Evaluation of the most intense high-intensity running periods in English FA Premier League soccer matches

Running title: Intense running profiles in elite soccer

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ABSTRACT

The aim of this study was to examine the most intense period of high-intensity running during elite soccer matches. Elite players (n=100) were analysed using a multi-camera computerised tracking system. High-intensity running distance (speed \( \geq 19.8 \text{ km}\cdot\text{h}^{-1} \)) and that covered in the most intense 5-min period were quantified during matches. High-intensity running was performed for \(~3\%\) of total time but this doubled (F[1,99] = 9.179, \( p<0.001, d>1.2 \)) during the most intense period (8.4±2.7 vs. 16.4±4.6 s). Recovery time between high-intensity efforts was \(~30\) s during the most intense period (33.3±19.7 s). The work:rest ratio between high-intensity bouts increased (F[1,99] = 2.018, \( p<0.001, d>0.6 \)) from 1:12 for the match average to 1:2 during the most intense period. The distance of each discrete high-intensity running bout increased (F[1,99] = 1.958, \( p<0.001, d>0.6 \)) \(~13\%\) during the most intense period compared to the match average (6.7±1.8 vs. 5.8±0.6 m). Central defenders were running at high-intensity for less (F[4,95] = 4.907, \( p<0.05, d>0.6 \)) time than full-backs, wide midfielders and attackers (12.9±2.4 vs. 17.9±3.4, 18.3±5.5 and 16.9±3.8 s). Central defenders had a greater recovery time (F[4,95] = 3.083, \( p=0.023, d>0.6 \)) between high-intensity efforts than wide midfielders. No differences were evident between playing positions for maximum running speed and average distances of high-intensity running. These results show that high-intensity running, work:rest ratios and average high-intensity distances increased during the most intense period of matches and is highly dependent on positional role. Therefore, conditioning drills and performance tests should closely mimic distances, work:rest ratios and recovery times of those found during intense periods.

Key words: Time-motion analysis, intense periods, positions, football.
INTRODUCTION

Time-motion analysis is a popular data collection technique used in team sports, such as soccer and is valuable for quantifying the physical demands of match-play (7,29). Although low intensity activities dominate soccer, the importance of maximal efforts should not be discounted. A high aerobic fitness has been suggested to aid recovery between high-intensity bouts (33). However, soccer-specific endurance has been found to be related to high-intensity running (21). Sprinting occurs every 90-120 s and high-intensity efforts every 40-70 s (7,29,30). Furthermore, the duration of high-intensity actions is ~4 s (26,27,34). These high-intensity efforts constitute the anaerobic components of soccer match-play and it is this period that may have the potential to affect the outcome of a match or induce fatigue (8). The observation that elite soccer players perform up to 250 brief high-intensity actions during a match and produce peak blood lactate concentrations of 10-14 mmol·L\(^{-1}\) indicates the high anaerobic demands of intense periods (8,22,27). Several studies have shown declines in physical performance during a match, particularly during the second half for high-intensity running parameters (7,13,22). Although some studies have provided a brief examination of 5-min periods of high-intensity running in elite soccer (8,11,27), none have provided a detailed breakdown of the most intense 5-min periods, in terms of work:rest ratios and decrements in high-intensity running across several variables.

