Title: Profiling the post-match top-up conditioning practices of professional soccer substitutes: An analysis of contextual influences

Running head: Top-up conditioning for soccer substitutes

ABSTRACT

Soccer practitioners implement 'top-up' conditioning sessions to compensate for substitutes' limited match-play exposure. Although perceived to be valuable for reducing injury-risk and augmenting positive physical adaptations, little research has considered the demands of post-match top-up training. To quantify post-match top-up responses, 31 professional soccer players wore 10 Hz Microelectromechanical Systems following 37 matches whereby they were selected in the match-day squad as substitutes (184 observations; 6±5 observations·player^{-1}). Linear mixed models and effect sizes (ES) assessed the influence of contextual factors on 23 physical performance variables. Top-ups lasted 17.13±7.44 min, eliciting total and high-speed distances of 1.7±6.2 km and 0.4±1.7 km, respectively. Each contextual factor (i.e., position, substitution timing, match location, result, time of day, stage of the season, and fixture density) influenced at least four of the dependent variables profiled ($p \leq 0.05$). Top-up duration, total, moderate-, and low-speed distance, and the number of repeated high-intensity efforts were greater for unused versus used substitutes (ES: 0.38-0.73, *small* to *moderate*). Relative to away matches, home top-ups elicited heightened total, low-speed, and high-speed distances, alongside more moderate-speed accelerations and decelerations, and repeated high-intensity efforts (ES: 0.25-0.89, *small* to *moderate*). Although absolute and relative running distances were generally highest when fixture density was low, the greatest acceleration and deceleration demands were observed during the most congested fixture periods. Late-season top-ups typically elicited lower absolute physical responses than early and mid-season sessions. These data provide important information for practitioners when considering the aims and design of substitute top-up conditioning sessions, particularly with reference to contextual influences.

KEY WORDS: Football; physiology; monitoring; high-speed running; training**.**

INTRODUCTION

In professional soccer, team managers or coaching staff often use substitutions to provide a physical or tactical impact upon a match, and thus potentially improve scoreline differentials (22). Strategic substitutions (i.e., replacements that are not made due to injuries sustained by on-pitch players) are most often made at half-time or during the second-half of match-play (7, 18, 19, 21), with individuals entering the pitch typically exceeding the relative total (TD) and/or high-speed running (HSR) distances of players who started a match (7, 21). However, substitutes consistently experience substantially lower absolute match-play demands compared with players who complete the full 90 min (19), whilst their reduced playing time may also restrict a substitute's opportunity to attain the 'peak' HSR responses of their whole-match counterparts (20).

For outfield players who play a full match, match-days typically represent the most physically demanding (i.e., in absolute terms) days within a training week (3, 24). Indeed, in-season preparatory strategies are often designed with the aim of maximizing recovery and minimizing fatigue prior to competition (3, 24). Because such objectives may require a reduction in weekly training volume or intensity compared with the pre-season period, it has been proposed that match-play itself could represent an important stimulus for several sport-specific physical adaptations (29, 35). In support, improvements in sprint speed and lower-limb strength have been associated with an individual's overall playing time throughout a professional soccer season (35), whilst the amount of HSR recorded during English Premier League fixtures acutely benefitted countermovement jump height and peak power output when assessed three days post-match (29). Given that match-day may account for up to >95% of a squad's HSR and sprinting (SPR) distance during specific microcycles, particularly when teams are required to fulfil multiple matches per week (3), these observations may highlight the potential for sub-optimal loading patterns regarding partial-match or non-selected soccer players. If an individual's exposure to HSR and SPR is restricted by a lack of playing time, and these deficits are not addressed through training, a lesser stimulus for the promotion of physical adaptation could be experienced which may increase injury-risk due to declines in ongoing loading (5, 11, 12). Notably, when combined match-play and training load was quantified across an English Premier League season, habitual 'non-starters' (defined as individuals who were selected in the starting team in <30% of matches) accumulated significantly lower HSR (19.9-25.1 km·h^{-1}; ~19 km vs. ~35 km), and SPR (>25.2 km·h^{-1}; ~3 km vs. ~11 km) distances compared with players who started in ≥60% of matches (2).

As the principle of reversibility suggests potential negative adaptations resulting from substantial fluctuations or ongoing reductions in physical loading (11, 12, 30), practitioners working in professional soccer frequently implement extra 'top-up' conditioning sessions for unused and partial-match players (10, 11, 22). In these scenarios, assuming that a period of reduced loading is not desired as part of the periodized training program, squad members who face limited match-play demands (i.e., typically determined based upon the number of minutes played, or assessments of the absolute physical demands experienced) undergo additional training in an effort to compensate for their lack of playing time (22). Whilst their unique match demands may suggest a benefit to implementing bespoke training and nutrition strategies for substitutes and non-selected players throughout the training week, uncertainty about an individual's future match-play exposure often requires practitioners to ensure that all players are equally prepared for the physical, tactical, and psychological demands of completing a full match (22). For example, managers may not reveal the final team selection until the day before a game, whereas players named in the match-day squad as substitutes could be required to play for anything from zero (i.e., if not introduced during a match) to 90+ min (i.e., if a starting player suffers injury or illness prior to or shortly after the match kick-off). Therefore, acknowledging that extra conditioning sessions may occasionally be undertaken at a team's training facility during subsequent days, a desire to ensure adequate recovery prior to the next fixture while avoiding prolonged periods of reduced physical loading means that top-ups are typically performed on the pitch immediately post-match (22).

Although match-day may represent an important opportunity to provide a conditioning stimulus for players who receive little or no match-play exposure, several practical and logistical considerations may modulate the activities that can be performed directly after a match ends (22). Professional soccer fixtures are often contested late at night and/or at venues situated long distances away from home, whilst the pitch-protection policies adopted by specific teams and/or governing bodies may restrict pitch-usage during the immediate post-match period (4, 22). Despite practitioners recognising the potential importance of top-up sessions for helping to maintain an appropriate degree of physical loading for all players within a team (22), we are unaware of any study to have directly profiled the post-match conditioning practices of players selected in the match-day squad as substitutes. Therefore, the aim of this study was to quantify the physical responses of professional soccer substitutes during post-match top-up sessions, while investigating contextual influences. Such information would represent a valuable addition to the limited literature concerning the preparatory practices of this under-researched population of soccer players and may help practitioners and regulators in optimizing current approaches for substitutes.

