



## **Variables Associated with the Effectiveness of Ball Possession in At-Home Futsal Matches**

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### ABSTRACT

*International Journal of Exercise Science* 17(6): 916-928, 2024. This study aims to identify contextual situations (score, game time, the interaction between teammates and opponents, start and restart plays) that increase the odds ratio of maintenance of ball possession and scoring a goal. Twenty professional futsal players were evaluated in seven home official matches. The games were filmed to analyze the offensive actions. In total, 828 attacking plays were analyzed. The absence of defensive pressure from the opponent resulted in a greater odds ratio (OR) for loss of ball possession (OR = 1.7, 95% CI = 1.7 to 2.2), but also increased total effectiveness (OR = 6.5; 95%CI = 2.2 to 19.5). The received fouls did not increase the total effectiveness (OR = 0.2; 95%CI = 0.01 to 4.2;  $p = 0.40$ ). The court regions close to the opponent's goal area and areas where there was less defensive pressure had a higher frequency of goals ( $p < 0.05$ ). The results demonstrated that shooting close to opponents' areas and having no defensive pressure were the situations with increased odds of goal-scoring. Maintaining ball possession per se did not increase the OR of goal scoring, however situations when shootings were performed with low defensive pressure could increase chances of goal scoring.

**KEY WORDS:** Team sports, competitive behavior, social interaction

### INTRODUCTION

Offensive actions that result in a goal or maintenance of ball possession are considered effective ball possession situations (9, 20). The physical capacities and technical-tactical skills of the

athletes are modifiable factors that can be manipulated by coaches and team staff to establish successful situations in the game (16, 17). However, in addition to individual talent and skills, and the technical-tactical strategies of teams, contextual situations during play can increase or decrease the chances of keeping ball possession and scoring goals in team sports (9, 12). The contextual situations that should be evaluated in the performance of team games include the time of the game (7), game status (losing, drawing, or winning) (2, 4, 5, 7, 10), tactical organization (1, 7, 9), positioning on the court (1, 4, 10, 12), and interactions between teammates and attackers-opponents (1, 4, 7, 9, 11, 13). These are key points to support information about behaviors that contribute to the outcome of the game (1, 11, 13).

Contextual situations that may be associated with the effectiveness of ball possession in Futsal include ball possession time (8, 11, 20), number of passes (6, 9, 20), quality of opponents (9, 16), fouls (8), the score of the game (14, 15), the playing time (8, 14), the numerical superiority of one of the teams (due to a sending off or use of the goalkeeper)(8, 14, 15, 20), the ball possession ending zone (9, 18, 20), and the presence of opposing players performing defensive actions on the attacking player (9, 15, 18). However, studies have considered the effectiveness of ball possession in a binomial way, that is, with a goal or no goal (9, 20). Other studies evaluated score-balanced situations (1 point difference) (9) or situations in numerical player imbalance (8, 20). Thus, in a whole game situation with different game statuses, it has not been established what type of decisive plays could guarantee the maintenance of possession of the ball or increase the odds ratio of scoring a goal.

There are limitations in the analysis of the effectiveness of ball possession in Futsal in specific situations such as, for example, the use or not of the goalkeeper (20) or games with a balanced scoreboard (up to one goal difference) (9). Numerical superiority using the line goalkeeper strategy seems to be a factor that increases the chances of a goal (20). The situation that started the offensive play is also an important aspect for maintaining ball possession (partial effectiveness), as well as for organizing the strategy for the next offensive play. In this sense, approximately 89% of plays with ball possession start with transitions or interceptions of the ball or application of game rules (18). The beginning of plays in set pieces and counterattacks seems to increase the effectiveness of the plays (9). On the other hand, although most of the set-piece plays (side throws, corner kicks, free penalty kicks from the second penalty mark at 10 m, and free kicks against opponents) are events that can contribute to the effectiveness of ball possession, their contribution to greater chances of success in the outcome of the game has not been established.

Another contextual factor associated with the effectiveness of ball possession is the region of the field where the player shoots at the goal (11, 18, 20). The end of the offensive play in the goal area contributes to 35 to 73% of the goals scored in official matches (11, 18, 20). However, the chances of loss of ball possession when the players reach this region of the last touch of the ball are not clear. In addition, regions of the court where the team has been fouled or needs to take wingers may be considered strategic for approaching the penalty area or opponent's goal area, increasing the chances of a goal.

