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Christopher Carling<sup>ab</sup>

<sup>a</sup> LOSC Lille Métropole Football Club, Camphin-en-Pévèle, France <sup>b</sup> Institute of Coaching and Performance, University of Central Lancashire, Lancashire, UK

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ORIGINAL ARTICLE

## Influence of opposition team formation on physical and skill-related performance in a professional soccer team

CHRISTOPHER CARLING

*LOSC Lille Métropole Football Club, Camphin-en-Pévèle, France, and Institute of Coaching and Performance, University of Central Lancashire, Lancashire, UK*

### Abstract

This study examined the influence of opposition team formation on physical and skill-related performance in a professional soccer team. Performance in 45 French League 1 matches played over three competitive seasons (2007–2008, 2008–2009, and 2009–2010) was analysed using multi-camera computerized tracking. Players ( $n = 21$ ) in the reference team (using a 4-3-3/4-5-1 formation) were analysed in matches against three opposition team formations: 4-4-2 (11 games), 4-3-3/4-5-1 (16 games), and 4-2-3-1 (18 games). Performance was compared for defending and midfield units as a whole and individually across four positions: full backs, central defenders, central midfielders, and wide midfielders. Collectively, players covered a greater total distance ( $P < 0.05$ ) and distance in low- to moderate-intensity running ( $0\text{--}14.3 \text{ km} \cdot \text{h}^{-1}$ ) ( $P < 0.05$ ) in matches against a 4-2-3-1 compared with a 4-4-2 formation. Distance covered in high-intensity ( $14.4\text{--}19.7 \text{ km} \cdot \text{h}^{-1}$ ) and very high-intensity running ( $\geq 19.8 \text{ km} \cdot \text{h}^{-1}$ ) was not affected by opposition formation. In contrast, players covered more distance in total high-intensity performance ( $\geq 14.4 \text{ km} \cdot \text{h}^{-1}$ ) when the reference team was in possession against a 4-4-2 compared with a 4-2-3-1 formation ( $P < 0.05$ ), while a greater distance was run at these speeds when the reference team was not in possession against a 4-2-3-1 ( $P < 0.01$ ) and a 4-3-3 ( $P < 0.05$ ) compared with a 4-4-2 formation. Players ran less distance at low-to-moderate intensities in the second- versus first-half of matches against all three formations ( $P < 0.01$  to  $P < 0.05$ ), whereas total distance and high-intensity performance were unaffected. None of the measures of physical performance across the individual playing positions were affected by opposition team formation. Skill-related performance varied according to opposition formation: players as a whole performed more passes versus a 4-4-2 than a 4-2-3-1 formation ( $P < 0.01$ ); ground and aerial duels versus a 4-2-3-1 compared with a 4-4-2 formation (both  $P < 0.01$ ); one-touch passes versus a 4-2-3-1 compared with a 4-4-2 formation ( $P < 0.01$ ) and a 4-3-3/4-5-1 formation ( $P < 0.05$ ). The mean number of touches per possession was highest versus a 4-4-2 compared with a 4-3-3/4-5-1 ( $P < 0.01$ ) and a 4-2-3-1 formation ( $P < 0.01$ ). While skill-related performance across the four individual playing positions was generally unaffected by opposition team formation, mean pass length was greater for central midfielders against a 4-4-2 compared with a 4-3-3/4-5-1 ( $P < 0.05$ ) and a 4-2-3-1 formation ( $P < 0.01$ ). In general, the findings suggest that physical performance in the reference team was not greatly affected by opposition team formation. In contrast, skill-related demands varied substantially according to opponent formation and may have consequences for tactical and technical preparation and team selection policies.

**Keywords:** *Playing system, football, motion analysis, technical performance*

### Introduction

A thorough understanding of the physical demands of professional soccer is required so that optimal training and preparation strategies can be constructed to respond to the demands of match-play. Recently, advanced computerized motion analyses of performance in contemporary match-play have

provided comprehensive insights into the activity profiles of professional soccer players and the physical requirements of competition (Drust, Atkinson, & Reilly, 2007). Motion analyses have also been used to investigate a myriad of variables that affect the physical performance profile of players in competition. These include the positional roles of players

(Barros et al., 2007; Di Salvo et al., 2007), cultural differences (Rienzi, Drust, Reilly, Carter, & Martin, 2000), standard of play (Mohr, Krusturp, & Bangsbo, 2003), team quality (Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009; Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009), match congestion (Odetoyinbo, Wooster, & Lane, 2008), score line (Bloomfield, Polman, & O'Donoghue, 2004), player dismissals (Carling & Bloomfield, 2010), substitutes (Carling, Espié, Le Gall, Bloomfield, & Jullien, 2010), and the physical condition (Krusturp et al., 2003) and age (Pereira Da Silva, Kirkendall, & Leite De Barros Neto, 2007) of players.

