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ORIGINAL ARTICLE

Analysis of entries into the penalty area as a performance indicator in soccer

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Abstract

This study examines entries into the penalty area as a performance indicator that distinguishes between winning, drawing and losing soccer teams. It assesses whether entries into the penalty area are influenced by match status, a player's dismissal and the respective quality of the competing teams. Two observers analysed the relation between defensive and offensive strategies and their scoring consequences for all 64 matches played in the 2006 World Cup. Kappa values ranged between 0.93 and 0.98 for intra-reliability and between 0.88 and 0.98 for inter-reliability. It was found that winning teams received significantly fewer entries into their own penalty area (mean = 41.42, $s = 11.86$) than drawing (mean = 50.07, $s = 14.75$) and losing teams (mean = 47.23, $s = 12.14$). Teams that received more entries into their own penalty area than the opposing team were significantly more likely to concede a goal ($P < 0.001$). Teams losing by one (mean = 0.41, $s = 0.21$), two (mean = 0.42, $s = 0.26$) or more than two goals (mean = 0.34, $s = 0.13$) received significantly fewer entries into the penalty area per minute than teams winning by one (mean = 0.55, $s = 0.27$) or two goals (mean = 0.59, $s = 0.39$). Teams with fewer players on the pitch received significantly more entries into the penalty area per minute than teams with more (mean = 0.22, $s = 0.07$) or the same number (mean = 0.14, $s = 0.05$) of players. Based on these results, it is suggested that teams should enter the opposing team's penalty area but should not allow their opponents to do the same. These results also highlight the significance of the dismissal of a player.

Keywords: Entry into the penalty area, soccer, team strategy, players' dismissal, notational research

Introduction

Notational research has paid considerable attention to goal scoring in soccer because goal scoring distinguishes success from defeat (James, Jones, & Mellalieu, 2004). However, simply assessing offensive play based on goals scored does not provide a full understanding of a team's performance. Notational research should evaluate all aspects of the game, particularly those that alter the balance between defence and offence and create risky situations and that may eventually lead a team to concede a goal (Garganta, 1998).

The present study analysed entries into the penalty area to provide further understanding of team performance and game dynamics. Lago, Martin

and Seirul-lo (2007) found a relationship between this variable and the performance of FC Barcelona in the 2004–2005 season. They concluded that the greater the difference between entries into the opponent's penalty area and entries into FC Barcelona's own penalty area, the better FC Barcelona performed. However, the generalizability of this study to other teams was limited. The current study attempted to broaden these results by using entries into the penalty area for top-level international soccer teams as an effective performance indicator. All teams participating in the 2006 Soccer World Cup were analysed. Entries into the penalty area were expected to be a performance indicator because score box possessions can be used as a proxy

for goals (Tenga, Ronglan, & Bahr, 2010), and shots made from inside the penalty area are more likely to be effective than those from outside (e.g., Acar et al., 2009; Bergier, Soroka, & Buraczewski, 2008; Grant, Williams, & Reilly, 1999b).

The present study also sought to analyse the influence of some situational variables on entries into the penalty area. Previous studies showed that the variables of match status (whether the team was winning, losing or drawing), player dismissal (whether the team was playing with a numerical deficit) and quality of opposition (strong or weak) have an important influence on soccer performance (Bar-Eli, Tenenbaum, & Geister, 2006; Lago, 2009; Taylor, Mellalieu, James, & Shearer, 2008). Match status is determined by whether a team is winning, losing or drawing at any given moment in the game. This variable is known to influence teams' strategies (Bloomfield, Polman, & O'Donoghue, 2005a). Teams often show a more defensive strategy when winning than when losing, and vice versa. For example, teams have more possessions when they are losing matches than when winning or drawing (James et al., 2004; Lago, 2009; Lago & Delall, 2010; Lago & Martin, 2007). From a physiological perspective, players on winning teams perform significantly less high-intensity activity than when losing or drawing (Lago, Casais, Dominguez, & Sampaio, 2010; O'Donoghue & Tenga, 2001). Conversely, Bloomfield, Polman and O'Donoghue (2005b) did not find any significant differences in intensity of play across match status. However, this study might be limited based on the ability to discriminate among different intensities of play because it used a two-category classification of motion ('Exercise' and 'Rest'). Consequently, the present study hypothesized that winning teams may adopt a more conservative strategy, evidenced by fewer entries into the opponent's penalty area and more entries into their own area, than teams that were drawing or losing.

