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ORIGINAL RESEARCH

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Differences in match running performance of elite male football players relative to playing position

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Abstract

Background: This study aimed to examine differences in match running performance (MRP) of elite male football players according to their team positions. **Methods**: The sample included 108 male football players from five Union of European Football Associations (UEFA) Europa League group-stage matches (2021/22). Players' movement performance was classified by position: central backs (CB; n = 22), fullbacks (FB; n = 21), central midfielders (CM; n = 28), wingers (W; n = 18), forwards (F; n = 19). Movement performance was assessed using the InStat Fitness optical system and classified by velocity: walking, jogging, running, high-intensity running and sprinting. Additional parameters included: total distance, average and maximum movement velocity, and the number of accelerations and sprints performed. **Results**: The main findings were: (i) Forwards covered a shorter distance (8449 m; $p = 0.001$) than other players—1587 m less than fullbacks, 1871 m less than central midfielders and 2157 m less than wingers. They also covered less distance in walking ($p = 0.006$) and jogging ($p = 0.001$) than other players; (ii) Wingers and central midfielders covered greater distances ($p = 0.001$) than central backs and forwards; (iii) Central backs covered less distance in high-velocity running (539 m; $p = 0.001$)—286 m less than fullbacks, 301 m less than central midfielders, 300 m less than wingers and 158 m less than forwards. They also sprinted less (62 m; $p = 0.001$)—91 m less than fullbacks, 95 m less than wingers and 80 m less than forwards—and performed fewer sprints overall; (iv) Central midfielders and wingers had the highest average velocity ($p = 0.001$); (v) No differences were found in the number of accelerations or maximum velocity. **Conclusions**: These findings highlight the different physical demands and roles of various positions in male football, informing training adjustments to enhance players' abilities.

Keywords

High-intensity running; Match analysis; Physical demands; Playing position; Soccer; Tactical role

1. Introduction

The last decade has brought a significant increase in the intensity of football matches [1, 2]. Today, players need to develop an array of physiological attributes, *e.g.*, aerobic fitness, running velocity, metabolic thresholds, muscular strength/power, change of direction ability, *etc.*, with a lot of greater variation in intensity, and in the future is likely to see continued increases to further highlight the trends direction [3–5]. A large number of high-intensity movements, including sprints, occur during critical periods that involve tackling, defensive and offensive actions and goal-scoring possibilities [6]. Specifically, computer-aided evaluation of motion allows for the tracking of players' work-rate patterns during competitions. Modern technological advancements in this field have resulted in widespread use at elite football teams of highly sophisticated systems designed for collecting and analyzing data on all players' physical performances during whole matches [7]. In most time-motion analysis investigations, physical activity measurements are reported as the total distances completed based on speed thresholds. Nevertheless, experts' explanations for intensity ranges in football-match analytics vary, owing to the employment of several sophisticated kinematic methods [8].

During a football match, professional players commonly cover distances of 9–14 km, with high-intensity running accounting for 5–15%, executing 150 and 250 movements and almost 1100 direction changes [3, 9–11]. Major distinctions regarding players' physical ability may be detected in this manner, by players' physical abilities and team tasks [12]. In accordance with the framework of competitive action and its general character, a hypothetical model of anthropologi-

cal features for football players in various positions can be defined. Outfield players are classified according to their positions on the field, which normally comprise five positions: central defenders (CD), fullbacks (FB), central midfielders (CM), wingers (WM) and forwards (FW) [13]. Particular responsibilities of players in various positions vary depending on team formations or playing styles, including cooperative and competing exchanges facilitating good match performance [1].

The significance of sprint activities for match results in elite football has been established [11]. A previous study [12] analyzed the correlation between aerobic fitness (AF) and game performance indicators in elite football according to the three groups of positions in the game. The research findings indicate that aerobic and anaerobic thresholds exhibit the highest effect sizes between positions (surpassing maximal oxygen consumption-VO2max). However, their correlation with game performance indicators are widely reported to be minimal [12] to moderate [14]. In addition, previous studies indicate that players in lateral roles (FB and WM) accelerate more frequently, whereas CB and CM decelerate less than other roles [15, 16].