METHODS

Experimental approach to the problem

To quantify the physical responses elicited during post-match top-up sessions, professional soccer players were monitored via wearable microtechnology during the ~60 min immediately following fixtures in which they were named in the match-day squad as substitutes. To maintain consistent treatment of all squad members on 'match day plus one' and to ensure adequate recovery prior to upcoming fixtures, the reference team targeted the immediate post-match period as the primary opportunity to undertake top-up conditioning sessions. Top-ups were designed and overseen by physical performance coaches working with the team, and aimed to ensure that players achieved individualized weekly physical loading targets by offsetting their limited match-play exposure. Post-match sessions typically consisted of ~15-30 s straight-line running intervals performed between the halfway line and the goal line, during which a player's distance to be covered per interval was prescribed based upon an appropriate percentage (i.e., according to the stage of the periodized program) of their maximum aerobic speed. Microelectromechanical Systems (MEMS) data were collected from both 'used' (i.e., players who had been introduced at some time during the match) and 'unused' (i.e., players who were named in the match-day squad but did not participate in any match-play) substitutes, while the influence of several situational variables was examined.

Subjects

Following approval from the School of Social and Health Sciences Research Ethics Committee at Leeds Trinity University, 31 professional players from an English Championship soccer club (age: 26 ± 5 years, stature: 1.82 ± 0.07 m, body mass: 77.0 ± 7.2 kg) volunteered to participate in this study. Of the 46 first-team fixtures profiled over 12 months, post-match top-ups were performed on 37 occasions, from which 184 individual player observations were analyzed (6 ± 5 observations·player^{-1}, range: 1-17 observations·player^{-1}). All players were briefed about the risks and benefits of participation before providing their written informed consent in advance of data-collection taking place during the 2018/2019 and 2019/2020 English Championship seasons.

Activity monitoring

Players' movements during top-up sessions were quantified via MEMS (10 Hz; S5, Optimeye, Catapult Innovations, Melbourne, Australia), which were worn beneath the playing jersey and harnessed between the scapulae in a vest designed to minimize movement artefacts. Sampling at 10 Hz has produced acceptable reliability (coefficient of variation; CV% = 2.0-5.3%) when assessing instantaneous velocity (36), alongside small-to-moderate typical errors of the estimate (1.87-1.95%) versus a radar gun when measuring sprinting speed (33). The 100 Hz accelerometers within the MEMS devices have also demonstrated good intra (CV% = 0.9-1.1%) and inter-unit (CV% = 1.0-1.1%) reliability within both laboratory and field test scenarios (6). All players were familiar with this form of activity monitoring as part of routine practices at the club, and each player wore the same MEMS unit on each occasion to avoid potential inter-unit variation.

The MEMS devices were activated according to the manufacturer's guidelines ~30 min prior to the pre-match warm-up, and raw data files were exported after the conclusion of exercise using proprietary software (Sprint 5.1.7, Catapult Innovations, Melbourne, Australia). Files were trimmed on an individual player basis to ensure that only data pertaining to post-match conditioning activities were retained for analysis. Session duration, as well as a combination of Global Positioning Systems- and accelerometer-derived variables relating to TD, low-speed running distance (LSR), moderate-speed running distance (MSR), HSR, SPR, PlayerLoad™ (PL), maximum velocity achieved, repeated high-intensity efforts (RHIEs), accelerations, and decelerations, were profiled (Table 1). These variables were chosen to reflect performance indicators reported in existing substitutes literature (18, 19). In keeping with the observational nature of the study, no attempt was made to influence players' responses as part of this research.

****INSERT TABLE 1 HERE****

Statistical analysis

Linear mixed models were used to assess the influence of several contextual factors on the physical responses elicited during post-match top-ups. Separate models were constructed for each dependent variable, whereby 'player' and 'match' were modelled as random effects in all instances. Contextual factors reflecting *playing position* ('midfielders', 'attackers', 'defenders', 'goalkeepers'), *substitution timing* during the match immediately beforehand ('unused', 'introduced at 75:00+ min', 'introduced at 60:00-74:59 min;' note that no post-match top-ups were performed by substitutes introduced prior to 60:00 min of match-play in any given instance), *stage of the season* ('early-season': August-October; 'mid-season': November-January; 'late-season'; February,-April), *match result* ('win', 'draw', 'loss'), *location* ('home', 'away'), and *time of day* ('early': kick-off at 12:00-14:59 h; 'afternoon': kick-off at 15:00-17:59 h, 'evening': kick-off later than 18:00 h) were separately specified as fixed effects. *Fixture density* was also entered as a fixed effect and was defined on a rolling basis as the number of additional (i.e., not including the match completed on the same day as the top-up session) fixtures scheduled for the reference team within the preceding and subsequent seven-day periods combined ('high-density': three additional matches; 'moderate-density': two additional matches; 'low-density': one additional match). Pairwise comparisons were made using least squares means tests to assess differences between each level of any given fixed effect, before standardized effect sizes (ES) were calculated and interpreted as: 0.00-0.19, *trivial*; 0.20-0.59, *small*; 0.60-1.20, *moderate*; 1.21–2.0, *large*; and >2.01, *very large* effects (23). Analyses were conducted using R Studio (v R-3.6.1.). Descriptive statistics are presented as mean ± standard deviation (SD), and ES are presented with 90% confidence intervals (CI).

RESULTS

Table 2 indicates the overall physical demands recorded during post-match top-ups and highlights the influence of playing position and substitution timing. Top-ups for unused substitutes were longer in duration and elicited greater absolute TD and LSR responses, alongside more RHIEs compared with sessions performed by players who had been introduced at 75:00 min of match-play or later (all $p \leq 0.05$, ES: 0.38-0.40, *small*). Unused substitutes also accumulated more MSR than substitutes introduced between 60:00-74:59 min ($p = 0.029$, ES: 0.73 [0.27-1.20], *moderate*). Irrespective of substitution timing, midfielders produced greater relative TD and PL responses, but performed less absolute MSR and fewer high-speed accelerations compared with defenders (all $p \leq 0.05$, ES: 0.42-0.66, *small* to *moderate*). Midfielders also exceeded attackers for relative TD ($p = 0.023$, ES: 0.48 [0.17-0.79], *small*), whilst the responses of goalkeepers did not differ from any outfield position for any variable.

