Modelling relationships between match events and match outcome in elite football

Liu, H, Hopkins, William and Gómez, MA (2016) Modelling relationships between match events and match outcome in elite football. European Journal of Sport Science, 16 (5). 516 - 525. ISSN 1746-1391

Running head: Relationships between match events and outcome in football

Title: Modelling relationships between match events and match outcome in elite football

Abstract

Identifying match events that are related to match outcome is an important task in football match analysis. Here we have used generalised mixed linear modelling to determine relationships of 16 football match events and one contextual variable (game location: home/away) with the match outcome. Statistics of 320 close matches (goal difference ≤ 2) of season 2012-2013 in the Spanish First Division Professional Football League were analysed. Relationships were evaluated with magnitude-based inferences and were expressed as extra matches won or lost per 10 close matches for an increase of two within-team or between-team standard deviations of the match event (representing effects of changes in team values from match to match and of differences between average team values respectively). There was a moderate positive within-team effect from shots on target (3.4 extra wins per 10 matches; 99% confidence limits ±1.0), and a small positive within-team effect from total shots (1.7 extra wins; ±1.0). Effects of most other match events were related to ball possession, which had a small negative within-team effect (1.2 extra losses; ±1.0) but a small positive between-team effect (1.7 extra wins; ±1.4). Game location showed a small positive within-team effect (1.9 extra wins; ±0.9). In analyses of nine combinations of team and opposition end-of-season rank (classified as high, medium, low), almost all between-team effects were unclear, while within-team effects varied depending on the strength of team and opposition. Some of these findings will be useful to coaches and performance analysts when planning training sessions and match tactics.

Key words: notational analysis, performance indicators, situational variable, soccer

Introduction

Performance analysis appears to be widely accepted by players, coaches and sport scientists as useful feedback in the coaching process (Drust, 2010). In the world of football, most professional clubs and teams use video feedback to some degree, and some employ performance analysts (James, 2006). Recorded videos of matches are analysed to evaluate and monitor team performances. Video analysis systems, such as AMISCO, OPTA and ProZone, provide an extensive database of match events and other variables. However, not all the recorded events and variables can be attributed as meaningful and useful performance indicators, because performance indicators should be related to the success of team performances which can be, for example, the winning of matches (Higham, Hopkins, Pyne, & Anson, 2014). Therefore, the question of which match events and variables are usefully related to the match outcome needs to be addressed with appropriate and powerful statistical methods (Moura, Martins, & Cunha, 2014; Yue, Broich, & Mester, 2014).

Previously, various studies across different sports were devoted to notational analyses trying to discriminate match performances according to the different competition and competitor characters, for instance, according to the difference of gender, outcome, and competition period (Casolino, Lupo, Cortis, Chiodo, Minganti, Capranica et al., 2012), the interaction of quality of opposition and match status (Marcelino, Mesquita, & Sampaio, 2011), the difference of competing court surface (O'Donoghue & Ingram, 2001), different competition levels (Lupo, Minganti, Cortis, Perroni, Capranica, & Tessitore, 2012), and the occurrence of skills and related creation of scoring opportunities (Thomas, Fellingham, & Vehrs, 2009). These studies identified that players' and teams' technical and tactical performances differed from different characters of competitions and competitors. Nevertheless, not many of these studies developed predictive models to determine relationships between performance-related match events/variables and the match outcome.

Several studies have focused on developing this kind of predictive modelling in football performance analysis (Sarmento, Marcelino, Anguera, Campanico, Matos, & Leitao, 2014). Linear models, such as discriminant analysis (Castellano, Casamichana, & Lago, 2012; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010; Lago-Peñas, Lago-Ballesteros, & Rey, 2011), logistic regression (Collet, 2013; Liu, Gómez, Lago-Peñas, & Sampaio, 2015), a multivariate combination of principal-component and cluster analysis (Moura et al., 2014), and Pearson's correlation analysis (Yue et al., 2014), have been used to identify match performance statistics related to goal scoring or match outcome. However, none of these models has properly accounted for the repeated-measures problem of multiple games played by each team. Generalised mixed linear modelling provides a solution to the problem, and it has been applied to the analysis of performance indicators in rugby sevens (Higham et al., 2014) and to track the progression of goal scoring of youth football teams (Malcata, Hopkins, & Richardson, 2012).