The demands of soccer require players to be competent across a number of fitness components (28). Arguably, the most important is repeated sprint ability due to the intermittent nature of soccer (10). Traditionally, repeated sprint tests have induced fatigue over ~5-min period (3,5,35). The distance covered and recovery times in these protocols are either based on outdated time-motion analysis or
unrelated to soccer match-play. A detailed examination of high-intensity running and recovery times in the most intense periods of contemporary match-play would provide valuable information for the development of ecologically valid repeated sprint tests. Regarding training, drills over an 8-12 wk period have been reported to improve repeated sprint ability (32), as well as maximal aerobic capacity (15) and Yo-Yo intermittent recovery test performance (16,18). Others have suggested that this adaptation could maintain and improve motor skill levels (24). Moreover, research indicates that soccer drills consisting of 15 m sprints with a 1:4 work:rest ratio produce the greatest improvements on repeated sprint performance (23). While others suggest that high-intensity training runs for 4-min periods are advantageous for developing speed endurance (31). This suggests that the exercise time for some speed endurance training drills are usually set at periods of ~5-min. Thus, to mimic the most intense periods of match-play, it would be prudent to reproduce the high-intensity actions and recovery times during the most intense 5-min period. This is particularly important for various positional roles given that the activity profiles and bioenergetics of players vary significantly. Therefore, the aim of this study was to examine decrements in high-intensity running following the most intense period. Furthermore, to analyse the most intense 5-min period of match-play across positional roles in elite soccer. We hypothesised that high-intensity distance would decrease following intense periods, and full backs and wide midfielders would not only perform the greatest high-intensity distance but also display the lowest recovery times.
METHODS

Experimental Approach to the Problem

A repeated measures design was used with all players analysed through 5-min periods of the match. All matches selected were played between teams of a similar standard, whereby they had a similar placing in the league table, and at the same time of day to reduce diurnal variation (2). However, environmental conditions were not controlled within this study but recent research has suggested minimal impact on match running performance (9).

Subjects and Performance Analysis System

A multi-camera computerised performance analysis system (ProZone Version 3.0, ProZone Sports Ltd®, Leeds, UK) was used in 20 English FA Premier League matches during the 2006/07 season. Each player’s movement was tracked by eight cameras at roof level. This analysis system has previously been validated (12). One hundred players in five positional roles (20 central defenders, 20 full-backs, 20 central midfielders, 20 wide midfielders and 20 attackers) were randomly allocated and used in this study. Only players completing the full match and in the same position throughout the match were included for analysis. To ensure confidentiality, all data was desensitised.

Match Activities

Match activities were divided into the following categories and speed thresholds: standing (0–0.6 km·h⁻¹), walking (0.7–7.1 km·h⁻¹), jogging (7.2–14.3 km·h⁻¹), running (14.4–19.7 km·h⁻¹), high-speed running (19.8–25.1 km·h⁻¹) and sprinting
(≥25.2 km·h⁻¹; 5,6). High-intensity running consisted of the combined distance covered in high-speed running and sprinting (≥19.8 km·h⁻¹).

**Match Distances**

The most intense period was classified as the 5-min that contained the most high-intensity running in a match (27). This was specific to every player (27) and each 5-min period was pre-defined by the match analysis system. High-intensity running with ball possession was defined as the high-intensity running distance covered when the players’ own team was in possession of the ball. High-intensity running without ball possession was the subtraction of high-intensity running distance with possession of the ball from total high-intensity running distance. Average high-intensity running distance was the total high-intensity running distance covered in the most intense 5-min divided by the total number of high-intensity actions. Average recovery time consisted of the time that elapsed between high-intensity running bouts (≥19.8 km·h⁻¹). Maximal running speed represented the average of all maximal run speeds reached during 5-min periods of the match. Previous research found that the inter- and intra-observer coefficient of variation for high-intensity running was <2% for the present tracking system (8).

**Statistical Analyses**

Descriptives were used to calculate means and standard deviations of match variables and z-scores were used to verify normality. Differences between 5-min periods were determined using a repeated measures analysis of variance (ANOVA). Bonferroni post hoc test was applied to make a pairwise comparison. Differences between positional subsets were performed using a one-way ANOVA. Tukey’s post
hoc tests were applied where appropriate. Statistical significance was set at \( p < 0.05 \). The effect size \((d)\) was calculated from the ratio of the mean difference to the pooled standard deviation. The magnitude of the effect size was classified as trivial (<0.2), small (≥0.2-0.6), moderate (≥0.6-1.2), large (≥1.2-2.0) and very large (≥2.0) based on guidelines from Batterham and Hopkins (6). All statistical analyses were conducted using SPSS for Windows 17.0 (SPSS Inc., Chicago, USA).
RESULTS

During a match, players stood for 5.7±2.3%, walked 58.8±4.7%, jogged 26.2±3.6% and were running for 6.6±1.6% of total time. High-intensity running represented 2.7±0.8% of total time, which consisted of 2.1±0.6% high-speed running and 0.6±0.3% sprinting.