****INSERT TABLE 2 HERE****

As indicated in Table 3, early-season top-ups lasted longer than mid-season and late-season sessions (both $p \leq 0.05$, ES: 0.50-0.54, *small*). Early-season sessions also produced the greatest values for absolute TD, MSR, and PL, high- and moderate-speed acceleration distance, the number of moderate-speed accelerations, and the number of RHIEs performed (all $p \leq 0.05$, ES: 0.34-0.76, *small* to *moderate*). Compared with mid-season, players during early-season top-ups performed more absolute LSR and high-speed decelerations, covered greater distance while decelerating at high-speed, yet recorded lower relative values for TD, PL, and HSR (all $p \leq 0.05$, ES: 0.40-0.69, *small* to *moderate*). Moreover, top-ups conducted early in the season elicited more absolute SPR, alongside an increased number of high-speed accelerations and moderate-speed decelerations, compared with late-season sessions (all p ≤0.05, ES: 0.44-0.57, *small*). Although late-season sessions exceeded mid-season for absolute MSR (p = 0.013, ES: 0.67 [0.35-0.99], *moderate*), greater relative TD, HSR, and PL values were observed during mid-season sessions (all p ≤0.05, ES: 0.47-0.69, *small* to *moderate*).

****INSERT TABLE 3 HERE****

With regards to fixture density (Table 3), players recorded higher absolute TD, PL, and LSR values, alongside greater relative LSR, SPR, and PL responses, during top-ups performed when fixture density was low, compared with moderate (all p ≤0.05, ES: 0.34-0.69, *small* to *moderate*). Conversely, periods of moderate fixture density exceeded low fixture density for relative HSR, the number of high-speed accelerations and decelerations performed, high-speed acceleration distance, and distance covered while decelerating at high- and moderate-speed (all p ≤0.05, ES: 0.37-0.87, *small* to *moderate*).

Although greater relative TD, LSR, and PL responses were observed for low fixture density, top-ups were shorter and produced lesser values for all acceleration and deceleration variables when fixture density was low, compared with high (all p ≤0.05, ES: 0.4-0.107, *small* to *moderate*). High fixture density exceeded moderate fixture density for session duration, absolute TD, absolute PL, high- and moderate-speed acceleration and deceleration distance, and the number of moderate-speed accelerations and decelerations performed (all p ≤0.05, ES: 0.40-0.68, *small* to *moderate*). In contrast, relative values for TD, HSR, and PL were greater when fixture density was moderate compared with high (all p ≤0.05, ES: 0.39-0.68, *small* to *moderate*).

Match location, result, and time of day, each influenced certain physical responses (Table 4). Top-ups completed following home matches were longer and elicited greater absolute values for TD, LSR, and HSR, as well as an increased number of moderate-speed accelerations, more RHIEs, and more moderate-speed decelerations, compared with away matches (all p ≤0.05, ES: 0.25-0.89, *small* to *moderate*). When the reference team had won the preceding match, players recorded more high-speed decelerations, alongside greater responses for absolute and relative MSR, moderate-speed acceleration distance, high-speed deceleration distance, and moderate-speed deceleration distance, compared with top-ups performed following losses (all p ≤0.05, ES: 0.34-0.45, *small*). Wins and losses each exceeded draws for absolute HSR, relative LSR was higher following draws than following wins, whilst top-ups performed immediately after losses elicited greater absolute and relative SPR responses compared with draws (all p ≤0.05, ES: 0.35-0.68, *small* to *moderate*). Compared with evening matches, greater absolute and relative MSR, and relative LSR values were observed following afternoon fixtures (all p ≤0.05, ES: 0.50-0.53, *small*). Moreover, top-ups conducted after afternoon matches elicited less absolute HSR, less absolute and relative SPR, and lower peak velocities compared with evening matches, while also producing lower peak velocities along with less moderate-speed deceleration distance than early matches (all p ≤0.05, ES: 0.43-1.26, *small* to *large*).

****INSERT TABLE 4 HERE****

DISCUSSION

This study quantified the physical demands of professional soccer substitutes during post-match 'top-up' conditioning sessions, while assessing contextual influences. On average, top-ups lasted for ~17 min and elicited ~1.7 km of TD. However, sessions were longest for unused squad members, who typically produced greater absolute physical responses compared with substitutes who had been introduced into the preceding match. Observations of heightened demands during top-ups conducted at home versus away, alongside the influence of situational factors such as fixture density, stage of the season, time of day, and match result, highlight practical and logistical considerations relating to post-match conditioning (22); factors which may be important for practitioners when designing and monitoring top-up sessions.

Top-ups are typically prescribed with the aim of helping to compensate for deficits in physical loading for individuals who receive either no match-play exposure, or substantially less than that of whole-match players (22). In particular, although differences in the availability of resources and/or fixture scheduling may lead to substantial between-team variation, providing a HSR stimulus often represents a primary objective during these sessions (22). Players in the current study performed ~0.4 km of HSR during post-match top-ups, values which fall substantially below the ~0.8-1.0 km typically accumulated by professional soccer players throughout a 90 min match (9, 14, 31). Given the role of top-ups as a means of offsetting discrepancies in match-play demands, it is unsurprising that unused members of the match-day squad recorded generally greater absolute top-up responses compared with players who had experienced partial match-play (i.e., those substitutes who were deployed during the immediately preceding match). However, acknowledging that any match-exposure must also be considered when assessing an individual's overall match-day loading, and that considerable variation may exist in relation to a substitute's match demands, an existing study of English Championship soccer players indicated that substitutes typically covered just ~0.1 km of HSR following entry onto the pitch (19). Moreover, substitutes may accumulate little or no HSR or SPR during preparatory activities performed prior to match introduction (18, 19), with many practitioners deeming a substitute's pre-pitch-entry responses to be too minimal to warrant inclusion within assessments of match-day loading (22). As match-play may represent an important stimulus for promoting sport-specific physical adaptations (29, 35), the likely reduction in absolute match-day loading for unused or partial-match players compared with their whole-match counterparts has the potential to negatively influence an individual's adaptive responses, particularly for those who are repeatedly omitted from the starting team over the course of multiple fixtures.

Whereas absolute HSR in the current study equated to <50% of whole-match values for players occupying outfield players (9, 14, 31), relative HSR of ~28.1 $m \cdot min^{-1}$ far exceeds the ~4.8-10.1 $m \cdot min^{-1}$ typically recorded across a playing bout for both partial- and whole-match players (7, 9, 19). Indeed, such values broadly reflect the relative HSR responses reported during the 'peak' 2-3 min period of match-play (13, 17, 20). Although the role of HSR 'intensity' in physical preparation and injury-management remains to be determined, it may be important for practitioners to consider the potential for differing physiological responses when substantially overloading relative HSR compared with typical match-play demands, and to assess the volume of HSR that can be safely accumulated in the limited time available for post-match conditioning (10). Within the context of the overall periodized training program, such decisions may be informed on an individual player basis with reference to factors such as a player's ongoing HSR loads and perceived physical development priorities (10).