The effectiveness of both defensive and offensive strategies was also analysed. A team was considered to use an offensive strategy when it frequently entered the opponent's penalty area but did not allow the opposing team to enter its penalty area. Findings from previous studies suggested a positive relationship between offensive tactical strategies and team success (Grant, Williams, & Reilly, 1999a; Hook & Hughes, 2001; Lago et al., 2007). For example, an offensive indicator, such as having significant ball possession, has been related to successful performance (Grant et al., 1999a; Hook & Hughes, 2001). Likewise, Lago et al. (2007) concluded that ball possession was a determining factor for FC Barcelona in the 2004–2005 season only when the team took the initiative in the game, such as trying to reach the opponent's goal, trying to score a goal or trying to make a shot on

goal, but not when their opponents took the initiative. Therefore, ambitious use of the ball was related to good performance. Accordingly, winning teams were expected to show offensive strategies by performing more entries into the opponent's penalty area and receiving fewer entries into their own penalty area than losing teams. Furthermore, using a more offensive strategy than the opposing team was expected to increase the likelihood of scoring a goal.

An additional purpose of the present study was to analyse the effect of a player's dismissal in terms of the number of entries into the penalty area. Dismissing players is used as a negative sanction in soccer because it is assumed that a numerical disadvantage may negatively affect a team's effectiveness (Bar-Eli et al., 2006). Previous studies on the effect of red cards on team performance found that a sanctioned team's chances of scoring or winning were substantially reduced following the sanction (Bar-Eli et al., 2006; Ridder, Cramer, & Hopstaken, 1994). In the current study, teams at a numerical disadvantage because of fewer players were expected to receive more entries into their penalty area than teams at a numerical advantage.

Finally, the existing literature suggests that other situational variables, such as the quality of a team and of its opponent should be taken into account when soccer performance is analysed (e.g. Lago et al., 2010; Lago & Martín, 2007; Taylor et al., 2008). Overall, playing against strong opposition has been associated with a reduction in time spent in possession, and vice versa (Lago, 2009; Lago & Dellal, 2010; Lago & Martin, 2007). Therefore, teams playing against strong opponents were expected to receive more entries into the penalty area than those playing against weak ones.

In summary, the present study analysed (1) the suitability of entries into the penalty area as a performance indicator to discriminate between winning, drawing and losing teams; (2) whether receiving more entries into the penalty area than the opposing team was related to conceding a goal; (3) the influence of match status on entries into the penalty area; (4) the extent to which a player's dismissal influenced teams' entries into the penalty area; and (5) the influence of the respective quality of the competing teams on entries into the penalty area.

Methods

Data were collected from all 64 matches played in the 2006 World Cup in Germany. An observational methodology was used for the acquisition of data (De Baranda, Ortega, & Palao, 2008; Remmert, 2003). An entry into the penalty area was defined as an event that took place either when the team in possession of the ball passed it into the opponent's

penalty area (regardless of whether the pass was received by a teammate) or when a player in possession of the ball went into that area of the pitch. The matches were analysed through systematic observation by two experienced observers. Reliability was assessed through intra- and inter-observer testing procedures. Entries into the penalty area in five 2006 World Cup matches were coded by observers for intra-observer reliability testing. The matches were re-analysed after a 6-week period, and these data were compared with data from the original coding sessions. Subsequently, inter-observer reliability was assessed using data from the first coding session. Kappa (k) values ranged from 0.93 to 0.98 for intra-reliability and 0.88–0.98 for inter-reliability.

Three variables related to entries into the penalty area were examined:

- (1) Match status: the number of entries into the penalty area per minute that each team received when drawing, winning by one goal, winning by two goals, winning by more than two goals, losing by one goal, losing by two goals or losing by more than two goals.
- (2) Team strategy consequence: the number of entries into the penalty area that each of the two contending teams received before a goal was scored. Receiving more entries into the penalty area than the opposing team during that period of time was related to defensive strategies, and vice versa. There were two possible consequences to these team strategies: conceding a goal or scoring a goal. Therefore, this variable assessed whether the number of entries received into the penalty area before a goal was scored was associated with conceding or scoring a goal. For example, in a match that ended with a score of 1–1, the number of entries into the penalty area received by teams A and B between kick-off and the first scored goal was recorded. Next, the number of entries into the penalty area that each team received between 1–0 and 1–1 was noted. Thus, it was possible to ascertain which team received more or fewer entries into the penalty area in each score line preceding both goals.
- (3) Player dismissals: the number of entries into the penalty area per minute that each team received when playing with a numerical advantage (one player more than the opponent), numerical equality or a numerical disadvantage (one fewer player than the opponent). A total of 28 red cards were shown in the tournament, resulting in a total of 671 minutes when the teams were imbalanced. There were no imbalances of more than one player in any match of the tournament.
- (4) Quality of teams: teams were classified according to the FIFA final ranking of the tournament (FIFA, 2006). Teams ranked between the 1st and 10th position were grouped as strong (Italy, France, Germany, Portugal, Brazil, Argentina, England, Ukraine, Spain and Switzerland), whereas those between the 11th and 20th were categorized as medium (Netherlands, Ecuador, Ghana, Sweden, Mexico, Australia, Korea Republic, Paraguay, Côte d'Ivoire, Czech Republic). Weak teams were those ranked between the 21st and 32nd positions.