In the present study, we have employed generalised mixed linear modelling to quantify relationships of 16 football match events and one contextual variable (game location: home and away) with the match outcome. Following the analyses and recommendations of previous authors (Bradley, Lago-Peñas, Rey, & Sampaio, 2014; Gómez, Gómez-Lopez, Lago, & Sampaio, 2012; Gómez, Lago-Peñas, & Pollard, 2013; Lago-Peñas & Lago-Ballesteros, 2011; Sarmento et al., 2014), we have also attempted to determine how the effects were modified by strengths of the team and opposition.

Method

Sample and variable

Match performance statistics of all 380 matches of season 2012-2013 in the Spanish First Division Professional Football League (*La Liga BBVA*) were analysed. Data were obtained from OPTA Sportsdata Spain Company (Madrid). The OPTA tracking system has an acceptable inter-operator reliability (Liu, Hopkins, Gómez, & Molinuevo, 2013). Ethics committee approval was gained from the Polytechnic University of Madrid.

According to the suggestion of some professional coaches and performance analysts of football, and in line with the available related literature (Castellano et al., 2012; Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas et al., 2010; Lago-Peñas et al., 2011; Liu et al., 2015; Liu et al., 2013), 16 performance related match events and one contextual variable were chosen as predictor variables in the analyses (See Table 1). Operational definitions of these match events are included in the table as well (Liu et al., 2015; Liu et al., 2013).

**** Table 1 near here****

Identification of close matches

A k-means cluster analysis was undertaken to identify the cut-off value in goal difference in order to classify close matches and unbalanced matches (Liu et al., 2015). The analysis was performed in the data package of IBM SPSS Statistics for Windows, Version 20.0 (Armonk, NY: IBM Corp.). Results identified one cluster of 60 matches (unbalanced matches) with a goal difference of more than 2 goals (3.75 ± 0.73, ranged from 3 to 6, n = 120 observations), and another cluster of 320 matches (close matches) with a difference of less than and equal to 2 goals (0.99 ± 0.72, ranged from 0 to 2, n = 640 observations). Data of the 320 close matches were then imported into the Statistical Analysis System (SAS Institute, Cary, NC) for further statistical analysis.

Generalised mixed linear modelling

Events expressed in percentage units (ball possession, pass accuracy, and aerial advantage) were analysed as absolute values; other events were analysed as counts per 50% of ball possession. A mixed-model reliability analysis (Proc Mix in SAS) with a random effect for team was performed to estimate between-team and within-team standard deviations (SD) for each match event (Higham et al., 2014). The between-team SD, which represents differences between average team values, was estimated from the random effect. Residual variance of the model was used to calculate the within-team SD, which represents changes in team values from match to match.

The cumulative logistic-regression version of the generalised mixed linear model (Proc Glimmix in SAS) was used to estimate the effect of a given predictor variable. Match outcome expressed as win, loss or draw was the dependent variable and was modelled as the log of the odds of a team winning. For the effect of differences in the predictor variable between teams on match outcome, the value of the predictor variable was each team's season mean, and the effect was estimated as the ratio of the odds of winning for a typically high value of the predictor (+1 between-team SD) compared with a typically low value (-1 between-team SD). For the effect of changes in the variable within a team between matches, the individual values of the predictor in each game were used, and the effect was estimated as the ratio of odds of winning for a typically high compared with a typically low value of the predictor (±1 within-team SD). The odds ratios were converted to the difference or change in percent probability of winning a close match defined by centring the two probabilities on 50%. The effect of "game location" was derived as the effect of winning a home game vs an away game and could be estimated only as a within-team effect. The identity of teams was a random effect in all models. Modelling was performed separately for each of the 16 match events and for the contextual variable of game location.