There is also speculation that the physical efforts of players in match-play are influenced by team formation (Bradley et al., 2009b; Carling, Bloomfield, Nelsen, & Reilly, 2008; Drust et al., 2007). Indeed, the choice of team formation should take into account individual physical abilities such as endurance and speed (Bauer, 1993). Furthermore, the interaction between physical, tactical, and technical skills should also be considered when evaluating performance according to team formation (Carling, Williams, & Reilly, 2005). Yet to date, only one preliminary study using a relatively small sample size (19 matches) has examined the effects of team formation on physical and skill-related (tactical and technical) performance (Bradley et al., 2009a). The performance of teams adopting 4-4-2, 4-3-3, and 4-5-1 formations was compared. The results showed that teams using a 4-4-2 performed more high-intensity running and passes than those using a 4-5-1 formation. Furthermore, no study has investigated the direct influence of opposition team formation on physical and skill-related performance in a reference soccer team. Related research in professional Italian soccer has shown that physical performance in a reference team was directly related to the physical activity completed by opponent teams (Rampinini et al., 2007). However, no information was provided as to the possible influence on findings of the respective team formations used by opponents.

Further research using match analyses into the influence of opposition team formation on physical and skill-related performance is therefore warranted. This information may have implications for aiding team selection and optimizing physical and tactical preparation strategies for matches against different formations. It may also be useful in identifying a link between match-related decrements in physical performance and opposition team formation. Declines in physical performance in competition can occur directly after intense periods of activity and during the later stages of games, suggesting temporary and

permanent fatigue (Mohr, Krusturp, & Bangsbo, 2005). The identification of reduced physical performance in competition that occurs specifically against certain team formations would be beneficial in informing strategies to aid teams to maintain performance throughout such matches.

Consequently, the aim of this study was to investigate the effect of opposition team formation on physical activity profiles and skill-related (tactical and technical) performance in a reference team during professional soccer match-play.

## Methods

### *Participants and match sample*

With ethics approval from the internal review board of the sampled football club, physical, tactical, and technical demands of match-play were analysed for outfield soccer players in a professional soccer team that competed in the French League 1 division (highest standard in French soccer). To ensure player confidentiality, all performance data were anonymized before analysis.

A total of 45 official games over three seasons (2007–2008,  $n=15$ ; 2008–2009,  $n=18$ ; 2009–2010,  $n=12$ ) in which players completed the entire match were used for analysis. Performance in the reference team was analysed in matches against three team formations commonly used in professional soccer: 4-4-2 (11 games, 9 teams), 4-3-3/4-5-1 (16 games, 12 teams), and 4-2-3-1 (18 games, 13 teams). The reference team recorded two top-ten finishes (9th and 5th) in the first two seasons and was placed 5th at the moment the final game was analysed in the current season. The standard of the sample of opponent teams analysed for each formation was: 4-4-2 = 4 top-ten and 7 bottom-nine placed teams; 4-3-3/4-5-1 = 9 top-ten and 7 bottom-nine placed teams; and 4-2-3-1 = 9 top-ten and 9 bottom-nine placed teams. The interaction between opposition standard (based on League position) and team formation was verified for the performance measures. Two- and three-way analyses of variance showed no significant interactions between factors ( $P > 0.05$ ), indicating that the standard of opposition did not confound the results.

To determine opponent team formations, two UEFA-qualified coaches (one from the reference club's coaching staff and one independent observer) observed video recordings of the sampled games. These observers subjectively determined team formations at the start of games and also verified that the formations were consistent throughout the games. Games in which a dismissal occurred were not included for analysis. Teams that played a 4-3-3 formation were combined with those using a 4-5-1

system. Distinction between these two systems was deemed to be difficult by the observers, as teams often played a 4-3-3 when in possession and reverted to a 4-5-1 when out of possession. The reference team was generally organized in the 4-3-3/4-5-1 format and only games in which this formation was used were included for analysis.

Altogether, 21 players participated with a median of 15.5 matches (in which the full 90 min were played) per player (range 1–38). This sample led to a total of 297 observations of match performance. Of this total, the number of observations for each position was respectively: full backs,  $n=82$ ; central defenders,  $n=80$ ; central midfielders,  $n=78$ ; and wide midfielders,  $n=57$ . Forward players were excluded due to a low number of observations in both the reference and opposition teams.