Other contextual aspects include playing time, the number of passes and players involved in plays, and defensive pressure (6, 8, 9, 15). However, these aspects have been investigated by a few studies and were not correlated with the maintenance of ball possession and game outcome (8, 20). These contextual situations were also evaluated in situations of the numerical superiority of the attacking team (8, 20).

Considering it is still not clear the effect of many common contextual variables on the effectiveness of ball possession, the objective of this study was to determine which common contextual factors during a game could influence the probability of scoring a goal or maintaining ball possession in home-advantage conditions.

## **METHODS**

### *Participants*

It is an observational study on the effect of game contextual variables on the effectiveness of ball possession of 20 Futsal players ( $26.0 \pm 4.8$  years,  $74.2 \pm 4.9$  kg, and  $1.76 \pm 0.04$  cm) in official matches, at home-advantage. Athletes from a professional team were monitored during the State Futsal Championship (1st division of the state of Paraná championship), and the National Futsal League (first national division) in 2019. The games were filmed and all plays with ball possession in attacking actions were analyzed. Players must be contracted by the team for the full season, be injury-free, and regularly participate in more than 80% of weekly training sessions. All players who participated in attacking plays were included in the analysis. The defensive plays and players who played exclusively in defensive plays were excluded from the analysis. Plays where it was not possible to identify the number of all players on the court were excluded from the analysis. The study procedures were approved by the Research Ethics Committee involving Human Beings of the State University of Londrina (protocol n. 3.389.340). Players and coaching staff were informed about the objectives and procedures of the study, and all players and coaching staff signed the Informed Consent Form. All procedures followed the recommendations of the Helsinki Declaration.

### *Protocol*

Analysis of the effectiveness of ball possession: 20 male adult Futsal players from a professional Futsal team were evaluated. To assess the plays with total (goal scoring) and partial effectiveness of ball possession (maintenance of ball possession), the games were filmed using two cameras (Hero 7 Silver, GoPro, San Mateo, USA) positioned on the sides of the field (side stands), capturing the total area of the court. The analysis of actions was performed by two researchers, previously trained and calibrated, with more than 10 years of experience in the area of training Futsal and Soccer players, with a kappa correlation coefficient  $> 0.95$  for intra- and inter-subject analysis. Disagreements between the observers' assessments were resolved by the assessment of a third researcher (Futsal coach).

Contextual variables were adapted from criteria described by Vicente-Vilas and Lago-Penãs (2016) and described in Table 1. Goalkeeper participation was computed as actions in which the

goalkeeper played as a regular field player, or the goalkeeper was replaced by a field player (5 vs. 4). Numerical dismissal occurred of both teams and represented the numerical advantage or disadvantage of the analyzed team. Defensive pressure was defined by the presence of one or more opponents guarding athletes with ball possession or shooting.

**Table 1.** Contextual game variables associated with the effectiveness of attacking actions.

Criteria	Classification and units
Score	Victory / Draw / Defeat
Match outcome	Advantage (2 goals or more) / Balanced / Disadvantage
Match status	(2 goals less)
Time	
Duration of ball possession	Seconds
Period	First/second period
Interactions between players	
Passes	Number of passes per play
Players	Number of players involved in passes per play.
Numerical dismissal	yes / no
Goalkeeper participation	yes / no
Interactions with opponents	
Defensive pressure on the shooting player	yes/no
Opponents foul	yes / no
Foul	yes / no
Numerical dismissal	yes / no
Goalkeeper participation	yes / no
Start and restart of play	Kick-off Kick in Goal clearance Corner kick Direct free kick Indirect free kick Ball transition
Ending zone	Region of the court where the last touch of the ball occurs (Figure 1).

The effectiveness of ball possession was established as the maintenance of ball possession at the end of the rally, with or without a goal (10). Different play outcomes of ball possession effectiveness were scored from zero (loss of ball possession) to 8 (goal) in arbitrary units. The effectiveness scale was established through a consensus of 20 professional Futsal coaches working in the National Futsal League or the first division of the state championships, in 2018-19, based on their perception of greater to lesser chances of scoring in offensive plays. Each play completion (effectiveness outcome) was assigned a score, as described below:

- Failure:
  - (0) loss of ball
- Partial effectiveness (maintenance of ball possession):
  - (1) Kick in, in the defensive field side, and goal clearance
  - (2) Kick in, in the attacking zones

- (3) Direct free kicks with the wall behind the 10-meter line
- (4) Corner kick
- (5) Direct free kick with a wall ahead of the 10-meter line
- (6) Direct free kick (cumulative fouls)
- (7) Penalty
- Total effectiveness:
  - (8) Goal.