Analyses were also performed to take into account the modifying effects of strength of team and opposition in each game. Strength was classified into three groups according to the end-of-season rank (Gómez et al., 2013): high-level teams (rank 1-6); medium-level teams (rank 7-13); and low-level teams (rank: 14-20). The effect of each predictor variable for each of the nine combinations of strength of team and opposition was estimated by including the interaction of team and opposition strength as fixed effects (intercepts and interacted with each predictor). Between- and within-team SD for evaluating the effects were derived from corresponding reliability analyses. Because of the relatively small number of teams in each combination, almost all the between-team relationships were unclear; therefore, results of the between-team modelling with the nine combinations are not presented.

Inferences

Uncertainty in the true effects of the predictors was evaluated using non-clinical magnitude-based inference (Hopkins, Marshall, Batterham, & Hanin, 2009). Effects were deemed clear if the confidence interval for the difference or change in the probability of winning did not include substantial positive and negative values (±10%, which represent one extra win or loss in every 10 close matches; (Higham et al., 2014; Hopkins et al., 2009). Magnitudes of clear effects were evaluated as follows: <10%, trivial; 10-30%, small; 30-50%, moderate; >50%, large. To reduce inflation of Type 1 error, only effects clear with 99% confidence intervals were evaluated.

Results

Descriptive statistics and estimated between- and within-team SD from the reliability analysis for each selected match event of all 320 close matches and 20 teams are presented in Table 2.

**** Table 2 near here****

Descriptive statistics of match-event values in subgroups defined by the nine combinations of team and opposition strengths are presented in Table 3.

**** Table 3 near here****

The between- and within-team relationships of selected variables with the probability of winning a close match without modification of team and opposition strength are presented in Figure 1. Of the 16 events analysed, 11 had clear between-team relationships with the probability of winning. Ball possession, pass, pass accuracy and aerial advantage had clear positive relationships, while cross, lost ball, ball recovery, tackle, foul, yellow card and red card had clear negative relationships. All the analysed variables showed clear within-team effects on the likelihood of winning. Eight variables (shot, shot on target, offside, lost ball, ball recovery, tackle, foul and game location) had clear positive effects, while five (ball possession, pass, pass accuracy, cross and red card) showed clear negative effects, and other four variables had trivial effects.

**** Figure 1 near here****

Effects varied depending on the strength of team and opposition when we took into account the modifying effects of combination of team ranks. For high-level teams, only shot on target showed clear within-team effects (positive) in all three combinations of oppositions. Aerial advantage showed clear negative effects in matches against high-level oppositions; in matches against medium-level teams, shot, lost ball, ball recovery, tackle, foul and game location had clear positive effects, while ball possession and pass accuracy had clear negative effects; in matches against low-level teams, shot and pass showed clear positive effects, while ball possession showed a clear negative effect.

For medium-level teams, Shot on target and ball possession showed clear within-team effects (positive and negative respectively) on the probability of winning a close match for medium-level teams no matter which level of opponent they were facing. Within-team effects of the other variables differed depending on the strength of opposition. In matches with high-level oppositions, shot, lost ball, foul and game location had clear positive effects on the likelihood of winning, while pass accuracy had clear negative effect; in matches with medium-level teams, only tackle demonstrated clear within-team effect (positive); in matches with low-level opponents, eight events (shot, shot blocked, lost ball, ball recovery, tackle, foul and yellow card) showed clear positive effects, while none showed clear negative effect.

When low-level teams played against high-level teams, a two-SD increase in the value of yellow card would lead to a 23% higher likelihood of winning, and the same increase in pass and pass accuracy would bring them a 30 and 20% lower probability of winning. Eight variables demonstrated clear substantial effects on the probability of winning for low-level teams when facing medium-level oppositions, of which six (shot, shot on target, offside, foul, yellow card and game location) were clear positive and two (ball possession and red card) were clear negative. In the situation of facing low-level opponents, three variables (shot on target, tackle and game location) showed clear positive effects and two (shot blocked and cross) showed clear negative effects.