#### *Data collection procedures and measures of competitive performance*

A computerized player tracking system (AMISCO Pro<sup>®</sup>, Sport-Universal Process, Nice, France) was used to characterize activity profiles in the reference team. This multiple-camera system tracks the movements of every player at a sampling rate of 10 Hz over the course of matches and provides data on the distances covered at different movement speeds (Carling et al., 2005). A trained operator simultaneously codes technical actions involving the ball according to a pre-defined classification. The workings, accuracy, and reliability of the AMISCO Pro<sup>®</sup> system in measuring player movement and coding match-specific events in elite soccer competition have been described in more detail elsewhere (Carling et al., 2008; Di Salvo et al., 2007; Randers et al., 2010; Zubillaga, Gorospe, Hernandez-Mendo, & Blanco-Villanador, 2008).

Physical and technical performance was determined automatically from the raw data files by computerized analysis of player movements and actions using match-analysis software (AMISCO Viewer<sup>®</sup>, Sport-Universal Process, Nice, France). To avoid the potential effect of variations in duration across games, information obtained in injury time or extra time was not included for analysis. Performance data for each game were therefore analysed over 90 min (two halves of 45 min each).

The performance measures selected for the analyses were classified into three categories:

(1) *Physical performance* – total distance covered and distance covered in three categories of movement speed (Bradley et al., 2009b): 0.0–14.3 km · h<sup>-1</sup> (low-to-moderate intensity); 14.4–19.7 km · h<sup>-1</sup> (high intensity); and ≥19.8 km · h<sup>-1</sup> (very high intensity). Total high-intensity performance was

defined as movement performed at speeds ≥14.4 km · h<sup>-1</sup> (high-intensity and very high-intensity running combined). The distance covered in total high-intensity performance was measured for players when in individual possession of the ball and when their team was in (attacking play) and out (defensive play) of possession. In addition, both the mean time spent in recovery between actions performed in the total high-intensity performance category and the mean length of these efforts were calculated.

(2) *Declines in physical performance* – all measures of physical performance were compared across match halves. End-game performance was also analysed by comparing the percentage change in distance covered in total high-intensity performance. For this, the distance run in the final 15-min period was compared with that for the first 15-min period and the mean of other 15-min periods (mean of all periods minus final 15-min period).

(3) *Skill-related performance measures* defined and calculated in the AMISCO<sup>®</sup> Pro system included: frequency of passes and forward passes, mean length of passes, percentage of passes played with one touch, frequency of ball possessions, mean time and number of touches per possession, and frequency of ground and aerial duels. Finally, measures of the total time the ball was in play and the percentage of time spent in possession were measured across games for the team as a whole.

#### *Statistical analyses*

All statistical analyses were conducted using SPSS for Windows Version 14.0 (SPSS Inc., Chicago, IL, USA). Data are presented as means and standard deviations unless otherwise stated. Before using parametric statistical test procedures, the normality of the data was verified. Two-way analysis of variance (ANOVA) was used to test for differences in means for all players in performance measures against the three opposition formations and to examine the interaction between playing position and opposition formation. To investigate declines in performance, a three-way ANOVA was performed on each category of physical performance to examine the interaction between performance across match halves, opposition formation, and playing position. To study end-game decrements in performance, a two-way ANOVA was used to compare the interaction between percentage decline in physical performance (efforts in end 15-min period compared with first and mean 15-min periods), opposition formation, and playing position. Follow-up univariate analyses using Bonferroni-corrected pair-wise comparisons were used where appropriate.

Effect sizes for statistical differences were also determined. Effect size (ES) values of 0.20–0.49, 0.50–0.79, and  $\geq 0.8$  were considered to represent small, medium, and large differences, respectively (Cohen, 1988).

## Results

### *Physical performance*

Data on each category of performance against the three opposition team formations are presented in Table I. The total distance run for players in all positions combined varied when performing against the three opposition team formations ( $P=0.026$ ). Players covered greater total distances against a 4-2-3-1 compared with a 4-4-2 formation ( $P < 0.05$ ,  $ES = 0.32$ ).

The distance covered in low-/moderate-intensity running also varied when competing against the three opposition team formations ( $P=0.007$ ). Players ran more distance at low/moderate intensities against a 4-2-3-1 compared with a 4-4-2 formation ( $P < 0.01$ ,  $ES = 0.49$ ).

Distance covered in total high-intensity running by all players when their team was in possession varied when competing against the three formations ( $P=0.032$ ). Players covered more distance when their team was in possession against a 4-4-2 compared with a 4-2-3-1 formation ( $P < 0.05$ ,  $ES = 0.30$ ). Similarly, the distance covered in total high-intensity running when out of possession differed ( $P=0.004$ ) according to opposition team formation. Players ran significantly more distance against a 4-2-3-1 ( $P < 0.01$ ,  $ES = 0.40$ ) and 4-3-3 formation ( $P < 0.05$ ,  $ES = 0.37$ ) compared with a 4-4-2 formation.

