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A COMPARISON OF TWO DIFFERENT DEFENSIVE BASED PLAYING FORMATIONS ON THE RUNNING ACTIVITY PROFILES OF SOCCER TEAMS

PRIMERJAVA DVEH RAZLIČNIH OBRAMBENIH IGRALNIH FORMACIJ NA TEKALNO ZMOGLJIVOST NOGOMETAŠEV

ABSTRACT

This study aimed to examine the effects of two different defensive based playing formations (3-Defender formation and 4-Defender formation) on both the reference and the opponent teams' running activity profiles. 8 official matches (n=4, 3-Defender formation; n=4, 4-Defender formation) of Galatasaray football team (Turkish Super League) and opposition teams performed with two different playing formations were monitored. The sample matches were monitored and analyzed using a multiple-camera computerized tracking system. Running activity data variables obtained from the software were analyzed in 5 different categories (total running distance in kilometers, mean speed in km.h^{-1}, high-intensity running (20 km.h^{-1} to 24 km.h^{-1}) distance in meters, sprint (>24 km.h^{-1}) distance, sprint numbers. The results of this study indicate that running activity profiles of reference and opposition teams generally do not differ (p >0.05) according to the different game formation of the reference team. Only the reference team's total running distance was higher (p <0.05) in the 4-Defender formation than the 3-Defender formation (2.52%).

Keywords: playing formation, running activity profile, time-motion analysis

IZVLEČEK

Namen študije je bil preučiti učinke dveh različnih obrambnih igralnih formacij (3 obrambna formacija in 4 obrambna formacija) tako na referenčnih profilih kot na profilih tekaških aktivnosti nasprotnih ekip. Spremljali smo 8 uradnih tekem (n = 4, 3 obrambna formacija; n = 4, 4 obrambna formacija) nogometne ekipe Galatasaray (turška superliga) in nasprotne ekipe, ki so nastopile z dvema različnima formacijama. Vzorčne ujemanje smo spremljali in analizirali z računalniškim sistemom, ki za sledenje uporablja več kamer. Spremenljivke podatkov o tekaški aktivnosti, pridobljene s programsko opremo, so bile analizirane v 5 različnih kategorijah (skupna razdalja teka v kilometrih, povprečna hitrost v km.h^{-1}, tek z visoko intenzivnostjo (20 km.h^{-1} do 24 km.h^{-1}) razdalja v metrih, sprinterska (> 24 km.h^{-1}) razdalja, število sprintov. Rezultati te študije kažejo, da se profili tekaških aktivnosti referenčnih in nasprotnih ekip na splošno ne razlikujejo (p> 0,05) glede na različno obliko igre je bila skupna tekaška razdalja referenčne ekipe v 4 obrambni formaciji višja (p <0,05) kot v 3 obrambni formaciji (2,52%).

Ključne besede: igralna formacija, profil tekaške aktivnosti, analiza časovnega gibanja

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INTRODUCTION

Tactical approaches are a central component of success in modern elite football, and with the development of advanced tracking technologies, detailed scientific researches have been started on the tactics of the teams (Rein & Memmert, 2016). Although it is difficult to quantify among the external factors that affect performance in football; It is possible to show tactical ability, game formation, and style of play (McGarry, 2009). Besides, with the development of technological systems such as computer-based video analysis and GPS-based tracking, match analysis has grown as a methodological approach in sport science. (Sarmento et al., 2018). With the use of time-motion analysis methods, it has become important to examine the activity patterns among various popular formations in modern football (Bradley et al., 2011).

Formation in football expresses how the players of a football team are positioned on the field (Woreithing & Balaji, 2017). Team positioning and distribution of the players on the pitch is one of the strategic decisions because teams' performances are dependent upon how players are dynamically positioned according to the teams' overall space distribution principles and constraints at the scale of the environment (Araujo, Davids & Hristovski, 2006; Kannekens, Elferink-Gemser & Visscher, 2011).

