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Title: Impact of COVID-19 lockdown on professional soccer players' match physical activities

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Abstract

The COVID-19 pandemic forced the 2019-20 Italian Serie A competition to stop and players went into lockdown. During lockdown, players only trained at home, likely having a detrimental effect on players' physical fitness and capacity. This study investigated the effect of the COVID-19 lockdown on professional soccer players' match physical activities. Match activities of 265 male professional soccer players were assessed in two periods prior to (PRE1 and PRE2) and one period following the lockdown (POST) using a video tracking system. Linear mixed models were used to examine differences between-periods in total (TD), very high-speed (VHS), sprint (SPR), high-acceleration (ACC) and high-deceleration (DEC) distances, considering full match data and data from six 15-min intervals. TD and VHS during POST were lower than the two other competitive periods ($p<0.001$, *d* small-moderate). SPR did not show differences between periods ($p>0.636$). ACC and DEC during POST were lower than PRE2 ($p<0.015$, *d* small). Declines in most 15-min intervals after lockdown were observed in TD and VHS. There were small differences in the temporal distribution of SPR, ACC and DEC at POST. After the COVID-19 lockdown, soccer players' higher-intensity running activities were similar to those of games played before the lockdown, but TD and VHS decreased, both considering the entire match and 15-min intervals. The temporal distribution of running activities was mostly stable throughout the season.

Keywords: COVID-19 lockdown, Serie A, match running activities

Introduction

Soccer is a team sport that requires prolonged intermittent activity and is characterized by demanding activities such as high intensity running, accelerations and decelerations, sprints, tackles, direction changes and vertical jumps[1]. Semi-automatic video tracking systems are often used in professional soccer matches to quantify physical activities performed during games with a high reliability when measuring soccer specific metrics[2]. It has been reported that players typically cover 9-12 km during matches, of which ~ 900–1000 m at very high-speed (>20 $km \cdot h^{-1}$) and ~350 m with high acceleration/deceleration phases (> 3 $m \cdot s^{-2}$)[3-5]. In addition to monitoring entire matches, quantifying the running activities over shorter intervals (e.g., 15 minutes) has also been shown to inform our understanding of temporal changes within the match. For example, a decrease in distances run at very high-speed or with high acceleration and deceleration was observed between the first and final 15 minutes intervals of a match, suggesting a detrimental effect of fatigue[6-8]. However, it has been hypothesized that the reduction in distances covered during the final 15 minutes of matches should be attributed to players pacing strategies, adopted to preserve their physical readiness for when the game demands increase, rather than to a fatigue effect alone[9]. Aside from fatigue and pacing strategies, match running activities may also be influenced by physical fitness of players[10-13] and by several contextual factors such as playing position[14], match location[15], teams' level[16], score line[17], recovery between consecutive matches[18] and ambient conditions[19, 20].

Unimaginably, as a consequence of the COVID-19 pandemic, the 2019-2020 Italian Serie A was stopped after two-thirds of the official season had been completed. During this period, all professional soccer players followed government directives and were sent to mandatory home-isolation. During this period, players performed individual home-based training sessions prescribed by team's coaches. However, due to the likely inadequacy of the physical training stimuli during home isolation (i.e., absence of official matches, soccer-based specific activities, contact with team-mates, training equipment and space limitations), it was hypothesized that players detrained during this period[21-23]. There have been reported reductions in intermittent running and neuromuscular capacities after the COVID-19 quarantine[24-27].

Following the lockdown, after seven weeks of training without official matches, Serie A resumed. Teams were required to complete a higher frequency of games each week so that the remaining championship matches could be completed in a timely manner. Although some authors have failed to observe an effect of a congested fixture on match running activities in soccer[28], it has been suggested that playing with a high frequency may impair physical activities during games[18]. It has been previously showed that a full recovery of the neuromuscular function occurs at least 48 hours after a soccer match in professional players[29]. Other have reported reduced physical fitness, greater psychological disturbances, altered haematological parameters (reduced blood concentrations of erythrocytes and haemoglobin and a decreased haematocrit) and altered hormonal state (reduced blood concentration of testosterone and reduced testosterone-cortisol ratio) after a period of congested match play in professional soccer players that may have an impact on match physical activities[30, 31]. Moreover, it is not yet well understood whether playing very frequently and carrying out training sessions in between may further exacerbate match-induced fatigue. We hypothesize that the likely reduced physical fitness and altered haematological parameters and hormonal state, along with the possible effect of a congested match fixture may have impacted the match-related running activities of soccer players after the lockdown. However, to the author’s knowledge, while some authors already offered some insights on the effect of COVID-19 lockdown on players’ physical fitness, its impact on match-related running activities in professional soccer is yet to be investigated. Understanding the effect of lockdown on match running activities both considering the entire match and 15-minutes intervals may help coaches and practitioners in managing the effort and the substitutions within the match. It may also allow to prescribe recovery during congested match fixture as well as to prescribe training load to better prepare players to sustain match demands. Thus, the aim of this study was to investigate the effect of COVID-19 lockdown on match-related running activities (i.e., total distance, distances run at very high-speed and in acceleration/deceleration) in professional soccer players, comparing data from matches played prior to and following lockdown. We hypothesized a reduction of running distances in both total match and 15-min intervals following the lockdown, with a similar distribution of the physical activity within the match.