No differences were observed in the following variables in matches against the three opposition team formations: distance covered in high-intensity ( $P=0.476$ ) and very high-intensity movement ( $P=0.411$ ); total high-intensity performance – mean recovery time between ( $P=0.230$ ) and mean length of ( $P=0.667$ ) actions; distance run in individual ball possession ( $P=0.307$ ).

Finally, no significant interaction was observed in any of the measures of physical performance for efforts across the individual playing positions against the three opposition team formations.

### *Declines in performance*

The formation used by opponent teams affected the distance covered by the reference team in low-/moderate-intensity running across the two halves of matches ( $P=0.005$ ). Players in all positions combined performed less running at low/moderate

intensities in the second versus the first half of matches against the three formations: 4-4-2, first half =  $4267 \pm 201$  m vs. second half =  $4046 \pm 191$  m,  $P < 0.01$ ,  $ES = 1.20$ ; 4-3-3/4-5-1, first half =  $4281 \pm 191$  m vs. second half =  $4142 \pm 190$  m,  $P < 0.05$ ,  $ES = 0.71$ ; 4-2-3-1, first half =  $4280 \pm 198$  m vs. second half =  $4199 \pm 220$  m,  $P < 0.05$ ,  $ES = 0.40$ . The total distance run and distance covered at other movement speeds across match halves were unaffected by opposition team formation. Similarly, total high-intensity performance across match halves (recovery time between and length of actions; and the percentage decrement during the final 15-min period of matches) was unaffected by opposition team formation (Table II). Finally, performance in none of the physical performance measures across game halves within the four playing positions was affected by opposition team formations.

### *Skill-related performance*

A significant difference was observed for players in all positions combined in the following skill-related performance variables when playing against the three formations (Table III): passing frequency ( $P=0.007$ ) with players performing more passes versus a 4-4-2 than a 4-2-3-1 ( $P < 0.01$ ,  $ES = 0.50$ ); mean number of ball touches per possession ( $P=0.003$ ) with players taking more touches versus a 4-4-2 compared with a 4-3-3/4-5-1 ( $P < 0.01$ ,  $ES = 0.67$ ) and a 4-2-3-1 ( $P < 0.01$ ,  $ES = 0.63$ ); frequency of ground duels ( $P=0.022$ ) with players performing more duels versus a 4-2-3-1 compared with a 4-4-2 ( $P < 0.01$ ,  $ES = 0.57$ ); frequency of aerial duels ( $P=0.004$ ) with players performing more duels versus a 4-2-3-1 than a 4-4-2 ( $P < 0.01$ ,  $ES = 0.56$ ); percentage of passes played with one touch ( $P < 0.001$ ) with players performing more passes versus a 4-2-3-1 compared with a 4-4-2 ( $P < 0.01$ ,  $ES = 0.59$ ) and 4-3-3/4-5-1 ( $P < 0.05$ ,  $ES = 0.44$ ) formation. No difference was observed in the mean length of passes against the three formations for players in all positions combined ( $P=0.884$ ). While skill-related performance was generally unaffected across playing positions against the different team formations, mean pass length varied ( $P=0.018$ ), as this was greater in central midfielders against a 4-4-2 compared with a 4-3-3/4-5-1 ( $P < 0.05$ ,  $ES = 0.50$ ) and 4-2-3-1 ( $P < 0.01$ ,  $ES = 0.57$ ).

The time the ball was in play (4-4-2 = 50 min 40 s vs. 4-3-3/4-5-1 = 49 min 29 s vs. 4-3-2-1 = 49 min 0 s,  $P=0.419$ ) was similar against all formations. In contrast, the percentage of time spent in possession by the reference team varied against the three formations (4-4-2 = 55% vs. 4-3-3/4-5-1 = 52.4% vs. 4-2-3-1 = 50.3%,  $P=0.035$ ) with more

Table I. Comparison of distances covered at different intensities in a reference team against three opposition team formations

