Relationship between ball possession and match outcome in UEFA Champions League

Vinicius Martins Farias[1]* iD, Wesley Bierhals Fernandes[2] iD,
Gabriel Gustavo Bergmann[2] iD, Eraldo dos Santos Pinheiro[2] iD

ABSTRACT

This study aimed to verify the relationship between ball possession and match outcome in the UEFA Champions League. Official statistics from five seasons were analyzed, and descriptive analysis and the Chi-Square test were used for statistical analysis ($p<0.05$). Overall, teams with more ball possession won 49.2%, draw 22.0%, and lost 28.7% of the matches. In the group phase, teams with more ball possession won 50.5%, draw 23.0%, and lost 26.5% of the matches, while in the knockout phase, teams with more ball possession won 45.1%, draw 19.0%, and lost 35.9% of the matches. In general, teams with more ball possession won more matches in the competition, and this was especially true when the range of ball possession percentage between two teams in a match was higher.
KEYWORDS: Soccer, Sports, Match Analysis, Athletic Performance.

INTRODUCTION

Performance analysis in sport is based on the recording and examination of events that occurred in sports competitions. Performance analysis aims to improve performance by assessing performance indicators and identifying patterns related to success (Castellano et al., 2012; Hughes & Bartlett, 2002; Lago-Peñas et al., 2010). In that sense, various researchers have studied the factors that might influence soccer performance to identify those that can most relate to success (Castellano, 2008). As the number of goals in soccer matches is usually low, other indicators are commonly used to assess teams´ performance, with ball possession being one of the most popular (Goral, 2015; Kempe et al., 2014; Lago & Martín, 2007). In fact, many studies have focused on the relationship between ball possession and success in different levels of competitive soccer, among other performance indicators (Collet, 2013; Goral, 2015; Jones et al., 2004; Kempe et al., 2014; Lago-Peñas & Dellal, 2010; Parziale & Yates, 2013; Rodrigues et al., 2016).

Among the many authors that have discussed the relations between ball possession and success in soccer Liu et al. (2015a) found that ball possession was one of the variables that could distinguish teams from different levels in the UEFA Champions League. In another study by Lago-Peñas and Dellal (2010), the results showed that the mean percentage of ball possession of the top-placed teams in the Spanish League was higher than the less successful teams in the competition. The authors also found that the most successful teams presented less variation in their playing style and were able to maintain a pattern of play. In the same sense, Moura et al. (2014) studied game-related statistics from the 2006 World Cup and found that ball possession was one of the variables that could discriminate winning teams from those who draw or lose the competition. Lago-Peñas et al. (2010) also found that ball possession was one of the variables able to discriminate between winning, drawing, and losing teams in the 2008/2009 Spanish League.

In another study, Parziale and Yates (2013) found a strong correlation between points earned and ball possession in a regular season of the English Premier League, also larger ball possession rates for the top four teams in that competition. Hoppe et al. (2015) found a similar relationship between

total distances covered with ball possession and points accumulated in the 2012/2013 German Bundesliga. In the study by Liu et al. (2015b), the authors found that ball possession was one of the match statistics that had a positive effect on the probability of winning in the group stage of the 2014 World Cup. Furthermore, Goral (2015) also found that ball possession was related to success in the 2014 World Cup, as the top four teams had the most ball possession during matches. Moreover, Germany was the winner and the team with the highest mean ball possession percentage in the competition. In the same sense, Kempe et al. (2014) analyzed matches from two consecutive seasons of the Bundesliga and the 2010 World Cup, finding that the most successful teams preferred a ball possession style of play.

Nevertheless, in the study by Collet (2013), analyzing some of the most important soccer competitions, the author found that ball possession could be considered a direct predictor of match outcome, as teams with more possession shot more and scored more goals. However, when the quality of teams and home advantage were considered, and the strongest teams of the competition were removed from the analysis, the relationship was weakened overall. Also, time of possession was found to be a poor predictor of match results in those conditions. These results suggest that the relationship between ball possession and success found in that study was greatly influenced by the results of the strongest teams.

