Performance in Team Sports:
Identifying the Keys to Success in Soccer

by

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The aim of this study was to identify specific performance indicators that discriminate the top clubs from the others based on significantly different pitch action performance in the Spanish Soccer League. All 380 games corresponding to the 2008-2009 season have been analyzed. The studied variables were divided into three groups related to goals scored (goals for, goals against, total shots, shots on goal, shooting accuracy, shots for a goal), offense (assists, crosses, offsides committed, fouls received, corners, ball possession) and defense (crosses against, offsides received, fouls committed, corners against, yellow cards, red cards). Data were analyzed performing a one-way ANOVA. Significant differences across sections of the league table were found for the following pitch actions: goals for, total shots, shots on goal, shots for a goal, assists and ball possession. The main findings of this study suggest that top teams had a higher average of goals for, total shots and shots on goal than middle and bottom teams (p<0.05). Bottom teams needed a higher number of shots for scoring a goal than the other groups of teams (p<0.05). Middle teams showed a lower value in assists and ball possession than top teams (p<0.05). In conclusion, this paper presents values that can be used as normative data to design and evaluate practices and competitions for peak performance soccer teams in a collective way.

Key words: association football, performance indicators, success.

Introduction

Empirical research investigating performance analysis in association football 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, Robertson and Nicholson, 1988; Taylor, Mellalieu and James, 2004; Yamanaka, Hughe, and Lott, 1993). Recently, it has been suggested that researchers should focus upon the development and utilization of performance indicators (Carling, Reilly, and Williams 2009; Carling, Williams, and Reilly 2005; Hughes and Bartlett, 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, Mellalieu, and James 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, Villarejo and Palao, 2009; Sampaio, Lago and Drinkwater, 2010), there

has been little research into the construction of team performance indicators and profile in association football. The preponderance of research in these team sports is largely explained by the sport´s nature involving `plays´ which are easily identifiable and categorizable, with individual contributions which can be easily isolated. Conversely, association football´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, Williams, and Reilly 1999; Horn, Williams and Ensum, 2002; Hook and Hughes, 2001; Hughes and Churchill, 2005; Hughes and Franks, 2005; Hughes, et al., 1988; Jones, et al., 2004; 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 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. 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, Cooper and Nevill, 2002). Indeed, Hughes and Franks (1997) suggest that all computerised notational systems 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 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.

Based on the limitations of the existing research, this paper uses summative season long performance comparisons in an attempt to identify specific performance indicators that might be used to either (i) better understand the factors associated with a team´s success over a season, and/or (ii) separate the top clubs from the others based on significantly different pitch action performances.

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 assessment of performances obtained by teams in the Spanish soccer League (www.sdifutbol.com). The accuracy of the Gecasport System has been verified by Gómez, Barriopedro and Álvaro (2009) and Gómez, Álvaro and Barriopedro (2009). To ensure the reliability of the data, five randomly selected matches were coded by the authors of this study and then compared with those provided by Gecasport. The Kappa (K) values obtained ranged from 0.95 to 0.98.

Procedures

The studied variables were divided into three groups (Table 1). The following game-related statistics were gathered: goals for, goals against, total shots, shots on goal, shooting accuracy, shots for a

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	Goals for, Goals against, Total shots; Shots on goal; Shooting accuracy, Shots for a goal.
Variables related to offense	Assists; Crosses; Offsides committed; Fouls received; Corners; Ball possession.
Variables related to defense	Crosses against; Offsides received; Fouls committed; Corners against; Yellow cards; Red cards.

goal, assists, crosses, offsides committed and received, fouls committed and received, corners, ball possession, crosses against, corners against, yellow cards and red cards.

Statistical Analysis

A one-way ANOVA was performed, in every pitch action considered, to test the hypothesis that the averages for the Spanish Soccer League teams forming the top, middle, and bottom of the final league table were equal. The composition of these three groups of teams was the following:

- The *top four* teams (F.C. Barcelona, Real Madrid, Sevilla, and Atlético), qualified for the UEFA Champions (the most prestigious clubs cup competition).