Large fluctuations in physical loading may increase injury-risk amongst team sports players (15, 25, 26), while the presence of low ongoing loads may exacerbate such effects (12, 25, 26). As such, if an appropriate volume of top-up training is not performed, a reduction in a player's match-day demands could promote an increased susceptibility to injury as a consequence of declines in absolute loading over time (10). Acknowledging that the presence of sufficient training and match-play loads may be vital for developing tolerance to very high-speed efforts (12, 26), ensuring that players are regularly exposed to maximum or near-maximum velocity running could represent an important strategy for injury-risk reduction (12, 26, 27). However, as tactical preparations and fatigue-management often represent a team's primary foci during the days between competitive fixtures, the types of drills (e.g., small-sided games) typically adopted during squad training sessions may afford limited opportunities for a player to sprint during a professional soccer season (1, 3). Indeed, excluding match-day responses (i.e., typically ~0.2-0.3 $km \cdot player^{-1} \cdot match^{-1}$ for whole-match players (3, 9, 14, 31)), professional players may at times perform as little as <0.01 $km \cdot player^{-1} \cdot week^{-1}$ of SPR throughout an entire seven day microcycle (3). As top-ups in the current study elicited just ~0.03 km of SPR and players reached peak velocities of ~7.0 $m \cdot s^{-1}$, these data highlight the importance of ensuring appropriate SPR exposure during other training sessions throughout the week. Alternatively, or in conjunction, such observations could highlight an opportunity to address current practices by tailoring the design of post-match conditioning sessions to promote greater SPR responses. Notably, increasing a player's SPR volume could also provide a valuable stimulus for developing explosive physical performance, with improvements in 40 m sprint and maximum aerobic speed having been observed when professional players performed repeated sprints and high-intensity interval training once per week throughout 10 weeks of the season (16).

Notwithstanding the potential benefits to emphasising HSR and SPR during top-up conditioning sessions, several practical and logistical considerations may limit what can be achieved during the immediate post-match period. For example, The English Football Association handbook stipulates that activities performed after the conclusion of the match "shall last for no longer than 15 minutes" and gives discretion to ground staff to dictate which areas of the pitch can and cannot be used for this purpose (4). When one considers the likely need for unused substitutes to undertake appropriate warm-up or rewarm-up activity prior to performing very high-speed activities, alongside the fact that team management staff may wish to deliver tactical debriefing to all squad members immediately after the conclusion of play, the existence of spatial and temporal restrictions could at least partly explain the HSR and SPR responses observed in the current study. Indeed, given the limited time often available for post-match top-ups, practitioners may choose to prioritize other stimuli such as developing aerobic capacity, which can be achieved in a more time-efficient manner and may be perceived to carry a lower acute injury-risk in the circumstances (i.e., when up to ~120 min may have elapsed following cessation of the pre-match warm-up). If this approach is taken, it may be important for practitioners to ensure that players are exposed to maximum or near-maximum velocity running elsewhere within the microcycle.

Following home matches, top-ups lasted longer and elicited greater values for absolute TD, LSR and HSR, alongside the number of moderate-speed accelerations, RHIEs, and moderate-speed decelerations performed, compared with away matches. Such observations may appear unsurprising when one considers that return travel arrangements are likely to represent the main priority for players and team staff after the conclusion of away matches, particularly when played large distances from home (22). Moreover, post-match activities at away venues could be further limited by a reduced number of traveling support staff, tighter restrictions on pitch-usage, and/or the potential for increased hostility from opposition supporters. Whereas a longer session duration might explain the greater absolute responses observed, heightened RHIE, acceleration, and deceleration demands could partly reflect practitioners' increased freedom to prescribe activities that incorporate changes of direction and potentially small-sided games when sessions are performed on home turf (1). In contrast, pitch-protection policies at away grounds may limit post-match conditioning strategies to the use of primarily straight-line running drills. Acknowledging that restrictions may also be imposed by home ground staff and/or competition-wide legislation, it seems likely that more favorable treatment may be afforded to the home team. In support, whereas away sessions lasted for the ~15 min stipulated in The Football Association handbook (4), top-ups performed at home extended to ~19 min in duration. Irrespective of the underlying reasons, the potential for discrepancies in physical responses following home and away fixtures may need to be borne in mind by practitioners when assessing and prescribing training loads for players who receive limited match-play exposure.

The influence of contextual factors on post-match conditioning is further highlighted by observations that early-season top-ups typically elicited greater absolute demands compared with sessions conducted during the mid- or late-season periods. Although the primary focus of 'topping-up' often surrounds addressing deficits in match-play stimulus on an acute (i.e., per match) basis (22), these data may indicate the importance of considering a player's physical loading within the context of the overall training cycle. If an individual has experienced particularly high loads during the preceding days or weeks (e.g., having completed multiple matches), or a period of reduced loading is desired within the periodized training program, it may not be appropriate to prescribe a substantial volume of extra conditioning in these scenarios. For example, although the use of substitutions often reflects an effort to positively influence the outcome of a specific match, there may be instances in which certain players are named as substitutes (i.e., as opposed to being selected within the starting team) as part of a 'rotation policy' designed to reduce their overall loading or prevent the accumulation of fatigue across a whole squad (21, 22). Moreover, acknowledging the potential role of other factors such as the likely deteriorating pitch condition over the course of a season, the generally heightened absolute demands observed during early-season top-up sessions may partly reflect the team's broader periodization strategy. It seems likely that promoting physical adaptations may represent a primary training objective for a squad during the early stages of the season, whereas the continued accumulation of load over multiple matches means that fatigue-management may be increasingly prioritized as the season progresses (2, 24).

For certain variables, particularly those relating to acceleration and deceleration responses, top-ups performed during periods of high fixture density elicited greater demands compared with sessions conducted under moderate- or low-density conditions. Top-ups were also longer in duration when fixture density was high. Whilst such observations may seem surprising, these patterns may be attributable to the fact that an increase in fixture congestion typically reduces the amount of whole-team training that can be conducted within a given period (i.e., when travel and recovery considerations may account for a greater proportion of the time between fixtures). Therefore, because overall training demands may be limited when fixture density is high, greater importance may be attributed to post-match conditioning sessions as an opportunity to elicit a substantial stimulus, particularly for players who rarely feature in the starting team. Notably, fixture congestion may also restrict the volume of technical and tactical training that can be performed throughout the week. Acknowledging that time and space may often be limited during the post-match period, incorporating activities such as small-sided games within top-up sessions may allow practitioners simultaneously to provide stimuli for the development or maintenance of physical capacity and soccer-specific skills.

