 1-5 based on the participant classification framework (McKay et al., 2021).

2.1.2 Exposure

The exposures of interest are internal and/or external characteristics during netball match-play for a minimum of two full length (i.e., 60-minute) matches. External characteristic measures includes multidirectional movement metrics (e.g., PlayerLoad[™]) derived from tracking devices such as accelerometers, GPS units, LPS units, or video analysis systems. Internal characteristic measures include physiological function indicators such as heart rate (HR) monitoring, perceived exertion (RPE) or similar related markers.

2.1.3 Comparison

The comparisons of interest are different player positions, match-play phases (i.e., between quarters or match halves) or playing levels. Additionally, overall descriptives of internal and external characteristics during match-play (including studies with no direct comparison) will be included, even if the study aim was to compare either position, levels, or match-play phases.

2.1.4 Outcomes

The outcomes of interest are quantitative measures of internal (including, but not limited to: HR, RPE, blood lactate, TRIMP, etc.) and/or external characteristics (including, but not limited to: PlayerLoad[™], distance covered, frequency / distance and / magnitude of accelerations, decelerations, locomotor actions, changes of direction, jump and hop frequences and directions, etc.).

Secondary outcomes of interest include the relationships between internal and external characteristic measures, methodologies for assessing external (e.g., IMU's, GPS and LPS tracking, video analysis) and/or internal (e.g., heart rate monitors, RPE scales) characteristics, and implications for physical performance, training, and injury mitigation.

2.1.5 Study design

Studies were included for analysis if they: a) were a peer reviewed primary scientific articles (i.e., original investigations, case reports, technical notes) published in English; b) had the primary or secondary objective of monitoring internal and/or external characteristics during female netball match-play; and c) utilised validated data collection methods such as wearable sensors or video analysis techniques. Secondary articles (review), and special articles (letters to the editor, editorials, commentaries) were excluded.

2.2 Search Strategy

For the systematic review, the key search terms (Table 1.) will be applied in searches across PubMed, Scopus, SPORTDiscus and Web of Science databases. The search terms will be adapted for each database to reflect local syntax, with date ranges set from the inception of the database to present day. The systematic review will only include studies published in English and the reference lists of eligible studies will be screened for additional studies.

Population	("netball*" OR "netball play*") AND ("match
	play*" OR "gameplay" OR "competition*" OR
	"match*" OR "game*" OR "game perfor-
	mance" OR "tournament*")
	TITLE-ABS-KEY
Exposure	"track*" OR "tracking system*" OR "accel-
	erometer*" OR "GPS" OR "LPS" OR "video
	analys*" OR "wearable device*" OR "sen-
	sor*" OR "heart rate monitor*" OR "self-per-
	ceived effort" OR "time-motion" OR "nota-
	tion*" OR "monitor*"
	TITLE-ABS-KEY
Oucomes	"characteristics" OR "internal load*" OR "in-
	ternal demand*" OR "physiological load*"

Table 1. Search terms

OR "heart rate*" OR "rate of perceived exertion" OR "RPE" OR "external load*" OR "external demand*" OR "movement pattern*" OR "distance cover*" OR "acceleration*" OR "change* of direction" OR "COD" OR "multidirectional movement*" OR "linear movement*" OR "deceleration*" OR "PlayerLoad" OR "COST" OR "mechanical" OR "work" OR "force*" OR "impulse" OR "impact*" OR "SPRINT" OR "turn*" OR "metabolic" OR "profil*" OR "physical*" OR "load*" OR "biomechanical" OR "mechanobiological" OR "stress*" OR "strain*" OR "damage" OR "workload*" OR "trimp" OR "volume" TITLE-ABS-KEY

*indicates a wildcard, that the search term can have any ending. *TITLE-ABS-KEY* indicates a title, abstract and keyword search.

2.3 Study selection

Bibliographies of prospectively eligible studies will be exported from the databases and imported into Rayyan systematic review software (Qatar Computing Research Institute, Doha, Qatar), with duplicates then removed. Studies will initially be assessed based on title and abstract by two independent reviewers to identify potentially eligible studies. Following this, the full text of these studies will then be assessed to confirm if they met the eligibility criteria by two reviewers (NT and TDS), alongside screening citations for additional suitable studies. At this stage, the reasons for study exclusions will be recorded and reported in the PRISMA flow diagram. If any abstracts are selected without full text availability, the authors will be contacted with a full text request. If there is no response from the authors after two weeks, the abstract will be excluded, with the reason noted. If disagreement on eligibility occurred between the two reviewers (NT and TDS), a third independent reviewer (DR) will be consulted, and their decision deemed as final.

2.4 Data extraction

The data will be extracted from the selected articles independently by two reviewers (NT and TDS). The data that will be extracted from the selected studies are outlined below (Table 2.).

Table 2. Data synthesis

Торіс	Data extracted
General study information	Title
	Authors
	Year of publication
Methods	Participant characteristics
	Sample size
	Study design
Internal/external characteristics	Monitoring equipment
	Metrics collected
	Reliability/validity of equipment

2.5 Quality assessment of included studies and quality of evidence

Study quality will be independently assessed by two reviewers (NT and TDS) and independently verified by one reviewer (DR) using a modified version of the Downs and Black (1998) checklist for measuring study quality. The original 27 item checklist will be condensed into 16 items, specifically altered to assess the quality of observational studies of netball match-play. The modified Downs and Black checklist items will encompass four domains: (1) reporting (items 1-6); (2) internal validity (items 7-13); (3) power (item 14); and (4) additional criterion (items 15-16). The checklist scoring will range from 0-16, whereby study quality will be categorised as follows: "high" (14-16); "moderate" (10-13); "low" (6-9); or "very low" (0-5), as per McNulty et al. (2020). The results of the Downs and Black assessment will be used to assign an a priori quality rating to each study. Any study quality score disagreements between reviewers will be resolved by the independent third reviewer (DR).

2.6 Data Synthesis

Quantitative data related to study methodology, participant characteristics, internal and/or external characteristics measures and metrics, reliability measures, and results (Table 2.) will be obtained for qualitative analysis by two independent reviewers (NT and TDS). Results will be collated through identifying significant (p < 0.05) and non-significant findings (p > 0.05) for outcome measures and correlational r-values where applicable, while percentage changes and effect sizes will likewise be obtained if provided by the authors. The data will be presented in tabular form, with a narrative summary separated into relevant sub-sections based around the highlighted topics (Table 2.).

Contributions

Contributed to conception and design: NT, TDS, DR Drafted and/or revised the article: NT, TDS, DR Approved the submitted version for publication: NT, TDS, NT

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Conflicts of interest/Competing interests

All authors declare no conflict of interest/competing interests.

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