- The *middle dozen* (Villarreal, Valencia, Deportivo, Malaga, Mallorca, Espanyol, Racing, Almeria, Athletic, Sporting, Osasuna, and Valladolid).

- The *bottom four teams,* including the three clubs relegated to the lower division (Betis, Numancia, and Recreativo) and the fourth worst team (Getafe), with very similar performance (Getafe reached the same punctuation as Betis, the best of the relegated clubs).

Post hoc multiple comparisons were performed according to the Bonferroni procedure. Statistical analyses were carried out using SPSS software release 17.0 (SPSS Inc., Chicago, IL, USA). The whole statistical analysis has been performed with a significance level of $p<0.05$.

Results

The ANOVA results are summarized in Table 2. For the first group of variables (goals scored), the average goals for ($F_{2,17}=13.33$, $p=0.01$), total shots ($F_{2,17}=9.09$, $p=0.01$), shots on goal ($F_{2,17}=6.36$, $p=0.01$), and shots for a goal ($F_{2,17}=8.55$, $p=0.01$), were found to be different across sections of the league table. The Bonferroni multiple comparisons found that the mean number of goals scored for the top teams section (mean 2.12, $SD=0.55$, $n=4$) was significantly higher than that for the middle (mean 1.33, $SD=0.20$, $n=12$) and bottom sections (mean 1.14, $SD=0.22$, $n=4$). Mean number of goals scored for the middle and

Table 2

One-Way ANOVA of pitch actions for the Spanish football teams grouped according to their respective position in the league table

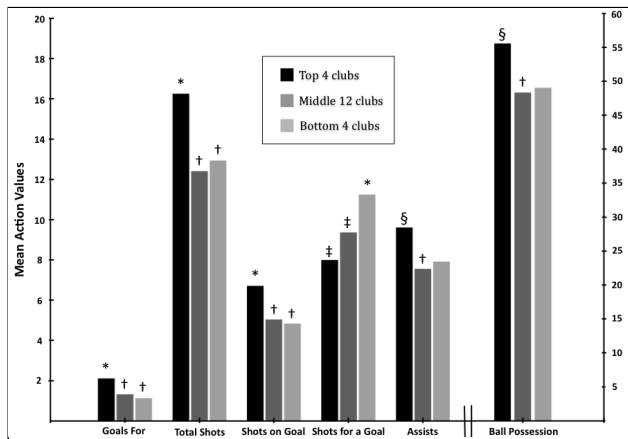|	Variable	Mean Action Values			F	P
		Top 4 clubs	Middle 12 clubs	Bottom 4 clubs		
Variables related to goals scored	**Goals For**	2.12	1.33	1.14	13.33	**0.000**
	Goals Against	1.20	1.49	1.58	2.99	0.077
	Total shots	16.25	12.41	12.93	9.09	**0.002**
	Shots on goal	6.71	5.04	4.84	6.36	**0.009**
	Shooting Accuracy	41.37	41.82	37.72	1.42	0.268
	Shots for a goal	8	9.33	11.25	8.55	**0.003**
Variables related to offence	**Assists**	9.61	7.56	7.91	7.20	**0.005**
	Crosses	29.06	28.56	28.78	0.05	0.948
	Offsides Committed	2.66	2.68	2.54	0.09	0.915
	Fouls Received	16.61	16.73	16.66	0.01	0.987
	Corners	5.65	5.21	5.06	1.08	0.362
	Ball Possession	55.57	48.34	49.04	6.14	**0.010**
Variables related to defence	Crosses Against	25.98	29.31	29.54	2.00	0.165
	Offsides Received	2.90	2.44	3.02	1.48	0.255
	Fouls Committed	15.60	17.22	16.31	1.65	0.221
	Corners Against	4.90	5.42	5.18	0.92	0.416
	Yellow Cards	2.73	2.95	2.94	0.53	0.596
	Red Cards	0.22	0.27	0.23	0.59	0.567

Table 1

Differences in pitch actions for the Spanish Soccer League teams

Notes: * Statistically higher than the other groups of teams. †
Statistically lower than the top 4 clubs. ‡ Statistically lower than the
bottom 4 clubs. § Statistically higher than the middle 12 clubs.

