Influence of contextual variables on styles of play in soccer

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Influence of contextual variables on styles of play in soccer

The aim of the present study was to evaluate the effect of match status, venue, and quality of opposition on the styles of play in soccer. Data were collected from 380 games of the English Premier League from the 2015-2016 season. Linear mixed models were applied to evaluate the influence of these contextual variables on membership scores for Direct Play, Counterattack, Maintenance, Build Up, Sustained Threat, Fast Tempo, Crossing, and High Pressure. The results showed that match status had a significant effect on the eight styles of play (all $P < 0.001$), venue had a significant effect on all styles of play ($P < 0.01$) except Counterattack and Maintenance, and quality of opposition had a significant effect on all styles of play ($P < 0.05$) except Counterattack. Moreover, the interaction between match status and quality of opposition, and venue and quality of opposition showed significant effects on some styles of play. The results of this study imply that contextual variables influence the use of styles of play in soccer match play. Consequently, this provides meaningful recommendations for practitioners in soccer.

Keywords: match analysis; performance analysis; English Premier League; tactics; mixed models

Introduction

Tactical match analysis represents an important aspect when analysing teams in soccer (Carling, Williams, & Reilly, 2005; Rein & Memmert, 2016). Previous studies analysed different attacking and defensive tactical variables in soccer such as ball possession (Bradley, Lago-Peñas, Rey, & Gomez-Diaz, 2013; da Mota, Thiengo, Gimenes, & Bradley, 2016; Link & Hoernig, 2017), ball recovery (Barreira, Garganta, Guimaraes, Machado, & Anguera, 2014; Liu, Hopkins, & Gomez, 2016), passing variables (Goncalves et al., 2017; Hughes & Franks, 2005; Redwood-Brown, 2008; Rein, Raabe, & Memmert, 2017), shooting variables (Ensum, Pollard, &

Taylor, 2005; Lago-Peñas, Lago-Ballesteros, Dellal, & Gomez, 2010), pressure (Link, Lang, & Seidenschwarz, 2016), set plays (Casal, Maneiro, Arda, Losada, & Rial, 2014; Casal, Maneiro, Arda, Losada, & Rial, 2015; Link, Kolbinger, Weber, & Stockl, 2016), team formation (Bradley et al., 2011; Carling, 2011), and their link to performance in match play. Furthermore, contextual variables (e.g. match play, venue, quality of opposition) influence tactical variables and should be considered when analysing soccer match play (Mackenzie & Cushion, 2013).

Match status is one of the contextual variables that influence tactical behaviour in soccer. For instance, losing teams tend to defend in more advanced zones of the pitch (Almeida, Ferreira, & Volossovitch, 2014), losing teams increase ball possession compared to winning or drawing teams (Lago, 2009), and losing or drawing teams prefer long passing sequences, whereas winning teams prefer shorter passing sequences (Paixao, Sampaio, Almeida, & Duarte, 2015). These results provide useful insights about the behaviour of the teams when match status changes. Nevertheless, a more detailed classification of the winning and losing states (i.e. winning or losing by smaller or larger margins) could also provide a better estimation of teams' tactical behaviours (Gomez, Lorenzo, Ibanez, & Sampaio, 2013).

Similarly, researchers have investigated the influence of venue (i.e. playing home or away) on tactical variables during match play. Some of the previous findings showed that away teams regain the ball and place the position of their defensive line closer to their own goal (Santos, Lago-Peñas, & Garcia-Garcia, 2017), and that has an increase in the total passes played in the defensive pitch third and a decrease in the total of passes played in the attacking pitch third in comparison when playing home (Taylor, Mellalieu, James, & Barter, 2010). Home advantage is a phenomenon that has been widely studied in soccer (Lago-Peñas, Gomez, & Pollard,

2017; Pollard, 2006; Pollard & Gomez, 2009), and is often higher when compared to other sports, such as Baseball, Basketball, Hockey, Rugby or Football (Jamieson, 2010). Therefore, venue is an important variable to consider due to its impact on match play performance.

Furthermore, the quality of opposition has an impact on tactical variables. Generally, teams with a higher ranking have higher ball possession values compared to lower ranking teams (Bradley, Lago-Peñas, Rey, & Sampaio, 2014; Lago, 2009). In addition, according to a one team case study, ball recovery location and the defensive line are closer to a team's own goal when the opposition is stronger (Santos et al., 2017). Hence, quality of opposition seemed to affect tactical behaviour in soccer. Moreover, the interaction between venue and quality of opposition shows that teams playing against stronger opposition decrease ball possession compared when playing at home (Lago, 2009). However, previous research examining the influence of opposition quality, venue and match status have often used isolated variables or performance indicators, therefore limiting our understanding of tactical behaviour (Mackenzie & Cushion, 2013).