Discussion

The aim of the present study was to determine relationships of 16 football match events and one contextual variable with the match outcome in the Spanish First Division Professional Football League. All the variables showed clear within-team relationships and 11 events showed clear between-team relationships with the probability of winning. Ball possession had a small negative within-team effect but a small positive between-team effect on winning. Effects of three other events related to passing and organising and of most events related to defending were consistent with those of ball possession. Game location showed small positive within-team effect on winning. In the analyses of different strength combinations, almost all between-team effects were unclear, while within-team effects varied depending on the strength of team and opposition.

For the goal scoring-related variables, achieving more shots and shots on target would have positive within-team effects on the probability of winning. These findings are in agreement with those of prior research, which showed that the frequency and efficiency of shots were associated with the winning in football matches (Castellano et al., 2012; Lago-Peñas et al., 2010; Lago-Peñas et al., 2011; Liu et al., 2015; Yue et al., 2014). Furthermore, a very likely negative effect from the increase of shot blocked and a most likely positive effect from shot on target were found for low-level teams when playing against low-level opponents. This result is in line with the recent studies that showed *the quality of shots rather than the quantity determines the game results* (Liu et al., 2015; Yue et al., 2014). And our result further emphasizes the importance of this statement in the match situation of low-level teams playing against similar level of opposition.

Teams who had more ball possession tended to win more close matches in the between-team analysis, but in the within-team analysis, a team with more ball possession in a close match tended to have a lower probability of winning. Although previous authors did not state explicitly about between-team and within-team effects, their studies provided similar conclusions. Several authors (Collet, 2013; Jones, James, & Mellalieu, 2004; Lago-Peñas & Dellal, 2010) analysed ball possession using seasonal mean values for each team, which represents a between-team analysis. Their research showed that successful teams (teams winning more games) maintained a higher percentage of ball possession than unsuccessful teams, suggesting that successful teams made more accurate and difficult passes to avoid opponents' tackles and anticipated quicker teammates' movements and opponents' movements and the ball direction (Jones et al., 2004). Hence, successful teams could "control" the game by dictating play to approach the attacking third of the pitch to create goal-scoring opportunities (Bradley et al., 2014). Meanwhile, various authors (Bradley et al., 2014; Collet, 2013; Jones et al., 2004; Lago-Ballesteros, Lago-Peñas, & Rey, 2012; Lago-Peñas & Dellal, 2010; Lago-Peñas & Gómez-López, 2014; Lago, 2009; Lago & Martin, 2007) investigated ball possession at individual match level, which would probably bias outcomes towards a within-team analysis. In these studies, teams had more possession when they were losing than when winning, which led to the conclusion that "in league play, the effect of greater possession was consistently negative" (Collet, 2013, p. 123). Taking together, these findings implied that when teams are winning, they tend to change their tactics and playing styles to more defensive situations and prefer to play counter attacks and direct passes, thus their possession time decreases (Bradley et al., 2014; Lago-Ballesteros et al., 2012; Lago-Peñas & Gómez-López, 2014; Lago, 2009); conversely, when teams are losing, they tend to make greater efforts to maintain ball possession, hoping for goal-scoring opportunities to avoid defeat (Jones et al., 2004).

Pass, pass accuracy and lost ball are three match events related to passing and organising that are highly correlated to ball possession: more passes and higher pass accuracy lead to higher possession (Collet, 2013), while more lost balls lead to lower possession. Effects of pass and pass accuracy were consistent with those of ball possession: both showed positive between-team effects but negative within-team effects on probability of winning. These results are in accordance with findings of a previous study, which showed that the scoring team reduced the number and accuracy of passes after scoring (Redwood-Brown, 2008). However, the decrease does not happen for high-level teams in close matches against low-level opponents, because pass had negative within-team effects for low-level teams when playing against oppositions of high level, but positive effects for high-level teams when facing low-level opponents. Pass accuracy also showed negative within-team effects for low-level teams in the combination of low vs high.