Materials and Methods

Experimental approach to the problem

An observational case series study design was used to compare match physical activities of Italian professional soccer players performed during three different periods of the 2019-20 season, two prior and one following the COVID-19 lockdown. The design of study is shown in Figure 1. In Italy, the lockdown lasted from the 9th March to the 3rd May 2020 and during this period players could only train at home. Following the COVID-19 lockdown, players performed seven weeks of training without official matches. The Italian Serie A championship resumed the 22nd June 2020. Based on the interruption, the season was split into three periods: first competitive period before the COVID-19 lockdown (PRE1), from late August to early December 2019; second competitive period before the COVID-19 lockdown (PRE2), from early December 2019 to early March 2020; post COVID-19 lockdown period (POST), from late June to early August 2020. PRE1 lasted 12 weeks, during which teams performed ~65 training sessions and played 12 official matches (5.4 training sessions and 1.0 match per week). PRE2 lasted 17 weeks, during which teams performed ~90 training sessions and played 13 official matches (5.3 training sessions and 0.8 match per week). POST lasted only 7 weeks, during which teams performed ~30 training sessions and played 13 official matches (4.3 training sessions and 1.9 matches per week).

----Please insert Figure 1 about here----

Subjects

265 male professional players from 20 Italian Serie A soccer teams participated in this study (27.2 ± 4.1 years, 183.0 ± 6.1 cm, 76.5 ± 6.1 kg, professional experience: 9.2 ± 4.1 years). Each player included in the study played at least one entire match (range 1-29) during at least one of the periods of the season considered. Players involved were 35 central attackers, 75 central defenders, 80 central midfielders, 54 fullbacks and 21 wings. Data derived from routinely measured player activities during matches over the course of the competitive season, so no informed consent was required[32]. This study was approved by an Independent Institutional Review Board of and was performed according to ethical guidelines outlined in the Declaration of Helsinki.

Procedures

Objective measures of match physical activities were systematically collected during each match played by two reference teams and their opponent during the entire 2019-20 Italian Serie A season. Data was collected from 20 teams and 38 match days were monitored. Each match was monitored using a video tracking system (Stats Perform, Chicago USA). The reliability of video tracking systems (CV 0.2%-1.3%; ICC 0.99) has been previously reported[33, 34]. Full match data were used to investigate differences in overall match physical activity between the three different periods. Match data were also divided in six match intervals of 15 minutes (from the beginning of the match to minute 15, from minute 15 to 30, from minute 30 to 45, from minute 45 to 60, from minute 60 to 75 and from minute 75 to 90) to investigate the distribution of physical activity during different phases of the match. Match physical activities were expressed relative to the duration of the full match or to the duration of each match interval (15 minutes). Goalkeepers were excluded and extra time was not considered for the analysis. To avoid potential confounding effect of players involved in a small portion of the match, only data from players playing the entire match were considered for the analysis with a total of 929 complete individual match files retrieved. Players were divided in five tactical roles (central and wide defenders, central and wide midfielders, attackers), as previously done in soccer studies[35]. Of the many match physical activity variables used in previous studies[36], we selected for the analysis the variables that we believe relevant in match monitoring in professional soccer: total distance (TD, $m \cdot min^{-1}$), very high-speed distance (distance covered above 20 $km \cdot h^{-1}$, VHS, $m \cdot min^{-1}$), sprint (distance run above 25 $km \cdot h^{-1}$, SPR, $m \cdot min^{-1}$), high-acceleration distance (distance covered with acceleration above 3 $m \cdot s^{-2}$, ACC, $m \cdot min^{-1}$) and high-deceleration distance (distance covered with deceleration below -3 $m \cdot s^{-2}$, DEC, $m \cdot min^{-1}$).