Although it has been noted that there are certain differences based on playing position, it is still necessary to use modern technology to analyze player movement performance during matches. Therefore, there has been an increasing number of studies recently focusing on match running performance (MRP) in football players [1, 6, 14, 17–20]. However, recent studies have analyzed MRP in relation to other factors, such as: examining MRP differences between teams from top European leagues and other leagues [17]; the impact of MRP on match outcome [1, 6, 18] and team formation [19]; as well as the connection between MRP and aerobic performance [14, 20]. A recent systematic review [21] revealed extensive research focusing on the physical performance of football players based on their team positions. However, the authors highlighted several methodological limitations, such as a lack of clearly defined samples and insufficient descriptions of independent variables [21]. Accordingly, there is a need for methodologically stronger studies on this topic. Additionally, football research on player positions predominantly originates from Spain and England [21], underscoring the need for analyses of different competitions. Especially considering the variability between leagues/countries in football playing styles, where each league exhibits a unique combination of strategies and tactics [22]. In this regard, it would be essential to examine the specifics of one of the leading leagues in Europe, the UEFA Europa League, which could be significant given that it involves an elite sample of football players. Accordingly, the aim of this study was to examine the differences in running performance of football players during matches, depending on their team positions. In this way, our research will contribute to the existing literature on the physical demands of various team positions among elite football players.

2. Materials and methods

2.1 Participants and study design

The sample included 108 elite male football players. Data were collected from 14 teams during 7 group-stage matches of the UEFA Europa League in the 2021/22 season. Goalkeepers were excluded from the study due to the specificity of their position [23, 24]. Players' movement performance was classified according to the position they played: central backs (CB; n = 22), fullbacks (FB; n = 21), central midfielders (CM; n = 28), wingers (W; n = 18) and forwards (F; n = 19). The outfield players are classified into the five mentioned types of team positions, as in previous studies [11, 17]. The identities of players and teams are anonymous in accordance with the principles of the Declaration of Helsinki to ensure confidentiality. Also, the research was approved by the Ethics Committee of the Faculty of Medical Sciences, University of the Faculty of Medical Sciences, University of Kragujevac (decision number: 01-15731; date 29 December 2021).

2.2 Procedures

Data on match running performance (MRP) were collected using the semi-automatic multi-camera optical system InStat Fitness (InStat Limited, Limerick, Republic of Ireland). This optical system includes 3 static cameras (*i.e.*, 2 × Full HD and 1 × 4K cameras) mounted on the stadium roof. With a sampling frequency of 25 Hz, it tracks players by recognizing movement, shape and color attributes. The system has undergone the official test protocol of the International Federation of Association Football (FIFA) for electronic and performance tracking systems (EPTS) and has shown strong absolute and relative reliability [25]. Data from only one full match (90 min) were taken for each football player.

2.3 Variables

Movement performance was classified according to player movement velocity into: walking (0–2 m/s), jogging (2–4 m/s), running (4–5.5 m/s), high-intensity running (5.5–7 m/s) and sprinting (>7 m/s) [24, 26]. The following parameters were also included: total distance covered during the match (m), average movement velocity (m/s), number of accelerations performed (4–5.5 m/s), number of high velocity runs and sprints (>5.5 m/s), average velocity of player during match (m/s) and maximum running velocity of the player during the match (m/s). All parameters were calculated using the InStat system (InStat Fitness, InStat Limited, Limerick, Republic of Ireland).

2.4 Statistics

For all data obtained through testing, basic descriptive parameters were calculated, including the mean and standard deviation. Since the normality of the distribution of results has been confirmed, the conditions for conducting an analysis of variance (ANOVA) have been met. To determine differences in match running performance (MRP) between football players relative to their playing position in the team, a one-way ANOVA with a Tukey *post-hoc* test was conducted, with statistical significance defined at $p < 0.05$. Data analysis was carried out using IBM SPSS Statistics software, version 26

(SPSS Inc., Chicago, IL, USA).

3. Results

Based on the ANOVA test (Table 1), a significant difference was found between groups of players according to their positions in 9 out of 11 measured parameters. Post hoc analysis determined that CB and FB cover greater distances walking than forwards.