Position	4-3-3/4-5-1 vs.	Low/moderate (0–14.3 km·h <sup>-1</sup> )	High (14.4–19.7 km·h <sup>-1</sup> )	Very high (≥ 19.8 km·h <sup>-1</sup> )	Total distance (m)	Total ≥ 14.4 km·h <sup>-1</sup> (individual Possession)	Total ≥ 14.4 km·h <sup>-1</sup> (team in possession)	Total ≥ 14.4 km·h <sup>-1</sup> (team out of possession)
Full back	4-4-2	8270 ± 260	1542 ± 279	843 ± 128	10655 ± 497	97 ± 53	965 ± 281	1222 ± 179
Full back	4-3-3/4-5-1	8323 ± 292	1590 ± 207	911 ± 153	10824 ± 473	96 ± 48	1002 ± 182	1289 ± 243
Full back	4-2-3-1	8404 ± 334	1592 ± 266	848 ± 158	10844 ± 513	86 ± 36	916 ± 183	1308 ± 225
Central defender	4-4-2	8246 ± 348	1288 ± 177	470 ± 108	10004 ± 469	77 ± 43	471 ± 135	1017 ± 97
Central defender	4-3-3/4-5-1	8414 ± 247	1269 ± 191	477 ± 112	10161 ± 404	79 ± 45	480 ± 124	1021 ± 168
Central defender	4-2-3-1	8431 ± 325	1264 ± 185	497 ± 141	10192 ± 466	69 ± 51	430 ± 119	1061 ± 234
Central midfielder	4-4-2	8518 ± 267	2001 ± 297	658 ± 151	11177 ± 549	99 ± 61	1172 ± 336	1343 ± 293
Central midfielder	4-3-3/4-5-1	8545 ± 228	2029 ± 319	704 ± 188	11278 ± 446	95 ± 48	1098 ± 316	1466 ± 291
Central midfielder	4-2-3-1	8587 ± 263	1985 ± 308	678 ± 195	11250 ± 510	99 ± 69	1051 ± 387	1430 ± 233
Wide midfielder	4-4-2	8221 ± 410	1478 ± 270	844 ± 260	10543 ± 656	202 ± 47	1537 ± 279	652 ± 223
Wide midfielder	4-3-3/4-5-1	8413 ± 426	1633 ± 236	869 ± 201	10916 ± 546	157 ± 66	1372 ± 254	915 ± 184
Wide midfielder	4-2-3-1	8495 ± 480	1591 ± 263	861 ± 174	10948 ± 650	168 ± 70	1336 ± 231	905 ± 267
Mean all positions	4-4-2	8314 ± 329	1577 ± 373	704 ± 219	10594 ± 681	119 ± 65	1036 ± 448***	1058 ± 307
Mean all positions	4-3-3/4-5-1	8424 ± 301	1630 ± 376	741 ± 236	10795 ± 624	107 ± 57	988 ± 392	1172 ± 314****
Mean all positions	4-2-3-1	8479 ± 350**	1608 ± 374	721 ± 222	10808 ± 661*	106 ± 67	933 ± 409	1176 ± 310****

\*Significantly more distance covered against a 4-2-3-1 compared with a 4-4-2 formations ( $P < 0.05$ ).

\*\*Significantly more distance covered against a 4-2-3-1 compared with a 4-4-2 formations ( $P < 0.01$ ).

\*\*\*Significantly more distance covered against a 4-4-2 compared with a 4-2-3-1 formations ( $P < 0.05$ ).

\*\*\*\*Significantly more distance covered against a 4-3-3/4-5-1 ( $P < 0.05$ ) and 4-2-3-1 ( $P < 0.01$ ) compared with a 4-4-2 formation.

Table II. Characteristics of total high-intensity performance ( $\geq 14.4 \text{ km} \cdot \text{h}^{-1}$ ) of a reference team against three different opposition team formations

