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Warm-up strategies of professional soccer players: practitioners' perspectives

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Abstract

Recent research has challenged the typical pre-match and half-time (HT) interval warm-up (WU) routines currently used by professional soccer players. This study surveyed 2010/11 season WU strategies and their underpinning scientific reasoning and situational factors via an internet-based questionnaire, which was distributed to English Premier League and Championship practitioners, of which 43% responded. The pre-match WU duration was 30.8 (8.2) min, ranging between 15–45 min, and 89% of practitioners administered a WU of ≥ 25 min. Respondents also reported a 12.4 (3.8) min period between the end of the WU and match kick-off. Eighty-nine per cent recognised the physiological benefits of re-WUs during this “down-time” period, with 63% instructing players to engage in such activity. During HT, 58% instructed players to re-WU either on the pitch or within stadia facilities, but “unwillingness of the coach/manager” (42%) and a “lack of time” (63%) were major constraints. Practitioners reported that 2.6 (1.6) min might be available for HT re-WUs. Factors such as match regulations, league policy, and stadia facilities were not generally considered as major barriers to the delivery of WU and re-WU strategies. We suggest that researchers consider the time-demands and barriers faced by practitioners when developing experimental designs to examine WU regimens.

Keywords: survey, situational factors, current practice, theoretical reasoning

Introduction

In preparation for exercise performance the warm-up is ubiquitously employed by athletes and their coaches. The term “warm-up” is commonly used due to the temperature-dependent nature of many of the physiological responses that are considered to confer an enhancement in physical performance, such as an increased intra-muscular temperature, nerve conductance rate and metabolic reactions. However, increased blood-flow, oxygen consumption, and post-activation-potential are temperature-independent physiological benefits associated with preparation or athlete readiness for performance (see Bishop, 2003 for a review). Whilst the term “warm-up” is indicative of its physiological and physical benefits, preparatory activity of this nature is also considered to ready the athlete for the mental and technical rigours of performance, and also reduce the risk of injury.

It is this holistic approach to acute preparatory activity that may explain the discrepancy between physiologically-based research evidence, and applied practice in team sport scenarios. For example,

anecdotal evidence in soccer research suggests that players warm-up for between 25–40 min prior to match play (Mohr, Krstrup, Nybo, Nielsen, & Bangsbo, 2004; Zois, Bishop, Ball, & Aughey, 2011). Yet, such a prolonged warm-up routine has been shown to be non-beneficial (Zois et al., 2011), and may unnecessarily deplete energy reserves and elevate core body temperature (Gregson, Batterham, Drust, & Cable, 2005). Thus an enhanced understanding of the pre-match warm-up routines, together with the factors that underpin the warm-ups administered by practitioners at the professional level would be welcome.

Research has also challenged the typically passive half-time (HT) interval in soccer (Lovell, Midgley, Barrett, Carter, & Small, 2013b; Mohr et al., 2004; Weston, Batterham, et al., 2011). During this period muscle temperature has been shown to decrease by 1.5–2.0°C (Lovell et al., 2013b; Mohr et al., 2004), which may result in impaired muscular performance at the start of the second half. In support of this hypothesis, research studies administering active re-warm-ups in the latter 5–7 min of the HT interval

have attenuated the reduction in muscle temperature, and the associated decline in high-intensity tasks, such as sprinting, jumping and dynamic strength (Lovell et al., 2013b; Mohr et al., 2004). Whilst seemingly efficacious, it is presently unclear whether re-warm-ups are being administered in applied practice and what situational factors govern the HT routines of elite players and officials. For example, the English Premier League Pitch Protection Policy currently prohibits the use of the pitch by non-substitute players. Moreover, the HT interval is typically characterised by tactical and motivational exchanges between players and coaches, together with any necessary medical treatment, rehydration and general preparatory tasks. Therefore the scope in the elite environment for re-warming practices during the HT interval, together with its perceived value by sport-science and fitness practitioners, is unknown.