Statistical analysis

Before running linear mixed effect models, boxplots and histograms were checked to determine potentially influential data points. Then, residual plots were visually inspected to determine deviations from homoscedasticity or normality. Two different groups of linear mixed models were constructed to examine: (1) between-period differences in physical match activities performed during the entire match (PRE1 vs PRE2 vs POST) and (2) between-period differences in physical match activities performed during different match intervals. In the first analysis, the interaction between each period of the season (three levels: PRE1, PRE2 and POST) and the tactical role was included as a fixed effect in the model, while in the second analysis the interaction between each match interval and the period of the season (six 15-minutes bouts of match play in PRE1, PRE2 and POST) was included as a fixed effect. In both analyses each player and each team were included as random effects, to allow the intercept to vary. To control for match contextual variables, match location, opponent rank and the tactical role of each player (only in the second analysis) were included as fixed effects. ‘Step-up’ model construction strategies were employed, similar to those used in previous team sport studies[37]. Each process began with an unconditional model containing only a fixed intercept and the random factors. The model was then implemented by adding each fixed effect. The Akaike information criterion (AIC) and degrees of freedom for each model were visually compared with the previous model, in which a lower AIC represented a better model fit. For the first and second analysis, the best fit for the data was found by including all fixed effects (e.g., interaction between period and tole or interaction between match intervals and period of the season, along with match location, opponent rank and tactical role). An Analysis of Variance (ANOVA) was performed on models built for the first analysis to investigate the main effect of the interaction between period of the season and tactical role, while an ANOVA was performed on models built for the second analysis to investigate the main effect of the interaction between match intervals and period of the season. Significant interactions or main effects were followed up using simple main effect analyses with pairwise comparisons using Tukey’s post-hoc test. The t statistics from the mixed model were converted into Cohen’s *d* effect sizes and associated 95% confidence intervals (CI). Effects sizes were interpreted as follows: ≤0.2 trivial, >0.2-0.6 small, >0.6-1.2 moderate, >1.2-2.0 large, >2.0-4.0 very large and >4.0 extremely large[38]. Intraclass correlation coefficient (ICC) for each random effect was calculated using the variance of the random effect divided by the sum of the variance for the two random effects (i.e. player and team) and the residual to determine the variability in the model for any player or team in comparison to the variability in the intercepts across the population[39]. Statistical significance was set at P≤0.05. All statistical analyses were conducted using the *lme4*, *lmerTest*, *lsmean*s and *compute.es* packages in R statistical software (version 3.6.3) (R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. 2019).

Results

The interaction between period of the season and tactical roles was not statistically significant for any variable considered (p>0.066). Differences in total distance, very high-speed distance and sprinting distance between PRE1, PRE2 and POST are shown in Figures 2 and 3.

----Please insert Figure 2 and Figure 3 about here----

TD during POST was lower than both PRE1 (-3.2 ± 22.2 $m \cdot min^{-1}$, p<0.001, *d* = -0.58 [-0.74 to -0.41]) and PRE2 (-5.4 ± 22.3 $m \cdot min^{-1}$, p<0.001, *d* = -1.01 [-1.18 to -0.84]). Additionally, TD during PRE2 was higher than PRE1 (p<0.001, *d* = 0.41 [0.25 to 0.46]). VHS during POST was lower compared to both PRE1 (-0.8 ± 6.9 $m \cdot min^{-1}$, p<0.001, *d* = -0.41 [-0.57 to -0.24]) and PRE2 (-1.0 ± 6.9 $m \cdot min^{-1}$, p<0.001, *d* = -0.53 [-0.69 to -0.36]). There were no statistically significant differences in SPR between the three periods. ACC during PRE2 was higher than both PRE1 (0.12 ± 1.46 $m \cdot min^{-1}$, p = 0.003, *d* = 0.26 [0.10 to 0.41]) and POST (0.11 ± 1.38 $m \cdot min^{-1}$, p = 0.010, *d* = 0.24 [0.08 to 0.40]). DEC during POST was lower than PRE2 (-0.12 ± 1.46 $m \cdot min^{-1}$, p = 0.014, *d* = -0.23 [-0.39 to -0.07]). Furthermore, random effects' ICC showed low values (<0.5) in all the models, with ICC for individual player higher than ICC for each team.

Differences in total distance, very high-speed distance and sprinting distance between PRE1, PRE2 and POST during 15-min match intervals are shown in Figures 3, 4 and 5. TD during each match interval in POST was lower compared to each corresponding match interval in PRE1 (p range = 0.001 to 0.023, *d* range = -0.31 to -0.98) and PRE2 (p<0.001, *d* range = -0.38 to -1.02), except for the last phase of the match, where there were no differences between POST and PRE2. Furthermore, TD during the first and the third match intervals were lower in PRE1 compared to PRE2 (p<0.01, *d* = -0.32 and -0.84).

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VHS during the second match interval was lower in POST compared to both PRE1 (p<0.001, *d* = -0.48 [-0.65 to -0.32]) and PRE2 (p<0.001, *d* = -0.44 [-0.61 to -0.28]). VHS during the third match interval was higher during PRE2 compared to PRE1 (p<0.001, *d* = 0.57 [0.42 to 0.73]) and POST (p = 0.002, *d* = 0.35 [0.19 to 0.52]). During the fourth match interval, VHS was lower in POST compared to PRE1 (p<0.001, *d* = -0.42 [-0.58 to -0.26]) and PRE2 (p<0.001, *d* = -0.44 [-0.61 to -0.28]). During the fifth match interval, a statistically significant difference in VHS was found between POST and PRE2 (p = 0.001, *d* = -0.37 [-0.53 to -0.21]).

There were statistically significant differences observed in sprinting distance between POST and PRE2 during the first match interval (POST higher than PRE2, p = 0.002, *d* = 0.36 [0.20 to 0.52]), between PRE1 and PRE2 during the third interval (PRE2 higher than PRE1, p = 0.011, *d* = 0.26 [0.17 to 0.49]) and between POST and PRE2 during the fourth match interval (POST lower than PRE2, p = 0.008, *d* = -0.33 [-0.49 to -0.17]).