Statistical analysis

Differences in entries received into the penalty area and into the opponent's area across each match score (winning, drawing and losing) were analysed using a one-way ANOVA.

Chi square (χ^2), phi coefficient (ϕ) and Cramer's V statistic were used to estimate associations between team strategies (receiving more or fewer entries into the penalty area than the opponent) and the subsequent scoring consequence (conceding or scoring a goal).

Two separate one-way ANOVA tests were used on entries into the penalty area received per minute to examine any differences across match status and player dismissals.

Three different one-way ANOVA tests were run on entries into the penalty area received per minute (one to analyse each of the strong, medium and weak team quality groupings) to look at differences across quality of opposition (strong, medium and weak). No violations of normality or homogeneity were noted in any of the one-way ANOVA tests. Eta squared (η^2) values are provided as a measure of effect size. Fisher's Least Significant Difference (LSD) tests were used as follow-ups. The alpha level for significance for all analyses was set at $P < 0.05$.

Results

Teams received different numbers of entries into the penalty area depending on the match score; $F(2, 123) = 4.85$, $P < 0.01$, $\eta^2 = 0.07$. Winning teams received fewer entries into their penalty area (mean = 41.42, $s = 11.86$) than drawing (mean = 50.07, $s = 14.75$) or losing teams (mean = 47.23, $s = 12.14$). Likewise, the number of entries made into the opponent's penalty area differed according to match score; $F(2, 123) = 4.77$, $P = 0.01$, $\eta^2 = 0.07$. Losing teams made fewer entries into the opponent's penalty area (mean = 41.60, $s = 11.88$) than drawing (mean = 50.07, $s = 14.75$) or winning teams (mean = 47.50, $s = 12.01$) (Figure 1).

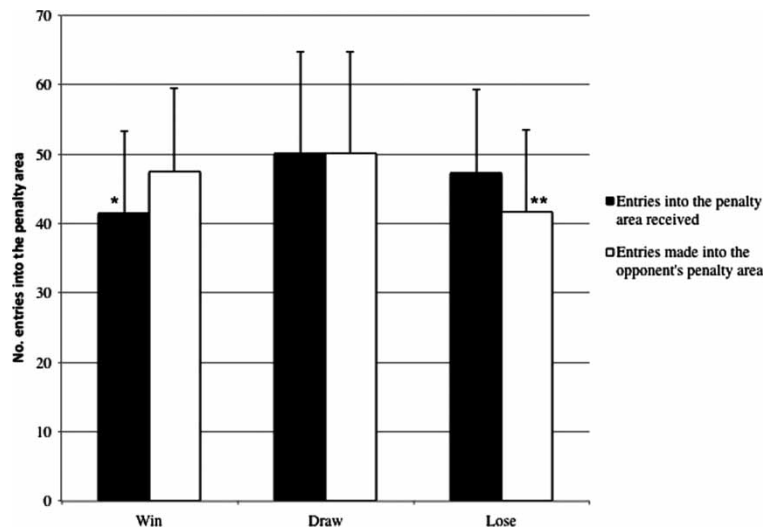


Figure 1. Mean and standard deviation of entries received into the penalty area and made into the opponent's penalty area according to match score (win, draw, lose). *Significantly different from draw and lose ($P < 0.01$). **Significantly different from win and draw ($P = 0.01$).

The relationship between team strategy and scoring consequence was significant: $\chi^2(1, N = 266) = 29.11$, $P < 0.001$. This association was of moderate strength: $\phi = 0.331$ (Figure 2). Teams with more entries into their own penalty area than the opposing team were significantly more likely to concede a goal, and teams with more entries into the opposing team's penalty area were more likely to score a goal.

