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'Match load' construct in professional football: complexities and considerations

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ABSTRACT

The differentiation between training load and match load is an important consideration in applied practice, with the match load construct being used in athlete monitoring to inform training prescription and return to play decision-making post-rehabilitation. The term 'match load' lacks a clear definition, and its complexity requires greater recognition. We propose a practical, conceptual framework for match load and influential contextual factors to consider within professional football that may impact a player's match load. The aim of the article is to provide practitioners with definitions of match load categories and to guide future research that may help enhance the measurement and management of load to inform training and rehabilitation processes.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The concept and monitoring of load in professional sport is well established and plays a key role in athlete wellness. Existing literature focuses primarily on the construct of training load and the measurable components of internal and external loads.

WHAT THIS STUDY ADDS

⇒ This viewpoint provides a novel framework to clarify the widely used construct of match load. The multifactorial nature of match load is presented incorporating biomechanical, physiological, technical and cognitive dimensions, alongside influential contextual factors. This article builds on previous load monitoring paradigms to work alongside the construct of training load.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ By integrating real-world performance variables and contextual factors, this framework may help inform applied practice and guide future research through improved understanding of the complexity and monitoring of match load and subsequent use for training prescription and rehabilitation programming.

INTRODUCTION

The concept, application and monitoring of load is well established within professional sport impacting athletes' performance, physical and technical development and susceptibility to injury or illness.[1] A theoretical framework to define and conceptualise the construct of training load and the measurable components of internal and external loads has been developed.[2–5] In practice, the application and manipulation of training load aims to maximise the adaptive response from exercise to induce positive psychophysiological changes to improve performance.[2] Conversely, match load, a commonly used term in practice and acknowledged within research,[6] is difficult to control and less predictable compared with training due to multiple contextual factors.[7] Within a football microcycle, match load has been reported to be the highest load of the week impacting subsequent training intensity and injury risk,[8–10] with training load often expressed as a percentage of match load to inform training prescription.[11] Furthermore, injury incidence is higher in matches compared with training[12 13] and, within injury rehabilitation research, the construct of match load has been used to inform return to play (RTP) decision-making.[14 15] Therefore, differentiation between training and match load is an important consideration for practitioners.

Despite increasing investigation in applied football research, the term 'match load' is not well defined and the complexities and potential misunderstandings of using this construct need to be acknowledged. Scientific discussion providing clear definitions and distinctions between shared constructs, such as training and match load, is important for knowledge dissemination, reproducibility of research and to aid in further informing current practices.[16] Therefore, this article proposes a practical, conceptual framework to explore the complexities of match load in professional football. The article aims to provide practitioners with definitions of different match load categories and discuss potential future research directions. A clearer understanding of the construct may help enhance the measurement and management of load to better guide training prescription and rehabilitation processes, such as informing the return to training (RTT) and RTP decisions.

DEFINING MATCH LOAD CATEGORIES

Definitions and proposed different categories of match load are included in table 1 within the context of professional football.

Table 1 Operational definitions of load monitoring aspects and categories of match load in professional football