Midfielders typically accumulate the greatest absolute and relative match-play distances of any playing position (7-9, 18, 19, 28). Such discrepancies appear to suggest in favor of taking a position-specific approach to training prescription and may also warrant consideration in relation to post-match top-ups (32). In support, given the objective of compensating for deficits in loading compared with a player's typical whole-match demands, it seems appropriate that the physical loads of midfielders may need to be 'topped-up' to a greater degree than players in other positions (10). That said, whilst midfielders in the current study produced the greatest relative TD and PL values during post-match top-ups, defenders surpassed midfielders for absolute MSR and the number of high-speed accelerations completed. As position-specific session design was not adopted during the observation period for the current study, such heightened relative demands may be attributable primarily to factors such as a greater physical capacity amongst midfielders (28) and/or differences in individualized weekly loading targets, as opposed to reflecting conscious differences in training prescription between positional groups.

Although top-ups for outfield players elicited substantially lower absolute running demands compared with those typically observed throughout 90 min of match-play, the same may not be true for goalkeepers. Goalkeepers in the current study produced similar physical responses to players in outfield positions, accumulating ~0.4 km at >5.5 $m \cdot s^{-1}$ during post-match top-ups. However, professional goalkeepers may cover just ~0.1 km of HSR throughout a whole-match, even when a position-specific HSR threshold of >4.17 $m \cdot s^{-1}$ is employed (37). Given the increased injury-risk associated with spikes in HSR load (11, 15), caution must be exercised when goalkeepers participate in post-match conditioning sessions alongside outfield players, particularly for individuals who are unaccustomed to this form of training. Moreover, as match-play may require goalkeepers to perform several position-specific tasks such as jumps, dives, and high-velocity kicking actions (37), the adoption of bespoke top-up strategies that emphasise these explosive actions may help to provide an additional stimulus for the promotion of such crucial adaptations.

Several limitations should be noted when interpreting the findings of the current study. Although useful for monitoring specific aspects of external loading, MEMS data in isolation cannot quantify all contributions to a player's internal and external physical load. Nonetheless, given that top-ups often target specific objectives such as providing a HSR stimulus (10, 22), direct measurement of individual external load metrics gives valuable insight into the responses elicited during post-match sessions. Moreover, the use of PL, which represents a three-dimensional measure of instantaneous rate of change in acceleration, may provide an indication of external loading on a more global level. Empirical observations suggest that PL is widely used by practitioners as a marker of overall external load, and this variable has demonstrated strong relationships with heart rate and rating of perceived exertion-based training load measures (34). Although the influence of substitution timing was analyzed, this study assessed the responses to top-up conditioning sessions in isolation and did not monitor changes in physical loading over a longer period of time. A player's training and match-play demands over several days or weeks may be an important factor in determining what constitutes an appropriate degree of 'topping-up' and may thus influence the responses elicited during post-match sessions. Similarly, as data were collected only from substitutes who performed top-ups following any given match, contextual influences may have been partly obfuscated by the exclusion of instances in which a player or group of players did not undertake post-match conditioning. That said, this study provides novel insights into the match-day top-up conditioning practices of professional soccer substitutes while demonstrating the influence of several contextual variables. Such information may be useful to highlight the barriers currently existing in relation to post-match top-up sessions and could help applied practitioners to assess then address current practices.

PRACTICAL APPLICATIONS

This study quantified the physical responses of professional soccer substitutes during post-match top-up conditioning sessions. The importance of top-up sessions is highlighted by the fact that because team training programs are often designed on the basis that match-activities are expected to represent a substantial contributor to a player's physical loads during a season, there exists the potential for individuals who are repeatedly omitted from the starting team to experience reductions in loading compared with whole-match players. Notably, such declines may be associated with decreases in sport-specific physical performance adaptations and/or an increased risk of sustaining non-contact soft tissue injury. As several contextual variables such as substitution timing, match location, result, time of day, playing position, fixture density, and the stage of the season each influenced the demands of post-match sessions, practitioners should consider the presence of practical or logistical barriers when designing match-day top-ups. Moreover, because direct and indirect restrictions on the time and space available for training may limit what can be achieved during the immediate post-match period, management and support staff may decide that performing top-up sessions the next day and/or modifying training prescription throughout a microcycle (e.g., to ensure maximum or near-maximum velocity running elsewhere during the week) may offer greater flexibility to safely achieve the desired volume and intensity of stimulus. That said, the suitability of this approach must be assessed on case-by-case basis with reference to factors such as player and staff psychology, existing training and recovery demands, fixture scheduling/travel arrangements, and the availability of resources.

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LEGENDS

Table 1: Operational definition for Microelectromechanical Systems (MEMS)-derived outcome variables

Table 2: Descriptive statistics for substitutes' post-match top-up responses on an overall basis, according to substitution timing, and by playing position

Table 3: Descriptive statistics for substitutes' post-match top-up responses, with comparisons between different stages of the season and according to fixture density

Table 4: Descriptive statistics for substitutes' post-match top-up responses, with comparisons between match location, result, and time of day

Table 1: Operational definition for Microelectromechanical Systems (MEMS)-derived outcome variables

