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Master's thesis / Diplomski rad

2024

Degree Grantor / Ustanova koja je dodijelila akademski / stručni stupanj: **University of Split, Faculty of Kinesiology / Sveučilište u Splitu, Kineziološki fakultet**

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Download date / Datum preuzimanja: **2024-07-15**



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## ORIGINAL SCIENTIFIC PAPER

# Match Running Performance in UEFA Champions League: Do More Successful Teams Really Run Less?

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## Abstract

It is often hypothesized that more successful teams from elite football competitions achieve lower match running performance (MRP) than less successful teams. However, the results of previous studies investigating the associations between MRP and different success indicators are inconsistent. The main objective of this study was to identify the association between teams' MRP and the UEFA club coefficient as an indicator of long-term success in highest-level football. Individual MRPs ( $n=547$ ) of 378 outfield players were jointly evaluated into the team MRP and used as cases in this study. All data were collected by the semi-automatic optical video system InStat Fitness from matches ( $n=20$ ) of the UEFA Champions League group stage (UCL) in the 2020/2021 season. MRP variables included total distance covered and distance covered in different speed zones: walking ( $<7.1$  km/h), jogging (7.2–14.3 km/h), running (14.4–19.7 km/h), high-speed running (19.8–5.1 km/h), and sprinting ( $>25.2$  km/h). Pearson's correlation coefficient was used to identify the association between the teams' MRP and the UEFA club coefficient. Results indicated that the UEFA club coefficient was positively and negatively associated with sprinting and jogging distance covered, respectively. These findings show that teams with a higher UEFA club coefficient performed a lower amount of running at low intensity and a greater amount of running at maximal intensity, suggesting that teams are achieving greater long-term success in highest-level football play at a higher game pace.

**Keywords:** physical performance, success, association, elite soccer, UEFA club coefficient

## Introduction

Football is a highly complex sport characterized by high physical demands (Modrić, Versić, Sekulić, & Liposek, 2019; Freire et al., 2022). To understand such demands, global (GPS) and local (LPS) positioning systems or optical tracking systems are most commonly used to analyse match running performance (MRP) such as total distance covered, distance covered in different speed zones, accelerations, and decelerations (Modrić, Versić, & Sekulić, 2021). Thus, today is well-known that elite football players can cover 9–13km during a match, accounting for approximately 10% of that distance in high-speed running zone and 1–4% in the sprinting zone (Gomez-Piqueras, Gonzalez-Villora, Castellano, & Teoldo, 2019; Modrić, Versić, & Sekulić, 2021).

It is often hypothesized that MRP, particularly high-intensity running ( $>5.5$  m/s), is an important determinant of success in football. However, the results of studies that investigated the association between MRP and success in football are not consistent. For example, some studies showed that winning outcomes resulted in a lower amount of high-intensity running (Moalla et al., 2018), while other studies indicate no association between match outcome (i.e., win, draw, lose) and high-intensity running (Barrera, Sarmiento, Clemente, Field, & Figueiredo, 2021). Furthermore, some research reported that lower-ranked teams perform more high-intensity running than their counterparts on better teams (Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009). On the contrary, other research has revealed no differences in high-intensity running



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irrespective of final competition position (Hoppe, Slomka, Baumgart, Weber, & Freiwald, 2015).

Considering that the authors of these studies drew their conclusions by analyzing teams that belong to a single country, these inconsistencies may be characterized by the geographical, cultural, historical, and social aspects of the observed competition (Sarmiento et al., 2013; Sapp, Spangenburg, & Hagberg, 2018;). Therefore, an analysis of football competitions involving teams from different countries might be more appropriate to draw conclusions about the association between team success and MRP. Moreover, it has been suggested that future studies analyze top-level football competitions to clarify the association between running performance and success in football (Hoppe, Slomka, Baumgart, Weber, & Freiwald, 2015). Undoubtedly, the most elite and the most prestigious football competition involving teams from different countries is the UEFA Champions League (UCL) (Lago-Peñas, Lago-Ballesteros, & Rey, 2011).