The finding for lost balls could be explained by combining the effects of three defending-related match events: ball recovery, tackle and foul, which were also found to be consistent with those of ball possession. Lost ball, ball recovery, tackle and foul shared very similar relationships with the probability of winning. Their between-team effects were all negative, while within-team effects were all positive. The between-team effect reflects that teams that won more (stronger teams) committed less lost ball, ball recovery, tackle and foul, which is easy to understand: the stronger teams attacked more (defended less) and attacked with higher accuracy, while the within-team effect can be explained by the zone difference where these actions occurred (Almeida, Ferreira, & Volossovitch, 2014; Gómez et al., 2012). When a team won a match, it was more likely to perform offensive actions next to the goal-scoring area where the opponent's defending was focused, thus its chance of lost ball increased. However, as these lost balls were distant from the team's own goal area, it would not leave easy counterattack opportunities for its opponents (Gómez et al., 2012). Moreover, after the team committed these lost balls, it would immediately employ a proactive defensive strategy to recover them from interceptions and tackles in the area where they lost the balls (Almeida et al., 2014). Although these actions sometimes might end with a foul, regaining ball possession promptly and directly in the opponent's half of the pitch is associated with success in football competitions (Almeida et al., 2014; Vogelbein, Nopp, & Hokelmann, 2014).

In accordance with previous findings, results of the present study also showed some relationships that are not consistent with ball possession. For example, cross was previously demonstrated as a variable that discriminated winning and losing teams (Lago-Peñas et al., 2010; Lago-Peñas et al., 2011). Our results are in line with this finding: cross showed negative between- and within-team effects on probability of winning. The modelling accounted for different strength combinations showed that the negative within-team effect of cross was clear only for low-level teams when facing low-level oppositions. This finding may indicate that the match strategy of low-level teams was more closely depended on wide areas and winger players. Low-level teams are tactically and strategically worse prepared, they have poorer group-tactical behaviours in small zones of the pitch, and consequently the cross is a useful strategy for low-level teams during their offensive phases (Bourbousson, Seve, & McGarry, 2010). In addition, corners were believed to yield most set-piece goals and most achievable attempts in the area (Yiannakos & Armatas, 2006), and they were found to account for 20% of the total goals scored from set pieces during the 2006 World Cup; however, effectiveness of corner kicks was not found to be associated with match outcome (Sainz De Baranda & Lopez-Riquelme, 2012). Accordingly, results of the present study showed that corners had trivial within-team effects on probability of winning a close game.

Previous observations on offside showed contradictory conclusions: one showed there were differences among winning, drawing and losing teams (Lago-Peñas et al., 2010), while others showed that there were no differences (Castellano et al., 2012; Lago-Peñas et al., 2011). Our results showed that offside had a clearly positive within-team relationship with probability of winning. It has been verified that attacking space is highly concentrated by well-organised defense in Spanish professional league (Castellano & Álvarez, 2013); therefore, penetrative passes that could produce shot opportunities that are close to the goal-scoring area are of great importance in attacking, while this type of pass is normally associated with offside.

Aerial advantage can be understood as the advantage in fighting for high, long and crossing passes, which were identified as the most effective passes to precede goals (Yiannakos & Armatas, 2006). Indeed, a clear positive between-team relationship was found between this event and likelihood of winning close matches, which indicates that teams winning more aerial duels tended to win more games. This event is closely related to the event of cross: higher frequency of aerial duel always indicates higher adoption of cross strategy from one or both of the confronting teams. Therefore, teams winning more aerial duels are more likely to dominate both the attacking and defending phase and eventually to win the match. In the matches between high-level teams, aerial advantage showed negative within-team effects on probability of winning. This finding tends to reflect that, within a high-level team, winning more aerial duels in a close match (especially in a match against a high-level opponent) is likely associated with losing. As has been shown before, when a team is losing, it is more likely to use cross strategy instead of keeping control of ball possession (Lago & Martin, 2007). This kind of attempted cross strategy will bring high aerial advantage; however, combined with our finding on cross, within a team, employing more cross would actually reduce the probability of winning.