Teams received different rates of entries into the penalty area per minute depending on the match status; $F(6, 394) = 3.13$, $P = 0.005$, $\eta^2 = 0.04$ (Figure 3). Teams losing by one (mean = 0.41, $s = 0.21$), two (mean = 0.42, $s = 0.26$) or more than two goals (mean = 0.34, $s = 0.13$) received significantly fewer entries into the penalty area per minute than teams winning by one (mean = 0.55, $s = 0.27$) or two goals (mean = 0.59, $s = 0.39$). Furthermore,

teams losing by one goal (mean = 0.41, $s = 0.21$) received fewer entries into the penalty area per minute than teams drawing (mean = 0.49, $s = 0.33$) ($P < 0.05$).

Teams received different rates of entries into the penalty area per minute depending on their numerical status with respect to the opposing team; $F(2, 398) = 4.30$, $P < 0.05$, $\eta^2 = 0.02$ (Figure 4). Teams playing with one player less than the opposing team received more entries into the penalty area per minute than teams playing with numerical equality or superiority ($P < 0.05$).

Playing against strong, medium and weak opposition did not influence entries into the penalty area per minute received by strong teams ($F(2, 154) = 1.26$, $P = 0.29$), medium teams ($F(2, 119) = 1.70$, $P = 0.19$) or weak teams ($F(2, 119) = 0.18$, $P = 0.84$) (Table I).

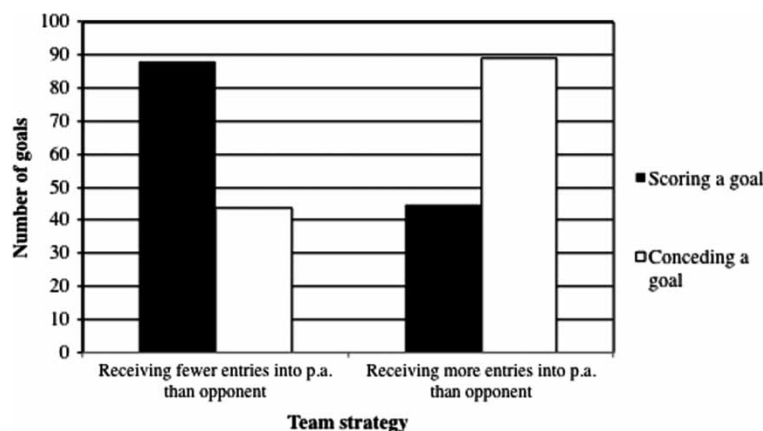


Figure 2. Descriptive results of team strategies and scoring consequences.

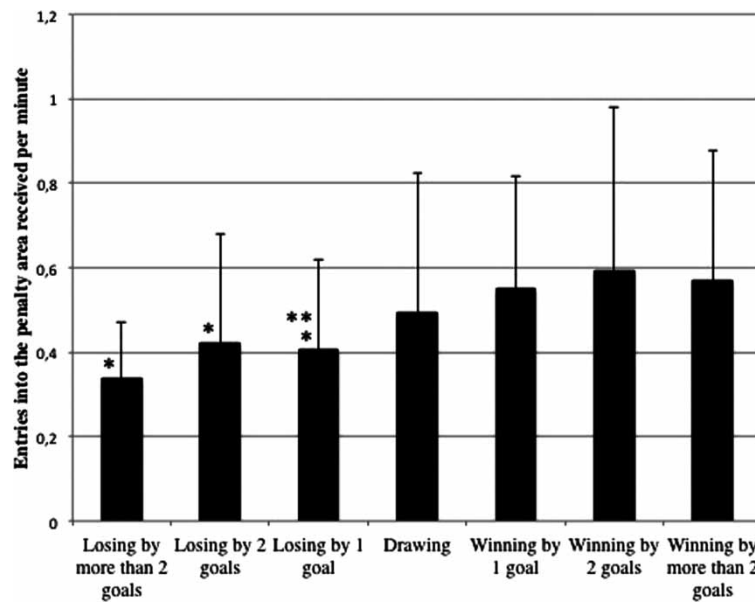


Figure 3. Mean and standard deviation of entries into the penalty area received per minute according to match status. *Significantly different from winning by one or two goals ($P < 0.05$). **Significantly different from drawing ($P < 0.05$).

