Strength Micro-dosing Approach: A Practical Framework for Integrating Strength Training in Football

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Strength training | Micro-dosing | Decision-Making | Football | Functional training | Resistance training

Headline

Football is a high-intensity intermittent sport, marked by frequent changes in pace and direction that reflect the substantial mechanical and metabolic demands placed on players (Bradley & Ade, 2018; Buchheit et al., 2024). The game's evolution toward greater speed, precision, and competitive density has increased the challenge for coaches and sports science professionals (Lago-Peñas et al., 2023).

Despite advances in technology, physical preparation, and training monitoring, injury rates—particularly muscular injuries such as hamstring strains—have not decreased and continue to rise (Ekstrand et al., 2022). In this context, modern football demands a strategic use of training science to: (1) optimize performance by developing specific physical qualities that support repeated high-intensity actions, and (2) enhance player availability by reducing individual risk factors.

Strength training has emerged as a key strategy to meet these demands (Beato et al., 2021; Gonzalo-Skok et al., 2016; McCall et al., 2014). However, integrating strength into a congested competitive schedule raises key questions: What type of strength training is most effective for performance and injury prevention? How can it be structured when matches are played every few days? How much load is needed to trigger adaptation without compromising readiness? And when should it be applied to avoid interference with tactical priorities?

These questions have no easy answers. Football's complex and dynamic nature resists simplistic models, and much of the literature still relies on reductionist approaches that overlook the interactions between variables (Bittencourt et al., 2016; Verhagen & Gabbett, 2019).

In the face of this complexity, and understanding that only through the strategic integration of physiological, contextual, and structural factors can useful and applicable knowledge be generated, this article proposes a practical and visual model to support decision-making around the key questions we ask about strength training in football.

Aim

This article aims to provide a practical framework to support, fitness coaches, strength and conditioning coaches (SCCs) and performance staff in contextualizing strength training in football, particularly within the constraints of limited training opportunities during the competitive season.

What to Do?

"Strength is the origin of motor function and, therefore, optimizing strength means optimizing movement" (Tous, 2017).

Based on this principle, strength training represents a fundamental pillar of physical preparation in football, developing the functional capacities required to meet the game's unique demands. However, its effectiveness relies on a deep understanding of the competitive load.

During a professional match, players execute between 1,200 and 1,400 activity changes, including accelerations, decelerations, changes of direction, and linear or curved sprints—often under residual fatigue. Simultaneously, they engage in 150 to 250 high-intensity duels involving jumps, collisions, and body contact, producing substantial neuromuscular stress and mechanical load (Bradley et al., 2010; Castellano et al., 2014; Chena et al., 2020).

Football is also a high-risk sport in terms of injury. Between 65% and 91% of professional male players suffer at least one injury per season. With an incidence rate of 8.1 injuries per 1,000 hours, most affect the lower limbs, particularly muscles and joints (Hägglund et al., 2013; López-Valenciano et al., 2020; Pfirrmann et al., 2016).

While tactical training remains central to stimulating the systems that underpin performance (Pons et al., 2020), it should be supported by targeted physical interventions. These coadjuvant strategies protect the athlete's physical integrity and prepare them to meet daily performance demands of tactical training and competition (Gómez et al., 2019).

From this perspective, strength training is not only a performance enhancer but also a protective strategy to manage injury risk. The strength and conditioning coach, acting as a performance facilitator, must provide movement solutions aligned with competitive demands while improving the athlete's ability to tolerate those demands.

Evidence shows that strength-based programs focusing on neuromuscular control and functional stability not only improve function but also reduce injury risk (Hernández-Abad, 2022; Mendiguchia et al., 2020; Turner & Stewart, 2014). These goals are not mutually exclusive but synergistic.

Authors such as Gabbett (2016, 2020) and Verhagen & Gabbett (2019) have emphasized the need to move away from the binary view of optimization versus prevention. Instead, they advocate for an ecological and integrated model in which the training process aims to generate both protective and performance-enhancing stimuli (Gabbett, 2020; Malone et al., 2017). From this perspective, what optimizes also prevents, and what prevents also optimizes.

Consequently, defining what to do in strength training requires an integrated and context-sensitive approach, in which competitive demands, the player's status, and the timing within the season act as key modulators in the decision-making process.

To address the question "what to do?", Figure 1 presents a conceptual map grounded in scientific literature and practi-

cal experience. This figure outlines possible decision-making pathways, including the type of analysis that may define the objectives, the physical qualities that can be targeted based on that analysis, and the most effective methods for intervention.

This model is designed to guide strength content planning using four key constructs: game demands, injury epidemiology, the player's physical profile, and individual risk factors.

This interaction allows for the design of strength programs that are individualized, context-aware, and aligned with both the needs of the "athlete" and the "football player." While the figure outlines different practical intervention scenarios, it is not intended as a prescriptive model. Rather, it offers a coherent and evidence-based framework to guide practitioners in selecting the most appropriate strength training content based on contextual demands and individual player profiles.

