

VARIABLES INFLUENCING FATIGUE IN SOCCER PERFORMANCE

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Introduction

Several descriptive studies have investigated the match activity profiles of soccer players in order to determine the physiological requirements of soccer performance with particular reference to fatigue. Nowadays, companies using automated video-computerized match analysis systems can supply professional soccer team with the match analysis data on all players a few hours after game ends.

In order to better understand the soccer match performance characteristics influencing the physiological demands and inducing fatigue, the aims of this study were to examine 1) the physiological demands according to playing position, 2) the relationship between total distance covered (TD) and the high intensity activities (HIA) of a team compared to those of its opponents, 3) the effect of the first half exercise intensity on the performance decrement in the second half.

Methods

Eighteen Premier League matches, 3 Champions League games and 3 FA Cup ties involving the same professional team (one of the top four Premier League teams) were monitored, using the ProZone image recognition system (ProZone®, Leeds, England). From the data obtained using the ProZone specific software, TD and HIA (running speed $>19.8 \text{ km}\cdot\text{h}^{-1}$) with and without the ball of the professional team and the opponent teams were selected for the statistical analysis. 1) The match analysis data on 296 soccer players were used to verify the differences among playing position, using a one-way ANOVA with the Bonferroni's test as post hoc. 2) The relationships between TD and HIA for the reference team and its opponents were examined using Pearson's product moment correlation. 3) To examine the effect of first half exercise intensity (independent variable) on the decrement of various indices of soccer performance in the second half (dependent variables), two levels of the independent variable, high vs low exercise intensity first half, were respectively defined as above (High-INT) or below (Low-INT) the individual median first half HIA distance within a group of elite professional soccer players ($n=10$). The mean percent changes between the first and second half of the dependent variables (TD, HIA, and HIA with and without the ball) between the two levels of the independent variable were compared with multiple paired t -test. The professional soccer players performed an incremental treadmill test for the determination of peak velocity, as index of maximum aerobic capacity.

Results

The differences in the selected soccer performance variables among playing position are showed in table 1. A significant relationship was found between the TD of the reference team and its opposing teams in the 24 matches analysed ($r=0.66$; $p<0.01$). Similarly, a significant relationship was found between the HIA of the reference team and its opposing teams ($r=0.70$; $p<0.01$). The effect of first half exercise intensity on the performance decrement (TD, HIA, HIA with and without the ball) in the second half is represented in figure 1. The peak velocity during the incremental treadmill test was significantly related to TD ($r=0.68$; $p<0.05$), while this was not significant with HIA ($r=0.42$; $p>0.05$).

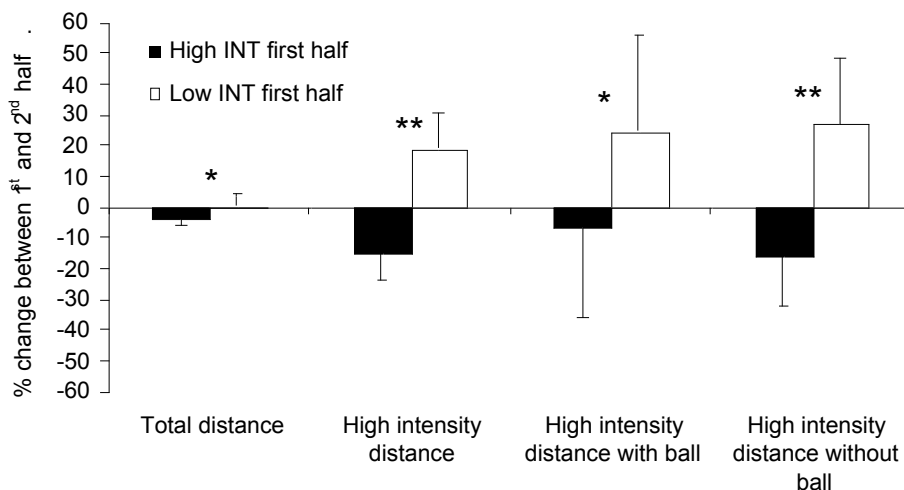
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Table 1. Mean total and high intensity distance covered (expressed in m) during 24 matches.

	Attackers (1) (n=36)	Centre-back (2) (n=57)	Centre-midfielders (3) (n=89)	Full-backs (4) (n=114)
Tot. Dist.	10415 ± 669 ^(2,3,4)	9984 ± 581 ^(1,3,4)	11720 ± 524 ^(1,2,4)	10971 ± 791 ^(1,2,3)
High int.	849 ± 187 ⁽²⁾	562 ± 137 ^(1,3,4)	854 ± 212 ⁽²⁾	935 ± 254 ⁽²⁾
High int. with ball	588 ± 159 ^(2,3,4)	94 ± 50 ^(1,3,4)	367 ± 216 ^(1,2)	386 ± 213 ^(1,2)
High int. without ball	218 ± 87 ^(2,3,4)	434 ± 106 ^(1,4)	460 ± 160 ⁽¹⁾	504 ± 141 ^(1,2)

(n), significantly different from group n

Figure 1. Comparisons of the percent changes, between first and second half, in the selected soccer performance variables between the two conditions (high intensity first half, high-INT, low intensity first half, Low-INT) defined using the median split technique (see *Methods*). *, $p < 0.05$; **, $p < 0.001$



Discussion

This study showed the peculiarity of the physiological demands required by each playing position. In particular, centre-midfielders covered the highest TD, while centre-backs covered the lowest distance at HIA. Interestingly, centre-back players performed the lowest amount of distance with the ball, while the attackers covered the highest distance with the ball and the lowest without. This

study showed a quantitatively positive relationship between the TD and HIA performed by a team and the same activities completed by its opponents. Furthermore, we found a strong effect of the first half exercise intensity on the second half soccer performance (figure 1). Lastly, our data confirm a relationship between maximal aerobic capacity (expressed as peak velocity during incremental treadmill test) and TD, but not HIA². In conclusion, our findings confirm that fatigue is influenced by various factors such as tactics (playing position and opposing teams), fitness levels and the physiological demands of the first half, especially if players tax their maximal working capacity¹.

References

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2. Bangsbo J. The physiology of soccer-with special reference to intense intermittent exercise. *Acta Physiol Scand Suppl* 1994; 619: 1-155