Moreover, success in the studies mentioned above was exclusively evaluated by final ranking or match outcome (Di Salvo et al., 2009; Hoppe et al., 2015; Moalla et al., 2018; Barrera et al., 2021). Although such indicators provide a valuable measure of success in a single match or over one season, we believe that final ranking or match outcome does not provide a real measure of success in football. Namely, it is well-known that “better” teams do not always win in football (Hargreaves, 2009), so it is logical that the winning outcome is not always a valid discriminator between more successful and less successful teams. On the other hand, team success in one season can be a result of different circumstances, such as the form of the key players or injury rates (Ruiz, Power, Wei, & Lucey, 2017). Therefore, we believe that evaluation of success utilizing long-term success indicators may provide a real measure of team success in football.

One of the success indicators considering the teams’ long-term success (i.e., a period of 5 years) is the UEFA club coefficient. However, considering no study to investigate the association between MRP and success by utilizing the UEFA club coefficient, the knowledge on MRP of teams achieving long-term success in football is limited. Furthermore, despite the aforementioned importance of analyzing top-level competitions involving teams from different countries to clarify the association between MRP and success in football (Hoppe et al., 2015), such studies are also lacking. Taking together, linking match MRP of teams that competed in UCL with UEFA club coefficient in a new study seems reasonable. Therefore, the main objective of this study was to identify the associations between teams’ MRP and the UEFA club coefficient as an indicator of long-term success in highest-level football. In addition, we evaluated the association between MRP and success by utilizing other success indicators (e.g., match outcome and final position on the table).

## Methods

### *Participants and Design*

In total, 547 individual match observations of 378 outfield players were used. One hundred twenty-eight of them were central midfielders (CM), 63 were central defenders (CD), 62 were forwards (FW), 63 were fullbacks (FB), and 62 were wide midfielders (WM). The players were members of 24 teams that competed in the group stage of the UCL in the 2020/21 season. All MRP data were obtained from 20 matches from groups

A (n=3), B (n=3), C (n=4), E (n=4), F (n=3), and G (n=3). Individual players’ performances were jointly evaluated into the teams’ performance and used as cases in this study. The investigation was approved by the ethical board of the Faculty of Kinesiology, University of Split (approval number: 2181-205-02-05-19-0020, 1 September 2019).

## Procedures

The MRP data were collected using a semi-automatic optical tracking system InStat Fitness (Instat Limited, Limerick, Republic of Ireland). The reliability of this tracking system has been demonstrated, as the tracking system has passed the official Fédération Internationale de Football Association (FIFA) test protocol for Electronic & Performance Tracking Systems (EPTS) (a report is available on: <https://www.fifa.com/technical/football-technology/resource-hub?id=aca57303eb0449f2835ac891b1beeb24>). The of this tracking system has appeared in previous research (Modric et al., 2021). The MRP variables included total distance covered (m) and distance in five speed categories: walking (<7.1 km/h), jogging (7.2–14.3 km/h), running (14.4–19.7 km/h), high-speed running (19.8–25.1 km/h), and maximal sprinting (>25.2 km/h).

Success in this study was evaluated using three different success indicators: (i) UEFA club coefficient which is based on the results of clubs competing in the UEFA Champions League, UEFA Europa League, and UEFA Europa Conference League season during the previous five seasons. Points awarded each season are in accordance with the relevant competition regulations for that specific season (UEFA, 2022) (ii) final position on the table at the end of the group stage of UCL (1st, 2nd, 3rd, and 4th position), and (iii) match outcome (win, draw, lost).