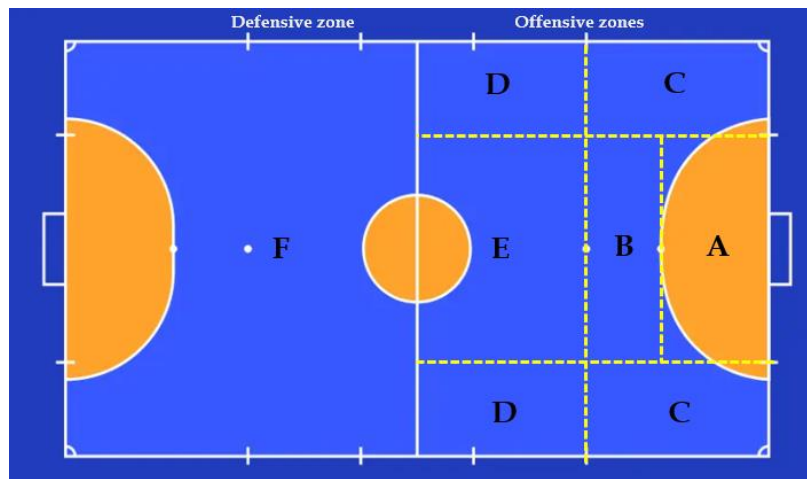


Figure 1. Ending zones.

### Statistical Analysis

The normal distribution of the data was evaluated using the Kolmogorov-Smirnov test. Parametric data are presented as mean and standard deviation and non-parametric data as median and interquartile range from 25 to 75%. Categorical data are reported in absolute frequency and percentages. Differences between parametric data were tested by the Student's t-test, one-way ANOVA test, and Tukey post hoc test. Non-parametric data were analyzed with the Mann-Whitney U test or Kruskal-Wallis test and Dunn post hoc test. Categorical data frequency differences were determined with the Chi-square test with Yates correction and the Odds ratio was presented with the 95% confidence interval. Differences between variables were considered significant if  $p < 0.05$ . Statistical analysis was performed in GraphPad Prisma 8.0 (GraphPad, La Jolla, USA). Statistical power was calculated *a posteriori* using G.Power 3.1.9.7.

## RESULTS

Seven non-consecutive matches were evaluated, with two defeats, two draws, and three victories. Three plays (0.3%) were excluded due to technical errors in recording images. Eight hundred and twenty-eight plays ( $118 \pm 10$  plays per game) with ball possession were analyzed. The effectiveness of ball possession is presented in Table 2. No play ended ensuring the start of the next play with a direct free kick (score 6). There were no differences ( $\chi^2 = 7.1$ ,  $p = 0.12$ ,  $1-\beta$  error = 1.00) in the frequency of plays with loss of ball possession, maintenance of ball possession, or goals in matches that ended in victory, draw, or defeat (Table 2). The match status

during play did not present a significant difference ( $\chi^2 = 8.3, p = 0.08, 1-\beta$  error = 0.60) in the distribution of effective actions (Table 2).

**Table 2.** Frequency of loss of ball possession (score 0), partial effectiveness for maintenance of ball possession (scores 1 to 7), total effectiveness for goal (score 8), game outcome, match status during play.

Score	Total <i>n</i> (%)	Game outcome			Match status during each play analysis		
		Defeat	Draw	Victory	Disadvantage	Balanced	Advantage
0	525 (63.4%)	167 (65.4%)	143 (58.3%)	215 (65.5%)	159 (61.1%)	219 (65.7%)	147 (62.5%)
1	20 (2.4%)	4 (1.5%)	3 (1.2%)	13 (3.9%)	6 (2.3%)	11 (3.3%)	3 (1.3%)
2	151 (18.2%)	48 (18.8%)	57 (23.2%)	46 (14%)	51 (19.6%)	51 (15.3%)	49 (20.8%)
3	34 (4.2%)	13 (5%)	5 (2%)	16 (4.9%)	9 (3.4%)	14 (4.2%)	11 (4.7%)
4	66 (8.0%)	19 (7.4%)	23 (9.4%)	24 (7.2%)	25 (9.6%)	22 (6.6%)	19 (8.1%)
5	6 (0.7%)	-	6 (2.4%)	-	5 (1.9%)	-	1 (0.4%)
7	2 (0.2%)	-	1 (0.4%)	1 (0.3%)	1 (0.4%)	1 (0.3%)	-
8	24 (2.9%)	4 (1.5%)	7 (2.8%)	13 (3.9%)	40 (1.4%)	15 (4.5%)	5 (2.1%)
Total	828 (100%)	255 (30.8%)	245 (29.6%)	328 (39.6%)	260 (31.4%)	333 (40.2%)	235 (28.3%)