Measurement	Variable	Definition
Distance covered	TD (m)	Total amount of distance covered by any means
	Relative TD ($m\cdot min^{-1}$)	Total amount of distance covered per min
	LSR (m)	Distance covered at a speed of ≤4 $m\cdot s^{-1}$
	Relative LSR ($m\cdot min^{-1}$)	Distance covered per min at a speed of ≤4 $m\cdot s^{-1}$
	MSR (m)	Distance covered at a speed of >4 to ≤5.5 $m\cdot s^{-1}$
	Relative MSR ($m\cdot min^{-1}$)	Distance covered per min at a speed of >4 to ≤5.5 $m\cdot s^{-1}$
	HSR (m)	Distance covered at a speed of >5.5 to ≤7 $m\cdot s^{-1}$
	Relative HSR ($m\cdot min^{-1}$)	Distance covered per min at a speed of >5.5 to ≤7 $m\cdot s^{-1}$
	SPR (m)	Distance covered at a speed of >7 $m\cdot s^{-1}$
	Relative SPR ($m\cdot min^{-1}$)	Distance covered per min at a speed >7 $m\cdot s^{-1}$
Running speed	Peak velocity ($m\cdot s^{-1}$)	Highest running speed attained
PL	PL (AU)	Quantification of external workload: Square root of the summed rates of change in instantaneous velocity in each of the three (forwards, sideways, upwards) vectors, divided by a scaling factor of 100
	Relative PL ($AU\cdot min^{-1}$)	Player load accumulated over X number of min, divided by X number of min
Acceleration/deceleration count	High-intensity accelerations (#)	Count of the number of accelerations >3 $m\cdot s^{-2}$ for a period of ≥0.4 s
	High-speed decelerations (#)	Count of the number of decelerations <−3 $m\cdot s^{-2}$ for a period of ≥0.4 s
	Moderate-speed accelerations (#)	Count of the number of accelerations >2 to ≤3 $m\cdot s^{-2}$ for a period of ≥0.4 s
	Moderate-speed decelerations (#)	Count of the number of decelerations <−2 to ≥−3 $m\cdot s^{-2}$ for a period of ≥0.4 s
Acceleration/deceleration distance	High-speed acceleration (m)	Distance covered whilst accelerating at >3 $m\cdot s^{-2}$
	High-speed deceleration (m)	Distance covered whilst decelerating at <−3 $m\cdot s^{-2}$
	Moderate-speed acceleration (m)	Distance covered whilst accelerating at >2 to ≤3 $m\cdot s^{-2}$
	Moderate-speed deceleration (m)	Distance covered whilst decelerating at <−2 to ≥−3 $m\cdot s^{-2}$
RHIEs	RHIEs (#)	Count of the number of occasions in which ≥3 qualifying efforts (qualifying effort defined as attaining a speed of >5.5 $m\cdot s^{-1}$, accelerating at >2 $m\cdot s^{-2}$, or decelerating at <−2 $m\cdot s^{-2}$) are performed over a ≤21 s period.
Time	Duration (min)	Length of time for any given period

AU: Arbitrary units, HSR: High-speed running, LSR: Low-speed running, MEMS: Micromechanical Electrical Systems, MSR: Moderate-speed running, PL: PlayerLoad™, SPR: Sprinting, TD: Total distance.

Table 2: Descriptive statistics for substitutes' post-match top-up responses on an overall basis, according to substitution timing, and by playing position

Variable		Overall	Substitute timing			Playing position			
			Unused	75:00+ min	60:00-74:59 min	Midfielders	Attackers	Defenders	Goalkeepers
Duration	(min)	17.13 ± 7.44	17.76 ± 6.80[b]	14.80 ± 8.28[a]	16.31 ± 10.46	16.24 ± 7.85	17.61 ± 8.07	18.72 ± 7.36	16.28 ± 5.30
TD	Absolute (m)	1695 ± 624	1763 ± 587[b]	1504 ± 748[a]	1474 ± 574	1670 ± 647	1697 ± 689	1796 ± 595	1636 ± 496
	Relative (m·min^{-1})	102.8 ± 18.6	101.7 ± 14.8	107.7 ± 23.9	103.2 ± 32.8	108.5 ± 20.2[e, f]	99.5 ± 16.9[d]	97.8 ± 12.0[d]	103.7 ± 21.4
LSR	Absolute (m)	874 ± 505	921 ± 477[b]	722 ± 518[a]	765 ± 672	819 ± 498	899 ± 587	929 ± 488	876 ± 375
	Relative (m·min^{-1})	50.0 ± 13.0	51.3 ± 13.0	46.9 ± 11.8	44.2 ± 12.9	49.1 ± 11.8	48.9 ± 12.8	48.5 ± 9.6	54.8 ± 17.0
MSR	Absolute (m)	361 ± 189	377 ± 185[c]	341 ± 210	258 ± 132[a]	338 ± 198[f]	357 ± 153	433 ± 245[d]	338 ± 149
	Relative (m·min^{-1})	22.9 ± 10.3	22.4 ± 9.2	25.8 ± 13.7	20.7 ± 11.4	23.1 ± 12.0	22.4 ± 9.3	23.6 ± 8.1	22.6 ± 10.9
HSR	Absolute (m)	427 ± 173	432 ± 170	410 ± 191	427 ± 166	474 ± 195	408 ± 146	407 ± 154	399 ± 181
	Relative (m·min^{-1})	28.1 ± 13.8	26.2 ± 10.9	32.7 ± 17.6	36.8 ± 22.5	33.8 ± 15.9	26.3 ± 13.0	24.2 ± 10.9	25.0 ± 10.7
SPR	Absolute (m)	32 ± 61	33 ± 63	31 ± 56	24 ± 36	39 ± 66	34 ± 57	27 ± 62	22 ± 56
	Relative (m·min^{-1})	1.9 ± 3.7	1.8 ± 3.7	2.3 ± 4.1	1.5 ± 1.8	2.4 ± 3.9	1.9 ± 3.6	1.6 ± 3.8	1.2 ± 3.1
PL	Absolute (AU)	159.79 ± 64.26	163.71 ± 60.38	145.80 ± 79.18	145.72 ± 61.96	158.82 ± 62.53	160.41 ± 70.92	167.85 ± 67.17	149.01 ± 52.6
	Relative (AU·min^{-1})	9.57 ± 1.85	9.37 ± 1.55	10.20 ± 2.10	10.08 ± 3.25	10.32 ± 2.14[f]	9.28 ± 1.44	9.04 ± 1.74[d]	9.29 ± 1.70
Peak Velocity	(m·s^{-1})	7.0 ± 0.5	7.0 ± 0.6	7.0 ± 0.4	7.0 ± 0.4	7.1 ± 0.5	7.1 ± 0.5	7.0 ± 0.7	6.8 ± 0.5
$_{ACC}$dist	High (m)	28 ± 15	29 ± 16	26 ± 15	27 ± 11	27 ± 14	28 ± 15	35 ± 18	25 ± 12
	Moderate (m)	43 ± 20	44 ± 19	38 ± 23	37 ± 16	41 ± 21	44 ± 19	48 ± 20	38 ± 17
$_{DEC}$dist	High (m)	10 ± 7	10 ± 7	9 ± 7	10 ± 8	10 ± 7	9 ± 7	10 ± 7	10 ± 7
	Moderate (m)	24 ± 14	24 ± 13	25 ± 18	22 ± 13	25 ± 14	26 ± 15	26 ± 14	19 ± 10
#$_{ACC}$	High (#)	13 ± 6	13 ± 7	11 ± 7	13 ± 5	12 ± 6[f]	12 ± 6	15 ±7[d]	12 ± 6
	Moderate (#)	15 ± 8	15 ± 8	13 ± 9	12 ± 7	14 ± 8	15 ± 8	17 ± 8	13 ± 7
#$_{DEC}$	High (#)	5 ± 4	5 ± 4	5 ± 4	5 ± 5	5 ± 4	5 ± 5	6 ± 4	6 ± 4
	Moderate (#)	12 ± 7	12 ± 7	12 ± 9	11 ± 7	12 ± 8	12 ±8	13 ± 7	9 ± 5
RHIEs	(#)	6 ± 4	6 ± 4[b]	5 ± 3[a]	5 ± 4	5 ± 3	6 ± 4	6 ± 4	5 ± 3