Term or category	Definition
Training load	A measure of external and/or internal load performed in training activities.[7]
Match load	A measure of external and/or internal load performed in match play.[7]
External match load	A measure(s) of the external demands a player is exposed to during match play.[7] External match load is further subcategorised into physical load and technical load inducing a biomechanical load (mechanical tissue stress), physiological load (metabolic stress) and cognitive load (psychological/mental stress).
Internal match load	A measure(s) of physiological load or perceptual 'response' (ie, heart rate, session rate of perceived exertion) due to the applied external load and of cognitive load due to the information-processing demands of match play (ie, high-speed decision-making, scanning requirements).[3 7]
Physical load	A subcategory of external load measuring running load outputs and other physical demands of match play. Running load is a measure of external loads describing running outputs.[7] This can be further subcategorised into: ► *Volume and frequency*: measures of total running loads completed and total number of exposures to a specific metric (eg, total distance, total number of sprint exposures). ► *Intensity*: measures of running loads completed within specific bands or above prespecified thresholds for a designated metric (eg, total distance over 90% maximum velocity). ► *Density*: measures of running loads completed per unit of time (eg, total distance per minute, sprint distance per minute). Other physical load subcategories: ► *Match movement patterns*: specific running movement patterns of a player that may vary, within game and game to game, dependent on tactics, positional switching, level of fatigue, current score as well as other influential contextual factors (eg, holding or box-to-box central midfielder). ► *Collision/impacts*: contacts with other players or objects. Depending on the magnitude, body region and type of collision, these contacts may alter the running mechanics or psychological state of a player (eg, head-to-head contact).
Technical load	A subcategory of external load measuring the technical actions (eg, ball releases, headers) completed by a player during match play. Further subcategorised into: ► *Volume and frequency*: measures of total technical actions completed and total number of exposures to a specific action (eg, total number of non-dominant leg ball releases). ► *Intensity*: measures of technical actions completed within specific bands or above prespecified thresholds for a designated action (eg, total number of dominant leg high-speed ball releases). ► *Density*: measures of specific technical actions completed per unit of time (eg, non-dominant leg touches per minute). ► *Technique*: the type or style of technical skill completed (eg, side foot pass, full or laces pass, full volley).
Biomechanical load	A measure(s) of forces and stress (eg, tension, compression, shear, torsion) experienced by the body through different movements during match play causing biomechanical challenges which, when applied to the musculoskeletal system, trigger specific mechanobiological tissue responses (ie, muscle, tendon, bone, ligaments and articular cartilage).[17]
Physiological load	A measure(s) of demands placed on the body's physiological systems (eg, cardiovascular, respiratory, metabolic) where metabolic challenge induces biochemical responses.[4 17]
Cognitive load	A measure(s) of the cognitive information-processing demands experienced by a player to interpret and respond to stimuli during match play and the mental resources invested in the resolution of tasks varied by the player's emotional state and complexity of the task (eg, cognitive rate of perceived exertion, scanning frequency).[18 23 27]
Influential contextual factors	External and situational factors that may impact the player's match load. Further subcategorised into: ► *Individual factors*: personal physical characteristics (eg, genetics, muscle fibre type), psychological traits (eg, confidence) and other factors (eg, age, injury history) related specifically to the individual player. ► *Match factors*: tactical (eg, pressing style), technical (eg, opponent level) and travel (eg, international away fixture) related influences on match play. ► *Environmental factors*: external conditions that influence the match load and player's internal response to match load (eg, sweat and heart rate variation dependent on the climate temperature).
Measurement factors	Potential variation due to different measurement factors such as: ► *Measurement durations*: different durations of match play data collection (eg, full match, MIP, MDP). ► *Device and parameter components*: variation due to measurement device (eg, GPS models, optical tracking system, light detecting and ranging systems) or other factors (eg, sampling frequency, signal quality).

GPS, Global Positioning System; MDP, most demanding passage; MIP, maximal intensity period.

A proposed framework for match load is presented in figure 1. Clarity and accuracy of specialised language is crucial in scientific discourse.[16] Therefore, the framework is designed to guide future research investigating categorisation of physical and technical loads and the measurement of different metrics to investigate the induced impact on biomechanical, physiological and cognitive loads, which may inform the progression of training, recovery and rehabilitation processes. The framework (figure 1) aims to help inform practitioners as to the complexity of match load and to consider multiple influential contextual factors (eg, motivation, playing position, temperature, device and parameter components) that potentially impact the match load of a player. A clear understanding of different categories of match