Match Running Performance

Time spent in high-intensity running was 16.4±4.6 s during the most intense period, equalling ~5.5±1.5% of total time (Table 1). This equated to double (F[1,99] = 9.179, p<0.001, d>1.2) the match average (7.5±2.5 s). The work:rest ratio between high-intensity bouts increased (F[1,99] = 2.018, p<0.001, d>0.6) from 1:12 for the match average to 1:2 during the most intense period. Total distance covered during the most intense period was 643.5±82.9 m, which included 110.6±27.5 m at high-intensity. More high-intensity running distance was covered (p=0.08, d<0.2) during the most intense period in the second half compared to the first half (101.5±27.1 vs. 96.7±28.7 m). Furthermore, players performed their most intense period during the second rather than the first half (58 vs. 42), and were most common between the 60-65th min (20%). The total number of activity changes during the most intense period was 152.4±28.8, with high-intensity running accounting for 17.5±5.9 bouts. The most intense period produced a 125% increase (F[1,99] = 8.319, p<0.001, d>1.2) in the number of high-intensity bouts performed compared to the match average (17.5±5.9 vs. 8.4±2.5). During the most intense period, players covered 51.7±37.3 and 57.9±32.1 m with and without ball possession at high-intensity. This equalled an increase of 136 (F[1,99] = 4.118, p<0.001, d>1.2) and 107% ([1,99] = 5.247, p<0.001, d>1.2) from the match average (21.8±13.3 and 27.6±10.8 m). Average
Distances per high-intensity bout during the most intense period was ~13% higher (F[1, 99] = 1.958, p<0.001, d>0.6) than the average distance throughout the match (6.7±1.8 vs. 5.8±0.6 m). Recovery time between high-intensity running bouts was 33.3±19.7 s. Furthermore, maximal running speeds were 8.4±0.6 m·s⁻¹ for players during the most intense period compared to 7.6±0.3 m·s⁻¹ for the match average (F[1, 99] = 5.394, p=0.18, d>0.6). In the next 5-min period following the most intense period, high-intensity running distance was reduced (p<0.005) by 61%. The next 5-min period was 15% less (p<0.005) than the match average (Figure 1). Moreover, a 64 and 60% decline (p<0.001) from the most intense to the next 5-min period was evident when the team was in possession and without possession of the ball (52.2±37.1 vs. 18.9±19.2 and 58.7±31.9 vs. 23.8±18.0 m), respectively. Recovery times observed in the next 5-min period following the most intense period of high-intensity running were ~140% longer (p<0.001) than the most intense period (81.0±72.7 vs. 33.3±19.7 s). Large effect sizes (d>1.2) were observed for all declines from the most intense to the next 5-min period.

