

Research article

## Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league

Carlos Lago-Peñas<sup>1</sup>✉, Joaquín Lago-Ballesteros<sup>1</sup>, Alexandre Dellal<sup>2</sup> and Maite Gómez<sup>3</sup>

<sup>1</sup> Faculty of Education and Sports Sciences, University of Vigo, Pontevedra, Spain, <sup>2</sup> University of Sports Sciences, Strasbourg, France and National Center of Medicine and Science in Sport, Tunis, Tunisia, <sup>3</sup> Faculty of Physical Activity and Sports Sciences, European University of Madrid, Spain.

### Abstract

The aim of the present study was to analyze men's football competitions, trying to identify which game-related statistics allow to discriminate winning, drawing and losing teams. The sample used corresponded to 380 games from the 2008-2009 season of the Spanish Men's Professional League. The game-related statistics gathered were: total shots, shots on goal, effectiveness, assists, crosses, offsides committed and received, corners, ball possession, crosses against, fouls committed and received, corners against, yellow and red cards, and venue. An univariate (t-test) and multivariate (discriminant) analysis of data was done. The results showed that winning teams had averages that were significantly higher for the following game statistics: total shots ( $p < 0.001$ ), shots on goal ( $p < 0.01$ ), effectiveness ( $p < 0.01$ ), assists ( $p < 0.01$ ), offsides committed ( $p < 0.01$ ) and crosses against ( $p < 0.01$ ). Losing teams had significantly higher averages in the variable crosses ( $p < 0.01$ ), offsides received ( $p < 0.01$ ) 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 total shots, shots on goal, crosses, crosses against, ball possession and venue. Coaches and players should be aware for these different profiles in order to increase knowledge about game cognitive and motor solicitation and, therefore, to evaluate specificity at the time of practice and game planning.

**Key words:** Association football, game-related statistics, discriminant analysis, match analysis.

### Introduction

Match analysis is the objective recording and examination of behavioural events that occur during competition (Carling et al., 2005). The main aim of match analysis is to identify strengths of one's own team, which can then be further developed, and its weaknesses, which suggest areas for improvement. Similarly, a coach analysing the performance of an opposition side will use the data to identify ways to counter that team's strengths and exploit its weaknesses (Carling et al., 2009). 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 an ideal profile that should be present in the athletic activity to achieve success and can be used as a way to predict the future behaviour of sporting activity (O'Donoghue, 2005).

Empirical research investigating match analysis in soccer has generally been focused upon goal scoring and

patterns of build-up play leading to shots (Ensum et al., 2002; Grant et al., 1999; Hook and Hughes, 2001; Hughes et al., 1988; Hughes and Churchill, 2005; Hughes and Franks, 2005; Jones et al., 2004; Konstadinidou and Tsigilis, 2005; Scoulding et al., 2004; Stanhope, 2001; Yamanaka et al., 1993). Some of these studies relate these aspects to the result of the game (winning or losing). However, playing patterns within previous studies have shown relatively contradictory findings.

For example Hughes, Robertson and Nicholson (1988) found that teams who reached the semi finals of the 1986 World Cup tended to occupy the centre of the pitch more often, whereas those that failed to progress beyond the group stages utilised the wings. In addition, when the ball was regained, attempts at goal were also significantly greater for the successful team. However, whilst this study provided some evidence of different patterns of play between teams deemed successful or unsuccessful, the findings may be less applicable to modern football due to the time period in which it was conducted. However a similar investigation was completed by Low et al. (2002) on 40 matches within the 2002 soccer World Cup which produced similar results to those of Hughes et al. (1988) although no statistics were utilised to compare the differences between the teams. Further investigations have been completed on playing patterns within World Cups, but have tended to focus on a single team. For example Griffiths (1999) selected matches involving France, who were at this time considered the best international team in the World. It was reported that France was able to create significantly more shots while also having the ability to retain possession for long periods. Interestingly France also created significantly more crosses than their opponents, which suggests that in modern soccer successful teams may utilise wing attacks more often than reported in earlier research (e.g. Hughes et al., 1988). Scoulding et al. (2004) suggest that in terms of passes in different areas of the pitch very little difference existed between the most successful and an unsuccessful team during the 2002 World Cup.