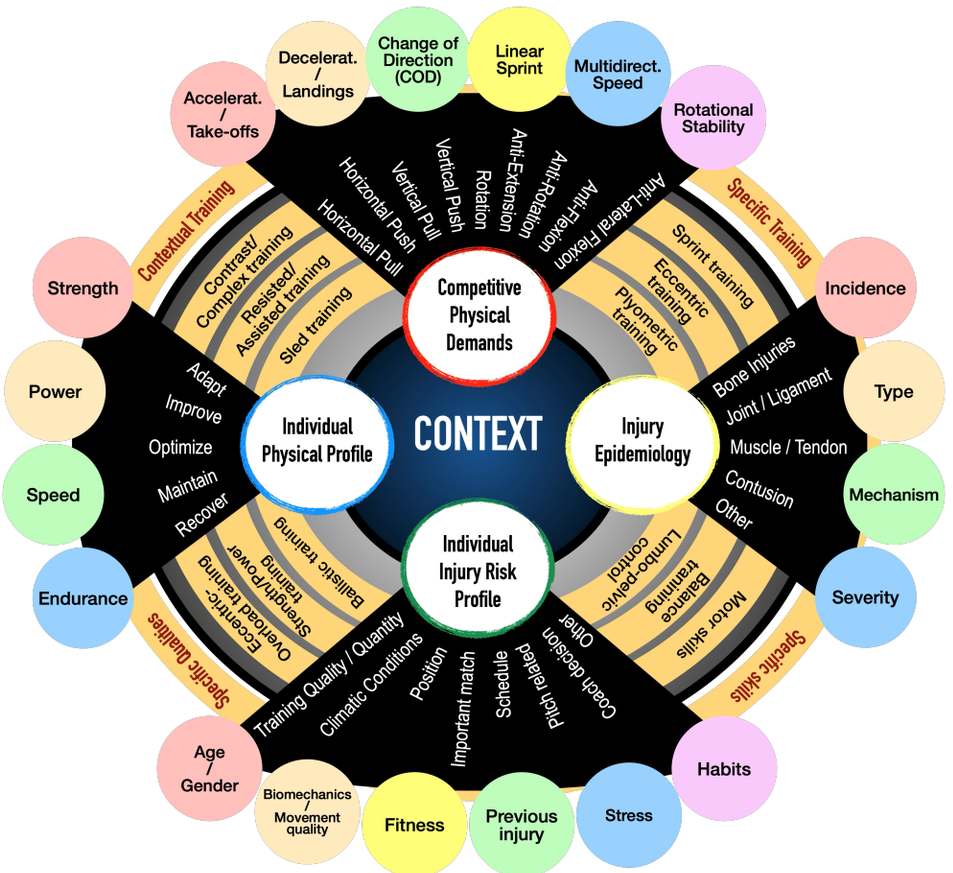

Fig. 1. Strength Decision-Making Framework. Visual synthesis of training methods aligned with the main constructs that condition strength training in football: competitive demands, injury epidemiology, individual physical profile, and individual injury risk profile.

How to Do It?

In professional football, the window for physical development during the competitive season is often narrow and fragmented (Afonso et al., 2022; Cuthbert et al., 2024). Fixture congestion, tactical training demands, and the constant need to manage fatigue and injury risk frequently limit the scope for traditional strength training approaches. Prioritizing physical conditioning over tactical preparation may even hinder performance outcomes (Cuthbert et al., 2024; House, 2021). However, as emphasized in The Quadrant System, if physical improvements are required to enhance performance, they must be achieved within the contextual limitations of the sport and through relevant and sustainable means.

Within this framework, micro-dosing has emerged as an effective strategy to maintain strength adaptations without interfering with tactical or technical objectives. Defined as brief, targeted, and frequent interventions strategically placed across the training week, micro-dosing enables continuity of strength work while preserving player availability (Afonso et al., 2022; Cuthbert et al., 2024).

Since a substantial portion of the physical stimulus must be delivered within or around on-field sessions, the first operational axis of the "how to do it" question focuses on implementing micro-sessions with clearly defined goals. These brief (10–20 minutes), individualized sessions are strategically performed either before or after tactical training, adjusted to the player's fatigue level, and aligned with the day's football-specific priorities.

Figure 2 summarizes the main types of micro-sessions applied in professional football: pre-habilitation, activation, performance-oriented strength, preventive strength, compensatory or supplementary strength, and recovery. Their implementation should be tailored to the player's profile, the microcycle phase, individual goals, and the team's tactical priorities.

While time constraints in football often limit the scope of strength work, it is important to highlight that not all inter-

ventions must conform to the minimum effective dose. Depending on the objective, the player's condition, and the competitive schedule, higher adaptive doses or short intensified blocks may be necessary to drive meaningful physical adaptations (Afonso et al., 2022).

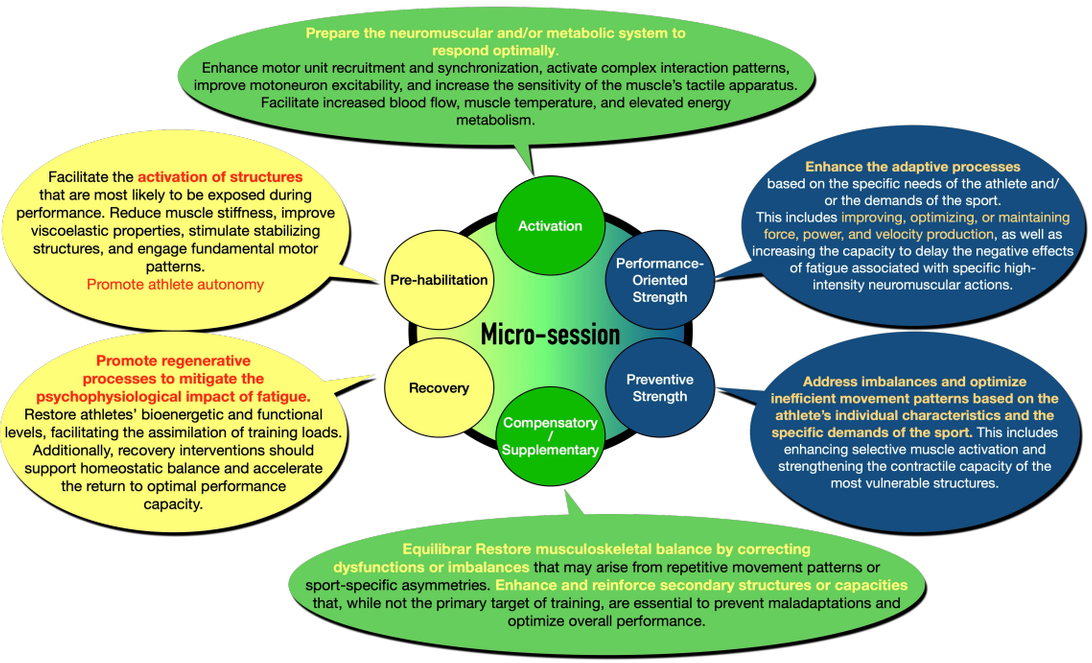

Fig. 2. Types of strength micro-sessions adapted to the football context.