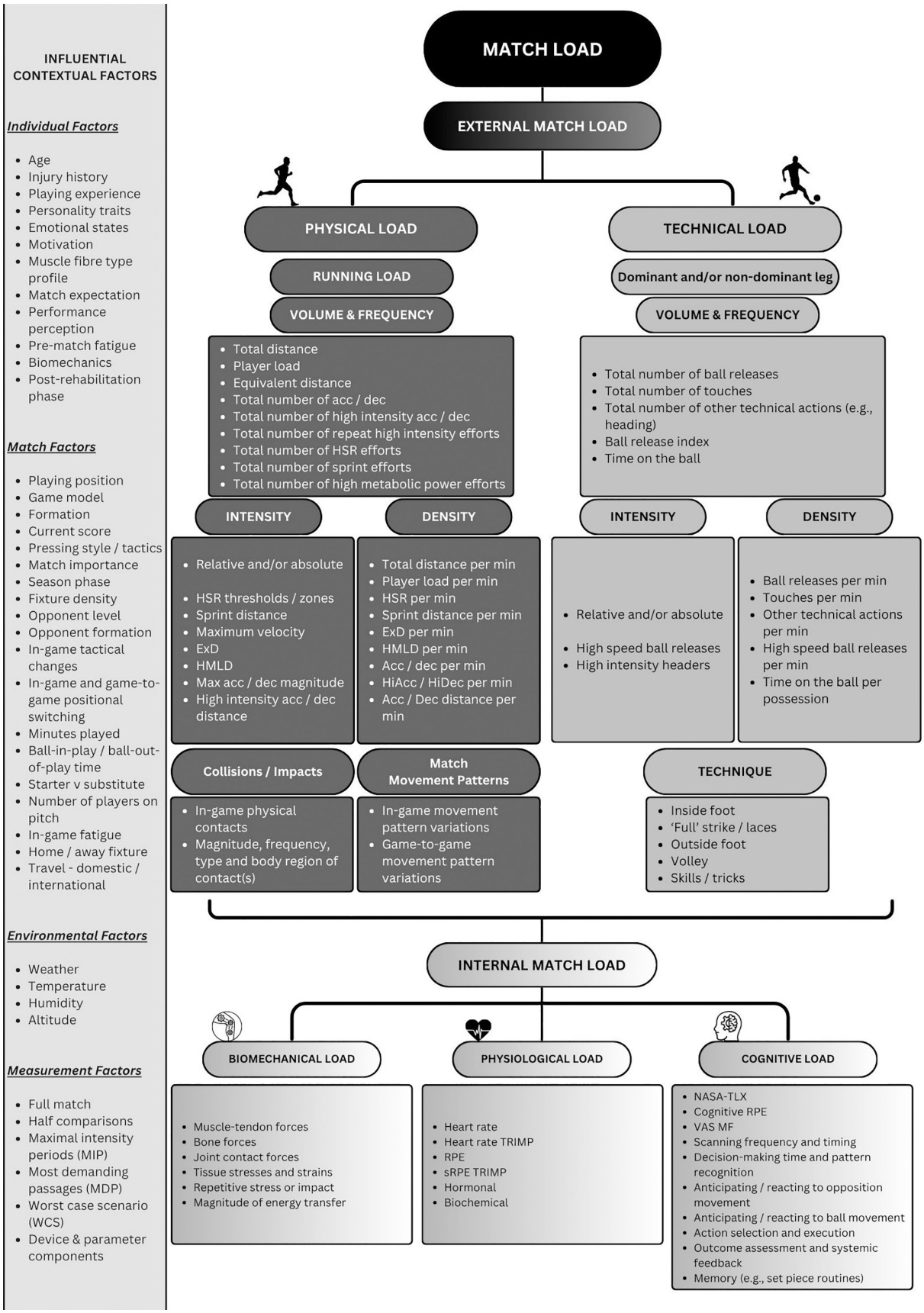

Figure 1 Conceptual framework for match load. acc, accelerations; dec, decelerations; ExD, explosive distance; HiAcc, high-intensity accelerations; HiDec, high-intensity decelerations; HMLD, high metabolic load distance; HSR, high-speed running; Max, maximum; MF, mental fatigue; NASA-TLX, National Aeronautics and Space Administration Task Load Index; RPE, rating of perceived exertion; sRPE, session rating of perceived exertion; TRIMP, training impulse; VAS, visual analogue scale.