A number of studies have identified a decrement in the work-rate of players (Lovell, Barrett, Portas, & Weston, 2013a; Mohr, Krstrup, & Bangsbo, 2003; Weston, Batterham, et al., 2011), referees (Mallo, Navarro, Garcia Aranda, & Helsen, 2009; Weston, Batterham, et al., 2011) and assistant referees (Krustrup et al., 2009; Mohr et al., 2003) in the opening period of the second half in comparison to the corresponding period in the first half. The reasons postulated for this phenomenon are equivocal, but are suggested to be due to a combination of sub-optimal preparation as a consequence of a passive HT-interval (Lovell et al., 2013b; Lovell, Kirke, Siegler, McNaughton, & Greig, 2007; Mohr et al., 2004), a suppressed match-tempo (Weston, Batterham, et al., 2011), or a pacing strategy adopted by the players (Lovell et al., 2013a). Although researchers' hypotheses and empirical data have furthered our understanding of within-match trends, particularly in the opening phases of each half, a survey of practitioners' opinions may provide valuable insights in this regard.

Although some researchers have focused upon the inactive HT interval, there has been little consideration in the literature for the period between the completion of the pre-match warm-up and match kick-off. Researchers have employed 5-min (Mohr et al., 2004) or 10-min (Lovell et al., 2013b) "down-time" periods to represent typical pre-match routines, presumably based on anecdotal reports. However, Weston, Batterham, et al. (2011) reported that there was 16 min of relatively sedentary activity in Premier League referees between the completion of the pre-match warm-up and kick-off. Whilst there is no equivalent data available for players, the English Premier League Pitch Protection Policy (2011/12) stipulates that pre-match warming up "shall end no later than 10 minutes before the

kick-off" (The Football Association Premier League Limited, 2011, p. 138). If substantiated, this period of inactivity (or "down-time") might be equally sub-optimal preparation for the players. However, it is presently unclear what barriers practitioners face in ensuring optimal player readiness prior to match-play.

In summary, previous research methodologies examining the pre-match warm-up routines and HT interval strategies in elite soccer have relied on anecdotal reports. Research of this nature should be cognisant of current regimens and understand the situational factors that practitioners face when attempting to implement evidenced-based-practice. Therefore the primary aim of this study is to determine the current warm-up practices of players both pre-match and during the half-time interval. Furthermore, this study examines the perceived value, theoretical reasoning and situational factors that underpin these current practices, together with the factors that might explain player work-rate patterns at the start of each half. It is anticipated that this information would be valuable to guide: 1) ecologically valid research designs; 2) player/coach education; and 3) governing body policy relating to player preparation for match-play.

Methods

Forty-four fitness coaches and sport scientists from professional English football teams competing in the Premier League ($n = 20$) and Championship ($n = 24$) divisions were identified from an internet search. A letter of invitation and guidelines for the online survey (surveymonkey.com, California, Palo Alto, USA) were distributed electronically and via mail to each individual. The survey invitations were circulated one month after the commencement of the 2010/11 English football season, when we assumed that football coaching staff and players would undertake typical in-season pre-match and HT routines. An additional electronic reminder was sent to clubs that had not responded three months after initial contact. Forty-three per cent (10 Premier League, 9 Championship) of the teams invited, responded to the survey. Whilst we acknowledge that this response rate was low, we considered that the representativeness of the sample was more important than its size, given the challenges in accessing practitioners working in elite sports such as professional soccer.

Survey inclusion criteria required that the individual completing the survey was responsible for designing and/or administering first team warm-ups. If a more suitable candidate existed within the club, survey guidelines requested that it be completed by that individual. All information disclosed in the survey was to relate to current practice and

only one practitioner from each club was permitted to complete the survey. Estimated survey completion time was ≤ 15 min. The study received institutional ethical approval and all information disclosed remained anonymous.

Survey content

The survey contained 32 questions in the form of rank order, categorial or scaled item design. These included a series of multiple-choice questions that provided basic information to determine the respondents' eligibility for inclusion.

Current practice

Information regarding player pre-match warm-up (WU) routines was ascertained by requesting the respondent to estimate the typical time spent by players warming-up, and the subsequent period of "down-time" prior to kick-off. In addition, respondents were asked if they utilised pre-match "down-time" to complete player re-WU activity immediately prior to kick-off. With regard to HT routines, respondents were also asked to estimate the time taken for players to return to the changing rooms, and to detail the type and duration of activities undertaken by players during the HT interval. Respondents were also asked to estimate the potential time available for HT re-WU activity and whether they administered re-WU activities during this interval.