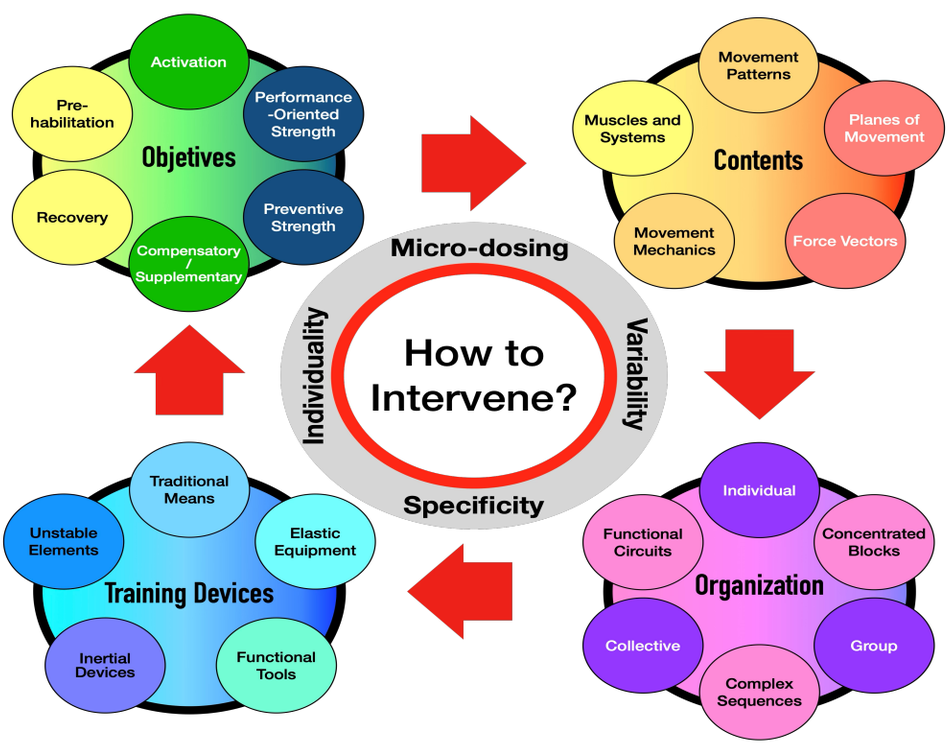

Fig. 3. Decision-making cycle to address the "how" of strength training in football.

This micro-structured approach enables practitioners to address specific weaknesses—either individual or within subgroups—while respecting the principle of minimal tactical interference. It supports consistent exposure to strength stimuli across the season without compromising the player's readiness for technical-tactical work or competition.

That said, the model should not be viewed as rigid. Some micro-sessions may be applied daily, while others may integrate multiple objectives within the same session. Contextual analysis must guide these decisions. According to the literature, integrated strategies are not only effective for performance development but also beneficial in reducing non-contact injury risk (Beato et al., 2021).

In this context, organizational flexibility and the intelligent distribution of high-value micro-stimuli become essential tools for achieving both individual adaptation and collective performance goals (Afonso et al., 2022; Cuthbert et al., 2024).

Once the type and purpose of a micro-session are established, the second operational axis focuses on selecting the appropriate training contents. These contents should align with both the specific goal of the micro-session and the biomechanical and neuromuscular demands of the day's football-specific activities.

In the case of higher-demand micro-sessions, the principle of dynamic correspondence must be respected—ensuring that selected strength exercises transfer meaningfully to football-specific movement patterns (Suarez et al., 2019; Tous-Fajardo et al., 2016). At the same time, practitioners should avoid overlapping neuromuscular stress. This requires identifying the muscle groups and systems already challenged during the field session and adjusting the strength work accordingly (Campos-Vázquez & Jiménez-Iglesias, 2024).

Ultimately, the biomechanical logic of training becomes a key guide in content selection. Whether based on muscle groups, motor patterns, force vectors, or mechanical demands, strength interventions should promote adaptation while minimizing residual fatigue and interference with football performance.

After defining both the objectives and contents of a micro-session, the third operational axis addresses a fundamental question: How should tasks be organized to optimize the stimulus? While multiple factors play a role, the session's primary objective is key—its structure can either enhance or limit the desired adaptive effect.

Two structural dimensions guide this organization. The first refers to group format: training can be individualized (for targeted needs), grouped (for players with similar profiles), or collective (aligned with team-wide priorities). The second relates to execution format: micro-sessions may be arranged as functional circuits, concentrated blocks focused on a specific goal, or contrast sequences that combine exercises of different natures. These decisions influence the session's density, neuromuscular response, and the impact on the system.

The fourth and final operational axis involves the selection of training tools and devices used to deliver the stimulus. Not all tools generate the same physiological response or serve the same purpose. Choosing the right equipment enhances specificity, regulates neuromechanical load, and improves the efficiency of the stimulus (Hernández-Abad, 2022).

This decision must consider both the training objective and the athlete's profile. While traditional free weights remain well-supported in the literature, other modalities—such as flywheel devices or elastic resistance systems—enable a more movement-based approach by adjusting force vectors and movement planes to meet the sport's mechanical demands (Gonzalo-Skok et al., 2017; Tous-Fajardo et al., 2016).

The type of task and tool selected directly affects perceived load and tissue stress. According to Hernández-Abad (2022), vector diversification can reduce localized overload: under the same external load, distributing force across multiple anatomical areas decreases the risk of delayed-onset muscle soreness (DOMS) and tissue fatigue. This strategy supports recovery and reduces overuse-related injuries.

