Original Article

The rotation strategy in high-level European soccer teams

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ABSTRACT

The purpose of the present study was to examine the rotation strategy in high-level soccer teams during a sequence of three games per week (1st domestic, 2nd European and 3rd domestic). Data were collected during the 2014-15, 2015-16, 2016-17 and 2017-18 competitive season for the soccer teams that were qualified in the quarter finals of the Champions League. Regression analysis showed that when a large number of players participated in the initial list for the three games, more points in the domestic league were lost. Similarly, increasing the changes of players in the initial list between the 1st and the 3rd game and between the 2nd and the 3rd game a negative effect on the domestic league was observed. In contrast, a positive effect of the number of changes of players in the starting line between the 1st and the 2nd game, regarding the total points won, was found. As the average time of the substitutes participated in the game increases in all three games, the total points of the teams are reduced. The biggest time of changes in the 2nd game had a negative impact on the points of European games. In order to achieve a more efficient rotation, coaches should have a qualitative and competitive roster of players. Furthermore, coaches should try to apply different tactics in previous matches in order, as many players as possible, to maintain high levels of homogeneity and competing readiness.

Keywords: Substitutions; Coaching; Champions League; Performance.

Cite this article as:
Bekris, E., Mylonis, E., Ispirlidis, I., Katis, A., Kompodieta, N., & Tegousis, A. (2020). The rotation strategy in high-level European soccer teams. *Journal of Human Sport and Exercise*, *15*(4), 894-903. doi:https://doi.org/10.14198/jhse.2020.154.16

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Submitted for publication September 2019
Accepted for publication December 2019
Published *December 2020 (in press* December 2019)
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2020.154.16

INTRODUCTION

Soccer is a demanding game with several activities taking place during a 90-min game. Players cover 9 to 12 kilometres, with 2 to 3 km including high intensity running and approximately 0.5 km including sprinting (Mohr et al., 2003; Bradley et al., 2008). Players also perform rapid accelerations and decelerations, changes of the direction (Varley & Aughey, 2013), jumping, kicking and throwing activities (Andersson et al., 2010). The increased soccer game demands often lead to players' fatigue which affects both the musculoskeletal and the nervous system (Reilly & Ekblom, 2005) and as a consequence players' performance.

The development of fatigue after a soccer game has been linked to the depletion of muscle glycogen stores (Mohr et al., 2003). The recovery of both muscle performance and muscle glycogen after a game lasts between 48 and 72 hours (Krustrup et al., 2011; Bendiksen et al., 2012; Gunnarsson et al., 2013). The ability of a soccer player to recover from official matches is often considered a crucial factor for players' performance (Mohr et al., 2003). Therefore, in order to accelerate the time to achieve full recovery a combination of techniques such as hydration, carbohydrate and protein consumption (Ekstrand et al., 2004; Dupont et al., 2010), low-intensity exercise and stretching (Cheung et al., 2003; Barnett, 2006), cryotherapy (Bailey et al., 2007; Vaile et al., 2008; Rowsell et al., 2009), and massage technique (Galloway & Watt, 2004; Weerapong et al., 2005) is widely used. However, the use of these techniques cannot prejudge the player's readiness for the next game which could be held in a short period of time.

In the top soccer leagues, players participate in approximately 50 to 80 soccer games during the competitive season. Players participate on the domestic championship, on the domestic soccer cup and on international soccer games with both their club and their national team (Ascensao et al., 2008). As a consequence, players often compete in three games during a 7-day period (Stolen et al., 2005). This soccer game pattern with short recovery time between games can cause acute and chronic fatigue and potentially could cause impairment of performance or even an injury potential (Ekstrand et al., 2004; Dupont et al., 2010). Ekstrand et al. (2004) reported that 60% of the players who played more than 1 match/week before the World Cup had decreased performance and increased injury potential during the tournament. Moreover, the 3 to 4 days of recovery that interposes between successive games at a high level may be insufficient time to restore normal homeostasis (Ispirlidis et al., 2008; Fatouros et al., 2010).

Coaches, in order to avoid the negative effects of the continuous games adopt the rotation strategy during which several players that participate from one game to the other or during the same game are replaced (Reilly, et al., 2008). It has been reported that players who participate as substitutes in a game cover greater distance compared to players who have been replaced (Bradley et al., 2014). Similar results were reported in Mohr's et al. (2003) study who found that the activities performed from substitutes who participate before the 75th minute of the game were increased compared to players that retained in the game for the last 15 minutes. Although several studies have examined the rotation strategy during a game, the rotation strategy for players that participate in three games per week (two domestic and one European) has not received the appropriate attention.