Differences in acceleration distance were only observed between POST and PRE1 during the first match interval (POST lower than PRE1, p = 0.011, *d* = -0.32 [-0.48 to -0.16]) and during the fourth match interval between PRE2 and both PRE1 (PRE2 higher than PRE1, p = 0.032, *d* = 0.28 [0.13 to 0.44]) and POST (PRE2 higher than POST, p = 0.002, *d* = 0.36 [0.20 to 0.52]). Deceleration distance was lower during the fourth match interval in POST compared to PRE2 (p = 0.012, *d* = -0.32 [-0.48 to -0.16]).

Random effects' ICC showed low values (<0.5) in all the models, with ICC for individual player higher than ICC for each team.

Discussion

The present study investigated the effect of COVID-19 lockdown on match-related running activities in professional soccer players, comparing data from matches played prior to and following lockdown. The present findings show that match total distance was moderately reduced after COVID-19 lockdown, while very high-speed distance showed small reductions compared to the two other competitive periods. On the other hand after the lockdown sprinting, acceleration and deceleration distances did not show changes or showed small differences compared to only the second competitive period,. Additionally, when considering 15-min intervals the largest differences between PRE and POST were found in total and very high-speed distances with small and often non statistically significant differences in SPR, ACC and DEC.

Both the TD and VHS levels observed during matches during the two competitive periods before the lockdown in the present investigation were similar to those previously reported in professional soccer players[5, 40, 41 42] (~115 $m \cdot min^{-1}$ of TD and ~10 $m \cdot min^{-1}$ of VHS). However, it is important to note that not all of these investigations employed the same methods and instruments for monitoring match running performance. However, there was a moderate reduction in TD and a small reduction in VHS after the COVID-19 lockdown compared to PRE1 and PRE2. We also observed small reductions in ACC and DEC after the lockdown compared to PRE2. However, the SPR activity remained stable throughout the season and its levels were similar to previously reported values[5, 40, 41, 43]. The effect of lockdown was similar across tactical roles, with no superior effect on any role. Thus, even if each role has its specific running activity during the match[44], after the lockdown total and very high-speed distances were reduced irrespective of playing position, while higher intensity seemed to be maintained.

Collectively, our results show that professional soccer players maintained the ability to perform higher intensity activities during match play after the lockdown (SPR, ACC and DEC), but significantly reduced overall running (TD) and to a less extent high-speed running (VHS). These findings show that the overall reduction in match running was as a result of less distances travelled in medium- and low-intensity. The adjustments in match activities following the COVID-19 lockdown are similar to previously described changes in pacing strategies, where players reduced low-intensity activity to preserve essential high-intensity movements[40]. In this regard, it has been reported that mental fatigue, experimentally induced by a period of sustained vigilance, induced a reduction in medium low-intensity activities during prolonged intermittent running, while high-intensity movements were maintained[45], showing that mental states can affect physical output.

In this regard, the effects of quarantine and lockdown restrictions encountered during the COVID-19 pandemic, has been shown to affect general psychological symptoms, with emotional disturbance, mental exhaustion, depression, stress, low mood, irritability, insomnia and emotional exhaustion reported both in the general and athlete populations[46, 47]. Although not directly assessed in the current study, it is likely that the COVID-19 lockdown period affected the mental state of the players who participated in this investigation. This, combined with the increased competition frequency and possible associated stress - following lockdown may have increased the cognitive demands and taxed the emotional resources of the players. We speculate that the collective effects of mental fatigue, psychological disturbances and increased competition may have influenced match physical activities. However, further specific research is needed to confirm this hypothesis.

In addition to the psychological factors, the reduction in match total and very high-speed distances after the home isolation period may have also been affected by the lack of specific training and deconditioning during the lockdown and the absence of crowds upon return to competition. Indeed, during the lockdown players only performed home-based training sessions with little opportunity to soccer specific training. It is possible that the absence of soccer specific training stimuli resulted in a reduction in some aspects of players' physical fitness, which has been reported elsewhere[24-27]. It is well known that there are several determinants of soccer physical performance, such as aerobic fitness, intermittent running capacity and strength qualities[1]. Specifically, it has been shown that aerobic fitness plays a role in the challenge of reducing the injury risk[48], contributes to the majority of energy provision during matches[49] and/or training and improves recovery between high-intensity efforts[50]. Furthermore, different authors suggested that intermittent running capacity is related to physical activity during matches[51]. Then, it was suggested that lower limbs strength and power characteristics, may have an influence on some qualities related to soccer physical performance, such as turning, sprinting and changing pace[52]. Thus, an impairment in those qualities may have an impact on physical performance during matches, as found in the present study. Whilst the players in this study undertake a brief re-training period before the recommencement of official matches, it may not have provided sufficient stimulus to allow them to reach optimal physical condition.

Another factor that may have affected match activity profile following lockdown was the absence of fans from the matches. The influence of crowds on match activity has been reported previously, with players covering more total distance and low-intensity running at home games compared to away games[17], with greater fan support considered paramount[53]. It was recently reported that home advantage (i.e., in terms of points gained during home matches), disappeared during games played after the lockdown in professional soccer players[54]. Along similar lines, the present findings show that physical activities may also have been influenced by changes in fans support.