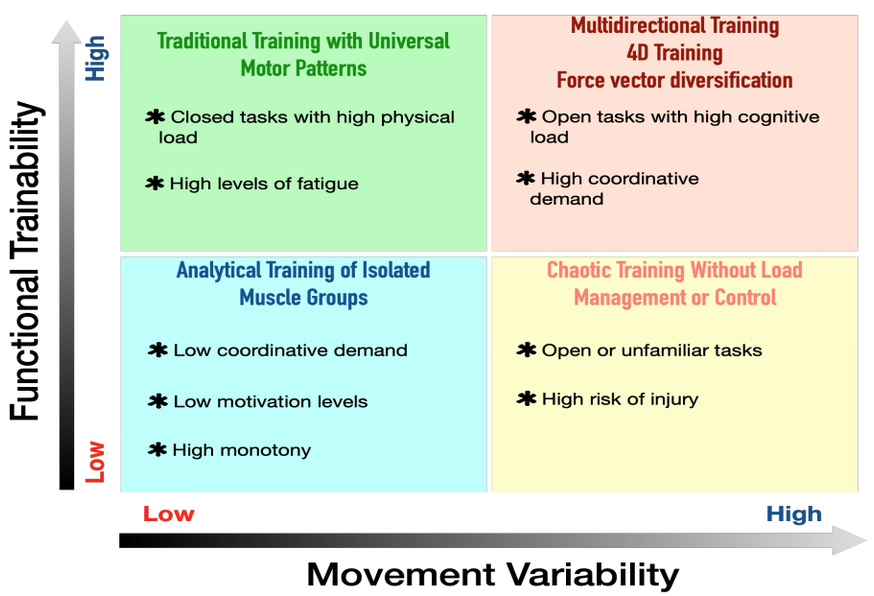

Fig. 4. **Task Selection Matrix Based on Functional Trainability and Movement Variability.**

Once goals, contents, structure, and tools are defined, the final step is the selection of specific exercises. These must be aligned with the player's trainability, functional needs, and performance goals. Grounded in recent literature (House, 2021), the next figure presents a practical framework to guide exercise selection, emphasizing trainability, injury prevention, and contextual relevance.

A critical aspect of micro-dosing implementation is the strategic use of alternation and variability. Research by Fernández-Valdés et al. (2020) highlights the adaptive benefits of neuromuscular variability in strength training. However, maintaining the same task constraints beyond four weeks may lead to reduced effectiveness due to increased predictability. To sustain adaptation and engagement, coaches are encouraged to periodically adjust training variables and constraints.

In summary, the question of "how to do it" cannot be reduced to a single dosing strategy. Instead, it involves multilayered decision-making: selecting contents, structuring tasks, and choosing tools that maximize training effects while minimizing physiological cost. This approach allows for high-quality work to be delivered consistently, without compromising player readiness, motivation, or adherence.

Importantly, individual responses to the same training stimulus can vary significantly. Therefore, micro-dosing must also serve as a vehicle for personalization—ensuring each intervention respects the athlete's neuromuscular status, avoids unnecessary overload on vulnerable systems, and promotes safe and effective adaptation (Mendiguchia et al., 2020).

How Much to Do?

In professional football, defining the appropriate training dose is a complex process requiring a dynamic balance between the desired adaptations, individual tolerance, and the realities of the competitive calendar. Rather than following fixed formulas, effective programming must consider fluctuating internal and external demands throughout the season.

The micro-dosing approach, often used to address time constraints in congested schedules, is frequently misunderstood as being synonymous with the minimum effective dose. However, recent literature emphasizes the importance of sustainable, frequent interventions that support long-term adaptation (Cuthbert et al., 2024).

A periodized framework remains essential. Cyclical constructs help sequence and organize strength interventions toward specific goals, and in some cases, micro-dosing must be combined with traditional methods to prioritize the development of targeted physical qualities (Williams et al., 2017).

To determine how much to do, it is crucial to understand that the applied dose of strength training is intrinsically linked to a physiological response. The "effective dose" is one that optimizes this relationship, but its magnitude will vary depending on the exercise, session, training period, and the individual athlete's condition (Cuthbert et al., 2024). Within this logic, a continuum of possibilities emerges—from minimum to maximum effective dose—each adapted to the context and athlete's profile.

Residual training effects refer to sustained physiological adaptations that persist following the cessation of training. Although they allow temporary maintenance of performance after the training stimulus is removed, their duration and quality depend on various factors, including the athlete's training status and the nature of the targeted physical qualities (Cuthbert et al., 2024).

In high-demand scenarios, applying a minimum effective dose can be advantageous to preserve key neuromuscular qualities while minimizing fatigue. However, the effectiveness of this strategy over time largely depends on how quickly specific physical qualities deteriorate and, on the athlete's current level of conditioning (Iversen et al., 2021).

Figure 5 summarizes commonly reported practices in strength and conditioning across the preparatory and competitive periods, outlining session frequency, duration, and volume (Campos-Vázquez & Jiménez-Iglesias, 2024; Loturco et al., 2022; Weldon et al., 2020). This overview serves as a practical benchmark for dosing decisions aligned with seasonal demands.

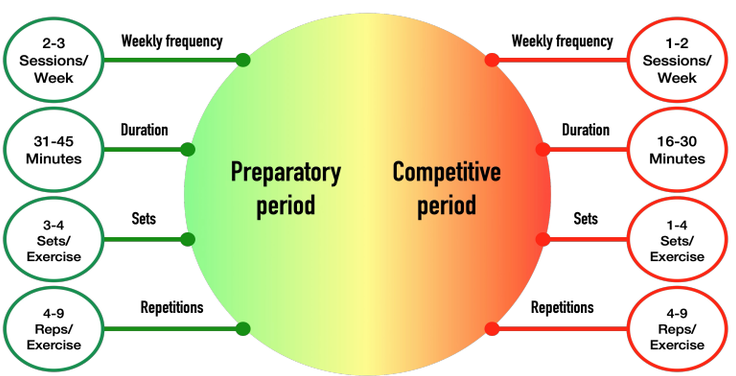

Fig. 5. Strength training prescription parameters across the preparatory and competitive periods in elite football (Loturco et al., 2022).

Despite these references, coaches face persistent challenges such as limited time, tight schedules, and fixture congestion, all of which make periodization difficult (Weldon et al., 2020). Here, micro-dosing re-emerges as a flexible tool, capable of delivering minimum, effective, or even maximum doses in smaller, more manageable formats. While micro-dosing may not always be necessary when a minimum dose is already applied, it can help sustain neuromuscular qualities, increase volume, or maintain performance under high contextual stress (Afonso et al., 2022; Cuthbert et al., 2024; Iversen et al., 2021).