Another study showing a poor relationship between ball possession and success was the work of Gama et al. (2016), in which was found that in the Portuguese Premier League of 2010/2011 the amount of ball possession did not relate to the outcome of matches. In this study, however, the analysis included the matches of only one team, so the particular style of play adopted by the club in question, among other factors, should be considered for the interpretation of the results found. In the study of Castellano et al. (2012), analyzing the World Cups of 2002, 2006 and 2010, the authors found that ball possession was not a discriminating variable between successful and unsuccessful teams when the three competitions were analyzed altogether. However, it could have been an important success factor in the competitions of 2006 and 2010, as the results showed ball possession as one of the variables that differentiated winning, drawing and losing teams in those competitions. In another study analyzing national leagues in Europe, Evangelos et al. (2014) found that ball possession percentage was different between teams only in matches where the result's range was wide, with the winning teams having higher percentages of ball possession than losing teams. However, when the result

ranges were short, the amount of ball possession found between teams was similar.

Therefore, despite a large number of studies on this subject, it remains inconclusive how much the adoption of a game model based on keeping possession of the ball can influence the outcome of a competitive match, and conflicting results are found in the literature indicate the need for more data in this area of study. One important aspect, commonly ignored when evaluating ball possession and match outcome, is the range of difference of ball possession percentages between the two opposing teams in a match. It is possible that some of the conflicting results found in literature could be related to authors not considering how large was the difference of ball possession between teams. Moreover, it is essential to emphasize that ball possession, however necessary, is only one of the many variables which can influence match outcome.

Therefore, this study aimed to investigate the relationship between the teams´ percentage of ball possession and match outcome and the influence of different ranges of the percentage of ball possession among five consecutive competitive seasons of the UEFA Champions League. The UEFA Champions League can be considered one the most important soccer competitions in the world (Parziale & Yates, 2013) as it includes the best-ranked clubs from the European national leagues (Liu et al., 2015a), so it is of most relevance to analyze the question in that context.

METHOD

The study protocol followed the guidelines following the declaration of Helsinki. Teams and players remained anonymous, and the data used was publicly available on the internet. For this reason, there was no submission of the project to the Research Ethics Committee.

Procedures

In this study, a total of 625 matches were analyzed from seasons 2014/2015, 2015/2016, 2016/2017, 2017/2018, and 2018/2019 of UEFA Champions League. Data regarding ball possession statistics and match results were obtained at the competition's official website (www.uefa.com). For each match, the percentage of ball possession of both teams and the team's match outcome with the most ball possession (win, draw or loss) was identified. The percentages were based on a sum of 100% and matches where both teams had the same percentage of ball possession (50%) were excluded from the analysis. The analysis results were split between competition stages (group stage and knockout stage) and also divided according to the difference between ball possession of the

two teams in a match, represented by the percentage of the team with most ball possession, in the following categories: group A (51-55%); group B (56-60%); group C (61-65%); group D (66-70%); and group E (≥71%).

Statistical analysis

All data were analyzed using the software SPSS Statistics. Descriptive analysis was used to quantify matches won, draw, and lost for teams with the most ball possession, and Chi-Square Test (χ^2) was used to determine significant statistical differences (Rodrigues et al., 2013). Nonparametric Pearson´s Chi-square test is used to determine the possible divergences between observed and expected frequencies of a given variable. In the present study, the number of matches won, draw, or lost by teams with the most ball possession was analyzed to determine possible statistical differences between their frequencies. The level of significance was set at $p<0.05$.

RESULTS

In the five UEFA Champions League seasons analyzed, a total of 26 matches presented the same percentage of ball possession for both teams, one in season 2014/15, eight in season 2015/16, six in season 2016/17, five in season 2017/18

and six in season 2018/19. These matches were excluded from statistical analysis. In general, the results showed that the teams with the highest percentage of ball possession won 295 (49.2%), draw 132 (22.0%), and lost 172 (28.7%) matches ($p=0.000$).