Following the lockdown, the teams played with double the match frequency compared to the usual competitive period which may have provided additional physical and psychological stress, and this may have also affected the physical activities of match play. Although some authors did not find an effect of a congested fixture on match running activities in soccer[28], others have shown that playing with a high frequency may impair physical activities performed during games[18, 55]. Another possible explanation for the adjustments in match activity profile during POST was the environmental effect: after the lockdown matches were played during the summer, while games during the two other competitive periods were played in autumn and winter, respectively. A detrimental effect of playing in a hot and humid environment on running activities during soccer games has been reported[19, 56, 57]. Therefore, it is possible that seasonal changes in ambient conditions, in combination with all the other factors mentioned above may have affected physical output after the lockdown.

In addition to the entire match data, we also analysed 15-min intervals data with the aim of understanding whether after the lockdown there was a different distribution of running activities throughout the match compared to the distribution of physical output prior to the lockdown. The present results showed that the temporal distribution of TD and VHS in the periods considered was not altered, since there were declines in most 15-min intervals after lockdown. In contrast however, the several measures of very intense activities such as SPR, ACC and DEC showed a few small differences in the temporal distribution at POST. Most notably, all these extremely high-intensity running activities consistently decreased in the first interval of the second half (45-60 min). Although it is difficult to provide the reasons for this consistent decline at the beginning of the second half, it is likely that the absence of fans and player’s lack of reconditioning partly explain the different changes in higher-intensity activities immediately after half time.

The current analysis has some limitations which must be considered when interpreting the findings. Firstly, our study involved players from only the Italian championship and did not involve every player from every team of that championship, making difficult to generalize findings to different teams, leagues or countries as they may have encountered different lockdown experiences and changes in competition demands. Further research may also focus on other indicators of match running activities, such as low and moderate intensity running distances, number of sprints and/or accelerations and decelerations and number of impacts. Further research could also compare match activities after the lockdown with matches of previous seasons, since we only considered the 2019-20 soccer season. Lastly, since each factor mentioned above may not have the same influence on match running activities, further research is required to distinguish the independent effects of each of those factors from the effect of lockdown.

In conclusion, after the COVID-19 lockdown, extremely high-intensity running activities performed by professional soccer players were similar to those of games played before the lockdown. However, total and very high-speed distances significantly decreased, both considering the entire match and 15-min intervals. Furthermore, the distribution of running activities within the match after the lockdown was similar to the competitive periods prior to the lockdown for each variable considered.

Although only a descriptive case series design, our results offer some insights that might be of interest to coaches and practitioners. The short re-training period after the lockdown was possibly not effective in reaching an optimal physical fitness, thus not allowing players to perform match running activities at the same level prior to the lockdown. Furthermore, the congested schedule after the interruption of the championship may have had an impact on the players' ability to sustain the physical demands of the game. So, in congested periods the focus of practitioners should be on balancing recovery, training and match-play. In this regard, rotation of players and turnover might be helpful.

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Figure 1. Design of the investigation.

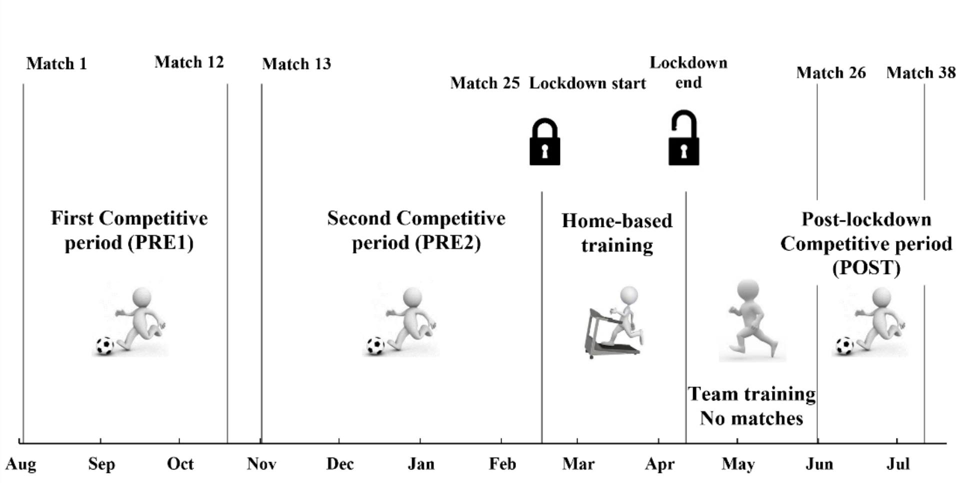

Figure 2. Total distance run (m·min^{-1}) during the entire match in PRE1, PRE2 and POST.