Effective dosing, therefore, is not about rigid values but about strategic alternation, adapting load intensity and frequency to match contextual and individual needs. In football's ever-changing environment, a single athlete may require different dosing approaches throughout the season.

Crucially, not all micro-sessions demand the same effective dose. As categorized earlier, each micro-session type—whether focused on optimization, recovery, or activation—imposes distinct neuromuscular demands. This variability means coaches must not only determine how much to apply, but also when to apply it, especially for sessions with high eccentric loads or concentrated muscle stress.

As Gabbett & Oetter (2024) emphasize, the body's response is shaped by the magnitude, nature, and timing of each stimulus. High-impact sessions require strategic placement within the microcycle to avoid excessive fatigue and safeguard player availability.

Muscle damage and recovery are influenced by a wide range of individual factors—including fitness level, age, sex, training history, and even genetics—making personalized dosing essential. Thus, prescribing the right load for high-impact micro-sessions is one of the most sensitive decisions in modern strength training.

Ultimately, dosing must be flexible, evidence-based, and player-centered, tailored to the fluctuating demands of competition and the athlete's capacity to adapt.

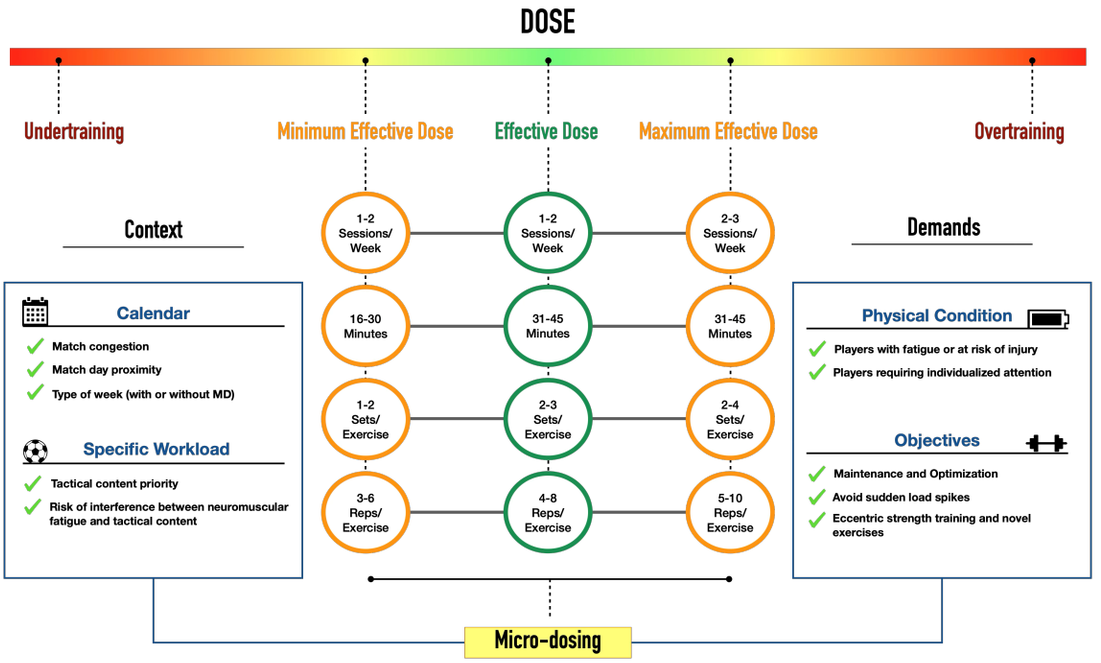

Fig. 6. Conceptual framework for strength training dose prescription in football, based on scientific literature. The model integrates contextual and individual demands to guide the use of minimum, effective, or maximum doses, with micro-dosing proposed as an empowering strategy to optimize adaptation and reduce interference.

To address the challenges of individualized dosing, a three-tiered framework is proposed: minimum effective dose, effective dose, and maximum effective dose—each adaptable through micro-dosing as a transversal strategy (Figure 6). This model, based on the conceptual work of Cuthbert et al. (2024), is supported by evidence from elite football environments and practical high-performance experience (Campos-Vázquez & Jiménez-Iglesias, 2024; Gonzalo-Skok et al., 2017; Loturco et al., 2022; Weldon et al., 2020).

Figure 6 integrates the logic of dose prescription by intersecting two key decision-making axes: the daily context and the player's individual profile, aligned with structural variables such as frequency, volume, and session duration. This multidimensional approach allows practitioners to define the most appropriate dose based on real-time demands.

The minimum effective dose aims to maintain neuromuscular function without accumulating fatigue or compromising tactical performance. It is particularly relevant during fixture congestion, tapering phases, or return-to-play periods.

The effective dose drives meaningful neuromuscular adaptation without exceeding recovery capacity. It represents the sweet spot of the dose–response relationship—maximizing force and power under stable training conditions.

The maximum effective dose involves higher neuromuscular demands and is best suited for pre-season, non-competitive weeks, or focused physical development blocks. While it promotes deeper structural adaptation, it requires greater recovery time and carries an increased risk of fatigue—limiting its use during congested competitive periods.

In this framework, micro-dosing is not a dose itself, but a delivery method—a way to apply any of the above doses in a distributed, efficient, and context-sensitive manner. Its value lies in maintaining consistency and progression under real-world constraints, and in addressing individual needs related to fatigue, injury history, or performance objectives.

Given the fluctuating conditions of elite football, training decisions must remain flexible and grounded in competitive reality. Variables such as player fatigue, calendar congestion, tactical load, and available recovery windows must be considered dynamically.

To support this complexity, a practical decision tree is proposed (Figure 7), helping coaches determine whether to prioritize recovery, apply a minimum or effective dose, or use micro-dosing as a modulating strategy that sustains adaptation while minimizing interference.