**Positional Roles**

Central defenders spent less (F[4, 95] = 12.066, p<0.01, d>0.6) time performing high-intensity running than full-backs, central midfielders, wide midfielders and attackers during a full match (104.2±24.6 vs. 158.4±37.5, 146.9±42.5, 191.6±44.0 and 151.2±48.4 s). Wide midfielders were running at high-intensity for a greater (d>0.8) duration than central midfielders (p=0.06) and attackers (p=0.17). In the most intense period, central defenders were running at high-intensity for less (F[4, 95] = 4.907, p<0.05, d>0.6) time than full-backs, wide midfielders and attackers (12.9±2.4 vs. 17.9±3.4, 18.3±5.5 and 16.9±3.8 s). Furthermore, central
defenders’ work:rest ratios were lower (F[4,95] = 4.712, \( p<0.01, \ d>1.2 \)) than full-backs, central midfielders and wide midfielders (1:3.8 vs. 1:1.8, 1:2.0 and 1:1.5). However, attackers covered less (F[4.95] = 3.501, \( p<0.05, \ d>0.6 \)) distance than central defenders and full-backs whilst not in possession of the ball during high-intensity running (38.3±25.0 vs. 71.0±13.4 and 67.2±29.6 m). No differences were found for average distances per high-intensity bout and maximal running speed. However, wide midfielders demonstrated less recovery time (F[4.95] = 3.083, \( p=0.023, \ d>0.6 \)) between high-intensity running bouts than central defenders (26.5±12.2 vs. 44.8±23.9 s). Central midfielders and attackers covered 32.3±20.3 and 37.2±23.1 m in their 5-min periods following the peak 5-min period, which was 33 and 26% less (F[1,19] = 2.562, \( p<0.05, \ d>0.6 \)) than the match average (47.6±12.2 m and 49.8±13.8 m, respectively) (Figure 2).
DISCUSSION

The ability to repeatedly produce high-intensity efforts is essential in soccer and may play a role in inducing fatigue and determining the outcome of a match (5,7-8,27). Our data demonstrates that high-intensity running was performed for ~3% of total time but this doubled during the most intense period, indicating the high anaerobic demands during selected periods. The total number of high-intensity bouts during the most intense periods showed an increase of 125% compared to the match average. Recovery time between high-intensity running bouts was ~30 s during the most intense period. Work:rest ratios between high-intensity bouts increased from 1:12 for the match average to 1:2 during the most intense period. Central defenders covered less high-intensity running distance during the most intense period and had a greater recovery time than all other positional roles.

Match Running Performance

Decrement in high intensity running following the most intense period may prove decisive during match play. Through accurately examining the most intense 5-min periods and the decrements that follow, training and testing protocols can be created to minimise the effects during matches. High-intensity running speeds are also of importance, where this study found that utilising speeds of ≥19.8km·h⁻¹ was more sensitive.

Previous studies have found decrements in high-intensity running (≥14.4-15.0 km·h⁻¹) after the most intense period and at the end of the match for both domestic and international players (8,27). Bradley et al. (7) reported that following the most intense period, high-intensity running was lowered to a similar extent for elite domestic and international players. A decline was also reported for high-
intensity running after the most intense period for elite Italian (27) and English league players (7,8). Moreover, the amount of high-intensity running in the 5-min following the most intense period has been reported to be less than the match average (27), which supports the finding of this study. The subsequent 5-min period was 15% less than the match average. This indicates that the level of performance was reduced temporarily following intense exercise. However, this study incorporated a different speed threshold ($\geq 19.8 \text{ km}\cdot\text{h}^{-1}$) for the high-intensity running category. The reduction in high-intensity running was more pronounced ($\sim 60$ vs. $\sim 50\%$) than declines in other studies (7,8,27). It is clear that this speed threshold ($\geq 19.8 \text{ km}\cdot\text{h}^{-1}$) results in a more pronounced decrement in high-intensity running and that this measure could be more sensitive to changes than other speed thresholds ($\geq 14.4-15.0 \text{ km}\cdot\text{h}^{-1}$). It is vital that applied sports scientists attempt to individualise high-intensity speed thresholds based on anaerobic threshold indices (1) or players’ sprinting speeds (17).

