ANALYSIS OF THE SHOTS TO GOAL STRATEGIES OF FIRST DIVISION BRAZILIAN PROFESSIONAL SOCCER TEAMS

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The purpose of this study was to analyze the shots to goal strategies during four soccer matches, through computational tracking. Software Dvideow was used to obtain data about players' position and their technical actions and data treatment was performed in Matlab® environment. The results showed that the teams usually win the ball possession in their defensive soccer field and ball possessions that resulted in shot to goal can involve few or great number of passes depending on the game situation. Results do not corroborate with literature studies due to different methods of data treatment. Information about to these shots to goal strategies can help coaches to improve technical training, to find possible team mistakes and present it to players.

KEY WORDS: soccer, computational tracking, technical actions, shots to goal strategies.

INTRODUCTION:

Dufour (1993) affirms that the major purpose of analyzing the technical aspect of a soccer match is to correlate the technical elements with the match score. This is the main reason that leads some researchers to study the shots to goal strategies of professional soccer teams from several countries of whole world.

One of the pioneer papers about shots to goal strategies was demonstrated by Reep & Benjamin (1968) who collected data from 3213 matches between 1953 and 1968. Their main findings were that 50% of all goals came from possession gained in the final attacking quarter of the pitch and roughly 80% of goals resulted after a sequence of three passes or less. A similar study of soccer match analysis was presented by Garganta et al. (1997) who investigated 104 scored goals in 44 matches of five European teams. Their results showed that the scoring movements of European top level soccer teams often win the ball in their attacking third and perform only few passes (three or less). These findings corroborate the "direct-play" idea, defended by Bate (1988), who supported a strategy with fewer passes per team possession.

Several studies also have presented a completely different idea of that supported by Reep and Benjamin (1968), Bate (1988) and Garganta et al. (1997). Hughes et al. (1998) evaluated the patterns of play for successful and unsuccessful teams of the 1986 World Cup and found that successful teams executed more touches of the ball than unsuccessful teams. Furthermore, Hughes and Franks (2005) examined the 1990 and 1994 World Cup goals and concluded that there were more shots per possession at longer passing sequences than there were at shorter passing sequences for successful teams. These authors also suggested a different way of data analyzing, proving that distinct methods can yield different results.

Therefore, the purpose of this study was to analyze the shots to goal strategies (field place where the team gained the ball possession and passing sequence length) of first division Brazilian soccer teams using an automatic tracking method.

METHODS:

Data Collection: Four Brazilian first division Championship matches, with eight different teams were filmed by four digital cameras (JVC, model GR-DVL9500). The cameras were fixed at the highest points of the stadiums, each covering roughly a quarter of the field.

Subjects: The technical actions of 86 different players (including reserves) were registered. This study received the approval of the Ethics Committee of the Paulista State University.

Automatic Tracking Method: The video images were transferred to computers for analysis after the games. The automatic procedures of segmentation and tracking of the players were adopted using an interface of DVideow software (Figueroa et al, 2006) during all the game. After all the processes of obtaining the 2D coordinates of all players, the procedure of registering soccer players' technical actions was performed using Dvideow software.

Technical actions register: Dvideow software has an especial interface specially developed to soccer match study, which in the end of the analysis provide all players technical actions information, instant of time when this action occurred and the 2D coordinates where the player was positioned during the action. After registering the players' technical actions, Dvideow software yields a six-row matrix file, for each game, that was used in the data treatment.