0 = loss of ball possession; 1 = kick in in defensive area and goal clearance; 2 = kick in; 3 = free-kick with barriers behind the 10-meter line; 4 = corner kick; 5 = free-kick with barriers in front of the 10-meter line; 7 = penalty; 8 = goal.

No differences were observed in mean play duration with different effectiveness scores ( $p = 0.30, KS = 7.1, 1-\beta$  error = 1.00, Table 3). The ball possession effectiveness actions had a similar distribution between the first and second periods of the matches ( $\chi^2 = 1.2, p = 0.53, 1-\beta$  error = 0.82, Table 3).

Regarding interactions between teammates (Table 3), no differences were observed concerning the number of players involved in the passes ( $p = 0.20, F = 1.4, 1-\beta$  error = 0.22) and the median number of passes ( $p = 0.39, KS = 7.30; 1-\beta$  error = 0.17). However, a statistical power analysis was weak for these variables.

The frequency of defensive pressure was lower in plays that resulted in the loss of ball possession ( $\chi^2 = 36.5, p < 0.0001, 1-\beta$  error = 0.99, Table 4), resulting in a higher odds ratio (OR) of failure when there were no players on the opposing team blocking the attacking player (OR = 1.7, 95% CI = 1.7 to 2.2). The frequency of defensive pressure was also lower in situations that resulted in a goal ( $p = 0.0001; Fisher's$  exact test), with OR = 6.5 (95% CI = 2.2 to 19.5).

**Table 3.** Frequency of loss of ball possession (score 0), partial effectiveness for maintenance of ball possession (scores 1 to 7), total effectiveness for goal (score 8), duration of ball possession, period of the game, number of players involved in passes and number of passes per play.

	Total	Ball possession duration (s)	Game period		Number of players	Number of passes <sup>1</sup>
			First	Second		
0	525 (63.4%)	8.9 ± 7.4	258 (62.4%)	267 (64.3%)	2.8 ± 1.2	2 [1 - 4]
1	20 (2.4%)	9.7 ± 8.5	11 (2.6%)	9 (2.1%)	2.4 ± 1.1	1 [0,5 - 4]
2	151 (18.2%)	8.1 ± 6.7	70 (16.9%)	81 (19.5%)	2.7 ± 1.0	2 [1 - 4]
3	34 (4.2%)	9.1 ± 6.1	17 (4.1%)	17 (4.1%)	2.8 ± 1.2	2 [1 - 4]
4	66 (8.0%)	9.5 ± 8.1	40 (9.6%)	26 (6.3%)	2.8 ± 1.0	2 [1 - 4]
5	6 (0.7%)	9.5 ± 3.9	5 (1.2%)	1 (0.2%)	3.0 ± 1.4	3,5 [2 - 4]
7	2 (0.2%)	1 - 3 <sup>2</sup>	2 (0.5%)	-	2 - 3 <sup>2</sup>	-
8	24 (2.9%)	6.9 ± 7.1	10 (2.4%)	14 (3.7%)	2.2 ± 1.2	1 [1 -4]
Total	828 (100%)	8.6 ± 7.3	413 (49.9%)	415 (50.1%)	2.8 ± 1.1	2 [1 - 4]

0 = loss of ball possession; 1 = kick in in defensive area and goal clearance; 2 = kick in; 3 = free-kick with barriers behind the 10-meter line; 4 = corner kick; 5 = free-kick with barriers in front of the 10-meter line; 7 = penalty; 8 = goal. <sup>1</sup>Data expressed as medians and interquartile ranges from 25 to 75%.

Committed fouls were responsible for 17 (3.2%) of the losses of ball possession. Suffering fouls did not contribute to an increased odds ratio ( $p = 0.40$ , OR = 0.2; 95% CI = 0.01 to 4.2,  $1-\beta$  error = 1.00) of goal-scoring (Table 4).

