



Differences in performance indicators between winning and losing teams in the UEFA Champions League

by

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The aim of the present study was to identify performance indicators that discriminate winning teams from drawing and losing teams in the UEFA Champions League. All 288 matches played at the group stage in the 2007-2008, 2008-2009, and 2009-2010 seasons were analyzed. The game-related statistics gathered were: total shots, shots on goal, effectiveness, passes, successful passes, crosses, offsides committed and received, corners, ball possession, crosses against, fouls committed and received, corners against, yellow and red cards, venue, and quality of opposition. Data were analyzed performing a one-way ANOVA and a discriminant analysis. The results showed that winning teams had significantly higher average values that were for the following game statistics: total shots ($p<0.01$), shots on goal ($p<0.01$), effectiveness ($p<0.01$), passes ($p<0.05$), successful passes ($p<0.05$), and ball possession ($p<0.05$). Losing teams had significantly higher values in the variable yellow cards ($p<0.01$), and red cards ($p<0.01$). Discriminant analysis allowed to conclude the following: the variables that discriminate between winning, drawing and losing teams were the shots on goal, crosses, ball possession, venue and quality of opposition. Coaches and players should be aware of these different profiles in order to increase knowledge about game cognitive and motor solicitation and, therefore, to design and evaluate practices and competitions for soccer peak performance teams in a collective way.

Key words: Soccer, game-related statistics, discriminant analysis, match analysis.

Introduction

Empirical research investigating performance analysis in association soccer has generally been limited to studies exploring specific aspects of the game such as patterns of play of teams or physiological estimates of

positional work rates of individual players (Hughes and Franks, 2005; Hughes et al., 1988; Taylor et al., 2004; Yamanaka et al., 1993). Recently, it has been suggested that researchers should focus upon the development and utilization of performance indicators (Carling et al., 2009; Carling et al., 2005; Hughes and Bartlett,

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2002). This recommendation is based upon the fact that performance indicators, when expressed as non-dimensional ratios, can be independent of any other variables used (Hughes and Bartlett, 2002). Performance indicators are defined as the selection and combination of variables that define some aspect of performance and help achieve athletic success (Hughes and Bartlett, 2002). These indicators constitute a profile of ideal performance that should be present in the athletic activity to achieve this performance and can be used as a way to predict the future behaviour of sporting activity (Jones et al., 2004; O'Donoghue, 2005).

Despite recent attempts to construct individual performance profiles in team sports such as basketball, baseball, rugby, and American football (Boulier and Stekler, 2003; Csataljay, et al., 2009; Ibáñez, et al., 2008; Jones, et al., 2004; Ortega et al., 2009; Sampaio et al., 2010), there has been little research into the construction of team performance indicators and profiles in soccer. The preponderance of research in these team sports is largely explained by the sport's nature involving "plays" which are easily identifiable and categorized and individual contributions which can be easily isolated. Conversely, soccer's continuously interactive nature together with relatively low scores and limited "set" plays does not facilitate decomposition, record and measurement.

To date, a small number of studies have attempted to provide indicators of team

performance through the comparison of winning and losing teams (Grant et al., 1999; Horn et al., 2002; Hook and Hughes, 2001; Hughes and Churchill, 2005; Hughes and Franks, 2005; Hughes et al., 1988; Jones et al., 2004; Lago et al. 2010; Stanhope, 2001). However, playing patterns within previous studies have shown relatively contradictory findings.

Hughes and Franks (2005) compared the performance of successful and unsuccessful teams in 1990 World Cup. They found differences between the two in converting possession into shots on goal, with the successful teams having the better ratios. However, Hughes and Churchill (2005) compared the pattern of play of successful and unsuccessful teams leading to shots and goals during the Copa America Tournament of 2001. They found that there were no significant differences between the successful and unsuccessful team's patterns of play leading to shots. Hook and Hughes (2001) found that successful teams utilized longer possessions than unsuccessful teams in Euro 2000, although no significant differences were found in the number of passes used in attacks leading to a goal. However, in a similar study Stanhope (2001) found that time in possession of the ball was not indicative of success in the 1994 World Cup. Jones et al. (2004) showed that successful teams in the English Premier league typically had longer possessions than unsuccessful teams irrespective of the match status (evolving score).

The existing performance analysis literature in soccer suggests that there is a paucity of research on team performance indicators and the resultant profiles. The findings of these studies have provided restricted information on specific areas of soccer due to the limited number of team indicators used by the authors. Moreover, although such studies examined indicators of success in soccer, some limitations and/or methodological problems in the study of these aspects can be observed. Many of these studies failed to demonstrate the reliability of the data gathering system used (Hughes et al., 2002). Indeed, Hughes and Franks (1997) suggest that all computerised notation system should be tested for intra-observer reliability (repeatability). Moreover, the findings should be approached with caution as the results have been gained through analysis of limited numbers of teams and as such may not be applicable to all teams. Finally, these studies are based on small samples and, largely, a univariate analysis of the observed variable is done. These factors are likely to influence a team's performance and may therefore contribute to the differences found in existing studies.