Position	4-3-3/4-5-1 vs.	Recovery time (s)			Length (m)			Performance decrement (%)	
		First half	Second half	Mean	First half	Second half	Mean	First vs. end 15 min	Mean vs. end 15 min
Full back	4-4-2	26.8±5.2	29.0±4.8	27.9±4.0	13.1±0.7	13.1±1.3	13.1±0.6	15.3±26.7	6.2±26.8
Full back	4-3-3	25.2±5.0	27.4±3.7	26.3±3.5	12.7±1.0	13.3±1.2	13.0±0.8	14.0±30.8	4.7±28.8
Full back	4-2-3-1	25.5±4.5	27.8±4.3	26.7±3.6	13.0±0.8	12.7±0.9	12.8±0.7	7.0±34.7	3.1±22.5
Centre defender	4-4-2	36.4±5.9	38.8±6.7	37.6±5.3	12.6±1.1	13.0±1.5	12.8±1.2	12±23.7	0.2±25.8
Centre defender	4-3-3	35.3±5.4	38.4±6.7	36.8±4.6	12.3±1.2	12.4±1.1	12.4±.9	18.0±25.0	8.2±24.9
Centre defender	4-2-3-1	35.1±6.3	37.8±7.0	36.5±5.8	12.4±0.9	12.2±1.2	12.3±0.8	14.6±38.0	5.8±36.6
Central midfielder	4-4-2	22.9±4.7	25.4±4.4	24.1±4.2	12.7±0.9	12.9±0.7	12.8±0.5	6.7±25.2	0.5±24.4
Central midfielder	4-3-3	22.2±4.1	24.3±4.5	23.2±3.9	12.6±0.9	12.7±0.9	12.6±0.8	6.2±43.3	10.2±22.8
Central midfielder	4-2-3-1	24.0±4.9	25.2±5.1	24.6±4.1	12.9±0.8	13.0±1.01	12.9±0.7	7.0±36.7	6.8±25.0
Wide midfielder	4-4-2	28.2±5.1	29.3±6.5	28.7±5.3	13.5±0.6	12.6±0.8	13.0±0.6	18.9±18.3	12.2±23.8
Wide midfielder	4-3-3	26.0±3.7	28.0±4.8	27.0±2.8	13.1±1.1	13.8±1.1	13.4±0.9	4.5±31.6	3.7±22.1
Wide midfielder	4-2-3-1	27.6±6.1	27.7±3.2	27.6±3.8	13.6±0.9	13.0±1.1	13.3±0.7	12.3±37.7	10.8±34.3
Mean all positions	4-4-2	28.6±7.4	30.6±7.6	29.6±7.0	13.0±0.9	12.9±1.1	13.0±0.8	12.4±23.9	3.7±24.9
Mean all positions	4-3-3	27.2±6.9	29.5±7.5	28.3±6.6	12.7±1.1	13.0±1.2	12.9±0.9	10.9±33.7	7.1±24.6
Mean all positions	4-2-3-1	28.0±6.9	29.6±7.1	28.8±6.4	13.0±0.9	12.7±1.0	12.9±0.8	10.2±36.5	6.6±29.5

Note: First vs. end 15 min = distance covered in the first 15-min period versus that covered in the final 15-min period.

Mean vs. end 15 min = distance for the mean of all 15-min periods (minus final period) versus that covered in the final 15-min period.

Table III. Comparison of skill-related performance in a reference team against three opposition team formations

Position	4-3-3/4-5-1 vs.	Passes ( <i>n</i> )	Forward passes ( <i>n</i> )	Mean pass distance (m)	One-touch passes (%)	Individual possessions ( <i>n</i> )	Mean touches per possession ( <i>n</i> )	Mean time per possession (s)	Ground duels ( <i>n</i> )	Aerial duels ( <i>n</i> )
Full back	4-4-2	53.1 ± 12.3	38.9 ± 8.4	19.6 ± 2.5	49.7 ± 12.4	57.1 ± 12.2	1.8 ± 0.3	0.9 ± 0.9	6.7 ± 2.4	4.7 ± 2.5
Full back	4-3-3/4-5-1	53.8 ± 16.6	41.3 ± 11.4	19.2 ± 3.4	49.5 ± 12.7	57.8 ± 17.1	1.8 ± 0.3	1.0 ± 0.3	7.0 ± 3.4	4.3 ± 1.7
Full back	4-2-3-1	49.5 ± 12.0	38.7 ± 9.8	19.0 ± 2.9	52.6 ± 11.8	53.6 ± 11.8	1.8 ± 0.3	1.0 ± 0.3	7.6 ± 3.2	4.8 ± 3.5
Centre defender	4-4-2	44.1 ± 11.2	35.4 ± 10.6	22.4 ± 2.1	37.9 ± 8.6	44.2 ± 15.0	2.1 ± 0.3	1.3 ± 0.4	3.7 ± 2.1	5.9 ± 2.8
Centre defender	4-3-3/4-5-1	39.7 ± 9.4	31.8 ± 7.2	24.0 ± 3.1	40.6 ± 9.5	41.0 ± 9.6	1.9 ± 0.3	1.2 ± 0.4	4.3 ± 2.3	6.8 ± 3.3
Centre defender	4-2-3-1	37.1 ± 10.7	30.6 ± 8.5	24.4 ± 3.7	45.8 ± 9.7	39.2 ± 11.4	1.9 ± 0.2	1.1 ± 0.3	4.5 ± 3.3	7.2 ± 4.1
Central midfielder	4-4-2	56.2 ± 13.8	35.6 ± 10.2	23.3 ± 15.6 <sup>#</sup>	34.9 ± 11.6	57.9 ± 17.5	2.1 ± 0.3	1.0 ± 0.3	6.6 ± 3.0	1.7 ± 1.0
Central midfielder	4-3-3/4-5-1	49.0 ± 16.6	31.8 ± 11.4	18.7 ± 3.4	33.8 ± 12.6	53.9 ± 17.1	2.1 ± 0.3	1.1 ± 0.3	7.9 ± 3.4	2.1 ± 1.7
Central midfielder	4-2-3-1	45.1 ± 11.8	29.1 ± 8.0	18.1 ± 3.2	36.7 ± 9.8	51.4 ± 13.2	2.1 ± 0.3	1.1 ± 0.3	8.9 ± 4.9	3.9 ± 2.9
Wide midfielder	4-4-2	42.7 ± 13.1	23.8 ± 9.6	17.4 ± 5.2	27.3 ± 8.2	54.9 ± 11.9	2.7 ± 0.7	1.6 ± 0.4	7.3 ± 2.5	2.1 ± 0.8
Wide midfielder	4-3-3/4-5-1	43.3 ± 11.8	25.6 ± 7.9	19.4 ± 2.9	34.0 ± 9.1	52.4 ± 11.7	2.2 ± 0.3	1.3 ± 0.4	8.8 ± 4.9	3.9 ± 2.9
Wide midfielder	4-2-3-1	41.0 ± 8.8	24.8 ± 9.1	19.8 ± 4.4	38.5 ± 10.5	52.1 ± 8.6	2.3 ± 0.4	1.3 ± 0.4	9.6 ± 4.6	4.6 ± 2.9
Mean all positions	4-4-2	49.0 ± 13.4*	33.4 ± 10.7	20.7 ± 8.6	37.5 ± 12.9	53.5 ± 15.4	2.2 ± 0.5**	1.2 ± 0.4	6.1 ± 2.8	3.6 ± 2.7
Mean all positions	4-3-3/4-5-1	46.4 ± 13.7	32.6 ± 10.3	20.3 ± 3.8	39.5 ± 11.7	51.3 ± 14.4	2.0 ± 0.3	1.2 ± 0.3	7.0 ± 3.8	4.3 ± 3.1
Mean all positions	4-2-3-1	43.2 ± 11.9	30.8 ± 9.9	20.3 ± 4.3	44.7 ± 11.6****	49.0 ± 12.9	2.0 ± 0.3	1.1 ± 0.3	7.7 ± 4.5***	5.1 ± 3.6***