Time-motion analyses have also been used to examine the team formations that affect the physical and skill-related performance of the soccer teams and players. The comparison of different playing formations' (1-4-4-2, 1-4-3-3, 1-4-5-1, 1-3-5-2, 1-3-4-3, 1-4-2-3-1) effects on physical and skill-related match performance (Bradley et al., 2009; Bradley et al., 2011; Tierney, Young, Clarke & Duncan, 2016; Baptista, Johansen, Figueiredo, Rebelo & Pettersen, 2019) and influence of opposition team playing formation (Carling, 2011) on performance variables were investigated. Besides the opposition team game formation, Aquino et al., (2018) examined the independent and interactive effects of situational variables like competition stage, match location, quality of opposition, and match outcome on match running performance of professional soccer players. Modric, Versic & Sekulic (2020) analyzed the differences in position-specific RPs in Professional football, when games are played with three defensive players (3-DF) and four defensive players (4-DF). To the best of our knowledge, no research examined both the soccer team's own and opposition teams running activities playing with two different playing formations. Although tactical formations are named numerically from the defensive to the attack line, by the effect of some head coaches in England Premier League currently they are named "4-DF or 3-DF" concerning the defensive formations. Additionally,

previous researches on tactical formations provided important data on the running profiles of the teams, most of these studies examined the 4-DF. However, the fact that the 3-DF has been used in important tournaments (Ex. the semi-final of the Champions League of season 2019/2020) that have recently shaped the tactical choices in football, indicates that there is an increasing trend in 3-DF choice and the trend will continue from now on (Modric, Versic & Sekulic, 2020; Baptista et al., 2019).

Analyzing the effects of different game formations on the running activities of soccer teams can provide extensive information to coaches for choosing the most appropriate formation. Therefore, this study aimed to examine the effects of two different defensive based playing formations on both the reference and the opponent teams' running activities.

METHODS

Participants

The observational design was used to determine the effects of two different playing formations on running activity in a reference team (Galatasaray) and opposition teams during 8 official matches. Since the data of the research were analyzed absolutely, the data of the players leaving and entering the game were not taken. Only the results of players who participated in the whole game were analyzed. Due to the manager change during the 2016-2017 football season, the Galatasaray football team played with two different game formations (3-DF and 4-DF). 8 official matches performed with two different game formations (n=4, 3-DF; n=4, 4-DF) were monitored and running activities of reference and opposition teams were recorded. The matches played with the different game formations were selected against the same opposition teams. The sample matches organized by the Turkish Football Federation were played per FIFA standards.

Data collection and measures

The sample matches were monitored and analyzed using a multiple-camera computerized tracking system (Sentio Sports Analytics®, İstanbul, Turkey). All outfield players' movements were captured during each game by two 4K cameras set up on a laptop to detect and track multiple soccer players in real-time. The data captured were analyzed using match analysis software (Sentioscope® İstanbul, Turkey). Running activity data variables obtained from the software were analyzed in 5 different categories. Dependent variables included: total running

distance in kilometers (TD), mean speed in $km.h^{-1}$ (S_{avg}), high-intensity running (20 $km.h^{-1}$ to 24 $km.h^{-1}$) distance in meters (HIR), sprint (> 24 $km.h^{-1}$) distance (SD), sprint numbers (SN). Obtained data were analyzed on the total values of the selected sample matches.

Statistical Analysis

IBM SPSS Statistics 24 software was used to analyze the obtained data. Descriptive statistics of the obtained data were given as mean and standard deviation. Besides, a two-way analysis of variance was used to determine the difference between the game-related (running distances, average speed, high-intensity running distance, sprint distance, sprint numbers) statistics according to the team formations (3- and 4-defender formations) of Galatasaray and opponents teams. Moreover, percentage differences of game-related statistics according to team formations were calculated with the formula "% Δ = (3-defender formation - 4-defender formation) / 3-defender formation × 100". The confidence interval was chosen as 95% and values below $p < 0.05$ were considered statistically significant.

RESULTS

There was a difference between the total running distances (Table 1) according to the 3- and 4-defender formations (F = 8.673; p = .026). Accordingly, the running distance in the 4-defender formation was found to be higher than the 3-defender formation (2.52% as a total running distance). Furthermore, it was found that there was no difference between Galatasaray and opponent teams according to the total running distances (F = .220; p = .656). In addition, the interaction between the teams' total running distances and teams' formations was not significant (F = .939; p = .370).