Underpinning theoretical and situational factors

The theoretical reasoning that underpinned practitioner WU routines was ascertained via rankings of perceived importance for the holistic benefits associated with a WU (1 = *most important* to 10 = *least important*). To avoid ambiguity or misinterpretation, a definition of terms (adapted from Bishop, 2003) was provided for this series of questions (see column 2 of Table I). To determine the situational factors that influence pre-match and HT preparatory routines, respondents were requested to rate the degree of significance ("not", "minor", "major" or "only" contributing factor) pertaining to each factor listed in the survey (i.e. facilities, league policy, time, motivation, etc.). The situational factors included in the survey were identified *a priori* using surveys and follow-up interviews from a pilot sample of the intended population.

Perceived value and determinants of player work rate

To determine the perceived value of pre-match and HT re-WU activities, respondents rated agreement to statements concerning player/staff motivation to

undertake these tasks (1 = *most important* to 10 = *least important* scale). Practitioners also rated the considered level of injury risk to players, and the determinants ("not", "minor", "major" or "only" contributing factor) of their physical work-rate during the initial stages of each half of match-play (0–15 and 46–60 min).

Data analysis

The present study is a descriptive cross-sectional survey design and, therefore, the analysis and presentation of data are predominantly descriptive. Some inferential statistics have been included where it was thought that these would make a notable improvement to the interpretation of the data. All statistical analyses were completed using PASW statistics 19 (SPSS Inc., Chicago, IL, USA). Normal distribution of data was assessed via quantile-quantile plots and box plots. Normally distributed data are presented as mean (s), and dependent-samples t-tests were used to compare mean differences between pre-match (PM) and HT. Data that were not normally distributed were presented as median interquartile range (IQR) and Wilcoxon signed ranks tests were used to compare median differences between PM and HT data. The two-tailed alpha level for all statistical tests was $P \leq 0.05$.

Results

Of the 19 respondents that completed the survey, 53% were employed by teams competing in the Premier League and 47% in the Championship. Respondent's roles included sport scientists ($n = 12$), fitness coaches ($n = 5$), physiotherapist ($n = 1$) and football coach ($n = 1$).

Current practice

The mean (s) pre-match WU duration was 30.8 (8.2) min, ranging between 15–45 min, of which 89% of practitioners administered a WU of ≥ 25 min. Practitioners reported a 12.4 (3.8) min "down-time" between the end of the pre-match WU and start of the match, and 63% of respondents instructed players to engage in re-warming activities during this time.

At HT, players arrived in the dressing rooms 1.7 (0.2) min after the start of the HT interval, creating an estimated player "down-time" period of ~ 13.3 min for player HT activities. Given the variable and over-lapping nature of HT activities, respondents reported that 2.6 (1.6) min might be available for HT re-WU's (Figure 1), and 58% administered re-WU activities either on the pitch or within stadia facilities.

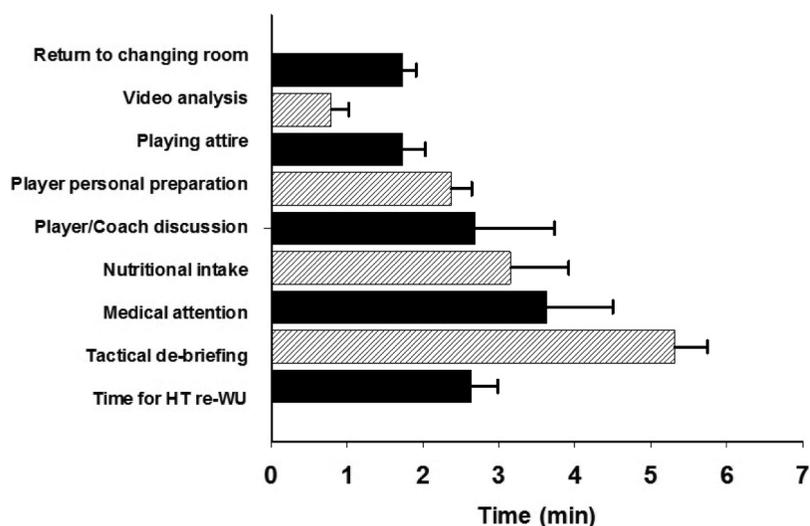


Figure 1. Mean (s) time spent by players undertaking typical half-time activities during a competitive domestic match. Half-time (HT) activities were variable and over-lapping in nature and therefore have a cumulative sum greater than the standard 15-min half-time interval. re-WU: re-warm-up.