Discussion

The aim of this study was to identify specific performance indicators that discriminate the top clubs from the others in the Spanish Soccer League, based on significantly different pitch action performance. Although summative season long performance comparisons between teams 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 football and may be viewed as normative values to the design of training sessions. The data obtained in this study is different from the data obtained in case studies as these authors proposed.

The results of the present study indicate that top teams made more shots and shots on goal than the middle and bottom teams. In this line, Armatas, et al. (2009) also found in the Greek Soccer First League, that top teams made more shots and had a better ratio between goals scored and shots made than bottom teams. Moreover, top and middle teams had better effectiveness: they needed a lower number of shots to score a goal, than the bottom teams (8 vs 9.33 vs 11.25, respectively). As a consequence, the number of goals scored for the best teams are higher than that for the middle and bottom level teams of the league table (2.12 vs 1.33 vs 1.14, respectively). Previous studies have concluded that differences between winning and losing teams are mainly evident in the frequency and effectiveness of shots at goal and passing (Grant et al., 1999; Oberstone, 2009). 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 offence, there were significant differences between top and middle teams in the number of assists, so that the former showed a greater amount than the later. The value for the bottom teams was nearly above the one for the middle clubs, but it was non-significantly different from those for the other sections of the league table. Armatas, et al. (2009) also found significant differences in this variable, but these differences were established between top and bottom clubs. They found that top teams presented greater number of assists than bottom teams and their average was twofold greater. Griffiths (1999) found that France, who was at this time considered the best national team in the World, created significantly more crosses than their opponents. However,

bottom sections were not found to be significantly different from each other. The same findings were revealed with respect to the mean total shots (mean 16.25, *SD* =1.98, *n*=4, for the top teams; mean 12.41, *SD*=1.23, *n*=12, for the middle clubs; and mean 12.93, $s\,\bar{x}$=2.12, *n*=4, for the bottom section), and mean shots on goal (mean 6.71, *SD*=1.30, *n*=4; mean 5.04, *SD*=0.70, *n*=12; and mean 4.84, *SD*=0.88, *n*=4; respectively). Mean number of shots for a goal for the top and middle teams were not found to be significantly different from each other but both of them were significantly lower than that for the bottom section. The Bonferroni multiple comparisons between sections of the league table are displayed in Figure 1.

For the second group of variables (offensive performance indicators), the average assists [$F_{2,17}$=7.20, *p*=0.01] and ball possession [$F_{2,17}$=6.14, *p*=0.01] were found to be different across sections of the league table. Post hoc multiple comparisons found that the mean number of assists for the top section (mean 9.61, *SD*=0.75, *n*=4) was significantly higher than that for the middle section (mean 7.56, *SD*=0.87, *n*=12), but there were no significant differences with respect to this pitch action in all other possible comparisons involving the bottom section (mean 7.91, *SD*=1.29, *n*=4). The same findings were revealed in relation to the mean time of ball possession (mean 55.57, *SD*=6.21, *n*=4, for the top teams; mean 48.33, *SD*=2.81, *n*=12, for the middle clubs; and mean 49.04, *SD*=2.59, *n*=4, for the bottom section).

For the third group of variables (defensive performance indicators), no significant differences were found between the three groups.

our results differ from those found by Hughes, et al. (1988), Luhtanen (1993) and Low, Taylor and Williams (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.

Lago and Martín (2007) noted that one of the most robust findings in match analysis of soccer is the correlation between the ability to retain possession of the ball for prolonged periods and success. The significant differences found in this study between top and middle teams in their amount of ball possession are consistent with the findings of previous literature (Bate, 1988; Carmichael, Thomas and Ward, 2001; James et al., 2004). Successful passing has been pointed as a key aspect in soccer performance in the dual sense of preventing its use by the opposition team and reducing the latter's chances of scoring, and providing a source of attacking plays culminating in shots at goal (Carmichael, Thomas and Ward, 2000; Oberstone, 2009). Hughes and Franks (2005) showed that there were differences between successful and unsuccessful teams in converting possession in shots on goal, with the successful teams having the better ratios.

Regarding defensive performance indicators, no statistical differences were found. 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.

In conclusion, 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. 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 to guide the training process along a season. 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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