Original Article

Influence of contextual factors on match running performance in elite soccer team

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Abstract:

The aim of the present study was to examine the main effects and interactions of playing position, match result and opposition level on match running activities of an elite soccer team during a competitive season. Twenty-eight (28) Super League matches played by a professional soccer team were collected during a season using global positioning system technology. Maximum speed, number of sprints (NrSP), total distance (TD), high (HSR), medium, low and walking speed distances were analyzed. Three (3) contextual factors of playing position, match result and opposition level were considered. A total of 157 data items from 20 players were used in statistical analysis. Significant interactions ($p < 0.05$) with large effect sizes between playing position and opposition level and between game result and opposition level were observed on TD and HSR. Further analysis of game result – opposition level interaction showed that the team significantly ($p < 0.05$) covered more HSR distance against best and middle teams when winning compared to losing, while the team covered significantly ($p < 0.05$) more TD against best and middle teams when the game result was win or draw in comparison to loss. Regarding the further analysis of interaction between playing position and opposition level on TD, HSR and NrSP, the results showed that CD covered significantly ($p < 0.001$) less TD, HSR and NrSP in comparison to MD and AT against best, middle and last teams. MD covered significantly ($p < 0.01$) more TD in comparison to CD, FB and AT against best teams, whereas no significant differences on TD were observed between playing position against last teams. These findings suggest that HSR distances covered by an elite team throughout a season affected by more than one contextual factors (playing position, match result and opposition level) interact with each other. These data broaden our knowledge on the impact of contextual factors, interactively, upon the physical match performance of an elite soccer team throughout a season.

Key Words: situational variables; physical performance; match activities; external load

Introduction

Monitoring of physical performance during competition in elite soccer is important, since understanding the demands of the game may improve performance and recovery outcomes. Indexes of physical match performance of players are total distance covered during a game (Reilly & Gilbourne, 2003) and high intensity running distances (Mohr et al., 2003; Rampinini et al., 2009). Various tracking technology methods, such as multiple camera semi-automatic systems, local position measurement systems and global positioning systems (GPS), are nowadays measuring tools of match physical performance (Bradley et al., 2011; Buchheit et al., 2014; Gregson et al., 2010).

Match running activities are influenced from contextual factors, like playing position, match location, match score line and opposition level. Specifically, a number of studies have shown that the activity of soccer players is dependent on their position (Gregson et al., 2010; Rago et al., 2017). Match location (home or away match) and opposition level are also significant factors influencing the physical performance of soccer players during a game (Paraskevas et al., 2020; Rampinini et al., 2007). Paraskevas et al. (2020) have found that total distance, high intensity runs and very high intensity runs were higher when teams competed against weak opponents during home games in comparison to away games. Match status (win, draw or lost result) is another variable that may affect players' physical performance, with players covering more total distance for matches won compared to matches drawn or lost (Lago et al., 2010). So, an effective and complete physical match performance assessment of players or teams requires knowledge of the effect of contextual factors on their match activity profile (Castellano et al., 2011; Rampinini et al., 2009; Taylor et al., 2008). This knowledge provides coaches useful information on physical performance in each contextual factor of the game and how these contextual factors interact upon player and team physical performance. However, limited information exists on

the interaction of these contextual variables on physical match performance in elite soccer players or teams (Lago et al., 2010; Paraskevas et al., 2020). Most studies up to date have examined the main effect independently of each contextual factor which may not provide adequate insight into the complexity of physical soccer performance (Darren et al., 2015, Reed & O'Donoghue, 2005).

The majority of studies examined the influence of contextual factors on total distance and distances at various running speeds in elite players or teams of the World Cup (Njororai, 2012), the English FA Premier League (Bradley et al., 2010; Bush et al., 2015), the Spanish Premier League (Castellano et al., 2011; Lago et al., 2010), the Italian Serie A (Rampinini et al., 2009) as well as Champions League (Rampinini et al., 2007). Hence, more information from different elite championships is needed because of the cultural differences of each national championship. Therefore, the purpose of the present study was to investigate the main effects and interactions of playing position, match status, match location of the game and opposition level on physical match performance - including total distance covered, distances covered at various speeds, number of sprints - of an elite Greek soccer team during a competitive season.

Material & methods

Design

An observational design was used to examine the influence of three contextual factors (playing position, game result and opposition level) on match running activities – distances covered at various speeds, total distance, maximum speed, number of sprints - of elite male soccer players from the same team during a competitive season.