Underpinning theoretical and situational factors

Respondents perceived “increased blood flow to muscles” and “muscle temperature increase” as the “most important” responses to a pre-match WU (Table I), whereas “technical readiness” and “arousal” were considered the least important. Eighty-nine per cent of practitioners acknowledged the physiological benefits of a secondary WU during the pre-match “downtime”. However, “lack of time” (64%) and “unwillingness of the coach/manager” (58%), were reported as the major situational barriers for undertaking such routines (Table II). Forty-nine per cent of practitioners considered that “the players are already physically prepared” prior to match kick-off and 48% reported that “the players autonomously perform their own activities” during the pre-match “down-time” period.

“Mental readiness” and “muscle temperature increase” were perceived as the “most important” re-WU benefits at HT (Table I), with “technical readiness” and “elevation of baseline oxygen” deemed the “least important”. Seventy-nine per cent of respondents acknowledged the physiological benefits of a HT re-WU (Table II). Situational factors perceived as major barriers to HT re-WU exercises included “lack of time” (63%), “unwillingness of the coach/manager” (42%), and “interferes with players psychological preparation” (42%). Forty-two per cent indicated that “the players autonomously perform their own activities” during the HT interval.

Perceived value and determinants of player work rate

Practitioners deemed that both players ($Z = 3.2$; $P = 0.002$) and coaches ($Z = 2.4$; $P = 0.018$) were less

motivated to complete re-warming procedures at HT in comparison to during the pre-match “down-time”. The starting players were considered less prepared to avoid risk of injury in the second half compared to the first half ($Z = 2.4$; $P = 0.019$; Figure 2).

Respondents identified “establish match tempo” (90%), “pressurise opponents” (84%) and “tactical strategy” (84%) as major contributory factors to player physical work-rate in the initial stages of the first half of match-play (0–15 min). Whereas in the corresponding period of the second half “establish match tempo” (85%), “assert superiority” (84%) and “tactical strategy” (79%) were considered as the major determinants of work-rate (Table III). Twenty-one per cent of practitioners considered “avoid player fatigue in the latter stages of the game” to be a “major” or the “only” contributory factor of player work-rate at the start of the second half, whereas “incomplete physical preparation” was not considered a work-rate determinant in the opening 15 min of either half.

Discussion

The aim of this study was to determine the current warm-up practices of elite-level soccer players both prior to and at the half-time interval of competitive match-play fixtures. Furthermore, we aimed to identify the situational factors and theoretical rationale that influence and underpin the acute preparatory strategies in applied practice.

Estimated typical pre-match WUs for domestic competitive league matches ranged between 15–45 min in duration, with a mean of 30.8 (8.2) min. We

Table 1. The mean (s) practitioner ranking (1 = *most important* scale) of the warm-up benefits during the pre-match (PM) and half-time (HT) routines of a competitive domestic match ($n = 19$).

WU Benefit	Definition	Mean Rank	
		Pre-Match	Half-time
Increased blood flow to muscles	An increase in blood flow to muscles to improve the delivery of metabolic fuels to the active muscle.	3.52 (0.56)	5.52 (0.55)
Muscle temperature increase	The increase of temperature inside the active muscle(s)	4.26 (0.84)	4.31 (0.70)
Increased nerve conduction rate	Improves central nervous system functions and increases the transmission speed of nervous impulses.	5.21 (0.50)	5.63 (0.60)
Elevation of baseline oxygen consumption	Elevated baseline oxygen consumption allows initial work to be completed aerobically, leaving more of the anaerobic capacity for later in the task.	5.63 (0.50)	6.52 (0.46)
Decreased muscle and joint resistance	A decrease in the viscous resistance of muscles and joints.	5.63 (0.55)	5.47 (0.57)
Speeding of metabolic reactions	The acceleration of metabolic substance breakdown and regeneration in humans when exercising.	5.63 (0.47)	5.26 (0.55)
Mental readiness	An appropriate level of player concentration and focus to achieve an ideal performance state.	5.73 (0.73)	4.57 (0.79)
Post Activation Potentiation	A transient increase in muscle contractile performance subsequent to an acute prior contractile activity.	5.78 (0.79)	5.89 (0.70)
Arousal	The state of general preparedness of the body (as a whole) for action.	6.47 (0.67)	5.05 (0.65)
Technical readiness	An appropriate level of technical preparation obtained through the use of performance rehearsal.	7.10 (0.57)	7.36 (0.70)