More recently, styles of play in soccer explain a broader concept of tactical behaviour, where these tactical variables and performance indicators contribute to them. Recent studies proposed a theoretical framework to measure styles of play (Hewitt, Greenham, & Norton, 2016) and quantified the use of attacking and defensive styles of play in soccer (Fernandez-Navarro, Fradua, Zubillaga, Ford, & McRobert, 2016). Behaviour indexes (Kempe, Vogelbein, Memmert, & Nopp, 2014), multivariate statistical approaches (Moura, Martins, & Cunha, 2014), and spatio-temporal analysis (Memmert, Lemmink, & Sampaio, 2017) have also been used to identify tactics and potentially identify styles of play. A previous study

examined the influence of match location on possession types in soccer considered as direct play and possession play. Although this research showed an initial approach to assess the effect of contextual variables on playing tactics related to styles of play, venue was the only contextual variable employed and a more detailed styles of play framework should be provided (Tenga, Holme, Ronglan, & Bahr, 2010). As a consequence of the novel research examining styles of play in soccer, no previous research has evaluated the effect of the contextual variables on them. Therefore, the aims of the present study were to analyse the effect of match status, venue, and quality of opposition on the styles of play in soccer.

Methods

Match sample

Match data from all 380 games of the 2015-2016 English Premier League (EPL) season were included in the study. There were 38 games for each of the 20 teams participating in the league, so an equal number of matches for every team was available. Data were obtained from a valid and reliable computerised multiple camera match analysis tracking system (STATS LLC, Chicago, IL, USA) (Bradley, O'Donoghue, Wooster, & Tordoff, 2007; Di Salvo, Collins, McNeill, & Cardinale, 2006). The present study was approved by the Human Research Ethics Committee of the University of Granada.

Procedure

A total of 380 individual games files containing all team possessions (N = 94966) for the season were merged into a single file using KNIME Analytics Platform (KNIME GmbH, Konstanz, Germany). Each possession was allocated a

percentage membership score for the 8 styles of play defined by STATS (Table 1). Each possession is given a value from 0 to 1 for each of the styles and any possession can score on multiple styles. For instance, a team possession could involve the use of Build Up (.8), Sustained Threat (.5), and Fast Tempo(.25) styles (Ruiz, 2016). Set plays were removed from the dataset as no clear styles occur during these actions. Possessions with values of 0 for every style were also removed as they represented quick turnovers of possession (e.g. a tackle, turnover possession followed by another tackle and turnover or an interception), leaving a total of 68766 possessions for analysis. The contextual variables match status, venue, and quality of opposition were also recorded for each possession. The five match status categories were losing by two goals or more, losing by one goal, drawing, winning by one goal, and winning by two goals or more. Most of the previous studies have only focused on analysing winning, drawing or losing in match status (Lago, 2009; Santos et al., 2017; Vogelbein, Nopp, & Hokelmann, 2014). In contrast, other research considered each possible scoreline occurring when analysing team performance (Redwood-Brown, 2008). We believe that distinctions between these losing and winning status based on the number of goals should be made because one goal advantages/disadvantages could influence the styles of play differently compared to two or more goals advantages/disadvantages (e.g. with a two goals advantage, receiving one goal will not change the wining status, however with a one goal advantage, receiving one goal will change the match status to drawing). Venue was categorised as playing home or away, whereas quality of opposition was measured according to the difference in the teams ranking position at the end of the season (Lago-Peñas, Gomez-Ruano, Megias-Navarro, & Pollard, 2016; Lago-Peñas et al., 2017). Therefore, a positive value in this ranking difference indicates facing a strong

opposition and, on the other hand, a negative value represents facing a weak opposition. The highest the absolute value of this ranking difference the stronger or weaker opposition is faced (e.g. a ranking difference of +14 shows that the team is facing an opposition team that is 14 positions above in the ranking).