Only one play (0.1%) had goalkeeper participation. Only three (0.4%) of the plays were numerically disadvantaged by the opponent and no attacking move was made in situations of numerical disadvantage by the analyzed team.

**Table 4.** Frequency of loss of ball possession (score 0), partial effectiveness (scores 1 to 7), total effectiveness with a goal (score 8), defensive pressure from the opponent, and fouls.

	Total	Defensive pressure		No foul	Fouls	
		Yes	No		Committed	Received
0	525 (63.4%)	266 (57.9%)	259 (70.2%) *	508 (66%)	17 (100%)	-
1	20 (2.4%)	10 (2.1%)	10 (2.7%)	20 (2.6%)	-	-
2	151 (18.2%)	103 (22%)	43 (13%)	149 (17.3%)	-	2 (4.8%)
3	34 (4.2%)	33 (7.2%)	1 (0.3%)	3 (0.4%)	-	31 (75.6%)
4	66 (8.0%)	35 (7.6%)	31 (8.4%)	66 (8.5%)	-	-
5	6 (0.7%)	6 (1.3%)	-	-	-	6 (14.3%)
7	2 (0.2%)	2 (0.4%)	-	-	-	2 (5%)
8	24 (2.9%)	4 (0.9%)	20 (5.4%) **	24 (2.5%)	-	-
Total	828 (100%)	459 (55.4%)	369 (44.6%)	769 (92.9%)	17 (2.1%)	41 (5%)

0 = loss of ball possession; 1 = kick in in defensive area and goal clearance; 2 = kick in; 3 = free kick with barriers behind the 10-meter line; 4 = corner kick; 5 = free kick with barriers ahead of the 10 meter line; 7 = penalty; 8 = goal. \* $p < 0.005$ , Chi squared test with Yates correction. \*\*  $p < 0.0005$ , Fisher’s exact test. <sup>1</sup>Data expressed as medians and interquartile ranges from 25 to 75%. <sup>2</sup>Values of the two plays resulted in a penalty.

Concerning restarting the ball in-game, the goal clearance presented a low odds ratio of scoring a goal (Table 5). No other action of restarting the ball in the game increased the effectiveness of ball possession (Table 5). Two penalties were recorded and resulted in goal scoring.

**Table 5.** Frequency and Odds Ratio of loss of ball possession (score 0), partial effectiveness (scores 1 to 7), and total effectiveness with a goal (score 8) after different start or restart play actions.

	Start or restart plays							Ball transition
	Total	Kick-off	Goal clearance	Kick in	Corner kick	DFK with wall behind 10-m	DFK with wall ahead 10-m	
0	525 (63.4%)	9 (69.2%)	81 (69.2%)	182 (61.9%)	42 (60.8%)	26 (76.5%)	3 (50%)	182 (68.1%)
1	20 (2.4%)	1 (7.7%)	9 (7.7%)	3 (1%)	1 (1.5%)	-	-	6 (2%)
2	151 (18.2%)	3 (23.1%)	12 (10.2%)	66 (22.4%)	9 (13%)	5 (14.8%)	1 (16.7%)	55 (18.7%)
3	34 (4.2%)	-	7 (6%)	10 (3.4%)	1 (1.5%)	-	-	16 (5.4%)
4	66 (8.0%)	-	7 (6%)	26 (8.8%)	10 (14.5%)	1 (2.9%)	2 (33.3%)	20 (6.8%)
5	6 (0.7%)	-	1 (0.9%)	2 (0.8%)	-	1 (2.9%)	-	2 (0.7%)
7	2 (0.2%)	-	-	-	2 (2.9%)	-	-	-
8	24 (2.9%)	-	-	5 (1.7%)	4 (5.8%)	1 (2.9%)	-	12 (4.1%)
Total	828 (100%)	13 (1.57%)	117 (14.3%)	294 (35.5%)	69 (8.3%)	34 (4.1%)	6 (0.7%)	293 (35.4%)
Loss of ball possession		OR = 1.3 (0.4 - 4.2), $p = 0.71$	OR = 1.3 (0.8 - 2.0), $p = 0.17$	OR = 0.90 (0.6 - 1.2), $p = 0.52$	OR = 0.89 (0.5 - 1.4), $p = 0.69$	OR = 1.91 (0.8 - 4.3), $p = 0.14$	OR = 0.57 (0.1 - 2.8), $p = 0.67$	OR = 1.0 (0.7 - 1.6), $p = 0.93$
Partial Effectiveness		OR = 0.87 (0.2 - 2.8), $p = 1.00$	OR = 0.85 (0.5 - 1.3), $p = 0.52$	OR = 1.2 (0.9 - 1.6), $p = 0.25$	OR = 0.98 (0.6 - 1.6), $p = 1.00$	OR = 0.49 (0.2 - 1.1), $p = 0.13$	OR = 1.9 (0.4 - 9.8), $p = 0.41$	OR = 0.85 (0.6 - 1.1), $p = 0.32$
Total Effectiveness		OR = 1.2 (0.07 - 21.6), $p = 1.00$	<b>OR = 0.11</b> <b>(0.009 - 1.7),</b> <b><math>p = 0.03</math></b>	OR = 0.46 (0.1 - 1.2), $p = 0.19$	OR = 2.27 (0.7 - 6.8), $p = 0.13$	OR = 1.0 (0.1 - 7.7), $p = 1.00$	OR = 2.5 (0.1 - 5.8), $p = 1.00$	OR = 1.8 (0.8 - 4.2), $p = 0.13$