The UEFA Champions League is the most prestigious club competition of the Union European Football Association UEFA (UEFA) and so one of the most popular annual sports tournaments all over the world. Millions of soccer supporters in Europe and throughout the world are interested in the games and the title winners.

However, to date, few studies have analyzed this competition (James et al., 2002; Papahristodoulou, 2008; Szwarc, 2007) and their results are not conclusive.

Based on the limitations of the extant research, the aim of this paper was to identify specific performance indicators that might be used to either (i) better understand the factors associated with a team's success in a match; (ii) separate the top clubs from the others in the UEFA Champions League based on significantly difference game performance.

Methods

Sample

The UEFA Champions League comprises of three qualifying rounds, a group stage, and four knockout rounds. The 16 winners of the third qualifying round ties, played late summer, join a similar number of automatic entrants in the 32-team group stage. At the group stage, the clubs are split into eight groups of four teams, who play home and away against each of their pool opponents, between September and December, to decide which two teams from each pool will advance to the first knockout round that starts in February. The third-place finishers in each pool enter the UEFA Cup round of 32 and the clubs that finish in the fourth position are eliminated. From the last 16 until the semi-finals, teams play two matches against each other, at home and away, with the same rules as the qualifying rounds applied. In the last 16, the group winners

play the runners-up other than teams from their own pool or nation, while from the quarter-finals on, the draw is without restrictions. The final is always decided by a single match. All together, the Champions League tournament consists of 125 matches, 96 at the group stage (12 matches in every group) and 29 matches (16 + 8 + 4 + 1) at the elimination stage. In order to carry out this study, all 288 games played at the group stage in the 2007-2008, 2008-2009, and 2009-2010 seasons of the UEFA Champions League have been analyzed. The collected data were provided by Gecasport, a private company dedicated to the performance assessment of teams in the UEFA Champions League (www.sdifutbol.com). The accuracy of the Gecasport System has been verified by Gomez et al. (2009a) and Gomez et al. (2009b). For previous uses of the Gecasport System see Lago and Martín (2007), Gomez et al. (2009a), Sola-Garrido et al. (2009), Lago (2009), and Lago et al. (2010). Reliability was assessed by the authors coding five randomly selected matches and the data being compared with those provided by Gecasport. The Kappa (K) values recorded from 0.92 to 0.95.

Procedures

The studied variables were divided into four groups (Table 1). The following game-related statistics were gathered: total shots, shots on goal, effectiveness (shots on goal x 100/total shots), passes, successful passes, crosses, offsides committed and received, fouls committed and received, corners, ball possession, crosses against,

corners against, yellow and red cards, venue (i.e. playing at home or away) and quality of opposition (the difference in the initial ranking inside the group of the considered team and the opponent, i.e.

$$\text{Quality of opposition} = P_A - P_B$$

where P_A is the initial ranking of the sampled team and P_B is the initial ranking of the opponent).

Group of variables	Variables, game statistics or performance indicators
Variables related to goals scored	Total shots; Shots on goal; Effectiveness ¹ .
Variables related to offense	Passes; successful passes (%); Crosses; Offsides committed; Fouls received; Corners; Ball possession.
Variables related to defence	Crosses against; Offsides received; Fouls committed; Corners against; Yellow cards; Red cards.
Contextual variable	Venue; quality of opposition.

¹Effectiveness = Shots on goal × 100 / Total shots

Statistical Analysis

Firstly, a descriptive analysis of the data was done. Then, a one-way analysis of variance

(ANOVA) was carried out in the goal of analyzing the differences between winning, drawing and losing teams. Finally, a discriminant analysis was conducted to find the statistical team variables that discriminate among the three groups. Discriminant analysis allows a researcher to study the differences between two or more groups of objects with respect to several variables simultaneously. By means of structural coefficients (SC) we identified the variables that better allowed discriminating winning from drawing and losing teams. It was considered as relevant for the interpretation of the linear vectors that the SC above 0.30 (Tabachnick and Fidell, 2007). Significance level was set at $p < 0.05$.

Results

Descriptive results of the game-related statistics for winning, drawing and losing teams are presented in Table 2. For the first group of variables (goals scored) winning teams had significantly higher values than the other groups of teams for the following game statistics: shots on goal ($p < 0.01$) and effectiveness ($p < 0.01$). Moreover, winning teams had average values that were significantly higher than losing teams for the variable total shots ($p < 0.01$). For the second group

of variables (offensive performance indicators), the game statistics with statistically significant differences between winning and losing teams included passes ($p < 0.05$), successful passes ($p < 0.05$) and ball possession ($p < 0.05$). No differences across the three groups of teams were found in the variables crosses, offsides committed, fouls received and corners. For the third group of variables (defensive performance indicators), the game statistics with significant differences between winning and losing teams were yellow cards ($p < 0.01$) and red cards ($p < 0.01$). No differences across the three groups of teams were found in the variables crosses against, offsides received, fouls committed and corners against.