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.

Grant et al. (1999) analysed the 1998 World Cup and concluded that successful teams (reached the semi-finals) were able to penetrate the defence by passing, running or dribbling the ball in a forward direction for longer sequences of play than unsuccessful teams (failed to pass the initial group stage). Employing similar methods Hook and Hughes (2001) found that successful teams utilised 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. These authors suggested that keeping the ball for longer durations was indicative of success. 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).

Other studies have tried to provide a 'formula' of winning by reporting statistics of successful teams on the assumption that mimicking these figures would create a "winning formula". For example, Horn et al. (2002), identified a specific part of the pitch, the central area just outside the penalty area. It was suggested that 86% of passes into this area would subsequently enter the penalty area and thus likely to provide shooting opportunities. In a similar vein, Taylor and Williams (2002) cited the importance of retained possession for the winners of the 2002 World Cup finals and suggested that possession gained in the defensive area resulted in more attempts on goal than for the other teams. This finding is similar to the ideas suggested by Pollard (2002) who discussed the ability to win matches with regard to the number of actions performed and were deemed successful, which he called 'yield'. It was suggested that unsuccessful teams would display a lower yield although categorical conclusions like this are impossible to substantiate in a sport like soccer where a late goal can completely alter the result of a match.

The analysis of game statistics, with regards to individual and collective skills, is one of the tools that can be utilized to describe and monitor behaviour in competition (Ortega et al., 2009). In spite of the limitations that can arise from the different variables used in these studies (Hughes et al., 2002), this type of data is useful to have greater knowledge of the game.

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., 2001). Indeed, Hughes and Franks (1997) suggest that all computerised notation system should be tested for intra-observer reliability (repeatability). Also, 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, 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 sample sizes and, largely, an 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.

Based on the limitations of the extant research, the purpose on the present study was to identify which game-related statistics allow discriminating winning, drawing and losing teams in the Spanish Professional League.

## Methods

### Sample

In order to carry out this study, all 380 games corresponding to the 2008-2009 season of the Spanish league have been analyzed. The collected data were provided by Gecasport, a private company dedicated to the performance assessment of teams in the Spanish Soccer League ([www.sdifutbol.com](http://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), and Lago (2009). 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 0.95 to 0.98.

### Procedures

The studied variables were divided into four groups (Table 1). The following game-related statistics were gathered: total shots, shots on goal, effectiveness, assists, crosses, offsides committed and received, fouls committed and received, corners, ball possession, crosses against, corners against, yellow and red cards, and venue (i.e. playing at home or away).

**Table 1. Variables studied in the Spanish soccer league 2008-2009.**

Group of variables	Variables or game statistics or performance indicators
Variables related to goals scored	Total shots; Shots on goal; Effectiveness <sup>1</sup> .
Variables related to offense	Assists; 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

<sup>1</sup>Effectiveness=Shots on goal×100/Total shots

### Statistical Analysis

Firstly, a descriptive analysis of the data was done. Then, a Krustal-Wallis H was carried out in the goal of analyzing the differences between winning, drawing and losing teams because the assumptions of normality and homogeneity of variances were not satisfied. 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

**Table 2.** Differences between winning, drawing and losing teams in game statistics from the Spanish soccer league 2008-2009.