Table 1. Comparison of the total running distances (km) of Galatasaray and opponent teams according to team formation.

Variables	N	3-defender formation $\overline{X} \pm$ S.D.	4-defender formation $\overline{X} \pm$ S.D.	Total $\overline{X} \pm$ S.E.	F	p
Galatasaray	8	110.08±3.56	113.80±1.89	110.91±1.04	.220	.656
Opponents	8	111.74±2.19	113.61±2.41	113.71± .077		
Total	16	110.91±2.87	113.71±2.01		**Interaction**	
% Δ		2.52 %				
F= 8.673; p= .026*					F= .939; p= .370	

**p<0,01; : Mean; S.D.: Standard Deviation; S.E.: Standard Error

There was no difference between the average speeds (Table 2) according to the 3- and 4-defender formations (F= 1699; p= .240). Furthermore, it was found that there was no difference between Galatasaray and opponent teams according to the average speeds (F = 1.928; p = .214). In addition, the interaction between the teams' average speeds and teams' formations was not significant (F = .189; p = .679).

Table 2. Comparison of the average speed (km/h) of Galatasaray and opponent teams according to team formation.

Variables	N	3-defender formation $\overline{X} \pm$ S.D.	4-defender formation $\overline{X} \pm$ S.D.	Total $\overline{X} \pm$ S.E.	F	p
Galatasaray	8	6.45± .31	6.60± .08	6.53± .08	1.928	.214
Opponents	8	6.65± .13	6.73± .22	6.69± .06		
Total	16	6.55± .24	6.66± .17		**Interaction**	
F= 1699; p= .240					F= .189; p= .679	

**p<0,01; : Mean; S.D.: Standard Deviation; S.E.: Standard Error

There was no difference between the high-intensity running distances (Table 3) according to the 3- and 4-defender formations (F= 5.681; p= .055). Furthermore, it was found that there was no difference between Galatasaray and opponent teams according to the high-intensity running distances (F = .280; p = .616). In addition, the interaction between the teams' high-intensity running distances and teams' formations was not significant (F = .008; p = .930).

Table 3. Comparison of the high-intensity running distance (m) of Galatasaray and opponent teams according to team formation.

Variables	N	3-defender formation	4-defender formation	Total	F	p
		$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.E.		
Galatasaray	8	4461.75±519.93	4945.75±266.69	4703.75±211.31	.280	.616
Opponents	8	4600.50±731.92	5123.00±320.16	4861.75±211.31		
Total	16	4531.13±624.60	5034.38±288.77		Interaction	
		F= 5.681; p= .055			F= .008; p= .930	

**p<0,01; : Mean; S.D.: Standard Deviation; S.E.: Standard Error

There was no difference between the sprint distances (Table 4) according to the 3- and 4-defender formations (F= 1.201; p= .315). Furthermore, it was found that there was no difference between Galatasaray and opponent teams according to the sprint distances (F = .280; p = .616). In addition, the interaction between the teams' sprint distances and teams' formations was not significant (F = .334; p = .584).

Table 4. Comparison of the sprint distance (m) of Galatasaray and opponent teams according to team formation.

Variables	N	3-defender formation	4-defender formation	Total	F	p
		$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.E.		
Galatasaray	8	2626.25±508.96	2694.75±332.59	2660.50±181.46	.280	.616
Opponent Teams	8	2322.25±493.50	2543.75±231.61	2433.00±181.46		
Total	16	2474.25±491.73	2619.25±277.33		Interaction	
		F= 1.201; p= .315			F= .334; p= .584	

**p<0,01; : Mean; S.D.: Standard Deviation; S.E.: Standard Error

There was no difference between the sprint numbers (Table 5) according to the 3- and 4-defender formations (F= .938; p= .370). Furthermore, it was found that there was no difference between Galatasaray and opponent teams according to the sprint numbers (F = .676; p = .442). In addition, the interaction between the teams' sprint numbers and teams' formations was not significant (F = .087; p = .778).