Table II. Situational factors that may restrict practitioners from delivering re-warming strategies, either after the pre-match warm-up (WU), or at half-time (HT) of a competitive domestic match. Data are reported as the cumulative percentage (%) of “only” and “major” contributory factors as reported by practitioners.

Situational factor	Pre-match re-WU	HT re-WU
Little physiological benefit	11%	21%
Interferes with players psychological preparation	26%	42%
Interferes with players tactical preparation	32%	32%
Interferes with players attire preparation	26%	26%
Lack of time	64%	63%
Unwillingness of the coach/manager	58%	42%
Dressing rooms too small (Home)	11%	11%
Dressing rooms too small (Away)	32%	26%
Lack of stadia facilities (Home)	5%	5%
Lack of stadia facilities (Away)	16%	26%
Lack of club facilities (i.e. ergometers)	26%	26%
The players are already physically prepared	49%	31%
Avoid player fatigue in the latter stages of the match	5%	11%
League policy (pitch protection)	22%	11%
Match official instructions	26%	26%
Media regulations	11%	11%
The players autonomously perform their own activities	48%	42%
Inhibits nutritional strategies (sports drinks etc.)	11%	11%

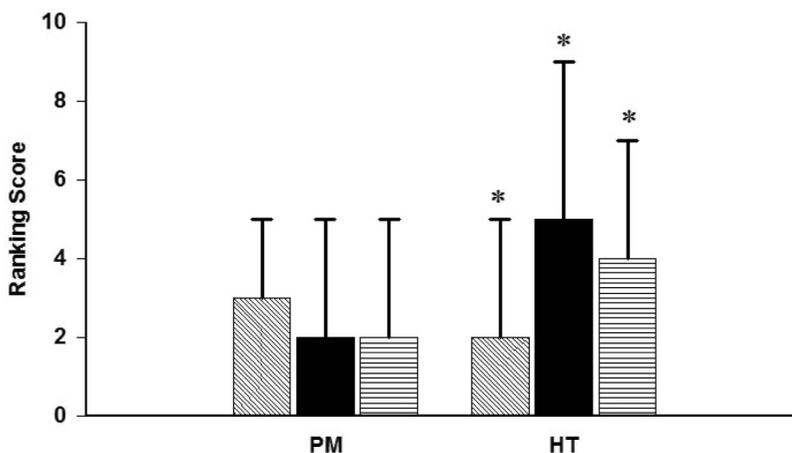


Figure 2. Median ranking score (1= most important to 10 = least important scale) and interquartile range of practitioner agreement with statements concerning player/staff motivation and player injury risk subsequent to the pre-match (PM) and half-time (HT) preparatory periods. ▨ = “I feel that the players are mentally motivated to complete warm-up exercises prior to...” ■ = “I feel that the coaching staff are motivated to ensure that players complete warm-up exercises prior to...” ▨ = “I feel that the playing 11 are sufficiently warmed to avoid risk of injury prior to...” * Denotes statistically significant.

Table III. Perceived importance of determinants of player physical work-rates during the initial stages of the first half (0–15 min) and second half (46–60 min) of competitive match-play. Data are reported as the cumulative percentage (%) of “only” and “major” contributory factors as reported by practitioners.

Work-rate Determinant	0–15 min	46–60 min
Pressurise opponents	84%	63%
Establish match tempo	90%	85%
Anxiety	21%	5%
Avoid player fatigue in the latter stages of the game	5%	21%
Assert superiority	79%	84%
Incomplete physical preparation (i.e. warm-up)	5%	5%
Tactical strategy	84%	79%
Motivational instruction	58%	74%
Arousal	47%	63%