Results of match outcome for the team with the highest ball possession percentage are shown in tables 1 and 2. Analysis divided by categories of differences in percentages of ball possession was also made. A total of 217 matches were included in Group A, and results showed that teams with the highest ball possession percentage won 85 (39.2%), draw 58 (26.7%), and lost 74 (34.1%) matches in this group ($\chi^2=5.097$, $p=0.078$). A total of 183 matches were included in Group B, and results showed that teams with the highest ball possession percentage won 85 (46.4%), draw 41 (22.4%), and lost 57 (31.1%) matches ($\chi^2=16.262$, $p=0.000$). In Group C, there was a total of 130 matches, and the results showed that teams with the highest ball possession percentage won 78 (60.0%), draw 21 (16.2%), and lost 31 (23.8%) matches ($\chi^2=42.754$, $p=0.000$). In Group D, there were 59 matches, and teams with the highest ball possession percentage won 42 (71.2%), draw 10 (16.9%), and lost 7 (11.9%) of them ($\chi^2=38.271$, $p=0.000$). Finally, in Group E, there was a total of 9 matches, and the teams with the highest ball possession

Table 1. Match outcome for the team with the highest ball possession percentage

Season	Matches	Won	Draw	Lost	χ^2	p
2014/2015	124	65 (52.4%)	28 (22.6%)	31 (25.0%)	20.435	0.000
2015/2016	117	53 (45.3%)	21 (17.9%)	43 (36.8%)	13.744	0.001
2016/2017	119	58 (48.7%)	32 (26.9%)	29 (24.4%)	12.824	0.002
2017/2018	120	59 (49.2%)	25 (20.8%)	36 (30.0%)	15.050	0.001
2018/2019	119	60 (50.4%)	26 (21.8%)	33 (27.7%)	16.252	0.000
Total	599	295 (49.2%)	132 (22.0%)	172 (28.7%)	72.284	0.000

Table 2. Match outcome for the team with the highest ball possession percentage according to the competition stage

Season	Group Stage						Knockout Stage					
	Matches	Won	Draw	Lost	χ^2	p	Matches	Won	Draw	Lost	χ^2	p
2014/2015	95	50 (52.6%)	21 (22.1%)	24 (25.3%)	16.063	0.000	29	15 (51.7%)	7 (24.1%)	7 (24.1%)	4.414	0.110
2015/2016	88	40 (45.5%)	13 (14.8%)	35 (39.8%)	14.068	0.001	29	13 (44.8%)	8 (27.6%)	8 (27.6%)	1.724	0.422
2016/2017	90	45 (50.0%)	29 (32.2%)	16 (17.8%)	14.067	0.001	29	13 (44.8%)	3 (10.3%)	13 (44.8%)	6.897	0.032
2017/2018	93	49 (52.7%	19 (20.4%)	25 (26.9%)	16.258	0.000	27	10 (37.0%)	6 (22.2%)	11 (40.7%)	1.556	0.459
2018/2019	91	47 (51.6%)	23 (25.3%)	21 (23.1%)	13.802	0.001	28	13 (46.4%)	3 (10.7%)	12 (42.9%)	6.500	0.039
Total	457	231 (50.5%)	105 (23.0%)	121 (26.5%)	61.777	0.000	142	64 (45.1%)	27 (19.0%)	51 (35.9%)	14.887	0.001

percentage won 5 (55.6%), draw 1 (11.1%), and lost 3 (33.3%) matches (χ^2=2.667, p=0.264). Results of matches won, draw, and lost in each group are shown in Figure 1.

DISCUSSION

The present study investigated the relationship between ball possession and match outcome to determine whether teams with a higher percentage of ball possession in a match were more likely to win, draw or lose in the UEFA Champions League. Results over five consecutive seasons showed that a greater number of matches were won by the teams with a higher percentage of ball possession ($P<0.05$) in all five seasons 2014/15 (52.4 %), 2015/16 (45.3%), 2016/17 (48.7%), 2017/18 (49.2%) and 2018/19 (50.4%), which indicates that teams that kept most ball possession won more matches overall. These findings agree with the results of most studies found in the literature. However, the main result of the present study remains in the analysis of groups where teams had different ranges of ball possession and in different competition stages.

By splitting the results between competition stages, we aimed to analyze the results in different contexts, assuming that in the group stage, the technical difference between teams would be greater than in the knockout stage, which included only the sixteen best-qualified teams in the group stage, where the quality of teams would be more balanced. In the group stage, the results also showed most of the matches played won by the team with the highest percentage of ball possession overall and in four of the five seasons assessed, except for season 2015/2016, when the number of matches won by teams with higher ball possession (40) was very similar to the number of matches lost (35). However, results of matches in the knockout stage showed similar numbers of matches won and lost by the teams with most ball possession, as seen in three of the five seasons analyzed with no statistical differences between winning, drawing, or losing. Moreover, in the two seasons where there was a significant statistical difference, it was related to the number of draws and not between wins and losses. Therefore, it seems that possible technical differences between teams could influence the results found.

