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The effect of an early dismissal on player work-rate in a professional soccer match.

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Running head: Work-rate in elite soccer

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Abstract

The aim of this study was to examine the effects of an early dismissal (after 5-minutes play) on work-rate in a professional soccer match. A computerised player tracking system was used to assess the work-rates of seven players who completed the match on the team with 10 players. A minute-by-minute analysis of the remaining 91mins following the dismissal was performed for the total distance covered, the distance covered in five categories of movement intensity and the recovery time between high-intensity efforts for each player. The data were calculated for each half and for three equal intervals within each half and profiled against normative data for the same players obtained from analyses of 15 games in the same season. Following the dismissal, the players covered a greater total distance than normal ($p<0.025$), particularly in moderate-intensity activities ($p<0.01$) and had shorter recovery times between high-intensity efforts ($p<0.025$). In contrast, there was a significant reduction between game halves for total distance covered at both the highest ($p<0.025$) and lowest running intensities ($p<0.01$). However, there were no differences in high-intensity activities across the three intervals in the second-half. These findings suggest that in 11 v 11, players may not always utilise their full physical potential as this match illustrated an increase in overall work-rate when reduced to 10 players. However, as a team with 10 players is likely to incur higher levels of fatigue, tactical alterations may be necessary and/or players may adopt a pacing strategy to endure the remainder of the match.

Key terms: fatigue, football, performance, locomotor activity, sprinting,

Introduction

A thorough understanding of the physical demands of elite soccer via information on work-rates is required so that optimal training and preparation strategies can be constructed to respond to the demands of match-play. Recently, research on elite soccer has furthered our understanding of the fitness requirements and position-specific work-rate profiles of players[1] as well as identifying the occurrence of a reduced work-rate notably in the latter stages of match-play[2].

While this research has important practical implications, a recent review on motion-analysis studies in soccer[3] has identified several areas that require further exploration and especially the impact of dismissals on work-rate. Consequently, this case-study aims to explore the effects of an early dismissal on work-rate in a professional soccer match.

Methods

A multiple-camera player tracking system (AMISCO Pro, Sport-Universal Process, Nice, France) was used to record work-rates in 1st Division French League games during the 2007/2008 season. In one match, an individual player belonging to the away team was dismissed after 5-minutes play. This provided a rare opportunity to analyse the work-rate in a team reduced to 10 players for over 90-minutes as there were 41 remaining minutes of the first-half and 50-minutes were played in the second-half. A total of seven outfield players (3 defenders and 4 midfielders) from the away side who completed the entire game were included for analysis to establish a dismissal match work-rate profile (DWP).

The objective measures of work-rate performance selected for the analyses were classified into two categories: 1) Match distances covered including the total distance and distance covered in five categories of movement intensity[1]: 0-11km/h (walking/jogging); 11.1-14km/h (low-intensity); 14.1-19km/h (moderate-intensity); 19.1-23km/h (high-intensity) and >23.1 km/h (sprinting). The absolute data were corrected to a minute-by-minute analysis of the distance covered to enable equal comparison of performance between the halves (as these were of differing duration) and three equally divided intervals in each half. 2) The average time spent in recovery between sprinting and high-intensity actions for each half.[3]

The DWP was then profiled against a normative data profile (NWP) for the same players during 15 matches randomly chosen from the start, middle and end of the season to explore any differences as a result of the sending-off. The sample included 10 home and 5 away matches in which the players completed the full match.

Statistical analyses (SPSS Science Inc, Chicago, Ill) were performed using paired *t*-tests to test for differences between game profiles and compare playing halves. One-way repeated-measures analysis of variance tests with Bonferroni's post-hoc tests were conducted to isolate any differences between intervals across each half. A pseudo-Bonferroni's adjustment was applied according to previously outlined procedures for objective measures of work-rate.[4] Thus, an operational alpha level of 0.025 ($p<0.05/2$) was used.

Results

Overall, the DWP for the seven players on this occasion was higher than the NWP. This result was observed through a greater total distance covered ($p<0.025$), particularly in the first-half ($p<0.025$), and throughout the match with more moderate-intensity activity ($p<0.01$) and shorter recovery times between high-intensity efforts ($p<0.025$). In the second-half, the distance covered at moderate-intensities was higher in the DWP ($p<0.025$) whereas distance covered in the walking/jogging category was higher in the NWP ($p<0.025$).