also observed that 89% of practitioners administered WUs that were greater than or equal to 25 min. During this preparatory activity the main physiological mechanisms targeted by practitioners included an increase in intra-muscular temperature and blood-flow. However, the time-course of both of these physiological responses is within 6–10 min of the onset of steady-state moderate intensity exercise (Barcroft & Dornhorst, 1949; Bishop, 2003). Moreover, recent evidence has shown that a traditional 23 min team-sport WU incorporating repeated bursts of high-intensity activities was actually detrimental to relevant performance attributes when compared to baseline (resting) measures (Zois et al., 2011). It was suggested that the repeated high-intensity nature of team-sports WUs might induce a degree of fatigue (Zois et al., 2011), and prolonged WUs might also incur unnecessary thermoregulatory strain and depletion of energy stores (Gregson et al., 2005). We reckoned that this dichotomy between research and applied practice would be reflective of other non-physiological benefits associated with a WU, however, “technical readiness”, “mental readiness”, and “arousal” were among practitioners’ lowest perceived WU benefits. This may be indicative of the roles and responsibilities of the practitioners surveyed in our study, or alternatively, is reflective of the historical practices or preferences of players and/or coaches.

The “Pitch Protection” policy of the 2010/11 Premier League Handbook states that “warming up by either team shall not last for more than 30 minutes” (The Football Association Premier League Limited, 2010, p. 138). However, in this study practitioners reported that “league policy” and “media regulations” had little impact on their decision making when developing and administering pre-match routines, and this is supported by the observation that 32% of Premier-League WU administrators exceed the WU time-allocation. The 2011/12 Premier League policy also dictates that pre-match WUs should end no later than 10 min before kick-off. Football League regulations that govern Championship League fixtures do not stipulate a pre-match cut-off for preparatory activities. Warm-up administrators reported an average 12.4 (3.8) min “down-time” period between the end of the WU and match kick-off, and this was not different between leagues ($T = -0.4$; $P = 0.707$). This finding supports the data presented by Weston, Batterham, et al. (2011) that reported a 16 min pre-match “down-time” period in Premier League referees. These authors suggested that such a prolonged sedentary period after the WU might negate many of the temperature and non-temperature related physiological benefits associated with WUs. Indeed, Galazoulas, Tzimou,

Karamousalidis, and Mougios (2012) have recently observed a rapid decline in sprinting (5%) and jumping (13%) performance when team-sports players had a 10-min passive rest interval after a typical WU. In this survey, 89% of practitioners acknowledged the physiological benefits of a re-warm-up before kick-off and 63% instructed and/or administered this type of routine, whereas 48% also reported that the players engage in such tasks autonomously. Time pressures and coach reluctance were the major barriers to pre-match re-warm-ups, whereas facilities and policy/regulations were not recognised as constraining factors. Hence, the data collected from the current study imply that practitioners are largely aware of the potential performance decrements following sustained periods of player “downtime” prior to match kick-off.

The typically passive HT rest interval has also been questioned in the research literature (Lovell et al., 2013b; Mohr et al., 2004; Weston, Batterham, et al., 2011), and has been suggested to contribute to the reduced player-work rate denoted in the opening period of the second half of competitive match-play (Lovell et al., 2013a; Mohr et al., 2003; Weston, Batterham, et al., 2011). In this study we surveyed what practitioners considered to be the determining factors of player work-rate during this period. In contrast to previous hypotheses in the research domain (Lovell et al., 2013a; Lovell et al., 2013b; Mohr et al., 2004), pacing-strategies and incomplete physical preparation were not perceived by practitioners to be influential, rather, tactical factors were judged as the most relevant determinants. Alternatively, it has been suggested that the reduced player work-rate after HT might be considered a statistical artefact as the opening period of match play may not be an appropriate reference point for within-match analysis (Lovell et al., 2013a). Researchers have considered this period of play as frantic in nature, where the tempo is at its most intense (Carling, Bloomfield, Nelsen, & Reilly, 2008; Weston, Drust, & Gregson, 2011). In this survey, 79–90% of practitioners judged the major determinants of the 0–15 min work-rate to be “establish match-tempo”, “assert superiority”, “tactical strategy”, and “pressurise opponents”.

Whilst the underpinnings of the reduced work-rate after the HT interval are not yet established, evidence suggests a passive HT is detrimental to the performance capacities of players (Lovell et al., 2007; Lovell et al., 2013b; Mohr et al., 2004). Players may also be at a heightened risk of musculo-skeletal injury after a passive HT period (Lovell et al., 2013b), and practitioners also demonstrated concerns in this regard. The majority acknowledged the physiological benefits of a HT re-warm-up, with 58% administering this strategy.