The total number of high-intensity bouts increased by 125% during the most intense period compared to the match average. This large increase may have an effect on the players’ ability to continue to perform multiple cycles of high-intensity running. Moreover, the increase in recovery time following the most intense periods, which increased 12% compared to the match average, highlights the high demands placed on players during these periods. In support of this, sprint performance was found to be reduced both temporarily during and at the end of a soccer match (22). These data indicate that the physical effort of elite soccer is high in selected periods when players have to perform repeated bouts of high-intensity activity during a match. Recovery time between high-intensity running bouts was $\sim 30$ s during the most intense periods. Intense soccer-specific speed endurance drills with short
recovery times (30 s) designed to mimic these most intense periods would possibly enhance the players’ anaerobic capabilities during matches. This is further evident in players’ work:rest ratios, where the ratio increased during the most intense periods to 1:2 from the match average of 1:12. This data outlines the importance of correct procedures to be implemented for training programmes and the necessity to consider accurate duration of ~15 s, average high intensity running distance of 5-7 m and work:rest ratios of 1:2 (23,24). Training should incorporate these repeated bouts in periods of 5-min that elicit ~90-95% of maximal heart rate and mix high-intensity interval running with small-sided soccer games (19,20). This data also has implications for the development of more ecologically valid repeated sprint tests that incorporate 8 repetitions of multi-directional high-intensity running interspersed by minimal recovery, at a work:rest ratio of 1:2-1:4.

During the most intense periods, players perform ~10% more high-intensity running when their team has possession of the ball. This suggests that performing high-intensity running is equally important when the team is with or without possession of the ball and this should be considered when designing training drills. Furthermore, an increase of 107-136% in high-intensity running without and with ball possession was evident during the most intense period compared to the match average. However, a greater decline was found following the most intense period when in possession compared to being without possession of the ball (64 vs. 60% decline). The present results further extend previous research (27), suggesting that it is important to be able to have the ability both on and off the ball to be a success in elite soccer. Training drills should incorporate ball work, where small-sided games have been found to replicate physiological measurements of that found during soccer match-play (25). The present data show that average high-intensity running
distances increased by 13% during the most intense period compared to the match average. This indicates that the distance of each run increases alongside the total distance of high-intensity running. Players also reached running speeds of 8.4 m·s\(^{-1}\) (30.2 km·h\(^{-1}\)) during the most intense period. This is markedly different to match average maximal speeds of 7.7 m·s\(^{-1}\) (27.7 km·h\(^{-1}\)) reported by Bradley et al. (7) showing a 9% increase in running speed from the match average to the most intense period. However, the data reported by Bradley et al. (7) is based on the average of maximal speeds gained in all 5-min periods throughout the match, rather than the actual maximal speed. Thus, fitness coaches should also incorporate distances of ~7 m per bout that can allow players to reach speeds of ≥19.8 km·h\(^{-1}\).

**Positional Roles**

Central defenders covered less distance than full-backs, central midfielders, wide midfielders and attackers whilst in possession of the ball during high-intensity running. It can be suggested that central defenders predominantly perform high-intensity running when not in possession of the ball. No differences were found between positional roles for average distances of high-intensity running. However, central defenders demonstrated 67% more recovery time between high-intensity running bouts than wide midfielders, and had a lower work:rest ratio than other positional roles (1:4 vs 1:2). Thus, it seems reasonable to conclude that fitness training and testing should be relative to players’ positional role and include the wide range found in this study for recovery time, high-intensity running distance and work:rest ratio. Eight high-intensity bouts of ~7-8 s interspersed with ~30 s active recovery (1:4 work:rest ratio) would mimic full backs, central midfielders, wide
midfielders and attackers. However, central defenders benefit from an increased recovery of ~45 s during the most intense period.

Current soccer-specific tests include data gained from all positional roles, including central defenders that have been found to be inferior to other positional roles for several match performance variables (7). Therefore, fitness training and testing protocols should mimic match-play and positional attributes, and incorporate data that has been broken down into 5-min periods. Maximal running speeds reached during the most intense period were higher for full-backs than other positional roles. This may be due to full-backs having the greatest amount of space in front of them and having a target in which to overtake (overlapping wide midfielders). In support of this finding, full-backs, wide midfielders and attackers have the highest running speed as shown by sprint tests (4). Central midfielders and attackers suffered decrements in high-intensity running, where their next 5-min periods were 33 and 26% less than the match average. Therefore, players may suffer a temporary drop in anaerobic performance during a soccer match. This decline may also be linked to match-related fatigue (4,14,27). Moreover, attackers demonstrated a difference between the next and average 5-min periods, where they have been suggested to suffer an increased decrement of high-intensity running in comparison to other positional roles (7,8).