As illustrated in Figure 7, micro-dosing becomes a particularly valuable strategy when athletes present high levels of accumulated fatigue, restricted recovery time, elevated tactical demands, low chronic training load, or when novel eccentric-based exercises are introduced. It is also well-suited for players with limited training history, low exposure to structured strength work, or complex injury backgrounds.

Rather than prescribing a universal solution, this framework is intended to guide context-specific decisions—adapting the training dose to the athlete's current condition, competition calendar, and the microcycle's structure. Its primary goal is to empower strength and conditioning staff to make informed, adaptable choices that sustain training efficacy under demanding conditions.

In addition to optimizing dose, recovery, and periodization, several complementary strategies can further enhance the value of microdosed performance sessions. These include training variability, cognitive demands, eccentric overload protocols, real-time biofeedback, and individualized fatigue monitoring using sensitive markers (Spiering et al., 2023).

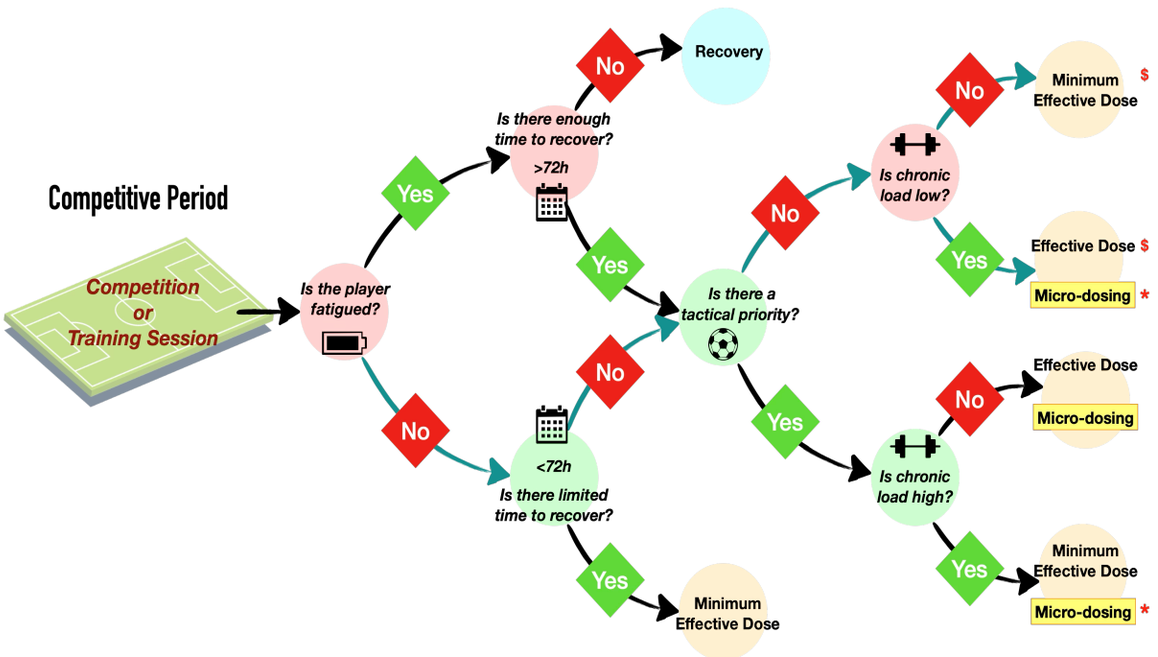

Fig. 7. Decision-making flowchart for strength training dose selection during the competitive period, based on contextual and individual factors. Micro-dosing is proposed as a strategy to optimize adaptation and reduce interference in sensitive scenarios.

*** Micro-dosing may be applied to these doses when tactical priority is low, or when working with players who have limited experience in strength training, complex injury histories recent load spikes, or when using novel exercises with high eccentric demands.**

$In optimal scenarios (no fatigue, sufficient time to recover, no tactical priority, and high chronic load), a maximum effective dose potentially micro-dosed may be applied, provided the player is well adapted to such stimuli. In the same scenario, but when chronic load is low, a cautious approach is recommended, favoring either an effective dose or a minimum effective dose, particularly when using novel or eccentrically demanding exercises.

When to Do It?

One of the main challenges in integrating strength training into professional football is determining the optimal timing—both within the microcycle and throughout the day—without disrupting tactical work or recovery. Planning must align with the structure and goals of the microcycle, as well as match proximity, while accounting for contextual factors that influence training outcomes (Campos-Vázquez & Jiménez-Iglesias, 2024).

Based on the proposed micro-session model (Figure 2), strength stimuli can be introduced daily to support performance and player availability. However, the following section focuses on the rationale behind those interventions that tend to raise the most uncertainty among strength and conditioning coaches.

In daily programming, neuromuscular activation should be strategically implemented based on the upcoming activity. If placed before a demanding tactical session, it serves as a strength activation micro-session to enhance neuromuscular readiness. When preceding a performance-oriented or preventive strength session, activation becomes part of the preparation, rather than a standalone unit.

This approach is grounded in the concept of post-activation performance enhancement (PAPE)—an acute increase in force or power output following brief, intense conditioning. It is associated with heightened neuromuscular excitability, greater contraction efficiency, and transient potentiation of the contractile system (Blazevich & Babault, 2019).

Activation, therefore, is not an accessory but a strategic component of the microcycle, enhancing readiness and amplifying the adaptive effect of subsequent training. Particularly in congested weeks, microdoses of activation strength—delivered through contrast methods or action chains—offer a practical solution for maintaining neuromuscular stimuli without compromising tactical performance (Cuthbert et al., 2024).

Table 1. Distribution of strength micro-sessions across various microcycle lengths based on performance and recovery priorities. This proposal is adapted from current scientific evidence and integrated with a micro-dosing approach for elite football. *Contents are optional and should be prescribed based on individual player needs or applied in specific cases (e.g., return to play, load reintroduction, post-fatigue contexts).