Variable	Winner		Drawer			Loser			P <sup>1</sup> Value	
	M	SD	Median	M	SD	Median	M	SD		Median
<b>Variables related to goals scored</b>										
Total shots	14.4	5.1	14.0	13.6	5.2	13.0	11.9	4.8	12.0	.000
Shots on goal	6.6	2.8	6.0	5.1	2.7	5.0	4.2	2.4	4.0	.000
Effectiveness	46.2	15.7	44.4	37.5	15.4	38.3	37.6	31.3	35.3	.000
<b>Variables related to offense</b>										
Assists	8.6	3.7	8.0	8.4	3.7	8.0	7.3	3.6	7.0	.000
Crosses	27.4	9.4	26.0	29.8	10.6	29.0	29.4	10.1	28.0	.004
Offsides committed	2.9	1.9	3.0	2.6	2.0	2.0	2.4	1.9	2.0	.001
Fouls received	16.7	4.2	17.0	16.7	5.3	17.0	16.8	4.7	17.0	.874
Corners	5.2	2.9	5.0	5.5	2.8	5.0	5.3	2.9	5.0	.387
Ball possession	50.6	8.4	50.0	50.0	8.2	50.0	49.2	7.9	50.0	.339
<b>Variables related to defence</b>										
Crosses against	29.4	10.1	28.0	29.8	10.6	29.0	27.4	9.4	26.0	.004
Offsides received	2.4	1.9	2.0	2.6	2.0	2.0	2.9	1.9	3.0	.001
Fouls committed	16.8	4.6	17.0	16.7	5.3	17.0	16.7	4.2	17.0	.822
Corners against	5.3	2.9	5.0	5.5	2.8	5.0	5.2	2.9	5.0	.387
Yellow cards	2.8	1.6	3.0	2.9	8.2	3.0	3.1	1.7	3.0	.291
Red cards	.19	.58	.0	.20	10.6	.0	.35	.68	.0	.000
<b>Contextual variable</b>										
Venue	.39	.49	.0	.50	1.98	.5	.61	.49	1.0	.000

<sup>1</sup>Kruskal Wallis H.

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 averages that were significantly higher than the other groups of teams for the following game statistics: total shots [ $\chi^2(2) = 31.94$ ,  $p < 0.01$ ], shots on goal [ $\chi^2(2)=103.22$ ,  $p < 0.01$ ] and effectiveness [ $\chi^2(2) = 64.50$ ,  $p < 0.01$ ].

For the second group of variables (offensive performance indicators), the game statistics with statistically significant differences between the groups of teams were the assists [ $\chi^2(2) = 20.21$ ,  $p < 0.01$ ], crosses [ $\chi^2(2) = 11.01$ ,  $p < 0.01$ ] and offsides committed [ $\chi^2(2)=14.79$ ,  $p < 0.01$ ]. No differences across the three groups of teams were found in the variables ball possession, fouls received and corners.

For the third group of variables (defensive performance indicators), statistically significant differences between the groups were the crosses against [ $\chi^2(2) = 11.00$ ,  $p < 0.01$ ], offsides received [ $\chi^2(2) = 14.79$ ,  $p < 0.01$ ] and red cards [ $\chi^2(2) = 18.63$ ,  $p < 0.01$ ]. No differences across the three groups of teams were found in the variables yellow cards, fouls committed and corners against.

Finally, playing at home or away (contextual variable) was statistically significant for explaining the results

of the three groups of teams [ $\chi^2(2) = 28.21$ ,  $p < 0.01$ ].

The results of the multivariate analysis are presented in Table 3. The discriminant functions classified correctly 55.1% 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 the total shots (SC = 0.50), shots on goal (0.75), crosses (0.69), crosses against (0.62), and ball possession (0.56).

**Table 3.** Standardized coefficients from the discriminant analysis of the game statistics between winning, drawing and losing teams in the Spanish soccer league 2008-2009.

Game statistics variable	Function	
	1	2
Total shots	.50*	.33*
Shots on goal	.75*	-.58*
Effectiveness	-.07	-.12
Assists	-.07	.38*
Crosses	-.59*	.47*
Crosses against	.62*	.89*
Offsides received	-.24	.05
Offsides committed	.24	.16
Fouls committed	.08	.06
Fouls received	.03	.10
Corners	.03	.05
Corners against	-.14	-.04
Ball posesión	.39*	.03
Yellow cards	-.04	-.08
Red cards	-.25	-.29
Venue	-.56*	-.08
Eigenvalue	.380	.028
Wilks' Lambda	.70	.97
Canonical Correlation	.52	.16
Chi-square	251.61	19.70
df	32	15
Significance	.00	.18
% of Variance	93.2%	6.8%

\*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	58.6 %	23.9 %	17.5 %
Drawer	30.0 %	35.6 %	34.4 %
Loser	15.0 %	22.4 %	62.6 %

## Discussion

The aim of this study was to identify the game-related statistics that discriminate between winning and losing teams in Spanish soccer. Although this aspect may be considered a limitation by different authors (Lago, 2009; Taylor et al., 2008; Tucker et al., 2005) this type of study can give general values that help to understand and analyse football and help to design training sessions. The data obtained in this study is different from the data obtained in case studies as these authors proposed.