The aim of the present study was to examine the rotation strategy in high-level soccer teams during a sequence of three games per week (1st domestic, 2nd European and 3rd domestic). The main research question had three aspects: First, does rotation strategy increases teams' total points won? Second, does rotation strategy increases teams' points won in the domestic games? Third, does rotation strategy increases teams' points won in the European games? Our main hypothesis was that rotation strategy would have an effect on teams' points won via alteration in several examination variables.

METHODS

Design and Procedures

To investigate the relationship between the rotation strategy and the performance of the teams during the domestic and the European games, data of the 2014-15, 2015-16, 2016-17 and 2017-18 competitive season of the European Champions League were collected. The quarter final phase of the Champions League was chosen and the teams that were qualified in this phase were selected for further examination.

Measures

Each team participating in the quarter final phase of the Champions League had already played ten games (six games in the group stage, two games in the stage of the final 16 teams and two games in stage of the final 8 teams). Therefore, ten (10) triple games, for each team, with following sequence were examined: Domestic Championship game-European Champions League game-Domestic Championship game.

For each team the following variables were estimated: 1) number of players in the 3 games, 2) number of initial players in the 3 games, 3) number of players that played 270' and 4) total time played in 3 games for the players that did not played at least in one game 90'. Moreover, the following variables were also estimated: 1) the average playing time for the rest of the players, 2) the number of changes in the initial list between the 1st and the 2nd game, between the 1st and the 3rd game and between the 2nd and the 3rd game, 3) newcomers in the initial list, 4) average number of newcomers in all 3 games, 5) points won in the domestic games, in the European games and the total points won, and 6) the average time each substitute participate in each game.

Statistical Analysis

All results are presented as mean (± SD). Descriptive statistics were used in order to present the under-examination variables. Similarly, regression analysis was conducted in order to predict the points won in the domestic games, in the European games and the points totally won. Analyses were performed using SPSS statistical package (Version 20.0, SPSS, Inc., Chicago, IL). Statistical analysis was accepted at $p < .05$.

RESULTS

The descriptive statistics of all the under-examination variables are presented in Table 1.

Table 1. Descriptive statistics of the under-examination variables (± SD).

	M	SD
Number of athletes in 3 games	18.19	1.76
Number of initial athletes in the 3 games	5.52	2.10
Number of athletes that played 270'	3.30	1.54
Total time played in 3 games for those athletes that did not played at least one game 90'	214.65	77.96
Average time played of the rest	117.99	21.05
Total points	6.55	2.17
European points	2.11	1.24
Domestic points	4.43	1.64
Number of changes between 1st and 2nd game	3.47	1.93
Number of changes between 1st and 3rd game	3.46	1.77
Number of changes between 2nd and 3rd game	3.47	1.87
Average number of changes in the 3 games	3.47	1.31

Newcomers in the team between 1st and 2nd game	3.27	1.79
Newcomers in the team between 1st and 3rd game	3.31	1.56
Newcomers in the team between 2nd and 3rd game	3.17	1.62
Average number of newcomers in all 3 games	3.25	1.28
Average time of changes in the 1st game	21.25	8.75
Average time of changes in the 2nd game	18.89	9.93
Average time of changes in the 3rd game	21.03	10.01
Average time of changes in all 3 games	20.37	5.90

In Table 2 the points totally won are presented. The regression model was statistically significant $F_{3,314}$ = 6.679, p = .000, R^2 = 0,06 (the backward method was used in order to have the most suitable model). All the assumptions of the regression model were satisfied normality, multicollinearity, autocorrelation and heteroscedasticity. The results showed that the variables of the number of changes between the 1st and the 2nd game (b = .215, p < .05), the number of newcomers players in the team between the 1st and the 2nd game (b = -.359, p < .01) and the average time of changes in all three games (b = -.063, p < .01) were statistical significant predictors of the points totally won.

Table 2. Regression model predicting the total points won during all competitive years.

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	p	Tolerance	VIF
(Constant)	8.264	.481		17.180	.000		
Number of changes between 1st and 2nd game	.215	.098	.190	2.182	.030	.395	2.532
Newcomers in the team of 14 players, between 1st and 2nd game	-.359	.105	-.295	-3.401	.001	.399	2.507
Average time of changes in all 3 games	-.063	.020	-.170	-3.082	.002	.979	1.022

In Table 3 the European points won are presented. The regression model was statistically significant $F_{2,315}$ = 5.641, p = .002, R^2 = .035 (the backward method was used in order to result to the most suitable model). The assumptions of the regression model were satisfied in relation to multicollinearity and autocorrelation. However, there was a deviation for the normality assumption and the homoscedasticity. The results showed that the number of newcomers players in the team between the 1st and the 2nd game (b = -.067, p < .10) and the average time of changes in the second game (b = -.019, p < .05) were statistical significant predictors of the European points won.