The limitations of this study include formations and style of play. Twenty players were used in each of the five positions, allowing for a moderate sample. However, the sample would be too low to further separate into formations. Additional limitations include the phase of the season, high or low importance of match (title decider or relegation battle), derby match and accelerations of players.
PRACTICAL APPLICATIONS

In summary, the present results suggest players perform twice as much high-intensity running, longer high-intensity running average distances, lower recovery time when compared to the match average and have work:rest ratios increase to 1:2 during the most intense period. Furthermore, high-intensity running is much dependent on positional role. Results from this study may help improve the testing and training elements in elite soccer. Although it has been suggested that aerobic fitness enhances recovery between high-intensity exercise (33), fitness coaches should incorporate repeated sprint and speed endurance drills. These should be carried out with correct work:rest ratios (1:4 for central defenders and 1:2 for all other positional roles) within training to allow players to cope with multiple cycles of high-intensity running during matches, and provide position-specific alternatives. Training and testing should include periods of ~5-min and consider correct high intensity running average distances, recovery time and work:rest ratios. This type of training could improve the physical capabilities of the team, whereby players can maintain high-intensity running and improve recovery times between the most intense periods.
REFERENCES


ACKNOWLEDGEMENTS

The University of Sunderland and Sunderland College for their help in funding Michele Di Mascio’s PhD.
FIGURE LEGENDS

Figure 1. High-intensity running in the most intense 5-min period during the match, the subsequent 5-min period (next), the final 5-min period (final) as well as the match average for elite soccer players. *Different from average (*p*<0.01). Values are mean±SD.

Figure 2. High-intensity running in the most intense 5-min period during the match, the subsequent 5-min period (next), the final 5-min period (final) as well as the match average for elite soccer players. *Different from average (*p*<0.05). #Greater high-intensity running distance than central defenders (*p*<0.05). *Greater high-intensity running distance than central midfielders (*p*<0.05). CD = central defenders, FB = full-backs, CM = central midfielders, WM = wide midfielders, AT = attackers. Values are mean±SD.
Table 1. Match performance variables during the most intense 5-min period.