load is vital when progressively increasing rehabilitation loads and ensuring a player is prepared for RTP. Acknowledging the scale of contextual factors may help inform the RTP decision. As technology evolves, the development and use of different metrics to more accurately measure different components of match load is inevitable, and the impact of contextual factors may be better understood. Examples of commonly used metrics and contextual factors are provided in figure 1, although they are not intended to be an exhaustive list. Moreover, an indication to practitioners of the range of possible impacting variables (eg, individual, match, environmental and measurement factors) is provided, further demonstrating the complexity of the construct.

PRACTICAL APPLICATION OF MATCH LOAD

A detailed understanding of the physical, physiological, neurophysiological, biomechanical, perceptual-cognitive and psychological demands of the match, and quantification of the external and internal loads performed during each match (ie, match load), is vital for practitioners.[2 17 18] Having an intricate understanding of match load helps to inform the design of a periodised training model that aims to target optimal adaptations, favourable performance outcomes and adequate recovery to minimise the risk of injury.[6 10] Additionally, an individualised, athlete-centred approach fulfils the psychosocial needs of the player and allows practitioners to adapt training loads in response to individual match loading, potentially increasing adherence and engagement in training programmes.[19] During the rehabilitation process, increasing running outputs in relation to match loads is recommended,[20] and objective performance criteria to inform RTP decision-making, using external load metrics relative to match load, are discussed.[15] The significance of the RTP decision should not be understated and, in contrast to training load, a practitioner's ability to regulate match load is limited due to several uncontrollable factors, impacting rehabilitation procedures[7] and the post-rehabilitation phase,[21] when aiming to return the player to maximum performance levels. Figure 2 presents an example of practical implementation of the framework within the RTT/RTP context.

Despite the importance in the applications of match load, discrepancies in measurement may provide inaccurate representation of the relative intensity, volume and/or frequency of key tasks. Due to these potential measurement discrepancies, caution must be advised when using match load to inform and progress training or rehabilitation prescription. In research, these limitations should be clearly acknowledged to minimise the potential for misinterpretation and the inaccurate prescription and progression of rehabilitation loads that may incorrectly influence RTT/RTP and post-rehabilitation decisions.

LOAD-RESPONSE AND CONTEXTUAL INFLUENCES

The importance of recognising the difference between the physiological and biomechanical load-response pathways has been acknowledged.[17] The physiological load-response pathway, where increased metabolic demands induce biochemical responses resulting in metabolic and cardiorespiratory adaptations, is relatively well researched.[4 17] The biomechanical demands of training and match play in professional football, however, where biomechanical demands induce different mechanobiological tissue responses of the muscles, tendons, ligaments, bones and articular cartilage, are still not well understood and difficult to quantify in a field-based environment.[17] Biomechanical responses and injury occur at a tissue level; however, the optimal loading thresholds and capacity are dependent on multiple factors (eg, tissue properties, loading history, recovery timeframe, age, injury history).[17] Mechanotransduction refers to the process by which the body converts mechanical loading into cellular responses.[22] These cellular responses promote structural change and have been shown to differ between tissue types.[22] Therefore, the nature of the load (eg, repetitive stress or impact), velocity of load and the magnitude of energy transfer are important to consider in injury prevention, training strategies and rehabilitation.[22] This supports the need to improve the quantification of biomechanical loads experienced during training and match play to improve our understanding of the in vivo biomechanical load-response pathways and monitor the accumulation of tissue-specific stresses and strains over time.[17]