Discussion

The first aim of the present study was to assess the suitability of entries into the penalty area as a performance indicator to distinguish between winning, drawing and losing teams. Winning teams made significantly more entries into the opponent's penalty area than drawing and losing teams. Likewise, losing teams received more entries into their penalty area than winning and drawing teams. Similar to the findings of Lago et al. (2007), making more entries into the opponent's penalty area and not allowing the other team to do the same was related to good team performance. The present study expanded on the previous study by Lago et al. (2007) by generalizing their findings about the use of entries

into the penalty area as a suitable performance indicator to top-level international soccer teams.

These findings have practical implications. From a defensive perspective, it is advisable to prevent the opposing team from introducing the ball into the penalty area. Therefore, coaches should analyse the methods used by the opposing team to reach the penalty area and attempt to neutralise these methods through strategies. Likewise, coaches should provide their teams with an offensive potential that enables them to reach the opponent's penalty area more frequently. Interactions with the opposing team should be considered; for example, counter-attacks are more likely to produce score-box possessions than elaborate attacks when playing

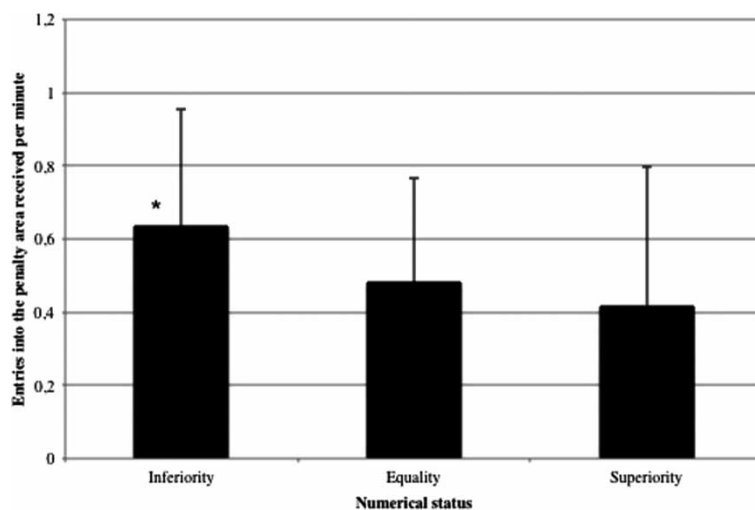


Figure 4. Mean and standard deviation of entries into the penalty area received per minute according to numerical status. *Significantly different from equality and superiority ($P < 0.05$).

Table 1. Entries into the penalty area received per minute by strong, medium and weak teams according to quality of opponent (standard deviations in parentheses).

Quality of analysed team	Quality of opposition		
	Strong	Medium	Weak
Strong	0.47 (0.22)	0.48 (0.25)	0.40 (0.31)
Medium	0.48 (0.23)	0.65 (0.43)	0.49 (0.41)
Weak	0.51 (0.33)	0.50 (0.26)	0.46 (0.26)

against an imbalanced defence (Tenga, Holme, Ronglan, & Bahr, 2010).

The findings from the second stage of the present study showed that receiving more entries into the penalty area than the opposing team increased the likelihood of conceding a goal; furthermore, making more entries into the opposing team's penalty area increased the probability of scoring a goal. These results were similar to those from studies linking poorer performance in performance indicators typical of an offensive strategy to team performance deterioration. These indicators included low ball possession (Grant et al., 1999a; Hook & Hughes, 2001) and unambitious use of the ball (Lago et al., 2007). Results from the present study highlighted the importance of maintaining initiative throughout the match, regardless of the score. Thus, teams should reconsider adopting a defensive strategy when winning because teams that use a defensive strategy receive an increased number of entries into their own penalty area.

Third, the influence of match status on entries into the penalty area was analysed. Teams losing by one, two or more than two goals received significantly fewer entries into the penalty area than teams winning by one or two goals. This better performance of losing teams was in agreement with previous studies that found losing teams to have more ball possession (James et al., 2004; Lago, 2009; Lago & Delall, 2010; Lago & Martín, 2007) and to perform more high-intensity activity (Lago et al., 2010; O'Donoghue & Tenga, 2001) than teams that were winning or drawing. Previous studies have proposed teams' deliberate strategies as the main cause for alterations of their game dynamic according to match status (Lago, 2009; Lago & Delall, 2010). This approach seems to explain alterations in losing teams. For example, it has been suggested that losing teams increase possession to "control" the game by dictating play (Lago, 2009; Lago & Delall, 2010). Similarly, in the present study, teams in the same situation might have made more entries into the opponent's penalty area while trying to equalize the match. However, the change of the game dynamic of leading teams might be less under their control, while the opponent's action is more