<table>
<thead>
<tr>
<th>Variables</th>
<th>CD (n=20)</th>
<th>FB (n=20)</th>
<th>CM (n=20)</th>
<th>WM (n=20)</th>
<th>AT (n=20)</th>
<th>Unspecified (n=100)</th>
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</thead>
<tbody>
<tr>
<td>Time HIR (s)</td>
<td>12.9 ± 2.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.9 ± 3.4</td>
<td>15.9 ± 5.5</td>
<td>18.3 ± 5.5</td>
<td>16.9 ± 3.8</td>
<td>16.4 ± 4.6</td>
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<tr>
<td>Percentage HIR (%)</td>
<td>4.3 ± 0.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.0 ± 1.1</td>
<td>5.3 ± 1.8</td>
<td>6.1 ± 1.8</td>
<td>5.6 ± 1.3</td>
<td>5.5 ± 1.5</td>
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<tr>
<td>Distance (m)</td>
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<td></td>
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<tr>
<td>Total</td>
<td>573.9 ± 77.3&lt;sup&gt;cde&lt;/sup&gt;</td>
<td>638.7 ± 75.2</td>
<td>674.7 ± 65.2</td>
<td>692.1 ± 75.0</td>
<td>638.1 ± 74.9</td>
<td>643.5 ± 82.9</td>
</tr>
<tr>
<td>HIR</td>
<td>86.5 ± 16.6&lt;sup&gt;ce&lt;/sup&gt;</td>
<td>118.5 ± 23.2</td>
<td>106.7 ± 28.8&lt;sup&gt;e&lt;/sup&gt;</td>
<td>129.4 ± 24.5</td>
<td>111.9 ± 25.1</td>
<td>110.6 ± 27.5</td>
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<tr>
<td>Frequency (n)</td>
<td></td>
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<tr>
<td>Total</td>
<td>143.5 ± 28.3</td>
<td>164.1 ± 30.8</td>
<td>150.1 ± 22.2</td>
<td>156.3 ± 31.1</td>
<td>148.2 ± 28.9</td>
<td>152.4 ± 28.8</td>
</tr>
<tr>
<td>HIR</td>
<td>14.3 ± 4.5&lt;sup&gt;e&lt;/sup&gt;</td>
<td>19.9 ± 5.8</td>
<td>16.7 ± 5.3</td>
<td>20.5 ± 6.4</td>
<td>16.2 ± 5.2</td>
<td>17.5 ± 5.9</td>
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<tr>
<td>Ball possession (m)</td>
<td></td>
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<tr>
<td>HIR with</td>
<td>15.6 ± 17.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.3 ± 29.6</td>
<td>43.4 ± 36.7&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>74.6 ± 36.4</td>
<td>73.6 ± 30.1</td>
<td>51.7 ± 37.3</td>
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<tr>
<td>HIR without</td>
<td>71.0 ± 13.4</td>
<td>67.2 ± 29.6</td>
<td>58.4 ± 38.5</td>
<td>54.7 ± 38.8</td>
<td>38.3 ± 25.0&lt;sup&gt;ec&lt;/sup&gt;</td>
<td>57.9 ± 32.1</td>
</tr>
<tr>
<td>Average HIR distance (m)</td>
<td>6.5 ± 2.0</td>
<td>6.3 ± 1.8</td>
<td>6.6 ± 1.6</td>
<td>6.6 ± 1.3</td>
<td>7.3 ± 1.7</td>
<td>6.7 ± 1.7</td>
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<tr>
<td>Recovery (s)</td>
<td>44.8 ± 23.9&lt;sup&gt;g&lt;/sup&gt;</td>
<td>28.6 ± 14.5</td>
<td>30.3 ± 10.6</td>
<td>26.5 ± 12.2</td>
<td>36.5 ± 27.3</td>
<td>33.3 ± 19.7</td>
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<tr>
<td>Work:rest ratio</td>
<td>1:4&lt;sup&gt;cde&lt;/sup&gt;</td>
<td>1:2</td>
<td>1:2</td>
<td>1:2</td>
<td>1:2</td>
<td>1:2</td>
</tr>
<tr>
<td>Maximum speed (m·s&lt;sup&gt;-1&lt;/sup&gt;)</td>
<td>8.4 ± 0.4</td>
<td>8.6 ± 0.5</td>
<td>8.4 ± 0.6</td>
<td>8.4 ± 0.5</td>
<td>8.4 ± 0.7</td>
<td>8.4 ± 0.6</td>
</tr>
</tbody>
</table>

<sup>a</sup>Less running distance than full-backs, central midfielders, wide midfielders and attackers (p<0.01). Inferior (p<0.05) compared to another positional role:

<sup>b</sup>central defender (CD); <sup>c</sup>full-back (FB); <sup>d</sup>central midfielder (CM); <sup>e</sup>wide midfielder (WM); <sup>f</sup>attacker (AT). HIR = High-intensity running.
Figure 1

[Bar graph showing high-intensity running (m) for different conditions: Most intense, Next, Final, Average. The graph indicates a significant difference between the Most intense condition and the other conditions, marked with an asterisk.]

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Figure 2

High-intensity running (m)

Most intense  Next  Final  Average

CD  FB  CM  WM  AT

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