Within the context of injury rehabilitation, there is a need to integrate increasing cognitive demands (eg, anticipation, decision-making) into RTP programming.[18] The cognitive demands of match play (eg, scanning, fast decision-making) have been linked to performance outcomes (eg, pass completion) and vary depending on contextual factors that can change in game and game to game (eg, opponent pressure, positional role).[23 24] It is anticipated that as the demands of professional football evolve, the demand on a player's neurophysiological capacity may increase.[18] Therefore, understanding the physical-cognitive requirements of match play, and the potential relationship with mental fatigue, is vital. The chronic and cumulative effects of mental fatigue can impact performance and potentially increase the risk of injury,[25] meaning improved measurement and knowledge of match cognitive demands (eg, amount of scanning) is important to inform rehabilitation progressions and the integration of players into team training and RTP during the post-rehabilitation phase.[21]

Future research is required into biomechanical load-response pathways of both physical and technical loads, as well as the cognitive demands of match play, to inform and evolve the match load framework and guide training, recovery and rehabilitation programming. With improvements in technology, and the evolution of machine learning techniques, additional precise insights on match loads will become available, aiding practitioners navigating the complexities of match load.[26]

FINAL REFLECTIONS

This viewpoint article proposes a practical, conceptual framework for practitioners to consider the complexities of match load in professional football. It aims to provide clear definitions of match load categories and to suggest future research directions that may help enhance the measurement