The maintenance of muscle temperature was again considered the major benefit of a HT re-warm-up, which is in agreement with the primary mechanism examined in the research literature (Lovell et al., 2013b; Mohr et al., 2004). It is unclear as to whether practitioners have formed this opinion based on this previous research, or based on their own theoretical knowledge. Interestingly, many practitioners considered that a HT re-warm-up might enhance players' concentration and focus for performance, yet, to our knowledge, this has not been empirically determined. It is also presently unclear whether half-time strategies impact on technical performance, but practitioners did not consider HT re-warm-ups to provide a benefit in this regard. Nonetheless, future research may be warranted to determine the impact of half-time strategies upon mental and technical readiness in players.

The results of the survey confirmed that practitioners have little time (~3 min) to administer re-warm-ups during the HT interval. Thus, the 5–7 min re-warm-up strategies used in previous research studies (Lovell et al., 2007; Lovell et al., 2013b; Mohr et al., 2004) may not be appropriate in professional match-play settings. Steady-state moderate intensity exercise increases muscle temperature at a rate of $0.15\text{--}0.38^{\circ}\text{C} \cdot \text{min}^{-1}$ (Cochrane, Stannard, Sargeant, & Rittweger, 2008; Gray & Nimmo, 2001; Yaicharoen, Wallman, Morton, & Bishop, 2012), hence within 3 min practitioners may expect to off-set the $1.5\text{--}2.0^{\circ}\text{C}$ muscle temperature decline at HT, by $\sim 0.5\text{--}1.0^{\circ}\text{C}$. Attenuating the HT-associated decline in muscle temperature to this degree has been shown to be beneficial in the performance of soccer-specific high-intensity tasks (Lovell et al., 2013b; Mohr et al., 2004). Thereby from a physiological perspective we would recommend that the 3-min window of opportunity to re-warm players during HT be used to improve player readiness for the second half.

The results of this survey indicated that players and coaches were less motivated to perform re-warming tasks during the HT break, in comparison to pre-match. Furthermore, on-pitch activities appear in contradiction to the "Pitch Protection" policy of the Premier League 2010/2011 Handbook, which confers that "only substitute players who have then not played in the match may warm up at half time" (The Football Association Premier League Limited, 2010, p. 138). To our knowledge, the English Football League does not administer this rule, and the practitioners audited in this study did not consider policy or regulations to inhibit their endeavours to maintain match-readiness at HT. Nonetheless, based on the current data we recommend that HT "on-pitch" activity be permitted universally by associated governing bodies. This is particularly relevant to lower-league practitioners who might be expected to have

fewer resources available within dressing rooms and stadia for acute player preparation. Twenty-six per cent of the practitioners surveyed also reported the lack of facilities and space available in "away" stadia as a major barrier to the administration of HT re-warming strategies. Therefore universal permission to use the playing surface at HT might encourage practitioners to undertake re-warming strategies on a routine basis.

We recognise that the present study is a descriptive cross-sectional survey design and is limited to its aims of determining the practices and perceptions of elite-level soccer practitioners. Although the current sample size was relatively low, this was not unexpected given the challenges in accessing professionals working in high-level sports, together with their competitive nature and the potential reluctance to share current practice. Due to the sampling and non-response biases, we generally did not attempt to make statistical inferences from the studied sample to the population, unless we considered it to facilitate the interpretation. However, we considered that the representativeness of the current sample, coupled with the high precision and negligible researcher bias features of closed-question surveys, provided valuable and reliable information pertaining to current practice in applied settings.

Conclusion

We suggest that researchers consider the time-demands and situational factors experienced by practitioners when developing research designs and testing acute preparation interventions. Furthermore, research is necessary to investigate the optimal intensity and modes of exercise within a short time-frame (~3 min) during HT to attenuate any physiological decrements associated with player "downtime". Educating players and coaches about the detrimental effects of the prolonged "down-time" periods may improve re-warm-up compliance and optimise players' physical performances at the start of each half. It is strongly recommended that a revised and universal policy for pre-match and half-time pitch use is considered to enhance the preparation of players for performance and to reduce the risk of injury.

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