In terms of jogging, W, FB and CM cover greater distances than forwards, as well as W compared to CB. For running, it was found that W and CM cover greater distances than CB, FB and F. Regarding high velocity running, CB achieves lower distances than all other positions on the team, and there are also differences for CM compared to F. It should be noted that CB performs fewer sprints than FB, W and F. In terms of total distance, F has lower distances than FB, CM and W.

Regarding average movement velocity, CB and FB achieved lower velocity than CM, W and F, as well as F compared to CM. Additionally, the results showed that CB performs significantly fewer sprints in a match compared to FB, CM and W.

There were no differences between groups of football players in the parameters of the number of accelerations, maximum velocity achieved by the player and energy expenditure.

Fig. 1 shows the players' movement performance classified by velocity categories and expressed as percentages. The values are presented for each position in the team.

4. Discussion

This research aimed to examine differences in match running performance of elite male football players according to their team positions. The main findings were: (i) Forwards covered a significantly shorter distance (8449 m; $p = 0.001$) compared to other players in the team, specifically 1587 m less than

TABLE 1. Differences in match running performance (MRP) of football players relative to their position in the team.

	CB	FB	CM	W	F	*p*	*post-hoc*
Walking (0–2 m/s)	3391 ± 501	3286 ± 595	2982 ± 528	3156 ± 570	2769 ± 694	0.006**	CB > F, FB > F
Jogging (2–4 m/s)	3830 ± 663	4012 ± 617	4272 ± 731	4437 ± 635	3309 ± 759	0.001**	W > CB, W > F, FB > F, CM > F
Running (4–5.5 m/s)	1458 ± 343	1772 ± 339	2147 ± 497	2020 ± 455	1575 ± 407	0.001**	W > CB, W > F, CM > CB, CM > FB, CM > F
High velocity running (5.5–7 m/s)	539 ± 141	825 ± 152	840 ± 183	839 ± 174	697 ± 165	0.001**	FB > CB, CM > CB, W > CB, F > CB, CM > F
Sprinting (>7 m/s)	62 ± 45	153 ± 97	98 ± 62	157 ± 85	142 ± 71	0.001**	FB > CB, W > CB, F > CB
Total distance (m)	9272 ± 1399	10,036 ± 1476	10,320 ± 1668	10,606 ± 1425	8449 ± 167	0.001**	FB > F, CM > F, W > F
Number of accelerations (4–5.5 m/s)	132 ± 30	150 ± 37	159 ± 41	161 ± 39	131 ± 41	0.018*	/
Number of sprints (>5.5 m/s)	55 ± 17	76 ± 16	77 ± 19	78 ± 19	65 ± 19	0.001**	FB > CB, CM > CB, W > CB
Average velocity (m/s)	1.76 ± 0.12	1.87 ± 0.12	2.03 ± 0.16	2.03 ± 0.14	1.90 ± 0.18	0.001**	CM > CB, CM > FB, W > CB, F > CB, W > FB, CM > F
Max velocity (m/s)	8.15 ± 0.47	8.48 ± 0.44	8.21 ± 0.45	8.47 ± 0.58	8.31 ± 0.42	0.095	/

*Legend: The values presented are means ± SD; CB: central backs; FB: fullbacks; CM: central midfielders; W: wingers; F: forwards; p: level of significance; **p < 0.01, *p < 0.05.*