$_{ACC}$dist:: Acceleration distance, AU: Arbitrary units, $_{DEC}$dist: Deceleration distance, HSR: High-speed running, LSR: Low-speed running, MSR: Moderate-speed running, PL: Player Load, RHIEs: Repeated high-intensity efforts, SPR: Sprinting, TD: Total Distance, #$_{ACC}$: Number of accelerations, #$_{DEC}$: Number of decelerations, [a]: different from unused substitutes, [b]: different from 75:00+ min substitutes, [c]: different from 60:00-74:59 min substitutes, [d]: different from midfielders, [e]: different from attackers, [f]: different from defenders (a single letter indicates differences at the $p \leq 0.05$ level, whereas a double letter denotes differences at the $p < 0.001$ level).

Table 3: Descriptive statistics for substitutes' post-match top-up responses, with comparisons between different stages of the season and according to fixture density

Variable		**Stage of season**			**Fixture density**		
		Early	Mid	Late	Low	Moderate	High
Duration	(min)	19.48 ± 6.84 [b, c]	15.46 ± 9.05 [a]	16.43 ± 4.10 [a]	17.61 ± 5.1 [f]	15.21 ± 5.81 [ff]	20.83 ± 10.09 [d, ee]

TD	Absolute (m)	1878 ± 658 [b, c]	1573 ± 641 [a]	1631 ± 490 [a]	1883 ± 530 [e]	1557 ± 536 [d, f]	1857 ± 779 [e]
	Relative (m·min^{-1})	97.3 ± 12.6 [bb]	110.4 ± 22.3 [aa, c]	99.1 ± 15.4 [b]	108.2 ± 16.4 [ff]	105.7 ± 17.8 [f]	93.3 ± 18.4 [dd, e]
LSR	Absolute (m)	989 ± 523 [b]	807 ± 582 [a]	820 ± 291	1030 ± 498 [e]	751 ± 381 [d]	1027 ± 656
	Relative (m·min^{-1})	48.3 ± 12.4	51.7 ± 14.2	49.5 ± 11.5	56.2 ± 13.7 [ee, f]	48.6 ± 12.4 [dd]	48.5 ± 12.6 [d]
MSR	Absolute (m)	420 ± 234 [bb, c]	289 ± 100 [aa, c]	391 ± 190 [a, b]	387 ± 147	343 ± 175	381 ± 235
	Relative (m·min^{-1})	22.3 ± 9.5	22.8 ± 11.6	23.9 ± 9.4	22.8 ± 8.7	24.3 ± 10.8	19.9 ± 9.7
HSR	Absolute (m)	429 ± 157	442 ± 201	403 ± 145	419 ± 174	434 ± 162	419 ± 195
	Relative (m·min^{-1})	24.4 ± 12.6 [bb]	33.6 ± 16.1 [aa, c]	24.9 ± 7.8 [b]	26.0 ± 14.7 [e]	31.1 ± 13.2 [d, ff]	23.3 ± 12.9 [ee]
SPR	Absolute (m)	41 ± 70 [c]	34 ± 63	17 ± 35 [a]	47 ± 76	28 ± 59	29 ± 52
	Relative (m·min^{-1})	2.3 ± 4.0	2.2 ± 4.1	0.9 ± 1.9	3.1 ± 5.1 [e]	1.6 ± 3.3 [d]	1.6 ± 3.0
PL	Absolute (AU)	183.19 ± 69.15 [b, cc]	144.37 ± 64.56 [a]	148.85 ± 45.93 [aa]	181.26 ± 56.04 [e, ff]	143.56 ± 53.94 [d, f]	176.86 ± 79.94 [dd, e]
	Relative (AU·min^{-1})	9.42 ± 1.36 [b]	10.03 ± 2.13 [a, c]	9.09 ± 1.84 [b]	10.39 ± 2.01 [e]	9.68 ± 1.77 [d, f]	8.79 ± 1.63 [e]
Peak Velocity	(m·s^{-1})	7.1 ± 0.5	7.0 ± 0.6	6.9 ± 0.5	7.1 ± 0.5	7.0 ± 0.6	7.0 ± 0.6
$_{ACC}$dist	High (m)	33 ± 18 [b, c]	28 ± 14 [a]	23 ± 11 [a]	23 ± 14 [e, ff]	28 ± 12 [d, f]	34 ± 19 [dd, e]
	Moderate (m)	49 ± 22 [b, c]	39 ± 20 [a]	39 ± 14 [a]	37 ± 15 [ff]	41 ± 17 [f]	50 ± 26 [dd, e]
$_{DEC}$dist	High (m)	12 ± 8 [b]	8 ± 6 [a]	10 ± 6	5 ± 4 [ee, ff]	10 ± 6 [dd, f]	13 ± 9 [dd, e]
	Moderate (m)	26 ± 14	24 ± 15	23 ± 10	17 ± 8 [ee, ff]	24 ± 11 [dd, f]	31 ± 18 [dd, e]
#$_{ACC}$	High (#)	14 ± 7 [c]	12 ± 6	11 ± 5 [a]	10 ± 6 [e, ff]	12 ± 5 [d]	15 ± 8 [dd]
	Moderate (#)	17 ± 8 [bb, c]	13 ± 9 [aa]	13 ± 5 [a]	13 ± 6 [f]	14 ± 7 [f]	18 ± 10 [d, e]
#$_{DEC}$	High (#)	6 ± 5 [b]	4 ± 4 [a]	5 ± 3	3 ± 3 [ee, ff]	5 ± 4 [dd]	7 ± 5 [dd]
	Moderate (#)	13 ± 7 [c]	12 ± 8	10 ± 5 [a]	9 ± 5 [ff]	10 ± 5 [f]	15 ± 10 [dd, e]
RHIEs	(#)	7 ± 4 [bb, cc]	5 ± 4 [aa]	5 ± 2 [aa]	6 ± 2	5 ± 4	6 ± 5

$_{ACC}$dist:: Acceleration distance, AU: Arbitrary units, $_{DEC}$dist: Deceleration distance, HSR: High-speed running, LSR: Low-speed running, MSR: Moderate-speed running, PL: Player Load, RHIEs: Repeated high-intensity efforts, SPR: Sprinting, TD: Total Distance, #$_{ACC}$: Number of accelerations, #$_{DEC}$: Number of decelerations, [a]: different from early-season, [b]: different from mid-season, [c]: different from late-season, [d]: different from low fixture density, [e]: different from moderate fixture density, [f]: different from high fixture density (a single letter indicates differences at the $p \leq 0.05$ level, whereas a double letter denotes differences at the $p < 0.001$ level).