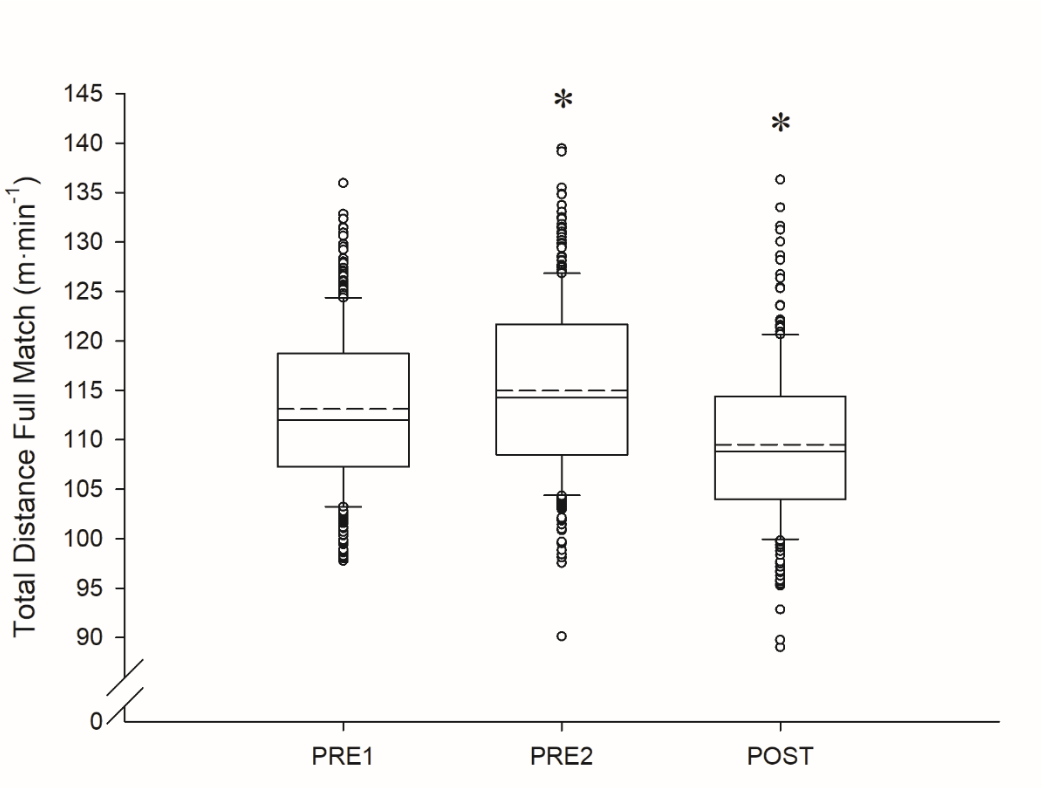

Figure 3. Very high-speed distance and sprinting distance run (m·min^{-1}) during the entire match in PRE1, PRE2 and POST.

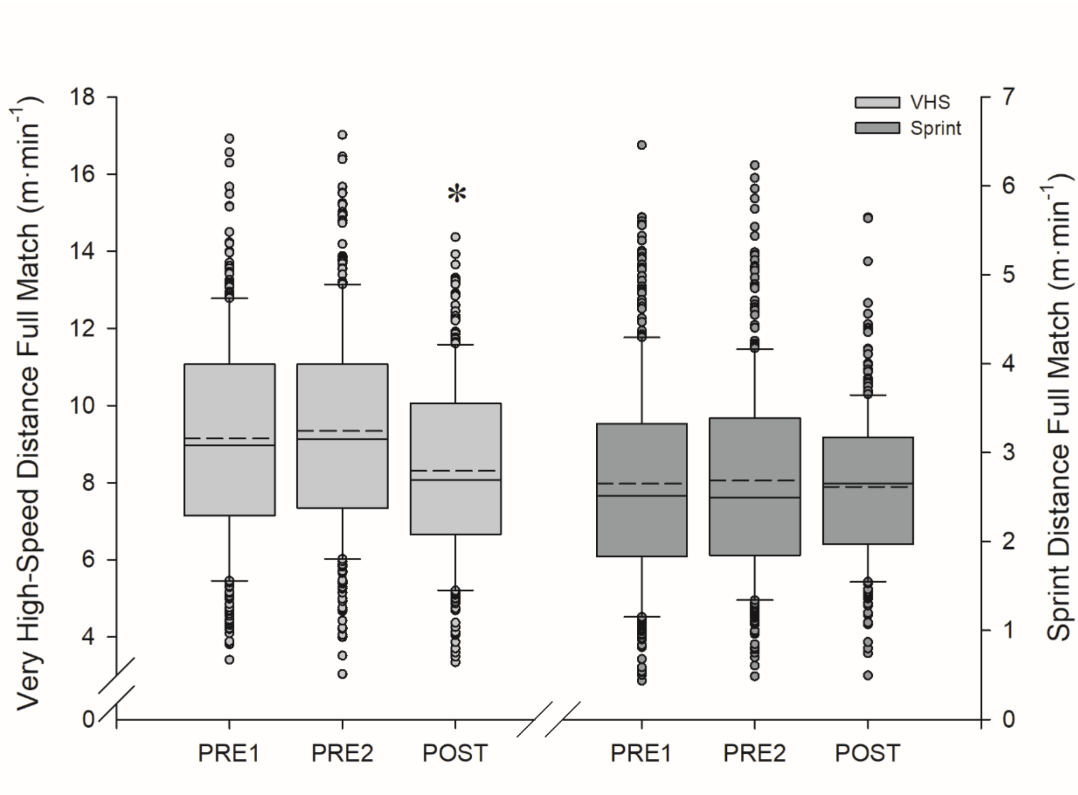
Very High-Speed Distance Full Match (m·min-1)
Sprint Distance Full Match (m·min-1)
VHS
Sprint
*
PRE1
PRE2
POST
PRE1
PRE2
POST
18
16
14
12
10
8
6
4
0
7
6
5
4
3
2
1
0

Figure 4. Total distance run (m·min^{-1}) during each match interval in PRE1, PRE2 and POST.