Another important factor that should be considered when evaluating match outcome is the range in ball possession percentages between the two teams in a match, in order to differentiate the results from matches where the percentages of both teams were close and matches where one of the teams had a much higher amount of ball possession than the other. Therefore, we analyzed the results by splitting the matches into groups related to the range of difference of ball possession percentages between teams. The results showed that when both teams in a match had a close percentage of
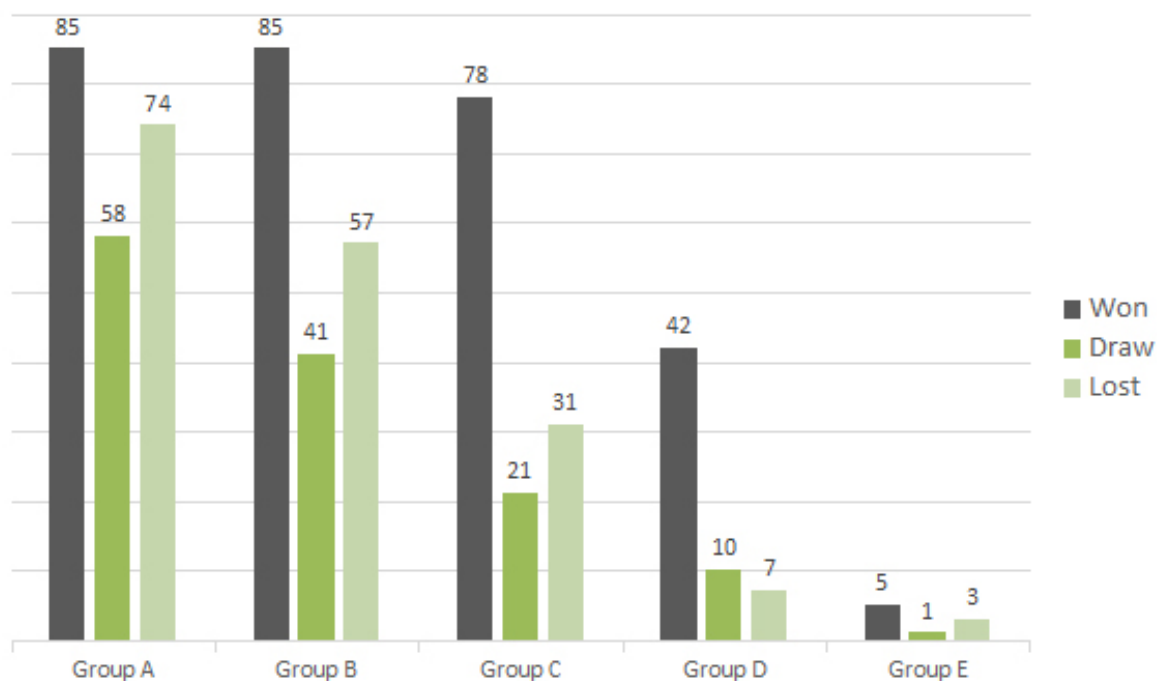

Figure 1. Match outcome for the team with highest ball possession percentage divided by groups

ball possession (Group A), there were no significant differences in the matches' outcome. However, as the difference in the percentage of ball possession between teams increased, different results were found. In Group B, with the range of ball possession between teams varying from 56-44% and 60-40%, there was a significant statistical difference between winning, drawing, and losing for the team with the most ball possession. Moreover, in group C, when the difference of percentage of ball possession between teams in a match varied from 61-39% to 65-35%, teams with most ball possession won 60.0% of the matches and lost only 23.8% ($p<0.05$). Furthermore, in group D, when ball possession differences could be up to 70-30%, the results also showed teams with higher percentages of ball possession winning 71.2% of the matches and losing 11.9% ($p<0.05$). Finally, in group E, a total of five matches were won, and three were lost by the team with the highest percentage of ball possession, with no significant statistical differences. The low number of matches found in this last group makes it difficult to assess significant statistical differences when most ball possession teams had a percentage of 71% or over. However, the same trend could be expected in the other groups, where the difference in ball possession percentage between teams was high. Besides, it is important to consider that when one of the teams has much more ball possession, the other team normally has an extremely defensive tactical posture. These characteristics impose great difficulty on the task of scoring goals. On the other hand, the team with less ball possession can create scoring opportunities from counter-attack plays. These features can help to explain the results found in the analysis of group E.