### *Statistical Analyses*

The Kolmogorov–Smirnov test revealed that all data were normally distributed (all K-S  $p > 0.05$ ). Homogeneity was evaluated using Levene’s test, and data are presented as means  $\pm$  standard deviations. K-means cluster analysis method was used to classify teams into the (i) teams with smaller UEFA club coefficient (mean:  $31.58 \pm 12.46$ ) and (ii) teams with greater UEFA club coefficient (mean:  $87.89 \pm 16.66$ ) (Liu, Yi, Giménez, Gómez, & Lago-Peñas, 2015). Spearman’s correlations were used to identify the association between MRP, and match outcome and final position on the table. To identify the associations between MRP and UEFA club coefficient, Pearson’s correlation coefficients were calculated with the  $r$  coefficient classification as previously suggested:  $r \leq 0.35$  indicates a low or weak correlation,  $r = 0.36$  to  $0.67$  indicates a modest or moderate correlation,  $r = 0.68$  to  $1.0$  indicates a strong or high correlation, and  $r > 0.90$  indicates a very high correlation (Taylor, 1990). For all analyses, Statistica (Version 13; TIBCO Software, Palo Alto, CA, USA) was used. A significance level of  $p < 0.05$  was applied.

## Results

The average total distance covered of teams that competed in UCL was  $116,271 \pm 4376$  m, while average walking and jogging distances were  $38,875 \pm 1243$  m and  $47,404$  m, respectively. Teams’ from UCL averagely achieved  $20,396 \pm 1441$  m in the running zone,  $8176 \pm 915$  m in high-speed running, and  $1399 \pm 307$  m in sprinting (Table 1).

**Table 1.** Descriptive statistics for running performances of teams that competed in UEFA Champions League.

	Mean	Minimum	Maximum	SD
Total distance (m)	116,271	105,653	125,258	4376
Walking (m)	38,875	36,509	41,644	1243
Jogging (m)	47,404	41,182	55,065	3148
Running (m)	20,396	17,783	23,494	1441
High speed running (m)	8176	6032	10,131	915
Sprinting (m)	1399	933	2260	307

Tables 2 and 3 present descriptive statistics and associations between MRP and different success indicators. UEFA club coefficient was positively and negatively associated with sprinting ( $r=0.39$ ,  $p=0.01$ ) and jogging ( $r=-0.36$ ,  $p=0.02$ ) distance, respectively. The average jogging distance for teams with greater and smaller UEFA club coefficients was  $46,675\pm 2687$  m and  $48,000\pm 3426$  m, respectively. The average sprinting distance for teams with greater and smaller UEFA club coefficient

was  $1486\pm 288$  and  $1327\pm 310$  m, respectively.

The final position on the table was negatively associated with sprinting distance covered ( $r=-0.34$ ,  $p=0.03$ ). The average sprinting distance for teams that finished at 1st, 2nd, 3rd, and 4th position in the group was  $1517\pm 376$  m,  $1563\pm 288$  m,  $1320\pm 282$  m, and  $1270\pm 236$  m, respectively. No significant associations between match outcome and MRP variables were evidenced (all  $p>0.05$ ).

**Table 2.** Descriptive statistics for running performances of teams that competed in UEFA Champions League according to the different success indicators.

		Total distance (m)	Walking (m)	Jogging (m)	Running (m)	High speed running (m)	Sprinting (m)
		Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
UEFA club coefficient	S	116,953 $\pm$ 4936	38,772 $\pm$ 1138	48,000 $\pm$ 3426	20,606 $\pm$ 1651	8276 $\pm$ 964	1327 $\pm$ 310
	G	115,438 $\pm$ 3535	39,002 $\pm$ 1383	46,675 $\pm$ 2687	20,139 $\pm$ 1127	8053 $\pm$ 863	1486 $\pm$ 288
Match outcome	L	115,563 $\pm$ 5307	38,834 $\pm$ 1339	47,504 $\pm$ 4025	20,040 $\pm$ 1745	7959 $\pm$ 910	1246 $\pm$ 296
	D	116,055 $\pm$ 4152	38,893 $\pm$ 1270	46,800 $\pm$ 2661	20,435 $\pm$ 1474	8429 $\pm$ 1014	1534 $\pm$ 289
	W	117,309 $\pm$ 3662	38,897 $\pm$ 1211	48,050 $\pm$ 2737	20,734 $\pm$ 1003	8093 $\pm$ 779	1395 $\pm$ 284
Final position in the group	1 <sup>st</sup>	115,856 $\pm$ 3842	39,931 $\pm$ 1177	46,013 $\pm$ 3022	20,020 $\pm$ 1467	8155 $\pm$ 1190	1517 $\pm$ 376
	2 <sup>nd</sup>	116,001 $\pm$ 4451	37,970 $\pm$ 999	47,471 $\pm$ 2529	20,835 $\pm$ 1448	8189 $\pm$ 896	1563 $\pm$ 288
	3 <sup>rd</sup>	117,679 $\pm$ 4360	38,782 $\pm$ 1293	48,346 $\pm$ 3311	20,888 $\pm$ 1415	8368 $\pm$ 607	1320 $\pm$ 282
	4 <sup>th</sup>	115,460 $\pm$ 4891	38,935 $\pm$ 925	47,417 $\pm$ 3523	19,867 $\pm$ 1359	8002 $\pm$ 1039	1270 $\pm$ 236