Yellow card and red card were previous found to differ significantly between winning and losing teams, but they apparently did not contribute significantly to discriminant functions for match outcome (Castellano et al., 2012; Lago-Peñas et al., 2010; Lago-Peñas et al., 2011). We have shown that both events had clear negative between-team effects on the winning probability of close matches, but their within-team effects were different: yellow card had trivial effects and red card had negative effects. A red card will lead to a player dismissal, which will weaken the performance of the sanctioned team in terms of goal scoring and match outcome (Bar-Eli, Tenenbaum, & Geister, 2006), while the sanction of yellow card may compromise a player's defensive performance in a way to avoid being sent off. Furthermore, yellow card had positive relationships with the chance of winning for medium-level teams (when vs low) and for low-level teams (when vs high and vs medium), while red card reduced the likelihood of victory for low-level teams when playing against opponents of medium level. These findings tend to indicate that teams of higher level are less influenced by the sanction of cards.

Results of the current study showed that game location was a contextual variable that had a positive effect on the chance of winning a close match, which is supported by findings from previous modellings (Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas et al., 2010). In addition, a recent study (Pollard & Gómez, 2014) identified a mean home advantage value of 62% in Spanish Professional League during seasons from 2006 to 2012. Therefore, the contextual variable of game location should be taken into account when analysing team performance in football. Prior authors also indicated that superior teams experience different effects of game location from inferior teams (Lago-Peñas & Lago-Ballesteros, 2011). The same trend was found in our results. Additionally, different game-location effects were found when playing with different oppositions. When playing against an opponent of the same level, the smallest game-location effects were found for high- and medium-level teams, while the largest appeared for the low-level teams. These findings are in line with previous studies which showed that game-location effect is influenced by strength of opposition, and that higher effects exist when the team is confronting an opponent of better quality (Oliveira, Gómez, & Sampaio, 2012; Pollard & Gómez, 2009).

The findings in this study represent associations between final score line and match events accumulated throughout the match, when the score line may be different. However, the score line during a match is highly correlated with the final score line, owing to the fact that football is a low scoring game (Gómez et al., 2013). Our findings therefore arise from and represent effects of score line during the match, but in future research it would be preferable to quantify the match events between each change in the score line, or to adjust total game events for the overall percentage of time spent in different score-line situations.

Conclusions

Generalised mixed linear modelling appears to be a powerful statistical approach to identify key performance indicators in football. The approach allows more objective information to be provided to the coach and performance analyst for evaluating their team's post-match performance and to take into account the strength of the opposition when planning training sessions and match tactics for an upcoming match. For example, the modelling in the current research identified a negative effect from the increase of shot blocked and a positive effect from shot on target in games where low-level teams played against low-level oppositions, which may indicate that the quality of shots rather than the quantity determines the game results in this type of encounter. Depending on this finding, coaches could therefore design pre-match training sessions to practice and improve players' shot qualities before such matches. Additionally, aerial advantage showed negative within-team effects on winning in close matches where high-level teams faced high-level opponents. While coaches and analysts from high-level teams should therefore plan match tactics to maintain ball possession by keeping the ball on the ground rather than trying too many long balls and crosses.

Acknowledgements

Removed for blind review

References

Almeida, C. H., Ferreira, A. P., & Volossovitch, A. (2014). Effects of Match Location, Match Status and Quality of Opposition on Regaining Possession in UEFA Champions League. *Journal of Human Kinetics*, *41*(1), 203-214. doi: DOI 10.2478/hukin-2014-0048

Bar-Eli, M., Tenenbaum, G., & Geister, S. (2006). Consequences of players' dismissal in professional soccer: a crisis-related analysis of group-size effects. *Journal of Sports Sciences*, *24*(10), 1083-1094. doi: 10.1080/02640410500432599

Bourbousson, J., Seve, C., & McGarry, T. (2010). Space-time coordination dynamics in basketball: Part 2. The interaction between the two teams. *Journal of Sports Sciences*, *28*(3), 349-358. doi: Doi 10.1080/02640410903503640

Bradley, P. S., Lago-Peñas, C., Rey, E., & Sampaio, J. (2014). The influence of situational variables on ball possession in the English Premier League. *Journal of Sports Sciences*, *32*(20), 1867-1873. doi: Doi 10.1080/02640414.2014.887850

Casolino, E., Lupo, C., Cortis, C., Chiodo, S., Minganti, C., Capranica, L., & Tessitore, A. (2012). Technical and Tactical Analysis of Youth Taekwondo Performance. *Journal of Strength and Conditioning Research*, *26*(6), 1489-1495. doi: Doi 10.1519/Jsc.0b013e318231a66d

Castellano, J., & Álvarez, D. (2013). Uso defensivo del espacio de interacción en fútbol. (Defensive use of the interaction space in soccer). *RICYDE. Revista Internacional de Ciencias del Deporte*, *9*(32), 126-136.