One important finding of the present study is the result showing that the range of the difference of ball possession percentage between teams in a match should also be considered for better interpretation of the relationship between ball possession and match outcome, as we found different results in matches where teams had similar percentages values and in matches where one team had a much higher percentage of ball possession than the other.

In the discussion about the relationship between ball possession and success in soccer, coaches and players should bear in mind that a ball possession style of play demands high levels of technical and tactical skills (Evangelos et al. 2014), and it might not be appropriate in all cases and contexts. According to Castellano (2008), keeping possession of the ball might help teams impose their offensive playing style. For Adams et al. (2013), keeping the ball allows a team to manipulate the opposition until creating attacking opportunities strategically. However, having possession of the ball should not be considered an aim for itself. Possession-based

approaches should only be a means for better construction of offensive plays, which should be finished as best as possible with the creation of shots and goal opportunities to avoid counter-attacks and goal opportunities for the opposition (Liu et al. 2015b).

Previous studies have found similar relations between ball possession and success in soccer (Goral, 2015; Hoppe et al. 2015; Kempe et al., 2014; Lago-Peñas et al., 2010; Lago-Peñas & Dellal, 2010; Liu et al., 2015a; Liu et al., 2015b; Moura et al. 2014; Parziale & Yates, 2013). However, many studies have shown that different aspects such as quality of teams; match venue; match status; team and opposition´s identities; location of ball possession and player´s position; and level of competition can influence the relationship between ball possession and success in soccer (Adams et al., 2013; Collet, 2013; Jones et al., 2004; Lago & Martin, 2007; Rodrigues et al., 2016). The results found in the present study indicate that the range of difference of ball possession percentage between teams in a match should also be considered when evaluating the relationship between ball possession and match outcome.

According to Lago-Peñas and Dellal (2010), ball possession can be influenced by alternations of teams' styles of play during a match. In their study, Lago and Martín (2007) concluded that match status, match venue, team identity, and opposition identity could influence the differences in ball possession between teams in a match. Also, analysis of ball possession in soccer should consider factors such as the field location of possessions and the teams' strength.

In the study by Jones et al. (2004), for instance, the authors found that the three top teams of the English Premier League of 2001/2002 had significantly longer possessions than the three bottom teams in the competition. However, the results showed that in both successful and unsuccessful teams, the durations of ball possession were longer when they were losing a match than when they were winning, which implicates that match status can change ball possession characteristics. Also, the study by Adams et al. (2013) showed that the amount of ball possession of defenders in the opposition´s half of the field was an important feature of top teams in the English Premier League of 2011/2012, which indicates the importance of analyzing location and players´ positions in relation to ball possession in soccer. Another factor to be considered is the level of competition. For instance, the results of the study by Rodrigues et al. (2016), analyzing three seasons of the Brazilian Serie A and Serie B national leagues, showed median and strong correlations between ball possession and success in all seasons of Brazilian Serie A. However, no significant correlation was found in the Serie B competition.

Limitations of the study include the fact that ball possession should be considered only one of the many variables that influence soccer matches, and it is far from being the sole cause of match outcome. Thus, its results should not be interpreted as isolated from other important performance indicators in soccer. Furthermore, the results found in the present study were observed over five seasons of the same competition, the UEFA Champions League, and can only be interpreted in that context. Furthermore, in the analysis divided by groups related to the range of ball possession percentages between teams, the small number of matches included in group E could have interfered in the results of the statistical analysis. Further research, including competitions of different levels and players from different age groups, is suggested to clarify ball possession's influence on match outcome in soccer.

In terms of practical application, depending on the game model and strategy adopted, a team can either choose to keep more ball possession in a match or allow the opposition to have the ball. If, on the one hand, keeping possession of the ball by itself does not guarantee success, on the other hand, the results found indicate that, overall, teams with most ball possession win more matches than teams with less ball possession over a competitive season. This could be particularly important in long competitions with a round-robin system of points.