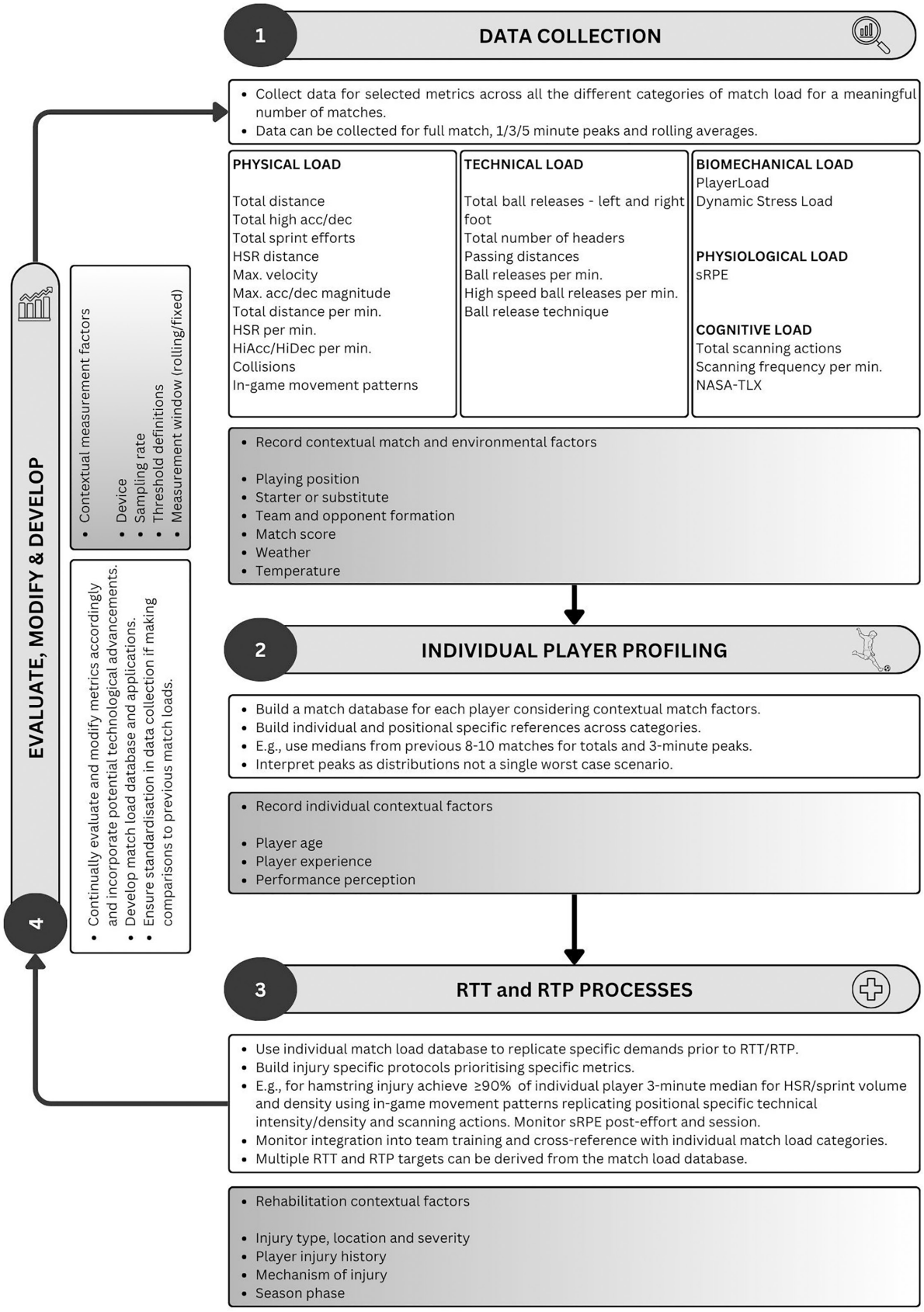

Figure 2 Practical implementation of the match load framework in the context of rehabilitation, RTT and RTP processes. Metrics and examples presented serve as guidance for practitioners and are not mandatory or exhaustive and may be used in multiple contexts. acc, accelerations; dec, decelerations; HiAcc, high-intensity accelerations; HiDec, high-intensity decelerations; HSR, high-speed running; Max, maximum; NASA-TLX, National Aeronautics and Space Administration Task Load Index; RTP, return to play; RTT, return to training; sRPE, session rating of perceived exertion.

and management of load prescription and rehabilitation processes by guiding RTT and RTP decisions.

Understanding of the match load construct is highly valuable in applied practice to provide a meaningful rationale for informing and manipulating training loads and individualising athletic development, recovery, rehabilitation and talent identification programmes. Caution is advised due to the complexity of metrics, the influence of multiple interacting variables and the difficulty in implying a causal relationship with injury. For research to inform best practice application of match load, consensus on clearer definitions, improved understanding and advancement of technology in the measurement, importance and effect of different metrics and acknowledgement of the limitations is required. Through this article, we encourage practitioners and researchers alike to continue to drive the evolution of the construct, improving our knowledge and understanding. Continual development is crucial to ensure translational evidence-based research is effectively integrated into practice, to enable practitioners to deliver optimal support to players during training, rehabilitation and RTP processes.