One similarity observed across both profiles was that the total distance covered in the second-half was lower than in the first-half in both the NWP ($p<0.025$) and DWP ($p<0.01$). In the NWP this was due to a decrease in low-intensity activity ($p<0.025$) whereas in the DWP,

the distance covered in sprinting ($p<0.025$) and walking/jogging ($p<0.01$) was reduced in the second-half. While further analysis of the DWP across the three intervals of the second-half showed a difference ($p<0.01$) in both total distance covered and walking/jogging with work-rate significantly dropping in the final interval, no significant difference was observed across intervals in distance covered at high-intensities (Table 1).

Discussion

In this relatively unique match, there are two major findings that merit discussion. First, the result showing a higher work-rate of players during the game in which the dismissal occurred compared to their habitual performances recorded over a series of matches. This finding, albeit only from one match, suggests that elite soccer players may not always utilise their full potential and partly confirms previous speculation[3] that work-rate is self-chosen. In this match, players may not have had the same opportunities to determine their efforts and were forced to work harder due to the tactical implications of the dismissal.

Second, in the dismissal work-rate profile there was a significant reduction in distance covered per minute in sprinting between halves, a result that did not occur in the normative game profile. This finding suggests either a different strategy of play and/or an earlier or higher occurrence of fatigue in players who perform for 90-minutes whilst participating in a team reduced to 10 players. The former theory may be supported by the lack of a statistical difference observed in high-intensity activities across three intervals in the second-half in this match when compared to the reduction in high-intensity running in elite soccer players at the end of the second-half reported in multiple matches without a dismissal.[2] In this respect, it could be suggested that the players may have either consciously applied a pacing strategy or changed tactics at half-time. The players carried out less actions especially at lower intensities and particularly during the final stages of the second-half potentially to 'spare' their efforts for the most crucial game actions as sprinting actually increased (albeit non-significantly) in the final interval when compared to the previous second-half intervals.

Although interesting, it is only possible to postulate on theory from this single performance and research using a larger sample of matches combined with information on technical performance as well as the work-rate of opponents is necessary. A recent investigation on elite match-play has notably shown that work-rate is significantly related to that of opponents as well as their competitive level[4]. In addition, it would be useful to establish normative values for various team formations and tactics in order to examine the relative work-rate subsequent to a dismissal if match tactics are modified. Furthermore, seasonal variations in work-rate as well as the effects of score-line should be taken into account when interpreting match performance.[3]

Practical implications

- The present findings are a first step in understanding how elite soccer teams cope physically with a dismissal and could aid in developing subsequent recovery strategies.

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Table 1: Comparison of work-rate in elite soccer players across three intervals in the first- and second-half after a player was dismissed 5-minutes into the match (mean±sd).

Distance run (m)	1st period	2nd period	3rd period	Significance	Post hoc
Total					
1st half	126.8 ± 6.1	127.6 ± 8.1	121.7 ± 3.9	p=.063	
2nd half	123.1 ± 4.7	124.0 ± 6.0	115.8 ± 9.9	p=.003	3 < 1, 2
Sprint					
1st half	6.0 ± 3.8	4.5 ± 4.0	3.8 ± 3.5	p=.503	
2nd half	2.5 ± 0.9	1.4 ± 1.2	3.3 ± 3.2	p=.267	
High-intensity					
1st half	7.0 ± 2.3	7.1 ± 2.1	7.6 ± 3.0	p=.664	
2nd half	6.7 ± 3.1	6.3 ± 2.0	6.6 ± 3.6	p=.876	
Moderate-intensity					
1st half	25.4 ± 6.8	21.4 ± 3.8	19.6 ± 6.3	p=.157	
2nd half	23.5 ± 5.2	24.3 ± 4.0	22,8 ± 9.0	p=.254	
Low-intensity					
1st half	20.5 ± 4.1	20.8 ± 6.0	16.6 ± 2.3	p=.099	
2nd half	19.9 ± 2.8	19.9 ± 4.7	18.3 ± 4.6	p=.242	
Walking/jogging					
1st half	68.6 ± 6.1	73.9 ± 2.0	74.2 ± 2.7	p=.026	
2nd half	70.6 ± 4.8	71.8 ± 3.0	64.2 ± 9.0	p=.008	3 < 1, 2

Data represent a minute-by-minute analysis of distance covered.