The present study evaluated the influence of ball possession from a different perspective from previously found in the literature, which only considered one team as having more or less ball possession than the other in a match and not considering how large was the difference of ball possession percentage between teams. Thus, according to the results found, it seems important not only to have a higher percentage of ball possession than the opposition team in a match, as we found that in matches where the difference of ball possession between teams was close, there were no statistical differences between winning, drawing or losing.

CONCLUSION

The results in this study showed that, in general, there was a trend for winning teams to have a higher percentage of ball possession in the matches of four consecutive seasons of the UEFA Champions League. However, this trend varied over seasons, and it is possible that in matches with technically balanced teams, it could be not as evident. An important result was that when the range between ball percentages of two teams in a match was higher, the number of matches won by teams with the most ball possession was also higher.

ACKNOWLEDGMENTS

REFERENCES

Adams, D., Morgans, R., Sacramento, J., Morgan, S., & Williams, M. D. (2013). Successful short passing frequency of defenders differentiates between top and bottom four English Premier League teams. *International Journal of Performance Analysis in Sport, 13*(3), 653-668. https://doi.org/10.1080/24748668.2013.11868678

Castellano, J. (2008). Análisis de las posesiones de balón en fútbol: frecuencia, duración y transición. *Motricidad. European Journal of Human Movement, 21*, 189-207.

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. https://doi.org/10.2478/v10078-012-0015-7

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. https://doi.org/10.1080/02640414.2012.727455

Evangelos, B., Aristotelis, G., Ioannis, G., Stergios, K., & Foteini, A. (2014). Winners and losers in top level soccer. How do they differ? *Journal of Physical Education and Sport, 14*(3), 398-405. https://doi.org/10.7752/jpes.2014.03061

Gama, J., Dias, G., Couceiro, M., Sousa, T., & Vaz, V. (2016). Networks metrics and ball possession in professional football. *Complexity, 21*(S2), 342–354. https://doi.org/10.1002/cplx.21813

Goral, K. (2015). Passing success percentages and ball possession rates of successful teams in 2014 FIFA World Cup. *International Journal of Science Culture and Sport, 3*(1), 86-95. https://doi.org/10.14486/IJSCS239

Hoppe, M. W., Slomka, M., Baumgart, C., Weber, H., & Freiwald, J. (2015) Match running performance and success across a season in German Bundesliga soccer teams. *International Journal of Sports Medicine, 36*(7), 563-566. https://doi.org/10.1055/s-0034-1398578

Hughes, M. D., & Bartlett, R.M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences, 20*(10), 739-754. https://doi.org/10.1080/026404102320675602

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. https://doi.org/10.1080/24748668.2004.11868295

Kempe, M., Vogelbein, M., Memmert, D., & Nopp, S. (2014). Possession vs. direct play: evaluating tactical behavior in elite soccer. *International Journal of Sports Science, 4*(6A), 35-41. https://doi.org/10.5923/s.sports.201401.05

Lago, C., & Martín, R. (2007). Determinants of possession of the ball in soccer. *Journal of Sports Science, 25*(9), 969-974. https://doi.org/10.1080/02640410600944626

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*, 288-293.

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. https://doi.org/10.2478/v10078-010-0036-z

Liu, H., Yi, Q., Giménez, J., Gómez, M., & Lago-Peñas, C. (2015a). Performance profiles of football teams in the UEFA Champions League considering situational efficiency. *International Journal*

of Performance Analysis in Sport, 15(1), 371-390. https://doi.org/10.1080/24748668.2015.11868799

Liu, H., Gomez, M., Lago-Peñas, C., & Sampaio, J. (2015b). Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. *Journal of Sports Sciences, 33*(12), 1205-1213. https://doi.org/10.1080/02640414.2015.1022578

Moura, F. A., Martins, L. E.B., & Cunha, S. A. (2014). Analysis of football game-related statistics using multivariate techniques.

Journal of Sports Sciences, 32(20), 1881-1887. https://doi.org/10.1080/02640414.2013.853130

Parziale, E. J., & Yates, P. A. (2013). Keep the ball! The value of ball possession in soccer. *Reinvention: International Journal of Undergraduate Research, 6*(1), 1-24.

Rodrigues, V. A. O., Santos, E. P. A., Praça, G. M., Matias, C. J. A. S., & Greco, P. J. (2016). A influência da posse de bola na posição final das equipes do Campeonato Brasileiro Série A e B. *Revista Acta Brasileira do Movimento Humano, 6*(1), 16-26.