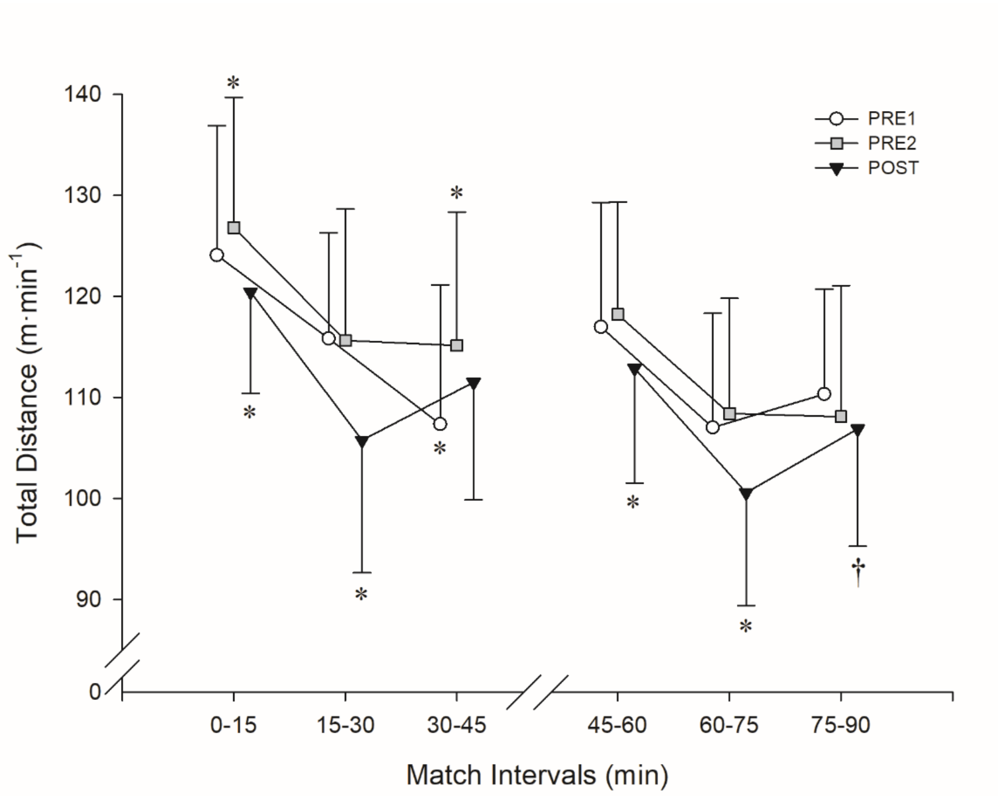

Figure 5. Very high-speed distance run (m·min^{-1}) during each match interval in PRE1, PRE2 and POST.