S – smaller, G – greater; L – lost, D – draw, W – win

**Table 3.** Correlations between running performance and different success indicators.

	UEFA club coefficient	Final position on the table	Match outcome
	r (p)	r (p)	r (p)
Total distance	-0.22 (0.17)	0.02 (0.92)	0.19 (0.25)
Walking	0.14 (0.38)	-0.05 (0.74)	0.03 (0.87)
Jogging	-0.36 (0.02)	0.15 (0.35)	0.11 (0.50)
Running	-0.16 (0.33)	-0.07 (0.68)	0.19 (0.25)
High speed running	0.07 (0.68)	-0.03 (0.83)	0.09 (0.57)
Sprinting	0.39 (0.01)	-0.34 (0.03)	0.23 (0.16)

## Discussion

This is one of the first studies investigating the association between teams' MRP and various success indicators, including the UEFA club coefficient as an indicator of long-term success. UEFA club coefficient was positively and negatively associated with sprinting and jogging distance covered, respectively. The final position on the table was negatively associated with sprinting, while match outcome was not associated with MRP.

These findings indicate that teams are achieving greater long-term success in highest-level football play at a higher game pace.

The total distance covered by the teams that competed in the UCL group stage in the 2020/21 season was 116,271 m, which is approximately 5% higher than the overall distances achieved in previous seasons. In particular, the total distance covered in the 2014/15 and 2015/16 seasons was 113,451 m

and 107,843 m, respectively (Windt, Ekstrand, Khan, McCall, & Zumbo, 2018). On the other hand, the results of our study show that the average distance covered at moderate intensities (i.e., running zone) was 20,396 m, which is in line with the results from previous seasons (21,765 m and 19,924 m, respectively) (Windt et al., 2018). Interestingly, the high-intensity distance covered by UCL teams in the 2020/21 season was 9575 m, which is ~7% lower than in the 2014/15 season, and ~10% greater than in the 2015/16 season (10,285 and 8760 m, respectively) (Windt et al., 2018).

Considering the results of previous research which reported that MRP in elite football tend to increase over the seasons, especially in terms of high-intensity running, such findings may seem surprising (Barnes, Archer, Hogg, Bush, & Bradley, 2014). However, MRP is generally highly variable and depends on many factors such as match location, opponents' level, match outcome, team's tactical formation or playing style (Lago-Peñas, 2012; Modric, Versic, & Sekulic, 2020). In addition, UCL is a specific competition in which different teams from various countries compete in each season. For example, in the 2020/21 season, 17 clubs that competed in the group stage did not compete in the 2014/15 season group stage. As the UCL group stage consists of 32 clubs, it is obvious that more than one-half of the clubs were different in the observed seasons. Given the fact that clubs come from different countries are characterized by different geographical, cultural, historical and social aspects (Sarmiento et al., 2013; Sapp, Spangenburg, & Hagberg, 2018), variation in MRP during different seasons in UCL is actually logical and expected.