In Table 4 the domestic points won are presented. The regression model was statistically significant $F_{5,312}$ = 3.729, p = .003, R^2 = .003 (the backward method was used in order to result to the most suitable model). The assumptions of the regression model were satisfied in relation to multicollinearity and autocorrelation. However, there was a deviation for the normality assumption and the homoscedasticity. The results showed that the number of newcomers players in the team between the 1st and the 2nd game (b = -.192, p < .01), the average time of changes in all three games (b = -.033, p < .05), the number of the initial athletes in the three games (b = -.240, p < .01), the number of changes between the 1st and the 3rd game (b = -.190, p < .01) and the number of changes between the 2nd and the 3rd game (b = -.128, p < .10) were statistical significant predictors of the domestic points won.

Table 3. Regression model predicting the European points won during all competitive years.

	Unstandardized Coefficients		**Standardized Coefficients**			**Collinearity Statistics**	
	B	Std. Error	Beta	t	p	Tolerance	VIF
(Constant)	2.695	.192		14.068	.000		
Newcomers in the team of 14 players between 1st and 2nd game	-.067	.038	-.096	-1.740	.083	.999	1.001
Average time of changes in the 2nd game	-.019	.007	-.156	-2.813	.005	.999	1.001

Table 4. Regression model predicting the domestic points won during all competitive years.

	Unstandardized Coefficients		**Standardized Coefficients**			**Collinearity Statistics**	
	B	Std. Error	Beta	**t**	**p**	Tolerance	VIF
(Constant)	8.176	1.035		7.898	.000		
Number of initial athletes in the 3 games	-.240	.089	-.309	-2.692	.007	.230	4.348
Number of changes between 1st and 3rd	-.190	.070	-.205	-2.708	.007	.528	1.895
Number of changes between 2nd and 3rd game	-.128	.069	-.145	-1.848	.066	.489	2.045
Newcomers in the team of 14 players between 1st and 2nd game	-.192	.066	-.210	-2.924	.004	.589	1.698
Average time of changes in all 3 games	-.033	.016	-.119	-2.132	.034	.965	1.036

The summary of all the under-examination variables is presented in Table 5.

DISCUSSION

The purpose of the present study was to examine the rotation strategy in high-level soccer teams during a sequence of three games per week (1st domestic, 2nd European and 3rd domestic). The results of the study showed that rotation strategy has a significant effect on totally points won, on points won during the domestic games and on points won during the European games. Based on these findings the main hypothesis of the study is accepted.

The increased number of newcomer players in the initial list between the 1st and the 2nd game resulted in significantly fewer totally points won, fewer points won in the domestic game and fewer points won in the European game (Table 2 & 5). It seems, therefore, that the greatest number of new entrants in the first two games does not help teams to win more points. This could be attributed to the quality of the players that participate for the first time in the initial list, on the lack of competitive rhythm due to decrease participation in the competitive season, on the alteration of the homogeneity of the team and probably due to potential injuries which does not permit coaches to select the best players for each game, thus leading to more newcomer players participating in the initial list (Arnason et al., 2004; Hägglund et al., 2013). Strudwick (2013) reported that squad management, notably selection and rotation, and player availability are key issues in coping with the high demands of contemporary training and match-play. If this is the case, then coaches should be very careful during the manipulation of newcomer players in the first two games.

Table 5. Summary of all the under-examination variables.

	Total points	**European points**	**Domestic points**
Number of athletes in 3 games	n.s	n.s	n.s
Number of initial athletes in the 3 games	n.s	n.s	$p < .01$, negative effect
Number of athletes that played 270'	n.s	n.s	n.s
Total time played in 3 games for those athletes that did not play at least one game 90'	n.s	n.s	n.s
Average time played of the rest	n.s	n.s	n.s
Number of changes between 1st and 2nd game	$p < .05$, positive effect	n.s	n.s
Number of changes between 1st and 3rd game	n.s	n.s	$p < .01$, negative effect
Number of changes between 2nd and 3rd game	n.s	n.s	$p < .1$, negative effect
Average number of changes in the 3 games	n.s	n.s	n.s
Newcomers in the team of 14 players between 1st and 2nd game	$p < .01$, negative effect	$p < .1$, negative effect	$p < .01$, negative effect
Newcomers in the team of 14 players between 1st and 3rd game	n.s	n.s	n.s
Newcomers in the team of 14 players between 2nd and 3rd game	n.s	n.s	n.s
Average number of newcomers in all 3 games	n.s	n.s	n.s
Average time of changes in the 1st game	n.s	n.s	n.s
Average time of changes in the 2nd game	n.s	$p < .01$, negative effect	n.s
Average time of changes in the 3rd game	n.s	n.s	n.s
Average time of changes in all 3 games	$p < .01$, negative effect	n.s	$p < .05$, negative effect

n.s = not significant.