[Table 1 near here]

Statistical analysis

A linear mixed model (LMM) was carried out for each of the eight styles using the MIXED procedure of the software SPSS v.23.0 for Windows (IBM, Armonk, NY USA). LMM organises data into a hierarchical structure by creating nesting units. For example, ball possessions are nested into matches. Ball possessions and matches represent two different levels were matches are higher in the hierarchy than ball possessions. In addition, model complexity can increase when more levels are added. For example, balls possessions can be nested into matches, and these matches can also be nested into teams. This represents a 3 levels structure being the unit team the higher in the hierarchy. A cross-classified multilevel design (Heck, Thomas, & Tabata, 2014) was developed considering matches and teams as the nesting levels. Therefore, the variables match and team were considered as random effects. The cross-classified multilevel models are suitable for data structures that are not purely hierarchical. In other words, data structures where units in one level are not nested only in a higher level. For example, matches are nested in two different teams as there are two teams participating in the game. Match status, venue, and quality of opposition (i.e. ranking difference) were considered as fixed effects in the models. In

addition, random slopes of these fixed effects and interactions between them were also checked to verify if they had a significant contribution to each model. We applied a general multilevel-modelling strategy (Heck et al., 2014) where we included fixed and random effects in different steps from the simplest to the most complex. The simplest model and the first one to apply was a 'Null' model were only the dependent variable (i.e. the style of play) in the hierarchy structure is modelled. No predictors (i.e. match status, venue, and quality of opposition) are added into this model. Later, the individual level random intercept is developed to examine the effect of the predictors at the individual level. Then, a group level random intercept model is developed including the predictors of the individual level. This model allows us to evaluate the effect of the other predictors on the dependent variable. Next, random slopes of the predictors are added in a following model to check if these variables randomly vary across units. In case any significant results are found when running the models with predictors with random slopes, interactions should be checked in following models to evaluate if they explain the variability in the random slopes. Model comparison for each step was done using the Akaike information criterion (AIC) (Akaike, 1973) where a lower value represented a better model, and a chi-square likelihood ratio test (Field, 2013). In other words, models were compared by subtracting the log-likelihood of the new model from the value of the old one and considering the degrees of freedom equal to the difference in the number of parameters between the two models. Besides de AIC, a lower value of the chi-square log-likelihood test represented a better model and showed if the changes were significant. These comparisons were done between each model according to the steps described above. After adding an additional predictor, random slope, or interaction, model comparison was performed to assess the improvement in the new model. Final

models presented in Table 2 were chosen according to better values of AIC, log-likelihood, and significant effect of variables. We used maximum likelihood (ML) estimation for model comparison and for the final model of each style of play we refitted the best model again using restricted maximum likelihood (REML) estimation. ML estimation was employed for model comparison as chi-square likelihood ratio tests requires this type of estimation (Field, 2013; Heck et al., 2014). We reported marginal and conditional R^2 metrics (Nakagawa & Schielzeth, 2013) for each LMM to provide some measure of effect-sizes. The level of significance was set to 0.05.

Results

The effects of match status, venue and quality of opposition on each of the eight styles of play employed by teams are shown in Table 2.

[Table 2 near here]

Match status

Compared to drawing, teams losing had a decrease in Direct Play ($P < 0.001$ for losing by one and losing by two or more goals) and Maintenance ($P < 0.001$), and an increase in Build Up ($P < 0.001$ for losing by one and losing by two or more goals), Sustained Threat ($P < 0.001$ for losing by one and losing by two or more goals), and Crossing ($P < 0.001$ for losing by one and losing by two or more goals). In addition, an increase in Fast Tempo ($P < 0.05$) was observed when teams were losing by two or more goals. In contrast, there were decreases in Maintenance ($P < 0.001$ for wining by one and wining by two or more goals), Build Up ($P < 0.001$ and $P < 0.05$

for wining by one and wining by two or more goals respectively), Sustained Threat ($P < 0.001$ and $P < 0.01$ for wining by one and wining by two or more goals respectively), Crossing ($P < 0.001$ for wining by one and wining by two or more goals) and High Pressure ($P < 0.001$ and $P < 0.01$ for wining by one and wining by two or more goals respectively), and an increase in Direct Play ($P < 0.001$ for wining by one and wining by two or more goals), Counterattack ($P < 0.001$ for wining by one and wining by two or more goals) and Fast Tempo ($P < 0.001$) for teams wining by two or more goals.

There was an interaction between match status and quality of opposition for Direct Play, Maintenance, and High Pressure styles. Direct Play decreased more when teams faced stronger opposition and were losing by one, or by two or more goals ($P < 0.01$ and $P < 0.05$ respectively). Maintenance increased when losing by one, or by two or more goals when facing stronger opposition ($P < 0.05$). In contrast, maintenance decreased when winning by two or more goals ($P <0.001$) against stronger opponents. High Pressure decreased when teams were winning by two or more goals against stronger opponents ($P <0.01$).