The results of the multivariate analysis are presented in Table 3. The discriminant functions classified correctly 79,7% of winning, drawing and losing teams (Table 4). Only the first discriminant function obtained was significant ($p < 0.05$). In this discriminant function, the variables that had a higher discriminatory power were shots on goal (0.51), crosses (0.36), ball possession (0.36), venue (0.75) and quality of opposition (0.86).

Table 2
*Differences between winning, drawing and losing teams in game statistics
 from the UEFA Champions League*

Variables	Winner	Drawer	Loser
Related to goals scored			
Total shots	14.0±5.1 [#]	12.9±5.5 [#]	10.9±4.9
Shots on goal	6.3±2.6 [*]	4.8±2.6 [*]	3.7±2.3 [*]
Effectiveness	45.6±14.6 [*]	37.1±17.6	34.6±18.0
Related to offense			
Passes	469.7±102.8 [†]	453.7±95.8	441.5±88.1
Successful passes (%)	73.7±6.9 [†]	71.8±6.1	71.4±7.2
Crosses	25.5±9.0	26.6±10.5	25.4±9.2
Offsides committed	3.1±2.1	2.6±1.9	2.7±2.1
Fouls received	15.9±4.9	15.5±5.1	15.5±4.8
Corners	5.2±2.7	4.9±2.3	4.8±2.8
Ball possession	50.8±7.4 [†]	49.7±6.9	48.6±7.3
Related to defence			
Crosses against	25.4±9.2	26.6±10.5	25.5±9.0
Offsides received	2.7±2.1	2.6±1.9	3.1±2.1
Fouls committed	15.5±4.8	15.5±5.1	15.8±4.9
Corners against	4.8±2.9	4.9±2.3	5.2±2.7
Yellow cards	1.6±1.2 [#]	1.9±1.4	1.9±1.3
Red cards	0.0±0.2 [#]	0.1±0.3	0.1±0.4

^{*}Significantly different from any other group ($p < 0.01$).

[#]Significantly different from losers ($p < 0.01$).

[†]Significantly different from losers ($p < 0.05$).

Table 3

Standardized coefficients from the discriminant analysis of the game statistics between winning, drawing and losing teams in the UEFA Champions League

Game statistics variable	Function	
	1	2
Total shots	0.05	-0.17
Shots on goal	-0.51*	-0.15
Effectiveness	-0.11	0.35*
Passes	-0.22	-0.47*
Successful passes (%)	0.18	0.96*
Crosses	0.36*	0.02
Crosses against	-0.16	-0.19
Offsides received	0.07	0.48*
Offsides committed	-0.00	0.32*
Fouls committed	-0.13	0.24
Fouls received	0.15	0.26
Corners	0.04	0.23
Corners against	-0.01	0.23
Ball posesión	0.36*	-0.05
Yellow cards	-0.03	-0.39*
Red cards	0.17	0.41*
Venue	-0.75*	-0.00
Quality of opposition	0.86*	0.12
Eigenvalue	1.02	0.10
Wilks' Lambda	0.47	0.90
Canonical Correlation	0.71	0.31
Chi-square	145.19	18.01
df	36	17
Significance	0.00	0.38
% of Variance	90.7%	9.3%

*SC discriminant value $\geq |.30|$

Table 4

Classification of the teams by their results and reclassification of them according to values of the discriminant functions

Original Group	Predicted Group Membership		
	Winner	Drawer	Loser
Winner	74.6	19.7	5.6
Drawer	20.0	56.0	24.0
Loser	7.0	23.9	69.0

Discussion

The aim of the present study was to identify performance indicators that discriminate winning teams from drawing and losing teams based on significantly different game performance in the UEFA Champions League. According to different authors (Lago, 2009; Taylor et al., 2008; Tucker et al., 2005) comparing winning and losing sides, it may therefore result in a potential loss of meaningful information due to each team possessing different styles of play and consequently, diverse performance profiles. However, comparing the aggregate data of two or more different teams (the winning and losing sides) rather than analysing one team's success and failure can give general values that can be used as normative data to design and evaluate practices and competitions for soccer peak performance teams in a collective way.