Participants

Match running activities data from twenty-eight (28) Greek Super League (highest level) matches played by a professional soccer team were collected during the 2018-2019 season using a Polar Team Pro tracking system (Polar Electro, Kempele, Finland) based on GPS technology. A total of 157 data items from 21 players (age: 25.2 ± 5.8 yrs; body mass: 73.1 ± 16 kg; height: 181 ± 0.06 m) who completed entire matches were used in the study. Players wore a GPS unit in a specific tight shirt located on the back. GPS data (distances covered at various speeds) were recorded at 10Hz (Polar Team Pro Sensor, Polar Electro, Kempele, Finland). There are studies to show that GPS units which sample at 10Hz are sufficiently accurate to quantify distance covered at higher speeds or time spent at very high power (Rampinini et al., 2015; Aughey, 2011), as well as the acceleration and deceleration running phases in team sports (Varley et al., 2012). The team investigated in the present study finished at the 6th place on the Table. From a tactical point of view, the team has used a 4-3-3 formation during the competitive period. All players were informed of the purpose of the study and gave their informed consent according to the Declaration of Helsinki.

Contextual Factors

Players were assigned to one of four outfield positions according to their tactical role on the pitch: Central defenders (CD; $n=3$; match observations =41), full backs (FB; $n=5$; match observations = 36), central midfielders (CM; $n= 5$; match observations = 32) and attackers (AT; $n= 7$; match observations = 48) to determine the influence of playing position on between-match variation in match activities. Match result (win, draw, loss) and opposition level were recorded. The team's match result record for the competitive season was 12 wins, 5 draws and 11 losses. Opposition level was classified according to the team's final league ranking (Best teams: 1st to 4th; Middle teams: 5th to 12th; Last teams: 13th to 16th) (Barrett et al., 2018).

Match Running Activities

The following match running activities were assessed (Di Salvo et al., 2007): total distance (TD), high speed running distances (HSR; distance covered with more than 19 km/h), medium speed running distances (MSR; distance covered with 14.4–18.99 km/h), low speed running distances (LSR; distance covered with 11–14.99 km/h), very low speed running distances (VLSR; distance covered with 7–10.99 km/h), walking distances (WALK; distance covered with 3–6.9 km/h), maximum speed (MS) and the number of sprints (NrSP; distance covered with more than 25 km/h). These speed zones were assessed in order to describe the very-low, low, medium and high intensity activities (Di Salvo et al., 2007). Maximum speed represents the maximal run speed a player reached during the game.

Statistical Analysis

Data are presented as the mean (M) $\pm$ standard deviation (SD). Before the use of parametric test the assumptions of normality and sphericity were verified. A three-way analysis of variance ($4 \times 3 \times 3$) was conducted to examine the main and interactive effects of three independent variables (playing position, match result and opposition level) on each match running performance dependent variable (distances covered at various velocities, number of sprints and maximum sprints). Specifically, playing position included four levels (central defenders, fullbacks, midfielders and attackers), game result consisted of three levels (win, draw and lost) and opposition level consisted of three levels (best, middle and last teams according to the final rank on the Super League Table). When the F ratio for main and interactive effects was significant, post hoc comparisons of means were analysed using the Bonferroni's multiple comparison tests. Effect sizes (η^2) were also calculated. The η^2

used to interpret these results were also adjusted so that 0.01, 0.06 and above 0.15 were considered small, medium and large, respectively (Cohen 1988). The level of statistical significance was set at $p < 0.05$.

Results

A significant main effect of playing position on TD ($F_{3,126}=11.898$, $p < 0.001$, $\eta^2=0.221$), HSR ($F_{3,126}=35.346$, $p < 0.001$, $\eta^2=0.457$), NrSP ($F_{3,126}=26.592$, $p < 0.001$, $\eta^2=0.388$), MS ($F_{3,126}=7.754$, $p < 0.001$, $\eta^2=0.156$), MSR ($F_{3,126}=19.934$, $p < 0.001$, $\eta^2=0.322$), LSR ($F_{3,126}=10.140$, $p < 0.001$, $\eta^2=0.194$), VLSR ($F_{3,126}=13.002$, $p < 0.001$, $\eta^2=0.236$) and WALK ($F_{3,126}=6.796$, $p < 0.001$, $\eta^2=0.139$) was found (Table 1). A similar main effect of opposition level was found on TD ($F_{2,126}=3.437$, $p < 0.05$, $\eta^2=0.52$) (Table 2). No significant main effect of game result was found on any of the dependent variables.