Data treatment: Matlab$^{®}$ environment was used to analyze the shots to goal strategies. Then, technical actions file was used during the following calculations and analysis:
a) Field place where the team gained the ball possession that resulted in shots to goal: Literature studies (Reep & Benjamin (1968), Garganta et al. (1997) and Hughes & Franks (2005)) registered the field position where the team gained the ball possession (that resulted in goals) at the place where the player recuperated the ball after the opponent last ball touch. However, data provided by this method can be misinterpreted. Sometimes, opponent touches the ball (like an incomplete tackle) and shortly afterwards the team recovers ball possession. Therefore, literature method can ignore some important events that happened previously. In this study, field place where the team gained ball possession that resulted in shots to goal was registered in the position where the player recuperated the ball possession completely, through a complete tackle, opponent mistake or foul, no matter if, during the attacking play, adversary player touches the ball and afterwards the team gets back the ball possession. Due to the small number of goals scored during the games analyzed, all the attacking plays that resulted in shots to goal were analyzed, independently if they provided goals or not.
Field place where the team gained the ball possession that resulted in shots to goal was represented by principal components analysis (Barros et. al, 2006).
b) Passing sequence length of ball possessions that resulted in shots to goal: a special algorithm was created to calculate how many passes were involved during the ball possessions that resulted in shots to goal. In the literature methods (Reep and Benjamin (1968), Bate (1988), Garganta et al. (1997) and Hughes & Franks (2005)), a sequence length of zero is an intended pass that was contacted by the opposition. A sequence length of 1 was a pass that was contacted by fellow team player but the second pass was contacted by the opposition. A two-pass sequence was ended when the third intended pass did not reach the fellow team mates, and so on. Free kicks and penalty kicks are counted as shots to goal preceded by a zero-pass sequence, while shots to goal that happened after a pass coming from a corner kick or free kicks are considered a one-pass sequence.
Again, results presented using this method also can be misinterpreted once ignore the number of passes that occurred before the stationary ball play. Therefore, in this study the number of passes involved was counted during all the attacking play, since the moment the team gains the ball possession until the shot moment.

RESULTS AND DISCUSSION

In all soccer matches evaluated, 109 ball possessions that resulted in shots to goal were performed by the teams, providing the follow results:
a) Field place where the teams gained the ball possession that resulted in shots to goal
Figure 1-A illustrates field place where the team gained the ball possession that resulted in shots to goal.
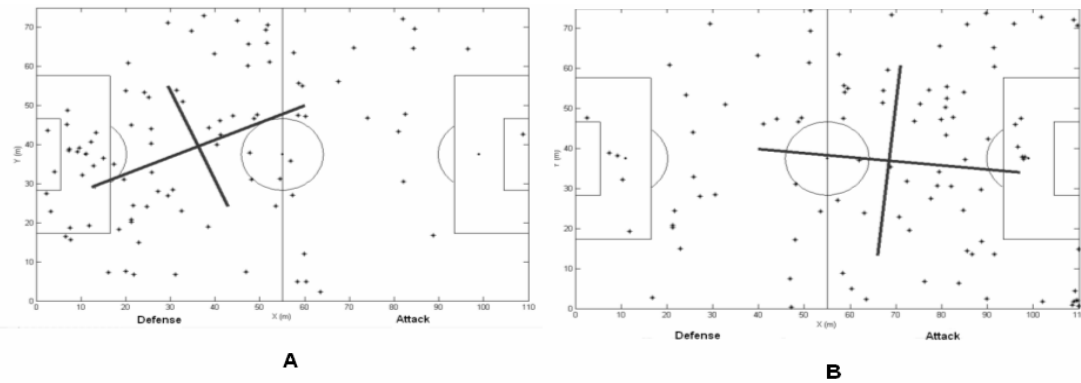
Figure 1. Field place where the teams gained ball possession that resulted in shots to goal using the present study method (A) and literature analyzing method (B).