The results from the present study indicate that winning teams made more shots and shots on goal than losing and drawing teams. Moreover, winning teams had a higher effectiveness than losing and drawing teams (45.6, 37.1 and 34.6, respectively). Previous studies have concluded that differences between the winning and the losing teams are mainly evident in the frequency and effectiveness of shots on goal and passing. For example, Lago et al. (2010), after examining all 380 matches corresponding to the 2008-2009 season of the Spanish League, showed that winning teams are stronger in the variables

related to goals scored than losing and drawing teams. Hughes and Franks (2005) showed that there were differences between successful and unsuccessful teams in converting possession into shots on goal, with the successful teams having the better ratios. In this line, Armatas et al. (2009) also found in the Greek Soccer First League that top teams made more shots than bottom teams. Szwarc (2004), after examined 2002 World Cup, showed similar results and concluded that finalist teams made more shots than unsuccessful teams (mean from 12 matches: 18.00 vs. 14.08).

Concerning the performance indicators related to offense, there were differences between winning and losing teams in the variables passes, successful passes and ball possession. Armatas et al. (2009) and Lago et al. (2010) reached similar results. They found that top teams presented greater number of passes than last teams and their average was twofold greater. However, our results differ from those found by Hughes et al. (1988) and Low (2002). A reason that might explain the difference in results is the sample used in those studies. Selecting matches from a one-off tournament means that the selected teams (successful and unsuccessful) are not balanced in terms of the strength of opposition and number of matches played. Moreover, in the study of Low (2002), no statistics were utilized to compare the differences between the teams.

Performance analysis studies have provided inconclusive information regarding the relationship between ball possession and

competition success (Bate, 1988; Grant et al. 1999; Hook and Hughes, 2001; Hughes and Franks, 2002; Stanhope, 2001). Some authors have suggested the existence of patterns of play involving ball possession shown by successful and unsuccessful teams (Hughes and Franks, Bloomfield et al., 2005), while others indicate that ball possession time is not a marker of success in a game (Bate, 1988; Stanhope, 2001). The small sample sizes examined, the limitation of case studies designs and the examination of matches in competitions in which the selected teams (successful and unsuccessful) were imbalanced in terms of the strength of opposition and the number of matches played, make it difficult to come to any conclusion. The results from the present study suggest that winning teams maintained possession for longer than unsuccessful teams. According to these results time in possession of the ball is indicative of success in the UEFA Champions League. Future studies should address the relationship between ball possession and competition success and analyze the influence of situational variables (match location, match status and quality of opposition) on team possession.

Regarding the performance indicators related to defence, the results of this study demonstrate that there were statistically significant differences between winning and losing teams in the following variables: yellow cards and red cards. In the articles reviewed for the present study, very few studies analyzed the

relationship between performance indicators related to defence and team results. Probably, this gap is due to problems of measuring these variables. Further research should address this topic. In a similar study, Lago et al (2010) found that there were differences between winning and losing teams in the Spanish league in the variables crosses against, offsides received and red cards.

When analyzing the results overall, the univariate analysis (Table 2) showed that there were eight variables with statistically significant differences (total shots, shots on goal, effectiveness, passes, successful passes, ball possession, yellow cards, and red cards). On the other hand, when applying a multivariate analysis (Table 3), the number of statistically significant variables was reduced to five (shots on goal, crosses, ball possession, venue, and quality of opposition).

These results indicate that the type of statistical analysis will determine some results. It should be the goals of the study that determine the type of analysis that is more adequate. In the articles reviewed for the present study, most studies used univariate statistics in their analysis. In the present study, the multivariate analysis indicated that the team that made more shots and shots on goal won the game. Moreover, the results suggest that the ability to retain possession of the ball is linked to success. The crosses appear to be relevant to explain team results. Finally, contextual variables (i.e. playing at home or away, and the quality of opposition: strong or weak)

may affect the behavioural events that occur during competition. These results are similar to those provided by Lago et al. (2010). They found that there were differences between winning and losing teams in the variables total shots, shots on goal, crosses, ball possession and venue. However, in this study the variables passes and successful passes were not considered.

Nonetheless, it must be kept in mind that the differences with regards to mathematical probability are only part of the analysis of the results (Ortega et al., 2009). Therefore, the values found in the analysis of play, whether or not they are significant, can serve as a reference for coaches to guide training seasons.

Conclusion

This study presents reference values of game statistics and demonstrates in which aspects of the game there are differences between winning, losing and drawing teams in soccer. The variables that better differentiate winning, losing and drawing teams in a global way were the following: total shots, shots on goal, passes, successful passes, venue and quality of opposition. This profile helps the coach to prepare practices according to this specificity and to be ready to control these variables in competition. For example, scouting of upcoming opposition and post-match assessments of team performance can be performed in a more objective way by establishing the impact of particular variables on team performance. Moreover, if a notational

analyst or coach has identified that the technical, physical or tactical aspects of performance are adversely influenced by specific situational variables, possible causes can be examined and

match preparation focused on reducing such effects. This practical intervention can be oriented in a positive way (things or number of things to try to achieve) or in a negative way (things or number of things to try to avoid).

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