important. For example, it is unlikely that leading teams in the present study deliberately allowed their opponents to make more entries into their penalty area. More likely, they unsuccessfully attempted to avoid entry. Similarly, Lago (2009) stated that leading teams decrease their possession because they may prefer to play counter-attacking or direct play. Likewise, James et al. (2004) argued that winning teams are content to allow the opposition to maintain possession, but they probably try to get defenders between the ball and the goal, confident that goal-scoring opportunities can be prevented. However, another reason (in line with results of the present study) for leading teams to decrease possession might have to do with the strategy and strength of the opposing team that is trying to even the match. For example, players of teams who were behind seemed to use their maximal capacities to score a goal. This strategy might lead them to dominate the game, forcing losing teams to adapt to their actions. Consequently, game dynamics might be more influenced by the losing team's initiative, which forces the winning team to react accordingly. Alternatively, psychological factors might also account for changes arising from match status. Leading teams might lose motivation and reduce their effort when winning, consequently reducing high-intensity activity (Lago et al., 2010; O'Donoghue & Tenga, 2001).

Next, the effect of a player's dismissal on entries into the penalty area was assessed. The results indicated that teams at a numerical disadvantage received significantly more entries into their own penalty area than those with numerical superiority or equality. This finding is similar to previous studies suggesting that a player's dismissal weakens a sanctioned team by decreasing the possibility of scoring or victory (Bar-Eli et al., 2006; Ridder et al., 1994). Consequently, a player's dismissal seems to significantly weaken the team at a numerical disadvantage, thereby increasing its vulnerability to an opponent's attack.

Finally, the present study analysed the influence of the respective quality of the competing teams on entries into the penalty area. Surprisingly, neither strong, medium nor weak teams received significantly more entries into their penalty area per minute when playing against strong opposition than against medium or weak opposition. These results were in line with previous studies that did not find more frequent threats to weak teams' goals than to strong teams' goals (Lago, 2009; Taylor et al., 2008). For example, a British team analysed by Taylor et al. (2008) did not perform more shots and crosses when playing against weak opposition than against strong opposition. Similarly, a Spanish team analysed by

Lago (2009) did not have more possessions in the attacking third of the pitch when playing against weak opposition than against strong opposition. However, teams had more ball possessions when playing against weak opposition than against strong opposition (Lago, 2009; Lago & Dellal, 2010; Lago & Martin, 2007). From a quantitative perspective, this control of the ball when playing against weak opposition does not seem to imply threatening their goal more often than when playing against strong opposition. This finding appears paradoxical; it may be expected that teams playing against weak opposition perform more entries into the penalty area, shots, crosses, etc. than those playing against strong opposition, thus increasing the chances of victory. Future studies could address this issue by examining the quality of those offensive performance indicators. Together with the quantitative approach used in the present study, this might provide a better understanding of game dynamics. Furthermore, the quality of entries into the penalty area might be influenced by a team's style of play. For example, Brazil had the highest number of scoring chances in the penalty area in the 1994 World Cup. In many of their games, Brazil used more possession-style techniques than their opponents, such as change-over with passing, free style of play and fewer long passes, long runs with the ball, overlapping and wall-passing combinations (Luhtanen, Korhonen, & Ilkka, 1995). Alternatively, another team that had forwards capable of winning aerial challenges and players with the ability to win "second ball" situations could create scoring chances into the penalty area by using a direct style of play and looking for crossing situations. Such studies could have practical applications for coaches by showing effective ways to reach the opponent's penalty area depending on the characteristics of teams and players.

Additionally, the influence of the game period on entries into the penalty area could be analysed. It is likely that a team that needs to score to win or draw will reach the opponent's penalty area more frequently as the remaining match time diminishes. Thus, analysing the interaction among other variables will lead to a better understanding of the factors that influence team behaviours.

Conclusion

Results of the present study suggest that entries into the penalty area can be considered a performance indicator that differentiates between winning and losing teams. When losing by one, two or more than two goals, teams received significantly fewer entries into the penalty area than those winning by one or two goals. Likewise, teams losing by one goal

received fewer entries into the penalty area than when drawing. These results suggest changes in team strategies based on match status. However, these results indicate that the defensive strategies that may result in receiving more entries into one's own penalty area and making fewer into the opponent's area were not effective because they increased the likelihood of conceding a goal. Finally, it was demonstrated that a player's dismissal led to the numerically disadvantaged team receiving more entries into their own penalty area than the team at a numerical advantage. Coaches and players should be aware of the significance of this critical fact.

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