Table 1. Match running activities (mean $\pm$ SD) according to playing position of elite soccer players from the same team during a season

	<i>Central Defenders (CD)</i>	<i>Fullbacks (FB)</i>	<i>Midfielders (MD)</i>	<i>Attackers (AT)</i>	<i>Post- hoc tests</i>
	(Observations=41)	(Observations=36)	(Observations=32)	(Observations=48)	
WALK (m)	3301.4 $\pm$ 229.8	3524.1 $\pm$ 376.7	3805.2 $\pm$ 496.6	3703.0 $\pm$ 320.8	CD* < (FB=FW=MD)
VLSR (m)	2802.9 $\pm$ 232.7	2324.8 $\pm$ 406.1	2184.3 $\pm$ 354.0	2272.0 $\pm$ 466.4	(MD=AT=FB) < CD*
LSR (m)	1985.1 $\pm$ 181.4	2144.9 $\pm$ 225.5	2447.7 $\pm$ 442.0	2048.6 $\pm$ 293.1	(CD=AT=FB) < MD*
MSR (m)	860.3 $\pm$ 138.1	1128.4 $\pm$ 231.2	1334.7 $\pm$ 279.2	1120.0 $\pm$ 199.0	CD* < (FB=AT) < MD*
HSR (m)	479.8 $\pm$ 116.4	869.4 $\pm$ 276.5	701.7 $\pm$ 187.9	1038.8 $\pm$ 210.4	CD* < MD* < FB* < AT*
MS (Km/h)	29.4 $\pm$ 1.8	30.7 $\pm$ 2.5	29.4 $\pm$ 1.6	31.4 $\pm$ 1.8	(CD=MD) < (FB=AT)*
NrSP	7.3 $\pm$ 3.1	14.9 $\pm$ 6.8	10.0 $\pm$ 3.8	20.0 $\pm$ 6.1	(CD=MD) < FB* < AT*
TD (m)	10080.0 $\pm$ 445.5	10580.6 $\pm$ 509.3	10954.3 $\pm$ 671.8	10736.5 $\pm$ 653.0	CD* < (FB=AT=MD)

* $p < 0.01$ Significant Differences between playing positions; TD: total distance; NrSP: Number of Sprints; MS: maximum speed; HSR: distance covered more than 19 km/h; MSR: distance covered with a moderate speed 15-18.99 Km/h; LSR:

Table 2. Match running activities (mean $\pm$ SD) according to playing position of elite soccer players from the same team during a season.

Opposition Level	TD (m)	MS (km/h)	NrSP	WALK (m)	VLSR (m)	LSR (m)	MSR (m)	HSR (m)
Best teams (observations =35)	10658 $\pm$ 677	30.1 $\pm$ 1.7	12.9 $\pm$ 7.7	3499 $\pm$ 383	2566 $\pm$ 391 [#]	2199 $\pm$ 393	1088 $\pm$ 303	754 $\pm$ 267
Middle teams (observations =65)	10683 $\pm$ 686*	30.7 $\pm$ 2.2	14.5 $\pm$ 7.5	3633 $\pm$ 419	2435 $\pm$ 445*	2138 $\pm$ 349	1080 $\pm$ 257	818 $\pm$ 324
Last teams (observations =57)	10396 $\pm$ 572*	29.9 $\pm$ 2.1	12.6 $\pm$ 6.7	3563 $\pm$ 389	2270 $\pm$ 448* [#]	2093 $\pm$ 276	1123 $\pm$ 255	766 $\pm$ 283

* $p < 0.01$ Significant Differences between playing positions; TD: total distance; NrSP: Number of Sprints; MS: maximum speed; HSR: distance covered more than 19 km/h; MSR: distance covered with a moderate speed 15-18.99 Km/h; LSR: distance covered with low speed 11-14.99 km/h; VLSR: distance covered with very low speed 7-10.99 km/h; WALK: distance covered walking with a speed 3-6.9 km/h

Significant interaction effects between playing position and opposition level, with large effect sizes, were found on TD [$F_{(6, 126)} = 2.491$, $p < 0.05$, $\eta^2 = 0.106$], HSR [$F_{(6, 126)} = 2.391$, $p < 0.05$, $\eta^2 = 0.102$] and NrSP [$F_{(6, 126)} = 2.403$, $p < 0.05$, $\eta^2 = 0.103$] and between game result and opposition level on TD [$F_{(3, 126)} = 4.410$, $p < 0.01$, $\eta^2 = 0.095$] and HSR [$F_{(3, 126)} = 5.228$, $p < 0.01$, $\eta^2 = 0.111$]. A tendency for significant interaction on NrSP between game result and opposition level was observed HSR [$F_{(3, 126)} = 2.614$, $p \leq .054$, $\eta^2 = .059$]. On the contrary, no significant interactions were found on MSR, LSR, VLSR and WALK distances among playing position, game result and opposition level of elite soccer players from the same team during the competitive season. Concerning the game result– opposition level interaction, Bonferroni's multiple comparison tests revealed that the team significantly ($p < 0.05$) covered more HSR distance against best and middle teams when winning compared to losing (Figure 1). Hence, the team covered significantly ($p < 0.05$) more TD against best and middle teams when the game result was win or draw in comparison to loss (Figure 1).