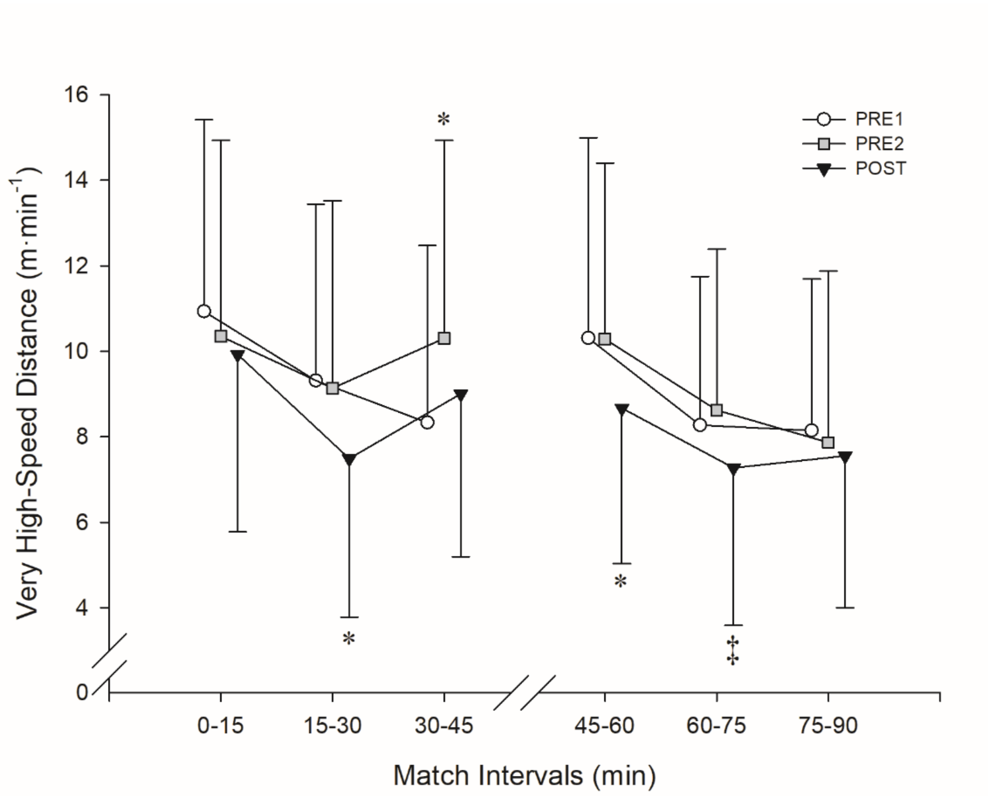

Figure 6. Sprinting distance run (m·min^{-1}) during each match interval in PRE1, PRE2 and POST.

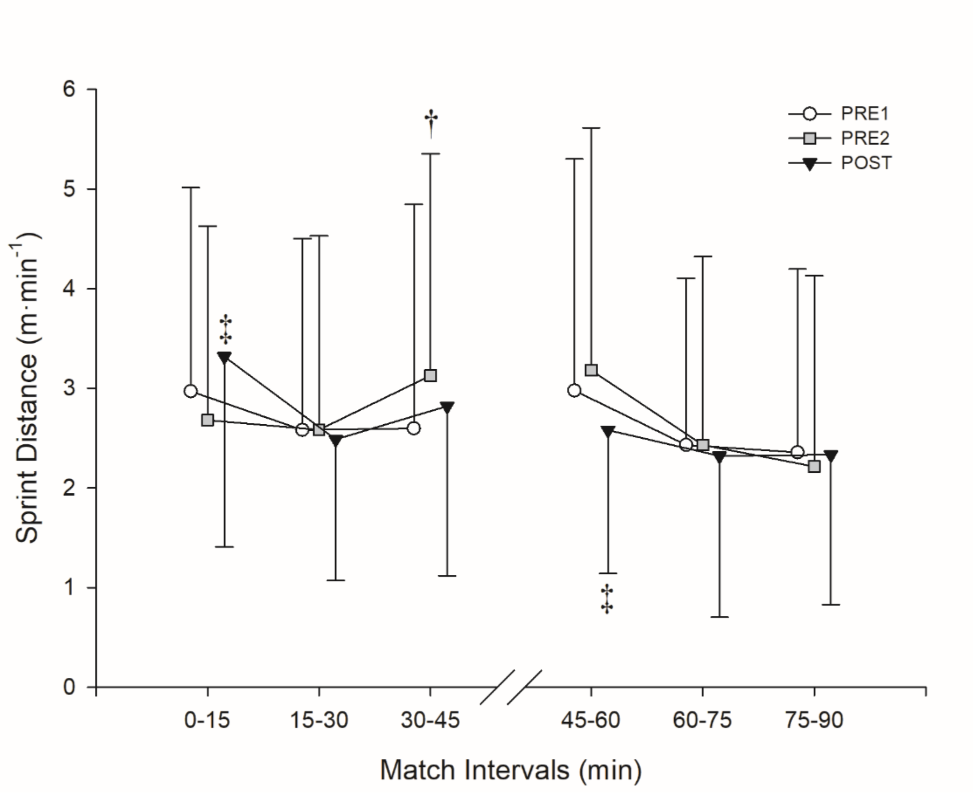

FIGURE LEGEND

Figure 1. Total distance run ($m \cdot min^{-1}$) during the entire match in PRE1, PRE2 and POST.

Legend Figure 1. Black line represents the mean, the dotted line represents the median, the box represents the standard deviation and the whiskers represents the 95% confidence interval.

* significantly different from the other two periods (p<0.05).

Figure 2. Very high-speed distance and sprinting distance run ($m \cdot min^{-1}$) during the entire match in PRE1, PRE2 and POST.

Legend Figure 2. Black line represents the mean, the dotted line represents the median, the box represents the standard deviation and the whiskers represents the 95% confidence interval.

* significantly different from the other two periods (p<0.05).

Figure 3. Total distance run ($m \cdot min^{-1}$) during each match interval in PRE1, PRE2 and POST.

Legend Figure 3. Each symbol represents the mean and the whiskers represent the 95% confidence interval.

* significantly different from the other two periods (p<0.05); † significantly different from PRE1 (p<0.05).

Figure 4. Very high-speed distance run ($m \cdot min^{-1}$) during each match interval in PRE1, PRE2 and POST.

Legend Figure 4. Each symbol represents the mean and the whiskers represent the 95% confidence interval.

* significantly different from the other two periods (p<0.05); ‡ significantly different from PRE2 (p<0.05).

Figure 5. Sprinting distance run ($m \cdot min^{-1}$) during each match interval in PRE1, PRE2 and POST.

Legend Figure 5. Each symbol represents the mean and the whiskers represent the 95% confidence interval.

† significantly different PRE1 ($p<0.05$); ‡ significantly different from PRE2 ($p<0.05$).