Castellano, J., Casamichana, D., & Lago, C. (2012). The Use of Match Statistics that Discriminate Between Successful and Unsuccessful Soccer Teams. *Journal of Human Kinetics*, *31*, 139-147.

Collet, C. (2013). The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010. *Journal of Sports Sciences*, *31*(2), 123-136. doi: 10.1080/02640414.2012.727455

Drust, B. (2010). Performance analysis research: meeting the challenge. *Journal of Sports Sciences*, *28*(9), 921-922. doi: 10.1080/02640411003740769

Gómez, M. A., Gómez-Lopez, M., Lago, C., & Sampaio, J. (2012). Effects of game location and final outcome on game-related statistics in each zone of the pitch in professional football. *European Journal of Sport Science*, *12*(5), 393-398. doi: Doi 10.1080/17461391.2011.566373

Gómez, M. A., Lago-Peñas, C., & Pollard, R. (2013). Situational Variables. In T. McGarry, P. O’Donoghue & J. Sampaio (Eds.), *Routledge Handbook of Sports Performance Analysis* (pp. 259-269). London: Routledge.

Higham, D. G., Hopkins, W. G., Pyne, D. B., & Anson, J. M. (2014). Performance indicators related to points scoring and winning in international rugby sevens. *Journal of Sports Science and Medicine*, *13*(2), 358-364.

Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive statistics for studies in sports medicine and exercise science. *Medicine and Science in Sports and Exercise*,

41(1), 3-13.
James, N. (2006). Notational analysis in soccer: Past, present and future. *International Journal of Performance Analysis in Sport, 6*(1), 67-81.
Jones, P. D., James, N., & Mellalieu, S. D. (2004). Possession as a performance indicator in soccer. *International Journal of Performance Analysis in Sport, 4*(1), 98-102.
Lago-Ballesteros, J., Lago-Peñas, C., & Rey, E. (2012). The effect of playing tactics and situational variables on achieving score-box possessions in a professional soccer team. *Journal of Sports Sciences, 30*(14), 1455-1461. doi: Doi 10.1080/02640414.2012.712715
Lago-Peñas, C., & Dellal, A. (2010). Ball possession strategies in elite soccer according to the evolution of the match-score: the influence of situational variables. *Journal of Human Kinetics, 25*, 93-100.
Lago-Peñas, C., & Gómez-López, M. (2014). HOW IMPORTANT IS IT TO SCORE A GOAL? THE INFLUENCE OF THE SCORELINE ON MATCH PERFORMANCE IN ELITE SOCCER. *Perceptual and Motor Skills, 119*(3), 774-784.
Lago-Peñas, C., & Lago-Ballesteros, J. (2011). Game location and team quality effects on performance profiles in professional soccer. *Journal of Sports Science and Medicine, 10*(3), 465-471.
Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., & Gómez, M. (2010). Game-Related Statistics that Discriminated Winning, Drawing and Losing Teams from the Spanish Soccer League. *Journal of Sports Science and Medicine, 9*(2), 288-293.
Lago-Peñas, C., Lago-Ballesteros, J., & Rey, E. (2011). Differences in Performance Indicators between Winning and Losing Teams in the UEFA Champions League. *Journal of Human Kinetics, 27*, 137-148.
Lago, C. (2009). The influence of match location, quality of opposition, and match status on possession strategies in professional association football. *Journal of Sports Sciences, 27*(13), 1463-1469. doi: Doi 10.1080/02640410903131681
Lago, C., & Martin, R. (2007). Determinants of possession of the ball in soccer. *Journal of Sports Sciences, 25*(9), 969-974. doi: 10.1080/02640410600944626
Liu, H., Gómez, M. A., Lago-Peñas, C., & Sampaio, J. (2015). Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. *Journal of Sports Sciences*, 1-9. doi: 10.1080/02640414.2015.1022578
Liu, H., Hopkins, W., Gómez, M. A., & Molinuevo, J. S. (2013). Inter-operator reliability of live football match statistics from OPTA Sportsdata. *International Journal of Performance Analysis in Sport, 13*(3), 803-821.
Lupo, C., Minganti, C., Cortis, C., Perroni, F., Capranica, L., & Tessitore, A. (2012). Effects of competition level on the centre forward role of men's water polo. *Journal of Sports Sciences, 30*(9), 889-897. doi: Doi 10.1080/02640414.2012.679673
Malcata, R. M., Hopkins, W. G., & Richardson, S. (2012). Modelling the Progression of Competitive Performance of an Academy's Soccer Teams. *Journal of Sports Science and Medicine, 11*(3), 533-536.
Marcelino, R., Mesquita, I., & Sampaio, J. (2011). Effects of quality of opposition and match status on technical and tactical performances in elite volleyball. *Journal of Sports Sciences, 29*(7), 733-741. doi: 10.1080/02640414.2011.552516
Moura, F. A., Martins, L. E., & Cunha, S. A. (2014). Analysis of football game-related statistics using multivariate techniques. *Journal of Sports Sciences, 32*(20), 1881-1887. doi:

10.1080/02640414.2013.853130
O'Donoghue, P., & Ingram, B. (2001). A notational analysis of elite tennis strategy. *Journal of Sports Sciences, 19*(2), 107-115. doi: Doi 10.1080/026404101300036299
Oliveira, T., Gómez, M., & Sampaio, J. (2012). Effects of match location, period, and quality of opposition in elite handball performances. *Perceptual and Motor Skills, 114*(3), 783-794.
Pollard, R., & Gómez, M. (2009). Home advantage in football in South-West Europe: long-term trends, regional variation, and team differences. *European Journal of Sport Science, 9*, 341-352.
Pollard, R., & Gómez, M. A. (2014). Components of home advantage in 157 national soccer leagues worldwide. *International Journal of Sport and Exercise Psychology, 12*(3), 218-233.
Redwood-Brown, A. (2008). Passing patterns before and after goal scoring in FA Premier League. *International Journal of Performance Analysis in Sport, 8*(3), 172-182.
Sainz De Baranda, P., & Lopez-Riquelme, D. (2012). Analysis of corner kicks in relation to match status in the 2006 World Cup. *European Journal of Sport Science, 12*(2), 121-129. doi: 10.1080/17461391.2010.551418
Sarmento, H., Marcelino, R., Anguera, M. T., Campanico, J., Matos, N., & Leitao, J. C. (2014). Match analysis in football: a systematic review. *Journal of Sports Sciences*, *32*(20), 1831-1843. doi: 10.1080/02640414.2014.898852
Thomas, C., Fellingham, G., & Vehrs, P. (2009). Development of a notational analysis system for selected soccer skills of a women's college team. *Measurement in Physical Education and Exercise Science, 13*(2), 108-121.
Vogelbein, M., Nopp, S., & Hokelmann, A. (2014). Defensive transition in soccer - are prompt possession regains a measure of success? A quantitative analysis of German Fussball-Bundesliga 2010/2011. *Journal of Sports Sciences, 32*(11), 1076-1083. doi: Doi 10.1080/02640414.2013.879671
Yiannakos, A., & Armatas, V. (2006). Evaluation of the goal scoring patterns in European Championship in Portugal 2004. *International Journal of Performance Analysis in Sport, 6*(1), 178-188.
Yue, Z. Y., Broich, H., & Mester, J. (2014). Statistical Analysis for the Soccer Matches of the First Bundesliga. *International Journal of Sports Science and Coaching, 9*(3), 553-560.