	Very Long	Long	Normal	Short	Very Short
MD+1	**Starter:** Preventive Strength + Supplementary + Recovery **Non-Starter:** Activation + Performance-Oriented Strength / Compensatory + Supplementary *(Acc/Dec; COD; RPA; Curve Sprint; Sprint; RSA; SSG; MSG)*	**Starter:** Preventive Strength + Supplementary + Recovery **Non-Starter:** Activation + Performance-Oriented Strength / Compensatory + Supplementary *(Acc/Dec; COD; RPA; Curve Sprint; Sprint; RSA; SSG; MSG)*	**Starter:** Preventive Strength + Supplementary + Recovery **Non-Starter:** Activation + Performance-Oriented Strength / Compensatory + Supplementary *(Acc/Dec; COD; RPA; Curve Sprint; Sprint; RSA; SSG; MSG)*	**Starter:** Preventive Strength + Supplementary + Recovery **Non-Starter:** Activation + Performance-Oriented Strength / Compensatory + Supplementary *(Acc/Dec; COD; RPA; Curve Sprint; Sprint; RSA; SSG; MSG)*	**Starter:** Preventive Strength + Supplementary + Recovery **Non-Starter:** Activation + Performance-Oriented Strength / Compensatory + Supplementary *(Acc/Dec; COD; RPA; Curve Sprint; Sprint; RSA; SSG; MSG)*
MD+2	Pre-habilitation + Preventive Strength *(Individual or Collective)* *Compensatory / Supplementary				
MD-5	Pre-habilitation + Preventive Strength *(Individual or Collective)*	Pre-habilitation + Preventive Strength *(Individual or Collective)* *Compensatory / Supplementary			
MD-4	Activation *(PAPE)* + Performance-Oriented Strength *(Acc/Dec; COD; RPA; SSG; MSG)*	Activation *(PAPE)* + Performance-Oriented Strength *(Acc/Dec; COD; RPA; SSG; MSG)*	Pre-habilitation + Activation *(PAPE)* + Performance-Oriented Strength *(Acc/Dec; COD; RPA; SSG; MSG)*		
MD-3	Activation *(PAPE)* + Performance-Oriented Strength *(COD; Curve Sprint; Sprint; RSA; LSG)* *Compensatory / Supplementary / Recovery	Activation *(PAPE)* + Performance-Oriented Strength *(COD; Curve Sprint; Sprint; RSA; LSG)* *Compensatory / Supplementary / Recovery	Activation *(PAPE)* + Performance-Oriented Strength *(COD; Curve Sprint; Sprint; RSA; LSG)* *Compensatory / Supplementary / Recovery	Activation *(PAPE)* + Performance-Oriented Strength *(Acc/Dec; COD; RPA; MSG; LSG)* *Compensatory / Supplementary	
MD-2	Preventive Strength *(Individual)* + Compensatory / Supplementary / Recovery *(Individual)*	Preventive Strength *(Individual)* + Compensatory / Supplementary / Recovery *(Individual)*	Preventive Strength *(Individual or Collective)* + Compensatory / Supplementary / Recovery *(Individual or Collective)*	Activation + Preventive Strength *(Individual; Curve Sprint; Sprint;)* + Compensatory / Supplementary / Recovery	Preventive Strength *(Individual or Collective)* + Recovery
MD-1	Pre-habilitation + Activation *(PAP; Agility; Reaction speed; SSG; MSG)*	Pre-habilitation + Activation *(PAP; Agility; Reaction speed; SSG; MSG)*	Pre-habilitation + Activation *(PAP; Agility; Reaction speed; SSG; MSG)*	Pre-habilitation + Activation *(PAP; Agility; Reaction speed; SSG; MSG)*	Pre-habilitation + Activation *(PAP; Agility; Reaction speed; SSG; MSG)*

In addition, "resistance priming"—a form of delayed potentiation—can be especially effective in pre-match sessions. These low-volume, high-specificity stimuli generate neuromuscular improvements between 6 and 48 hours post-intervention, enhancing performance in team sports (Harrison et al., 2020). Priming can also be applied in double-session days, preparing athletes for later training loads.

By contrast, performance-oriented strength and preventive sessions require higher mechanical or neuromuscular loads and must be strategically scheduled to allow recovery and avoid interference with field work (Tous-Fajardo et al., 2016; Turner & Stewart, 2014).

Research by Loturco et al. (2022) reveals common practices among elite coaches: strength sessions are typically scheduled 2–4 days before matchday, often in tandem with tactical sessions or within a 24-hour window. From a physiological perspective, adaptations to high-intensity stimuli typically require 48–72 hours, especially when structural muscle damage or inflammation is induced (Gabbett & Oetter, 2024; Markus et al., 2021).

According to practical insights from professional football clubs, the recovery time between an injury prevention program and a lower-body strength training session was either 24 hours or both were conducted within the same session (McCall et al., 2014).

However, recovery timelines vary based on individual characteristics—athletes with greater physical capacity recover faster—so interpretation must be personalized using a monitoring framework that accounts for training load and adaptive capacity (Gabbett & Oetter, 2024; Verhagen & Gabbett, 2019).

From a practical standpoint, microdosed strength stimuli can be implemented throughout the week, as long as objectives are rotated in accordance with the microcycle's type (short, regular, long, extended) and internal phases (recovery, stimulation, tapering).

Focusing on performance micro-sessions, Buchheit et al. (2022) reported that in 7-day microcycles, MD-5, MD-4, and MD-3 are commonly used for high-load sessions involving strength and speed. In 6-day microcycles, MD-4 and MD-3 are typically targeted. In shorter microcycles, high-load sessions decrease, and emphasis shifts toward preventive strategies.

To support strength training integration, Table 1 provides a practical guide based on current scientific literature and real-world practices from professional football (Buchheit et al., 2022; Loturco et al., 2022). This framework helps organize micro-sessions based on the length of the microcycle, aligning them with both performance and recovery priorities while minimizing tactical interference.