0 = loss of ball possession; 1 = kick in in defensive area and goal clearance; 2 = kick in; 3 = free kick with barriers behind the 10-meter line; 4 = corner kick; 5 = free kick with barriers ahead of the 10-meter line; 7 = penalty; 8 = goal. DFK: direct free kick; OR = odds ratio. 95% CI = 95% confidence interval.



The positions that resulted in a significant odds ratio of goal were A, B, and D (Table 6). Zone A also presented a lesser chance of failure. The defensive field region (F) was the zone position with the highest frequency of defensive pressure ( $n = 350, 62.7\%$ ), followed by B ( $n = 30, 47.6\%$ ), C ( $n = 42, 50\%$ ), E ( $n = 18, 3.9\%$ ), A ( $n = 15, 3.2\%$ ), and D ( $n = 4, 0.8\%$ ).

**Table 6.** Frequency and Odds Ratio of loss of ball possession (score 0), partial effectiveness (scores 1 to 7), and total effectiveness with a goal (score 8) when plays finish in different ending zones.

	Ending zone						
	Total	A	B	C	D	E	F
0	525 (63.4%)	16 (3%)	37 (7%)	51 (9.7%)	13 (2.5%)	45 (8.7%)	363 (69.1%)
1	20 (2.4%)	-	-	-	-	2 (10%)	18 (90%)
2	151 (18.2%)	4 (2.6%)	3 (2%)	11 (7.8%)	4(2.3%)	10 (6.6%)	119 (79%)
3	34 (4.2%)	-	-	-	-	-	3 (100%)
4	66 (8.0%)	4 (6%)	15 (22.7%)	19 (22.8%)	2 (3%)	6 (9.1%)	20 (30.3%)
5	6 (0.7%)	-	1 (16.7%)	1 (16.7%)	-	-	4 (66.7%)
7	2 (0.2%)	2 (100%)	-	-	-	-	-
8	24 (2.9%)	9 (37.5%)	6 (25%)	2 (8.3%)	3 (12.5%)	4 (16.7%)	-
Total	828 (100%)	35 (4.2%)	62 (7.5%)	84 (10.1%)	22 (2.7%)	67 (8.1%)	558 (67.4%)
Loss of ball possession OR (95% CI) <i>p</i> -value		<b>OR = 0.46</b> <b>(0.2 - 0.9),</b> <b><i>p</i> = 0.03</b>	OR = 0.84 (0.5 - 1.4), <i>p</i> = 0.58	OR = 0.88 (0.5 - 1.4), <i>p</i> = 0.63	OR = 0.82 (0.3 - 1.9), <i>p</i> = 0.66	OR = 1.19 (0.7 - 2.0), <i>p</i> = 0.59	OR = 1.24 (0.9 - 1.6), <i>p</i> = 0.16
Partial Effectiveness (score1 - 7) OR (95% CI) <i>p</i> -value		OR = 0.77 (0.3 - 1.6), <i>p</i> = 0.58	OR = 0.85 (0.5 - 1.5), <i>p</i> = 0.67	OR = 1.13 (0.7 - 1.8), <i>p</i> = 0.63	OR = 1.20 (0.5 - 2.8), <i>p</i> = 0.66	OR = 0.83 (0.5 - 1.4), <i>p</i> = 0.59	OR = 0.80 (0.6 - 1.1), <i>p</i> = 0.16
Total Effectiveness (score 8) OR (95% CI) <i>p</i> -value		<b>OR = 17.9</b> <b>(7.2 - 44.8),</b> <b><i>p</i> &lt; 0.001</b>	<b>OR = 4.42</b> <b>(1.7 - 11.7),</b> <b><i>p</i> = 0.006</b>	OR = 0.80 (0.2 - 3.4), <i>p</i> = 1.00	<b>OR = 5.90</b> <b>(1.6 - 2.5),</b> <b><i>p</i> = 0.02</b>	OR = 2.35 (0.7 - 7.1), <i>p</i> = 0.12	-