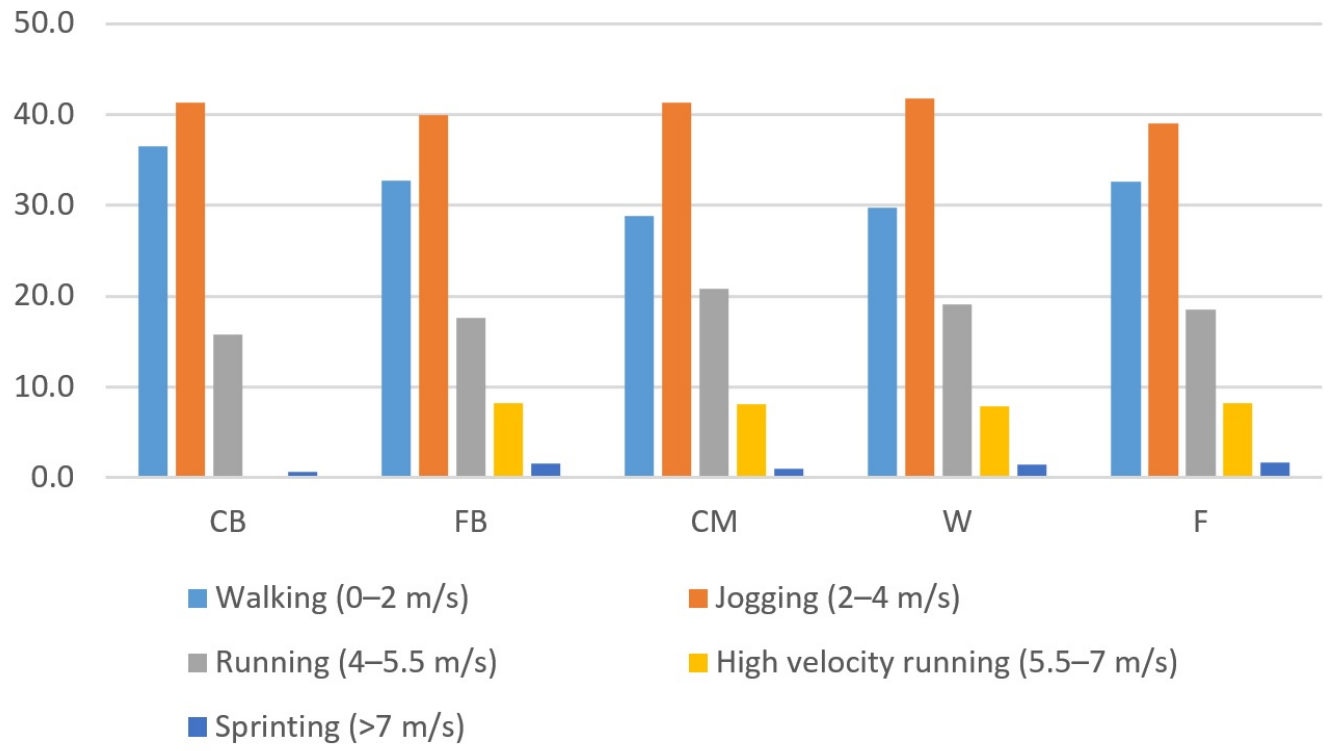

FIGURE 1. Match running performance given in percentages, according to positions in the team. CB: central backs; FB: fullbacks; CM: central midfielders; W: wingers; F: forwards.

fullbacks, 1871 m less than central midfielders and 2157 m less than wingers. Additionally, forwards covered significantly shorter distances in walking (p = 0.006) and jogging (p = 0.001) than players in other positions; (ii) In running, wingers (W) and central midfielders (CM) covered significantly greater distances (p = 0.001) than central backs (CB) and forwards (F); (iii) Central backs (CB) covered significantly shorter distances (539 m; p = 0.001) in high-velocity running compared to other players, specifically 286 m less than fullbacks, 301 m less than central midfielders, 300 m less than wingers and 158 m less than forwards. Furthermore, CBs covered significantly shorter distances (62 m; p = 0.001) in sprinting compared to other players, specifically 91 m less than fullbacks, 95 m less than wingers and 80 m less than forwards. They also performed fewer sprints compared to other positions in the team; (iv) Central midfielders (CM) and wingers (W) achieved the significantly highest average velocity compared to other players (p = 0.001); (v) there were no differences between groups of football players in the parameters of the number of accelerations, and maximum velocity achieved by the player.

The obtained results indicate important insights into the dynamics of the game from the perspective of physical demands by position on the field among elite male football players. We are witnessing an increasingly dynamic and physically demanding game that imposes extremely high standards on football players, requiring a specialized, position-specific approach [27]. Previous research [1, 17] also indicates a high number of sprints and accelerations among attackers during matches. Forwards cover an average of 458.7 meters in high-velocity running and 137.1 meters in sprints, while defenders cover 288.2 meters in high-velocity running and only 87.7 meters in sprints during a match [28]. Furthermore, earlier studies have shown that attackers do not cover a large area of the field, and thus, given their positional tasks, they are expected to exhibit maximum explosiveness and brief ball contacts (short durations with a ball in possession) [18]. Such results can be explained by the nature of energy expenditure during intense muscle activations as well as the range of components of fitness of players in this position [3], which is characteristic of elite players, while in lower leagues, the result is less influenced by positional differences within the team, as well as the importance of the individual [19, 29–32].