Table 4: Descriptive statistics for substitutes' post-match top-up responses, with comparisons between match location, result, and time of day

Variable		**Match location**		**Match result**			**Time of day**		
		Home	Away	Win	Draw	Loss	Afternoon	Early	Evening
Duration	(min)	18.99 ± 9.24 [bb]	15.14 ± 4.02 [aa]	17.56 ± 8.75	15.71 ± 5.19	17.25 ± 5.98	17.04 ± 7.54	15.32 ± 2.71	17.79 ± 7.59

TD	Absolute (m)	1859 ± 764 [bb]	1521 ± 357 [aa]	1708 ± 719	1658 ± 530	1697 ± 492	1699 ± 622	1594 ± 269	1693 ± 684
	Relative (m·min^{-1})	103.1 ± 20.5	102.6 ± 16.3	102.1 ± 19.9	107.2 ± 13.7	101.4 ± 18.6	103.8 ± 18.9	104.8 ± 12.2	98.5 ± 17.4
LSR	Absolute (m)	1002 ± 637 [bb]	738 ± 246 [aa]	854 ± 559 [d]	902 ± 498 [c]	893 ± 404	885 ± 504	677 ± 202	858 ± 543
	Relative (m·min^{-1})	50.4 ± 11. 8	49.5 ± 14.2	47.3 ± 12.4	55.2 ± 14.6	51.4 ± 11.8	51.3 ± 13.2 [h]	43.7 ± 7.0	44.8 ± 11.3 [f]
MSR	Absolute (m)	373 ± 225	348 ± 140	383 ± 222 [e]	379 ± 160	311 ± 123 [c]	379 ± 195 [h]	352 ± 108	282 ± 146 [f]
	Relative (m·min^{-1})	22.2 ± 11.3	23.6 ± 9.1	23.8 ± 11.0 [e]	24.2 ± 8.6	20.3 ± 9.6 [c]	23.8 ± 10.4 [h]	22.6 ± 3.3	18.8 ± 9.6 [f]
HSR	Absolute (m)	447 ± 179 [b]	406 ± 163 [a]	445 ± 187 [d]	363 ± 143 [c, e]	437 ± 156 [d]	410 ± 169 [h]	542 ± 113	487 ± 181 [f]
	Relative (m·min^{-1})	28.5 ± 15.2	27.7 ± 12.2	29.4 ± 14.1	26.5 ± 15.9	26.8 ± 11.7	27.1 ± 13.3	36.8 ± 11.9	31.5 ± 15.4
SPR	Absolute (m)	36 ± 66	28 ± 54	26 ± 53	14 ± 29 [e]	55 ± 80 [d]	25 ± 51 [h]	22 ± 17	66 ± 88 [f]
	Relative (m·min^{-1})	2.0 ± 3.7	1.8 ± 3.6	1.6 ± 3.3	1.3 ± 2.9 [e]	2.9 ± 4.4 [d]	1.6 ± 3.4 [h]	1.5 ± 1.3	3.3 ± 4.7 [f]
PL	Absolute (AU)	175.42 ± 78.48	141.83 ± 37.66	159.66 ± 72. 29	153.72 ± 56.21	161.82 ± 53.81	159.63 ± 64.18	149.97 ± 23.00	158.59 ± 69.99
	Relative (AU·min^{-1})	9.63 ± 2.10	9.52 ± 1.55	9.46 ± 1.92	9.82 ± 1.23	9.61 ± 2.06	9.65 ± 1.86	9.98 ± 1.86	9.16 ± 1.80
Peak Velocity	(m·s^{-1})	7.0 ± 0.5	7.0 ± 0.6	7.0 ± 0.5	7.0 ± 0.7	7.1 ± 0.6	6.9 ± 0.5 [h, g]	7.7 ± 1.4 [f]	7.2 ± 0.5 [f]
$_{ACC}$dist	High (m)	30 ± 17	27 ± 13	30 ± 17	26 ± 11	27 ± 14	28 ± 16	41 ± 7	28 ± 13
	Moderate (m)	45 ± 23	40 ± 16	46 ± 23 [e]	39 ± 14	39 ± 16 [c]	42 ± 20	55 ± 13	43 ± 19
$_{DEC}$dist	High (m)	10 ± 8	9 ± 7	11 ± 8 [e]	9 ± 5	8 ± 6 [c]	9 ± 8	12 ± 5	10 ± 5
	Moderate (m)	26 ± 16	23 ± 11	27 ± 16 [e]	23 ± 11	21 ± 11 [c]	24 ± 14 [g]	38 ± 8 [f]	24 ± 11
#$_{ACC}$	High (#)	13 ± 7	12 ± 6	13 ± 7	12 ± 5	12 ± 6	12 ± 7	18 ± 3	13 ± 6
	Moderate (#)	16 ± 9 [b]	13 ± 6 [a]	16 ± 9	14 ± 6	13 ± 7	15 ± 8	18 ± 6	15 ± 8
#$_{DEC}$	High (#)	6 ± 5	5 ± 3	6 ± 5 [e]	5 ± 3	4 ± 4 [c]	5 ± 4	5 ± 3	5 ± 4
	Moderate (#)	13 ± 8 [b]	10 ± 5 [a]	13 ± 8	11 ± 5	10 ± 6	12 ± 7	17 ± 3	11 ± 7
RHIEs	(#)	6 ± 4 [b]	5 ± 3 [a]	6 ± 4	5 ± 3	6 ± 3	5 ± 4	3 ± 1	7 ± 4

$_{ACC}$dist:: Acceleration distance, AU: Arbitrary units, $_{DEC}$dist: Deceleration distance, HSR: High-speed running, LSR: Low-speed running, MSR: Moderate-speed running, PL: Player Load, RHIEs: Repeated high-intensity efforts, SPR: Sprinting, TD: Total Distance, #$_{ACC}$: Number of accelerations, #$_{DEC}$: Number of decelerations, [a]: different from home matches, [b]: different from away matches, [c]: different from wins, [d]: different from draws, [e]: different from losses, [f]: different from afternoon matches, [g]: different from early matches, [h]: different from evening matches (a single letter indicates differences at the $p \leq 0.05$ level, whereas a double letter denotes differences at the $p < 0.001$ level).