However, it's essential to view this structure as a flexible reference, not a rigid formula. Competitive demands are dynamic, and individual needs vary widely. Throughout the season, significant differences often emerge between players with high match exposure and those with limited participation, requiring customized parallel interventions within the same squad. These adjustments should consider accumulated fatigue and the athlete's recovery capacity (Clemente et al., 2024). Once weekly distribution is planned according to microcycle type, the next consideration is the optimal time of day

to implement each micro-session. This decision is especially important for optimization and preventive strength work, as sequencing may influence both neuromuscular adaptation and the quality of tactical training. As proposed by Jukic et al. (2021), the training environment can be divided into pre-, in-, and post-performance windows, offering targeted opportunities for individualized intervention.

Recent research in youth football provides valuable insights. Gantzer et al. (2024) observed no significant differences in fatigue when lower-body strength training was applied before or after field sessions. Similarly, Ramírez-Campillo et al. (2020) reported greater improvements in physical fitness when plyometric training occurred before football-specific work.

While these findings are based on youth populations, they highlight the potential flexibility in strength training sequencing—particularly when loads are well-calibrated within the microcycle. That said, in professional football—where margins for error are small—timing must be adapted to the player's individual neuromuscular status and the session's objectives, ensuring performance and recovery are preserved.

Figure 8 summarizes the main pros and cons of implementing strength micro-sessions before or after field training, offering a visual guide for strategic application throughout the microcycle.

Ultimately, there is no universal answer to the question of timing. While team priorities often determine the overall session structure, individualization is key. Specific needs—related to physical condition, injury risk, or recent training history—may justify tailored interventions that diverge from the collective plan.

One concept particularly relevant to timing and load management is the repeated bout effect, especially observed in eccentric training. This phenomenon describes the reduction in muscle damage and soreness after an initially unfamiliar exercise is repeated following a recovery period (Cuthbert et al., 2024).

Eccentric or novel strength work often triggers structural and functional stress due to a lack of prior adaptation. While this stress may not be fully avoidable, it can be significantly mitigated through micro-dosing. By distributing eccentric or unfamiliar loads across micro-sessions, coaches can reduce the adverse effects while still eliciting the protective and adaptive benefits associated with such stimuli (Nosaka et al., 2001).

In summary, the proposed framework is not prescriptive, but rather a practical and adaptable tool for decision-making in strength training for football. It integrates solid scientific evidence with the complex realities of high-performance sport, where time, recovery, and tactical priorities constantly interact.

As highlighted throughout this article, each of these questions presents a significant challenge for strength and conditioning coaches in modern football. Importantly, these questions are not isolated; they are deeply interconnected, with the answer to one often influencing or depending on the others.

Instead of simplifying with rigid rules, this model promotes a smart and flexible approach, where micro-dosing is not just a matter of reducing volume, but a strategic method to preserve trainability, enhance transfer, and protect players.

Beyond guiding daily practice, this framework also serves as a foundation for future research, helping to explore the real-world effectiveness of micro-dosing strategies across different player profiles, training contexts, and phases of the season.

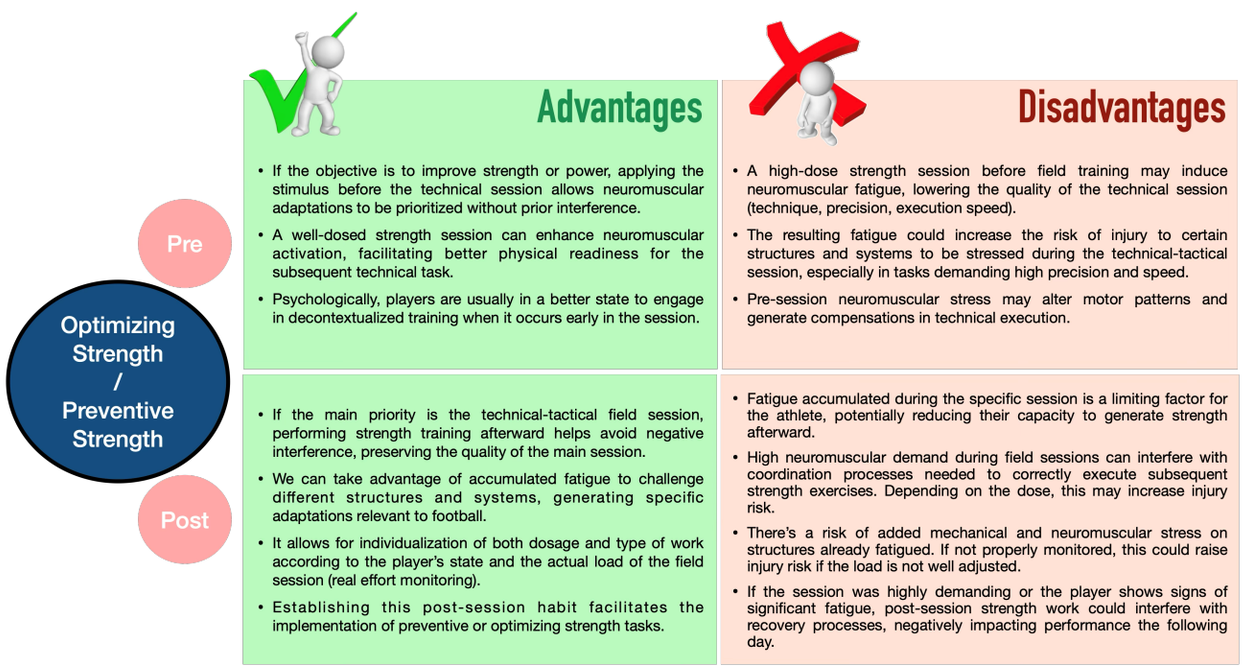

Fig. 8. Summary of potential advantages and disadvantages of implementing Optimizing or Preventive Strength training either before or after the main technical-tactical session during the microcycle.

Key points

- The integration of strength training into professional football requires adaptive, individualized, and context-sensitive strategies that go beyond rigid periodization models.
- Micro-dosing emerges as a practical and sustainable method to deliver effective strength stimuli under the constraints of congested calendars, tactical priorities, and limited training time.
- This framework offers a scientifically grounded, visually supported, and decision-oriented model to guide coaches and practitioners in planning, organizing, and adjusting strength interventions throughout the competitive season.

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