Table 5. Comparison of the sprint numbers of Galatasaray and opponent teams according to team formation.

Variables	N	3-defender formation	4-defender formation	Total	F	p
		$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.D.	$\overline{X} \pm$ S.E.		
Galatasaray	8	125.25±24.25	129.25±18.26	127.25±10.10	.676	.442
Opponent Teams	8	111.75±28.72	119.25±12.97	115.50±10.10		
Total	16	118.50±25.65	124.25±15.61		**Interaction**	
		F= .938; p= .370			F= .087; p= .778	

**p<0,01; : Mean; S.D.: Standard Deviation; S.E.: Standard Error

DISCUSSION

The present study provides an investigation of the running activity profile of elite soccer teams within two game formations. The results of this study indicate that running activity profiles of reference and opposition teams generally do not differ according to the different game formation of the reference team. Only the reference team's total running distance was higher in the 4-DF than the 3-DF. However, although it was not statistically significant, it was observed that the teams that played with the 4-DF or played against it, made more effort than 3-DF.

When the previous studies were examined, similar to the results of this study Baptista et, al., (2018) reported that match physical demands did not differ considerably between two tactical formations (1-4-5-1; 1-3-5-2). Similarly, Bradley et al., (2011) examined general match activity profiles in three common playing formations (1-4–4–2; 1-4–3–3 and 1-4–5–1) and they reported that players covered similar total and high-intensity running distances. On the contrary, Tierney et al., (2016) reported that 1-3-5-2 formation elicited higher total distance (TD), high-speed running (HSR), and high metabolic load distance (HMLD) than all other formations (1-4-4-2; 1-4-3-3; 1-3-4-3; 1-4-2-3-1). Also, they suggested that 1-3-5-2 formation overall is the most physically demanding of all formations. Aquino et al., (2018) reported that compared to 1-4-4-2 formation all running performance variables were higher in 1-4-3-3 formation.

The differences in the results of past researches and the current study on playing formation may be due to many limiting factors related to football. The running performances of the players can be highly variable (match-to-match variability) across and within the matches during the competition (Gregson, Drust, Atkinson & Salvo, 2010; Carling, Bradley, McCall & Dupont,

2016). Winning, losing or drawing is another situation that increases or decreases the running performance of the players during matches (Lago, 2009). In our study, during sample matches of the reference team, different match status numbers observed that can be affect running performance (4 winnings, 3 loses and 1 drawing). In our study, the total running distance for the 4-DF was found to be higher than the 3-DF (2.52 %). This could be caused by position-specific player loads according to playing formations. Midfielders appear to cover the greatest overall distances during the matches because of their linking role in the team (Bangsbo, 1994; Rienzi, Drust, Reilly, Carter & Martin, 2000; Di Salvo et al., 2007; Brito, Roriz, Duarte, & Garganta, 2018). However, there are more players in the midfield area for the 3-DF compared to the 4-DF. This could reduce the midfielders' total running distance and could cause total running differences between playing formations.

In another study that support the current study's results, examined the influence of opposition team formations (1-4-4-2; 1-4-3-3; 1-4-5-1 and 1-4-2-3-1) on physical and skill-related performance in a professional soccer team, researchers suggested that physical performance in the reference team was not greatly affected by opposition team formation (Carling, 2011).

CONCLUSION

This study provides a comprehensive evaluation of match running activity in a professional team and opposition teams according to two different defensive based playing formations. The findings suggest that defensive based playing formations generally do not influence the overall running activity profiles of players. Only total running distance found higher for the 4-DF than the 3-DF. As the analytics have become a crucial component of team organization and content of the training for structuring the elements of training and subsequent match preparation, sports scientists and performance analysts use data on match running performance (Bradley et al., 2009; Carling, 2010; Carling, Bloomfield, Nelson & Reilly, 2012). The trainers, performance analysts, and performance coaches can take into consideration these findings while developing the tactical and technical match preparation strategies and making decisions for team selection.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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