According to figure 1-A, the principal components direction and size show that ball possessions started at distinct positions but they concentrated in the defense field shows. This data do not corroborate with Reep & Benjamin (1968) and Garganta et al. (1997) studies, which affirmed that the most ball possessions that resulted in goals started in the attacking field. These divergences occurred due to different ways of data treatment. When the present collected data was analyzed according to literature method, results were similar, as figure 1-B illustrates. In this study, the purpose was to analyze the ball possessions that resulted in shots to goal, independently if they provided goals. Literature method registered the beginning of the ball possession from the opponent last touch in the ball, while, in this study, it was registered when the team completely gained ball possession through a tackle or after a mistake of the adversary players. This choice was adopted because sometimes opponent player performed an incomplete tackle or foul and afterwards the attacking team recovered the ball. In these situations, literature method can ignore important events that happened before these incomplete tackles or fouls and the results can be misinterpreted.

b) Passing sequence length of the ball possessions that resulted in shots to goal
Figure 2-A illustrates the sequence length of ball possessions that resulted in shots to goal. Results show that sequence lengths with ten or more passes resulted in a greater number of shots to goal compared with other sequence lengths. On the other hand, a big number of shots to goal was also preceded by sequence lengths of zero until five, which together represented roughly 52 % of the attacking plays.
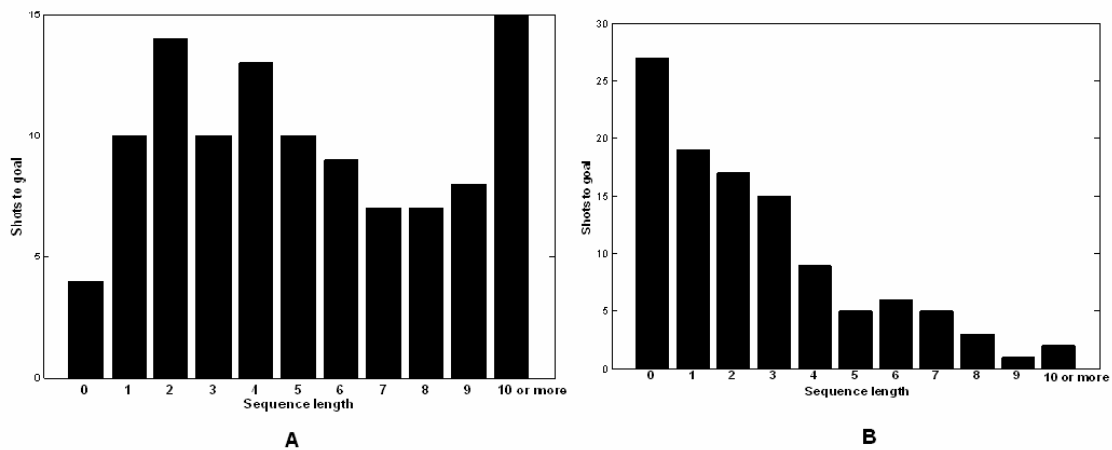

Figure 2. Sequence length of ball possessions that resulted in shots to goal according to present method (A) and to literature analyzing method (B).

This data do not corroborate with Reep & Benjamin (1968), Dufour (1993) and Garganta et al. (1997) studies, which concluded that the great number of goals happened after three passes or less. Again, these divergences occurred due to different ways of data treatment. When the analysis of the present collected data was made according to present method

results were similar to literature, as figure 2-B illustrates. Results showed that 71.6% of the attacking play involved up to three passes, while sequences lengths with a great number of passes resulted in a low number of shots to goal, proving that the distinction between the proceedings is the main responsible for these differences.

Hughes & Franks (2005) also analyzed the sequence length and concluded that the majority goals occurred after many passes, corroborating the current data. However, it is salient that the present results showed that a considerable amount of shots to goal happened after five passes or less. Therefore, there is not a principle that determines that ball possessions with few or many passes provide more or less shots to goal, once both ways can create kicks or headers conditions, depending on the match situations.

CONCLUSION

This study's purposes were to analyze the shots to goal strategies of Brazilian professional teams. The main findings were: a) ball possessions which result in shots to goal usually start in the team defensive field and b) ball possessions which result in shots to goal usually can have a short or a long passing sequence length, depending of the game situation. This study showed some features of ball possessions that resulted in shots to goal. However there are many issues that can be studied such attacking time and field place where the shots to goal were performed, during a larger number of matches. These data are extremely important to help coaches to improve technical training and to find possible team and opponent mistakes and present it to players.

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