\*Significantly more passes versus a 4-4-2 compared with a 4-2-3-1 formation ( $P < 0.01$ ).

\*\*Significantly more touches per possession versus a 4-4-2 than a 4-2-3-1 ( $P < 0.01$ ) and 4-3-3 formation ( $P < 0.01$ ).

\*\*\*Significantly more duels against a 4-2-3-1 than a 4-4-2 formation ( $P < 0.01$ ).

\*\*\*\*Significantly higher percentage of one-touch passes versus a 4-2-3-1 than a 4-4-2 ( $P < 0.01$ ) and 4-3-3 formation ( $P < 0.05$ ).

<sup>#</sup>Mean pass distance significantly greater in central-midfielders versus a 4-4-2 compared with a 4-3-3/4-5-1 ( $P < 0.05$ ) and 4-2-3-1 formation ( $P < 0.01$ ).



possession observed against a 4-4-2 compared with a 4-2-3-1 ( $P < 0.05$ ,  $ES = 0.67$ ) formation.

## Discussion

This study was a detailed investigation of the physical and skill-related activity profiles of a professional soccer team when competing against three common team formations. The major finding is that certain aspects of physical and skill-related performance in defensive and midfield units as a whole are affected when competing against different opposition team formations. In contrast, opposition team formation generally did not influence physical and skill-related performance across four individual playing positions. Similarly, physical performance across halves and towards the end of matches was generally unaffected by opposition team formation.

The total distance covered in elite soccer match-play provides a global indication of the intensity of exercise. Contemporary outfield male professional soccer players cover on average 9–13 km per match (Stølen, Chamari, Castagna, & Wisløff, 2005). In this study, players across the defensive and midfield positions ran distances within this range. However, the overall distance covered and distance covered at low/moderate intensities by players as a whole (attacking and midfield roles combined) were influenced by opposition formation and notably increased when performing against a 4-2-3-1 formation. The small effect sizes observed for these data, however, may indicate that these differences, though statistically significant, may have limited practical relevance (Di Salvo et al., 2009). Nevertheless, this finding tends to confirm previous speculation (Carling et al., 2008; Drust et al., 2007) that opposition team formations govern player efforts, as these determined the overall physical demands of elite soccer match-play. However, opposition team formation did not influence physical performance when the effect of individual playing position was taken into account. These results suggest that while the team as a whole may have needed to adjust its efforts against different team formations, the individual demands across playing positions did not vary according to opposition formation. Caution is required, however, when interpreting these findings, as information on forward players was not available and further research with these players included is warranted.