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REFERENCES

1 Gabbett TJ, Whyte DG, Hartwig TB, *et al*. The relationship between workloads, physical performance, injury and illness in adolescent male football players. *Sports Med* 2014;44:989–1003.
2 Impellizzeri FM, Marcora SM, Coutts AJ. Internal and external training load: 15 years on. *Int J Sports Physiol Perform* 2019;14:270–3.
3 Impellizzeri FM, Rampinini E, Coutts AJ, *et al*. Use of RPE-based training load in soccer. *Med Sci Sports Exerc* 2004;36:1042–7.
4 Impellizzeri FM, Rampinini E, Marcora SM. Physiological assessment of aerobic training in soccer. *J Sports Sci* 2005;23:583–92.
5 Jeffries AC, Marcora SM, Coutts AJ, *et al*. Development of a revised conceptual framework of physical training for use in research and practice. *Sports Med* 2022;52:709–24.
6 Teixeira JE, Forte P, Ferraz R, *et al*. Monitoring accumulated training and match load in football: A systematic review. *Int J Environ Res Public Health* 2021;18:3906.
7 Taberner M, Allen T, O'keefe J, *et al*. Contextual considerations using the "control-chaos continuum" for return to sport in elite football - Part 1: Load planning. *Phys Ther Sport* 2022;53:67–74.
8 Maughan PC, MacFarlane NG, Swinton PA. Quantification of training and match-play load across a season in professional youth football players. *Int J Sports Sci Coach* 2021;16:1169–77.
9 Oliveira RFS, Canário-Lemos R, Peixoto R, *et al*. The relationship between wellness and training and match load in professional male soccer players. *PLoS One* 2023;18:e0289374.
10 Soligard T, Schwellnus M, Alonso J-M, *et al*. How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *Br J Sports Med* 2016;50:1030–41.
11 Ammann L, Altmann S. Training and match load ratios in professional soccer-should we use player- or position-specific match reference values? *Front Sports Act Living* 2023;5:1151828.
12 Ekstrand J, Hägglund M, Waldén M. Injury incidence and injury patterns in professional football: the UEFA injury study. *Br J Sports Med* 2011;45:553–8.
13 Palmer B, McBride M, Jones G, *et al*. Injury trends in men's English professional football: an 11-year case series. *J Elite Sport Perform* 2023.
14 Picinini F, Della Villa F, Tallent J, *et al*. High return to competition rate after on-field rehabilitation in competitive male soccer players after ACL reconstruction: GPS tracking in 100 consecutive cases. *Orthop J Sports Med* 2025;13:23259671251320093.
15 Estévez Rodríguez JL, Rivilla García J, Jiménez-Rubio S. Return to performance of a soccer player with an adductor longus injury: A case report. *Medicina (Kaunas)* 2024;60:1998.
16 Impellizzeri FM, Jeffries AC, Weisman A, *et al*. The "training load" construct: Why it is appropriate and scientific. *J Sci Med Sport* 2022;25:445–8.
17 Verheul J, Nedergaard NJ, Vanrenterghem J, *et al*. Measuring biomechanical loads in team sports – from lab to field. *Sci Med Footb* 2020;4:246–52.
18 Taberner M, Allen T, O'keefe J, *et al*. Evolving the control-chaos continuum: Part 1 - Translating knowledge to enhance on-pitch rehabilitation. *J Orthop Sports Phys Ther* 2025;55:78–88.
19 King J, Roberts C, Hard S, *et al*. Want to improve return to sport outcomes following injury? Empower, engage, provide feedback and be transparent: 4 habits! *Br J Sports Med* 2019;53:526–7.
20 Taberner M, Allen T, Cohen DD. Progressing rehabilitation after injury: consider the "control-chaos continuum". *Br J Sports Med* 2019;53:1132–6.
21 Dixon B, Alexander J, Harper D. "Post-rehabilitation phase" in professional football: are we optimising player support after return to play? *Br J Sports Med* 2025;59:625–7.
22 Logerstedt DS, Ebert JR, MacLeod TD, *et al*. Effects of and response to mechanical loading on the knee. *Sports Med* 2022;52:201–35.
23 Habekost T, Ovesen J, Madsen JB. Cognition in elite soccer players: a general model. *Front Psychol* 2024;15:1477262.
24 Jordet G, Aksum KM, Pedersen DN, *et al*. Scanning, contextual factors, and association with performance in English Premier League footballers: An investigation across a season. *Front Psychol* 2020;11:553813.
25 Lam HKN, Sproule J, Phillips SM. Future directions in understanding acute and chronic effects of mental fatigue in sports: A commentary on bridging laboratory findings and real-world applications. *Int J Sports Physiol Perform* 2025;20:1172–6.
26 Harper DJ, Sandford GN, Clubb J, *et al*. Elite football of 2030 will not be the same as that of 2020: What has evolved and what needs to evolve? *Scand J Med Sci Sports* 2021;31:493–4.
27 Fuster J, Caparrós T, Capdevila L. Evaluation of cognitive load in team sports: literature review. *PeerJ* 2021;9:e12045.