According to the results of this study, central midfielders must be physically prepared to cover significantly longer distances at a moderate pace, with a combination of accelerations and sprints. A significant difference was observed in these variables compared to other analyzed player positions. Previous studies of a similar type also highlight the distance covered by central midfielders and other variables describing MRP [25, 33]. Additionally, earlier research has found that central midfielders cover the largest area of the field and spend the most time in possession [18, 20, 34]. This can be explained by the demands of the game, which are primarily distributed between the two penalty areas, where central midfielders play a crucial role as game creators, *i.e.*, those who create offensive attacks for their team when in possession of the ball.

The defensive line showed certain differences based on position—central backs versus fullbacks. The differences were evident in that fullbacks covered a greater running distance and had a higher average running velocity, while central backs performed significantly more accelerations and sprints, along with slower and shorter movements. These results align with

analyses from other studies [1, 14, 17], indicating a notable difference between these two positions in the analyzed variables defining MRP. Additionally, central backs showed an MRP similar to that of attackers, though with significantly lower numerical values. This can be explained by the fact that they are direct competitors for ball possession and are largely focused on marking each other, with their success often depending on quick, short sprints to secure a better position for scoring or defending the goal.

Comparative analysis between full-backs and central midfielders shows that their MRP are most similar to each other compared to other positions on the team [7]. This similarity likely arises from the requirement for both positions to cover a large portion of the field, while at the same time being positionally oriented toward defending each other. However, according to results analyzed by Teixeira *et al.* [18], the specific roles of these positions (central midfielders and fullbacks) differ: central midfielders, as game creators, tend to have more frequent ball contact and must pass the ball quickly and continue moving, shifting the game's focus from one side of the field to the other and linking the back line with the attack while positioning for a potential shot on goal. Meanwhile, fullbacks cover longer running distances but have less frequent contact with the ball.

However, this study's limitations include the small number of players analyzed. Additionally, one of the limitations is that the instrument used present some limitations (semi-automatic multi-camera optical system) and the data collection was conducted using a static method; therefore, future research should include a dynamic method. Also, although this system has been used in numerous studies, its validity and reliability should be confirmed. Moreover, for a complete understanding of the differences in match running performance among elite players, it would be beneficial to consider the type of competition, different periods within the competition and team formations. Also future studies should assess a wide range of components of fitness to outline the strength and magnitude of their associations with match running performance. Such comprehensive analysis could offer coaches and professionals invaluable support in the physical profiling and selection process for players by position, as well as provide conditioning coaches with data to inform training plans that optimize player preparation across competition levels and phases, depending on their field positions.

5. Conclusions

This research aim was to examine differences in match running performance of Elite/International man football players [35] according to their team positions during football match. The main findings showed that forwards covered shorter distances in walking, jogging and total distance, while wingers and central midfielders covered greater distances in running and achieved higher average velocity. Additionally, central backs covered shorter distances in high velocity running and sprinting, while there were no differences in the number of accelerations, maximum velocity and energy expenditure between players.

These findings are important because they highlight the different physical demands and roles of various positions in male football, which can inform training adjustments to enhance players' specific abilities. Understanding these differences enables coaches to optimize conditioning and tactical training, maximizing players' performance in their positions and reducing the risk of injury. However, these results should be taken with caution, as the data were collected using a semi-automatic multi-camera optical system.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

BK, RR and MS—Conceptualization; methodology. SD—software. RR and SD—validation. KG and AIB—formal analysis. MS—investigation. VAG and AIB—resources. SD and KG—data curation. BK, SD and MS—Writing–original draft preparation. BK, VAG and MS—Writing–review and editing. BK, RR and KG—supervision. RR, KG, VAG and AIB—project administration. VAG and AIB—funding acquisition. All authors have read and agreed to the published version of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All procedures conducted in the study were in accordance with the Helsinki Declaration and approved by the Ethics Committee of the Faculty of Medical Sciences, University of Kragujevac (decision number: 01-15731; date: 29 December 2021). Informed consent was waived by the Ethics Committee of the Faculty of Medical Sciences, University of Kragujevac.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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