Figure 1. Interaction effects on total distance (TD) and high speed running distance (HSR) between game result and opposition level.

Further analysis of the interaction between playing position and opposition level on TD, HSR and NrSP, post-hoc analysis has shown that CD covered significantly ($p < 0.001$) less TD, HSR and NrSP in comparison to MD and AT against best, middle and last teams (Figure 2). MD covered significantly ($p < 0.01$) more TD in comparison to CD, FB and AT against best teams, whereas no significant differences on TD were observed between playing position against last teams (Figure 2). AT covered significantly ($p < 0.05$) more HSR compared to all other playing positions (CD, MD and FB) against best teams, while against middle and last teams covered significantly ($p < 0.05$) more HSR compared only to CD and MD (Figure 2).

Figure 2. Interaction effects on total distance (TD), high speed running distance (HSR) and number of sprints (NrSP) between playing position and opposition level

Dicussion

The findings of the present study highlight the importance of considering contextual factors in the effective physical match performance evaluation in elite soccer. In this study, match running distances with various velocities during a competitive season of an elite soccer team were influenced interactively by playing position, match status and opposition level, whereas a significant main effect of playing position was found influencing physical running performance. Match running activities of elite professional soccer players has been well analyzed in relation to playing position (Dellal et al., 2011; Di Salvo et al., 2007; Mohr et al., 2003; Rampinini et al., 2007). The present study has only found a significant main effect of playing position on match running performance. In our study, defenders covered less TD and HSR distances in comparison to midfielders, with midfield players covering the highest distances during elite soccer matches and forwards performing more sprints than defenders and midfield players. Our findings are in accordance to activity profiles of elite soccer players from previous studies, using elite European teams and elite soccer teams from the English Premier League (Bradley et al., 2011; Di Salvo et al., 2007; Gregson et al., 2010; Rampinini et al., 2007). Possible reasons for playing position running differences among studies are the different time – motion methods used in activity analysis, the classification of running speed zones in each study, the playing style, the tactical organization of teams, as well as the cultural differences among the championships (Dellal et al., 2011; DiSalvo et al., 2007; Gregson et al., 2010; Rampinini et al., 2007). On the other side, the present study has not shown significant main effect of the match result (win, draw, lost) and opposition level on TD and HSR distances in elite soccer player throughout the competitive season. Previous studies have reported large influence in isolation of match result and opposition level on physical performance in elite soccer players (Bloomfield et al., 2005; Castellano et al., 2011; Lago et al., 2010). Specifically, Lago et al. (2010) have reported that less high-intensity activity was covered by top-class soccer players when they were winning than when they were losing, and the better the quality of the opponent, the higher the distance covered by walking and jogging. The absence of significant main effects of match result and opposition level on match running activities of the elite soccer team in our study may be due to the mild quality differences between the teams as reflected in the ranking table where the 6th to 12th team had only 6 points difference. Another possible factor that may explain the absence of significant main effect of match result on physical performance is that the majority of wins and losses were just within one goal difference resulting to a greater physical effort from the players to balance the match.

However, the present study was accompanied by significant interaction effects with large effect sizes of playing position, match result and opposition level on physical performance in an elite soccer team during the competitive season. Specifically, an interaction between playing position and opposition level was observed in the present study. Analyzing this interaction, attackers covered more total distance and HSR distances and performed higher NrSP against best and middle teams in comparison to last teams, while full backs covered more HSR distances and performed more sprints against middle and last teams compared to best teams. These differences in match running performance could possibly happen due to changes in the tactical behavior of players under specific circumstances. Probably, attackers being the first line of defend try to prevent the building attack from the back covering more distances against a quality team using short passes, in comparison to last and middle teams using long balls. On the other hand, full backs covered less HSR distances against best teams compared to middle and last teams because they are likely to emphasize their defensive duties covering their space. Against middle and last teams, they may involve more frequently in the attacking function of the team, covering distances up to their offensive third. Another significant interaction on physical performance observed in the present study was between match result and opposition level. Players covered more HSR distances when they won against best and middle teams compared to last teams. This may occur because they maximize their effort in order to keep the winning score against better or equivalent teams, while they cover less HIR distances when they win against last teams trying to slow down the pace of the match (Lago et al., 2010).

Conclusions

These findings suggest that HSR distances covered by an elite team throughout a season affected by more than one contextual factors (playing position, match result and opposition level) interact with each other. Data shown provide valuable information to coaches on how to plan, organize and implement training sessions simulated from certain contextual factors. Limitations of the present study are the lack of match evaluation of technical and tactical characteristics at both individual and team level under specific match situational variables. Future studies should focus on a more holistic approach – including physical, technical and tactical characteristics - to evaluate match soccer performance under the impact of specific contextual factors.

Conflicts of interest - The author declares no conflict of interest.

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