Venue

Away teams increased Direct Play ($P < 0.001$) and decreased Build Up ($P < 0.001$), Sustained Threat ($P < 0.001$), Fast Tempo ($P < 0.01$), Crossing ($P < 0.001$) and High Pressure ($P < 0.001$), in comparison to home teams. A significant interaction between venue and quality of opposition was observed for Build Up. Away teams decreased Build Up ($P < 0.05$) when facing stronger opponents.

Quality of opposition

There was an increase in Direct Play ($P < 0.001$), and decrease in Maintenance ($P <$

0.01), Build Up ($P < 0.001$), Sustained Threat ($P < 0.001$), Fast Tempo ($P < 0.001$), Crossing ($P < 0.001$) and High Pressure ($P < 0.05$) against stronger opposition.

Discussion

The aim of the present study was to examine the effect of match status, venue, and quality of opposition on different styles of play in soccer. The findings suggest that these contextual variables influence styles of play and should be considered when reviewing match play. However, these effects showed a small effect size on the styles of play measured. As some styles were infrequent, low values for these styles of play were shown in the normative profiles. Nevertheless, significant results showed that contextual variables produced a change in the average use of a style of play, even if it appeared as a low value. Mixed models also showed that these normative profiles could change across matches and teams, therefore teams demonstrated different tactical behaviours under different contexts. To our knowledge, this is the first study investigating the effect of contextual variables on styles of play used by teams in soccer.

Match status had a significant effect on the eight styles of play measured. For instance, losing teams decreased their use of direct play and increased build up and sustained threat. Whereas, winning teams increased their use of direct play and counterattack, and decreased the use of maintenance, build up, and sustained threat. Maintenance, build up and sustained threat are associated with ball possession, therefore teams who prefer a possession-based approach score higher on these styles. A possible explanation for winning teams reduction in these styles could be a focus on maintaining the advantage through defending, which results in reduced possession

time (Jones, James, & Mellalieu, 2004; Redwood-Brown, 2008). Moreover, this could also explain their increase in the use of direct play and counterattack when winning as these styles allow the team to keep players close to the own goal and taking advantage of the advanced position of opposing teams to try to score. On the other hand, teams losing decreased the use of direct play and increased the use of build up and sustained threat to try maintain the attack close to the oppositions goal. In addition, the retreat of the opposition team close to their goal could also cause this behaviour. These results are in line with previous studies that showed that ball possession by teams increased when losing and decreased when winning and drawing (Bradley et al., 2014; Jones et al., 2004; Lago, 2009; Lago & Martin, 2007) and that winning teams can take advantage of direct play and counterattack (Garcia-Rubio, Gomez, Lago-Peñas, & Ibanez, 2015).

Fast tempo style of play was affected in the extreme cases of match status (i.e. winning or losing by two or more goals). Teams winning or losing by a high margin of goals increased the use of fast tempo compared to a drawing status. The findings by Wallace and Norton (2014) showed that fast ball movement, generated by a combination of high passing rates and high ball speed, were advantageous in soccer. Therefore, teams losing by two or more goals could employ this style of play to create space in the opposing half and achieve a goal as soon as possible to allow them more possibilities of obtaining draw or win the game. In contrast, teams winning by a margin of two or more goals increased the use of this style possibly as a tactic to avoid intense pressure from the opposing team that is in a hurry to regain the ball and score as soon as possible. Furthermore, crossing decreased when winning and increased when losing. Previous research (Casamichana, Castellano, Calleja-Gonzalez, & San Roman, 2013; Liu, Gomez, Lago-Peñas, & Sampaio, 2015)

reported that crosses were more frequent for losing teams, which might suggest that losing teams employ this tactic to create more goal scoring opportunities when attacking. The use of high pressure by winning teams decreased. This could help the team 'save' energy in the game as they do not need to make efforts to equalise the game. Interaction between match status and quality of opposition showed significant differences for direct play, maintenance and high pressure. Firstly, losing teams showed a decrease in the use of direct play and an increase in the use of maintenance when facing a stronger opposition, and showed a decrease in maintenance when winning and facing strong opposition. This could be explained by a strong reaction of the losing teams to try dominate possession against better opponents. Secondly, when teams were winning by two or more goals, the use of high pressure decreased when facing strong opposition. The strategy of these teams could be to maintain the scoreline and prevent the other team from scoring by employing a defence close to their own goal.