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 (46.17, 37.54 and 35.57, respectively) 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). In this line, Armatas et al. (2009) also found in the Greek Soccer First League that top teams made more shots than bottom teams. Previous studies have concluded that differences between the winning and the losing teams are mainly evident in the frequency and effectiveness of shots at goal and passing (Grant et al., 1999). 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. The results of the present study support the notion that winning teams are stronger in the variables related to goals scored than losing and drawing teams.

Concerning the performance indicators related to offense, there were differences between winning, losing and drawing teams in the variables, assists, crosses and offsides committed. Armatas et al. (2009) reached similar results. They found that top teams presented greater number of assists than last teams and their average was two-fold greater. Griffiths (1999) found that France, who was at this time considered the best international team in the World, created significantly more crosses than their opponents. However, our results differ from those found by Hughes et al. (1988) and Low et al. (2002). A reason that might explain the difference in the 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 et al. (2002), no statistics were utilised to compare the differences between the teams.

Regarding the performance indicators related to defence, the results of this study demonstrate that there were statistically significant differences between teams in the following variables: crosses against, offsides received and

red cards. In the articles reviewed for the present study, there were no studies that analyze the relationship between performance indicators related to defence and team results. Probably, this gap is due to problems for measuring these variables. Further research should address this topic.

When analyzing the results overall, the univariate analysis (Table 2) showed that there are ten variables with statistically significant differences (total shots, shots on goal, effectiveness, assists, crosses, crosses against, ball possession, and red cards, and venue). On the other hand, when applying a multivariate analysis (Table 3), the number of statistically significant variables was reduced to six (total shots, shots on goal, crosses, crosses against, ball possession, and venue).

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, all 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 for and against appear to be relevant to explain team results. Finally, contextual variables may affect the behavioural events that occur during competition.

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. This profile helps the coach to prepare practices according to this specificity and to be ready to control these variables in competition.

The variables that better differentiate winning, losing and drawing teams in a global way were the following: total shots, shots on goal, crosses, crosses against, ball possession, and venue.

This paper has presented values that can be used as normative data to design and evaluate practices and competitions for soccer peak performance teams in a collective way. Coaches can use this information to establish objectives for players and teams in practices and matches. These objectives 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) with a special

reference to the offensive or defensive play.

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## Key points

- This paper increases the knowledge about soccer match analysis.
- Give normative values to establish practice and match objectives.
- Give applications ideas to connect research with coaches' practice.

## AUTHORS BIOGRAPHY

### Carlos LAGO-PEÑAS

#### Employment

Professor. Faculty of Education and Sports Sciences, University of Vigo, Pontevedra, Spain.

#### Degree

PhD

#### Research interests

Match analysis, soccer, training.

**E-mail:** clagop@uvigo.es

### Joaquín Lago-Ballesteros

#### Employment

Researcher. Faculty of Education and Sports Sciences, University of Vigo, Pontevedra, Spain.

#### Degree

MSc

#### Research interests

Match analysis, soccer, training.

**E-mail:** jlagob@uvigo.es

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**Alexandre DELLAL****Employment**

Assistant coach of the soccer national team of Ivory Coast (Côte d'Ivoire) especially for the fitness training.

**Degree**

PhD

**Research interests**

Science in soccer and the optimization of the performance in soccer.

**E-mail:** alexandredellal@gmail.com

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**Maité Gomez****Employment**

Chair of Department. Professor. Sport Department, Faculty of Physical Activity and Sport Science, European University of Madrid, Spain.

**Degree**

PhD

**Research interests**

Match analysis, soccer, coaching science.

**E-mail:** m\_teresa.gomez@uem.es

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**✉ Carlos Lago-Peñas**

Faculty of Education and Sports Sciences, University of Vigo, Pontevedra, Spain.