In scientific community and media, it is often postulated that high level of match MRP is important for achieving success in professional football teams (Hoppe et al., 2015). This postulation is partly in the line with our findings. Namely, results from our study indicated significant association between specific MRP variables and UEFA club coefficient. In particular, positive and negative correlations were found between UEFA club coefficient and sprinting and jogging distance covered, respectively (both moderate correlations). Most specifically, during UCL group stage matches, teams with a greater UEFA club coefficient accumulated ~12% greater amount of sprinting distance (1486 m) and ~3% lower amount of jogging distance (46,675 m) than teams with smaller UEFA club coefficient (1327 and 48,000 m, respectively). These findings indicate that teams are achieving greater long-term success in highest-level football play at a higher game pace.

Additionally, our results indicated a significant association between the final position on the table at the end of the UCL group stage and sprinting distance covered. Despite the relatively weak association, descriptive parameters show that sprinting distance of teams that finished in 1st position was approximately 20% greater compared to the teams which finished at the last position (i.e., 4th) at the end of the group stage of UCL (1517 and 1270 m, respectively). Such results are consistent with our previous conclusions that more successful teams play at a slightly higher game pace than less successful

teams while supporting earlier considerations about the importance of MRP in elite football (Longo et al., 2019; Longo et al., 2021). However, it is interesting to note that our results did not indicate an association between MRP and match outcome. Considering our previous conclusions (i.e., that more successful teams played at a higher game pace), such results may seem controversial. However, as "better" teams do not always win in football (Hargreaves, 2009), we believe that match outcome is not always a valid indicator of success and, therefore, cannot be comparable to the long-term indicators of success such as position on the table or UEFA club coefficient.

The present investigation has some limitations that should be considered. First, we did not analyze all matches from the group stage of the UCL (i.e., we only noted 20 randomly selected matches). However, this is a widespread obstacle in studies involving players who compete at the highest level of football (Bradley et al., 2011; Modric et al., 2021; Modric, Versic & Jelcic; 2022). Furthermore, the current study did not consider contextual factors, such as team and opposition quality or match location, which may affect MRP. However, differences in teams' and opponents' quality in UCL is most likely lower than in national competitions, and consequently, influence on MRP may be negligible. Additionally, all observed matches were played without audience or with limited capacity in the stands due to the COVID-19 pandemic (Link, & Anzer, 2022); therefore, the influence of match location (i.e., home advantage) may be insignificant. On the other hand, this study has several strengths. Specifically, this is one of the first studies to investigate the association between MRP and UEFA club coefficient, providing new knowledge on MRP of teams achieving long-term success in football. In addition, the data analyzed in this study included the MRP of most elite football teams worldwide, enabling detailed insight into the running characteristic of teams competing in the highest-level football. Finally, the findings from this study can be used by football coaches in decision-making processes for structuring the elements of training.

In conclusion, the main findings of this study show that teams with greater UEFA club coefficient cover less distance in jogging and more distance in sprinting, indicating that teams achieving greater long-term success in highest-level football play at a higher game pace. As playing at a high game pace requires the players' high conditioning level, it becomes clear that achieving long-term success in highest-level football requires the players' conditioning to be at the highest possible level. From the practical perspective, this should be accomplished by the implementation of exercises that provoke running at maximal intensity (i.e., over 7 m/s) in the training process. Finally, to better understand the association between long-term success and MRP, future research should utilize a larger sample and analyse a greater number of MRP variables (i.e., accelerations, decelerations, metabolic power), considering a range of contextual factors which may affect MRP.

**Received:** 14 March 2022 | **Accepted:** 19 September 2022 | **Published:** 01 October 2022

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#### Acknowledgements

The authors are particularly grateful to InStat Fitness (InStat Limited, Limerick, Republic of Ireland) for providing the data used in the study. Support of the Croatian Science Foundation is gratefully acknowledged (Grant No. DOK-2020-01-9298).

#### Conflict of interest

The authors report no conflict of interest.

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