The analysis of high-intensity running activity (distances covered, mean recovery times, and lengths of actions) showed that performance did not vary for all players or across individual playing positions in the reference team when competing against the three opposition team formations. The efforts made at high intensities are often critical to the outcome of matches (Di Salvo et al., 2009), yet the present

results suggest that opposition formation did not affect the overall demands placed on players in this aspect of play. In contrast, total distance covered in total high-intensity performance (movement  $\geq 14.4$  km  $\cdot$  h<sup>-1</sup>) varied substantially according to team ball possession (Table I). Players in all positions combined covered more distance when their team had possession against a 4-4-2 compared with a 4-2-3-1 formation. In games against the latter and the 4-3-3/4-5-1 formations, players ran more when their team was out of possession than against the 4-4-2 formation. A related study in Premier League soccer players also showed that distance in high-intensity movement according to ball possession varied significantly across teams using different formations (Bradley et al., 2009a). The present results tend to support this observation and suggest a link with the attacking and defensive tactical demands imposed by opposition formations. Indeed, the significant variation in the percentage of time in ball possession in the reference team against three opposition formations is noteworthy, as the team had substantially less possession ( $-4.7\%$ ) in games against a 4-2-3-1 compared with a 4-4-2 formation. Players may therefore have had to cover greater distances in defensive play (e.g. to regain possession) in matches against a 4-2-3-1 formation. These results imply that the evaluation of performance in high-intensity running both in and out of possession should take into account opposition team formation and the time spent in ball possession.

Overall, the total distance covered by all players dropped significantly in the second half of matches when opposition formation was not taken into account ( $P < 0.001$ ). This fall in overall performance between halves is commonly observed in elite-standard soccer (Reilly, Drust, & Clarke, 2008). In contrast, the physical efforts across match halves (total distance run and that covered at high and very high intensities, and recovery time between and length of actions in total high-intensity performance) were unaffected when opposition formation was considered. Similarly, no decrement in total high-intensity performance during the final 15-min period of matches was reported irrespective of opposition formation. In addition, opposition team formation did not influence any decline in physical performance across individual playing positions. Indeed, the aim of any team formation is to ensure optimal team organization to best utilize the physical capacities of players and reduce the efforts required to gain and use possession (Doucet, 2002). While the distance covered in low-/moderate-intensity movement declined significantly in the second half of games, this reduction was common to matches against all formations. These results as a whole generally imply that game-related decrements in physical performance in

the present team were not influenced by opposition formation.

The choice of team formation is tactically important, as the designation of player positions and roles aims to give the team the best options for manoeuvring in both attacking and defensive play (Bangsbo & Peterson, 2000). In this study, the analysis of skill-related performance showed that the frequency of several game actions was heavily influenced by opposition team formation, although this was generally not the case for the individual playing positions. Once again, the moderate effect sizes observed for these differences may, to a certain extent, limit practical relevance. Nevertheless, when competing against a 4-4-2, defending and midfield players as a whole performed more passes and more ball touches per possession versus a 4-2-3-1 formation. These results again suggest a link with the time spent in ball possession, as the reference team dominated possession in games versus a 4-4-2 formation. In contrast, players performed considerably more duels (aerial and ground) and one-touch passes against a 4-2-3-1 compared with a 4-4-2 formation. In addition to time spent in ball possession, these findings may be linked to the specific tactical role of opposition players with respect to certain formations as well as the technical ability of individuals across teams (Carling et al., 2005). Nevertheless, the present findings are noteworthy and may have consequences for tactical preparation and team selection based on opposition formation. For example, the higher frequency of one-touch passes against teams using a 4-2-3-1 formation suggests that players in the reference team could have benefited from performing one-touch passing drills in preparation for matches against this particular formation.

The limitations of this study were the relatively low number of players within certain positional roles and the non-representation of all playing positions, especially centre forwards. Also, the process of determining team formations and ensuring that these were consistent throughout games relied solely on the subjective assessment of observers. Further study is warranted to attempt to determine an objective and reliable means for assessing the choice of team formation and when changes occur. Finally, comparative information on physical and skill-related performance in matches against other team formations (e.g. 3-5-2 or 4-4-1-1) used in professional soccer was not available.

## Conclusions

The present study provides a comprehensive evaluation of physical and skill-related activity profiles in a professional soccer team when competing against three different team formations. These findings help

broaden our understanding of one of the many factors that can impact on physical performance in professional soccer match-play. A major aim of motion analyses of physical performance is to aid coaches and practitioners in making objective decisions for structuring the conditioning elements of training and subsequent match preparation (Bradley et al., 2009b; Carling, 2010). However, the present results on the whole do not lend support to the implementation of specific physical conditioning regimes to prepare for matches against any of the three common formations adopted by the present opposition teams. In contrast, skill-related demands varied substantially for the reference team as a whole when competing against the three opposition formations, and these differences may have consequences for tactical and technical match preparation strategies and team selection policies.

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