Venue showed a significant effect for all styles of play except counterattack and maintenance. According to previous research, ball possession increased for home teams (Lago-Peñas & Dellal, 2010; Lago, 2009; Lago & Martin, 2007). Our data supports this previously reported increase in possession for home teams, but more specifically that this is a result of increased possession during build up and sustained threat and a reduction in direct play. Therefore, home teams dominate possession in more attacking areas (i.e. attacking third) compared to away teams (Lago, 2009). Consequently, these results support home advantage phenomena in soccer and other sports. Although this aspect has been widely studied, the reasons for it are not clear (Carron, Loughhead, & Bray, 2005). Crowd support seems to be a major factor (Nevill & Holder, 1999), however, referee bias, psychological factors, familiarity

with the pitch and travel effects seems to be also some of the possible explanations (Pollard & Pollard, 2005). In addition, the use of fast tempo, crossing, and high pressure were higher when playing home in comparison when playing away. These styles of play suggest aggressive play that aims to get as many scoring opportunities as possible and seems to be a team behaviour when the team is playing home (Lago-Peñas et al., 2017). Regaining ball possession in advanced zones of the pitch as a consequence of high pressure strategies is linked to success (Almeida et al., 2014), similarly as fast ball movement (Wallace & Norton, 2014). Therefore, this fact could explain this aggressive behaviour by home teams. An interaction between venue and quality of opposition was significant for build up. Teams playing away tend to decrease their use of build up when facing strong opposition. This could be because the stronger team at home team would further dominate ball possession and increase the home advantage effect.

Moreover, quality of opposition demonstrated an effect on all the styles of play except counterattack. Previous research observed that facing a strong opposition was associated with a decrease of ball possession (Lago-Peñas, Lago-Ballesteros, & Rey, 2011; Lago, 2009). The present study also showed that the direct play increased, whereas maintenance, build up, and sustained threat decreased when facing a stronger opposition. This suggests that weaker teams maintain players closer to their own goal and employ direct play, while stronger teams tend to dominate using possession-based styles. The use of fast tempo decreased when facing a strong opposition. As this style of play requires good passing and dribbling abilities of players, it is expected that better teams have better players that are able to develop fast tempo in their ball possessions. In addition, results showed that the use of crossing was significantly higher when playing against weak opposition. Previous

research indicated contradictory conclusions, showing that losing teams had higher averages for crosses (Lago-Peñas et al., 2010). Difference in crosses might be due different tactical behaviours between the Spanish League and English Premier League. Results of the present study also showed that the use of high pressure increased when facing a weaker opposition. This is in accordance with previous research showing that better ranked teams in the UEFA Champions League were more effective in applying high pressure (Almeida et al., 2014) and that facing a strong opposition made teams regain the ball and locate their defensive line closer to their own goal (Santos et al., 2017). Better teams could feel more confident defending next to the opposite goals, mainly because better players playing in these teams can perform this pressure successfully.

The current study uses a large data set from a full season, however data corresponded to a single league. Consequently, generalisation to other leagues and seasons is limited and should be considered with caution (Mackenzie & Cushion, 2013). As previous research showed with ball possession (Collet, 2013), it is possible that effects of contextual variables on styles of play employed by teams could be diminished in different contexts (e.g. non domestic leagues). In addition, the styles of play defined in this study are a proposal for styles of play in soccer. Maybe other researchers and practitioners could consider different ways to define the same styles of play described in this study or even consider different ones. However, the approach employed in this study is generally in accordance with previous research and practitioners' points of view. Moreover, event data was used for this study and the use of spatio-temporal data could provide a more insightful analysis of team behaviour (Link, Lang, et al., 2016; Memmert et al., 2017). As a consequence of the previous reasons, caution is needed when interpreting the present findings. Future

research should extend the investigation to other leagues and seasons to account for more different situations. The results of this study and the approach employed could be used by coaches, performance analysts, and other practitioners in practice. Knowing the behaviour of teams under specific contextual variables will prepare teams to react to their opponents and improve their tactics on training. Similar models could be applied to evaluate the influence of contextual variables on other leagues and teams.

Conclusions

This study showed that match status, venue, and quality of opposition influence the use of styles of play in soccer match play. The use of mixed models is useful to evaluate these situations under a multilevel approach, suitable for soccer. Models show in detail how these contextual variables affect the eight styles of play considered in the study (Direct Play, Counterattack, Maintenance, Build Up, Sustained Threat, Fast Tempo, Crossing, and High Pressure). Consequently, contextual variables should be accounted for when analysing styles of play in soccer.

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