The results of the present study also showed that points are lost in both European and domestic games (Table 5). In the National Championship, more often, the players that participate are not selected for the European games and therefore, may not be able to successfully respond to the domestic game needs. Furthermore, it is possible that newcomer players for the European game are of a lower level for the Champions League and so this strategy seems to have a negative impact on the European points won. Therefore, irrespective of the importance of the game (European game or domestic game) it seems that high rotation in the initial list during the first two games (1st domestic and 2nd European) does not lead to increased points won. In contrast, a negative effect is observed.

Moreover, as the number of athletes participating in the initial list in all three games increases, the number of points won in the domestic league reduces (Table 4 & 5). It seems that players are not able to compete in all three games with increased performance and probably select to maximize their performance in the 2nd game (European) keeping power and having reduced performance in the first game. It is clear that when more players are used in the initial list during the three consecutive games, it is very difficult to remain high performance in all three games and as a consequence the winning points in the national championship are negatively affected. This seems to be accompanied by the negative effect of the number of changes in the initial list between the 1st and the 3rd game and between the 2nd and the 3rd game (Table 4 & 5). The increased number of changes that occur mainly in relation to the 3rd game are decisive and have negative consequences regarding the winning points on the domestic league. Coaches, during the 3rd game mainly use players who did not start in the initial list or did not participate in previous games. In this way, coaches' aim is to give adequate time to players who participated in the first two games to rest or give the opportunity to other players to prove their value.

The results of the study showed a positive effect of the number of players that were changed between the 1st and the 2nd game on the total points won (Table 2 & 5). It seems that the increased number of changes between the first two games has a positive effect, probably because the appropriate players participate in the suitable game, and as consequence fatigue for most of the players is avoided. In this way for both domestic and European games an adequate number of points is winning which has a positive effective on the totally points won. This strategy of increased players changing during the first two games is a suitable solution for players' performance during the 2nd game, as according to Mohr et al. (2016) in the 2nd game the high intensity running ability is reduced by 7% compared to the 1st game. In contrast, this strategy does not seem to have the same effect between the 1st and the 3rd game, but also between the 2nd and the 3rd game, because apparently in the 3rd game there is increased physical and psychological fatigue, or the changes made specifically in the 3rd game are about players who are not able to win points. It seems, therefore, that the quantity and the quality of the roster of a soccer team is an important factor that a coach should appropriate manipulate.

In addition, the average time each substitute participated in all three games seems to significantly affect the overall points and points won in the domestic league (Table 2 & 4). As the average time each substitute participated in the three games increases, the teams' total points won reduces. A possible explanation is that several teams use substitutes for more time probably because the outcome of the game requires the change of the score or because teams try to maintain a suitable for them score. This is in accordance to Bekris et al. (2018) study who found that the most successful teams have scored more goals and have received fewer goals during the first half. The need, therefore, for substitutes is greater for the teams that are losing, or the score is not the desired one. This was totally confirmed in the European games in which the increased time of substitutes in the 2nd game had a negative impact on the points won on the European games (Table 3 & 5). The score, therefore, is the most important factor explaining the appropriate timing of substitutions (Del Corral et al., 2008) which coaches should take into consideration when applying the rotation strategy.

CONCLUSIONS

The results of the study showed that coaches should have a qualitative and quantitative roster of players able to respond to the demands of both the domestic and the European games. If this is the case, then coaches should try to apply different tactics in previous matches in order, as many players as possible, to maintain high levels of homogeneity and competing readiness. Coaches, therefore, should try to adequate prepare the players who do not have sufficient time of participation in the games in order to be ready to respond to the needs of the game when coach will use them. Finally, coaches should know the level of the teams that compete before and after the European game. This variable in combination with the ranking place during the Champions League group stage, for example qualifying to the next round before the last game is played, are significant factors that need further examination and should be taken into account by coaches when applying the rotation strategy.

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