0 = loss of ball possession; 1 = kick in in defensive area and goal clearance; 2 = kick in; 3 = free kick with barriers behind the 10-meter line; 4 = corner kick; 5 = free kick with barriers ahead of the 10 meter line; 7 = penalty; 8 = goal. OR: odds ratio. 95% CI: 95% confidence interval.

## DISCUSSION

Among the main contextual factors pointed out by different authors as influencing goal scoring (1, 3, 6, 8, 9, 14, 15, 18, 20), only defensive pressure and ending zone contributed to increasing the odds ratio of scoring a goal (total effectiveness) but not of maintaining ball possession

(partial effectiveness). Contrary to the study hypothesis, the frequency of plays that ended in the maintenance of ball possession was not higher in games that ended in victory. Moreover, there were no significant differences in interactions with teammates and opponents, duration of plays, and period of the game, with different scores on the effectiveness of ball possession.

A previous study estimated a lower failure rate of plays (50.4%) than the present study (63.4%)(9). However, the authors investigated the effectiveness of ball possessions during play-offs and in situations of balanced scores between teams, whereas the present study evaluated all plays in games during the classificatory phase. Moreover, only at-home matches were included due to the standardization of recording procedures and end zone marking. In this way, the absence of away games is a limitation of this study. It was observed that failure occurred in situations with a lower frequency of defensive pressure, suggesting that the majority of losses of ball possession may occur due to pass errors or interceptions. On the other hand, goals were scored more frequently in the absence of defensive pressure. This is in agreement with a previous study reporting increased effectiveness of ball possession when there was low defensive pressure (9, 20).

Regarding partial effectiveness of ball possession, neither the interaction with teammates (number of passes, players involved with passes, and play duration) nor opponents (match status and received fouls) presented differences in the frequency of effectiveness of ball possession scores. It has been reported that a low number of passes is associated with high effectivity in ball possession when there is a numerical advantage (20). On the other hand, other authors reported reduced goal scoring when plays have fewer than three passes (9). Moreover, faster attacks were reported to have lower effectiveness than longer attacks (8), in situations of numerical superiority of attacking teams. Our results suggest that in most of the plays, without numerical superiority, the mean number of passes and duration of play had no important influence on the total and partial effectiveness of ball possession.

Defensive fouls also did not significantly increase the frequency of maintenance of ball possession and the total effectiveness of ball possession in subsequent plays. This suggests that despite ball possession being mandatory to achieve goal scoring, there are no significant differences in the effectiveness odds of maintaining ball possession when receiving a foul or gaining ball possession from the opponent (by opponent's errors or ball transitions). A previous study demonstrated that more than three fouls from the opponent increased the effectiveness of ball possession and goal (8). However, the authors investigated a specific situation of 2-minute numerical inferiority of teams.

Except for the penalty, no other starting or restarting play actions presented significant odds of failure or maintenance of ball possession. Other authors have pointed out that most of the goals were scored due to set pieces, counterattacks, and positional attacks (1). Although we did not specifically evaluate the set pieces and positional attacks, they follow plays that started in goal clearance, kick-in, and corner kick. On the other hand, ball transitions were included in counterattacks. When these actions were considered in overall offensive actions, and not only in

those that resulted in goal score, none presented increased odds of the effectiveness of ball possession. This is in agreement with a previous study that found no significant influence of set pieces and counterattacks on the maintenance of ball possession (9).

The ending zone has been described as an important factor for goal scoring (8, 9, 18, 20). Only 2.9% of the actions ended with goal submission, but we can highlight that positions A and B had a high probability of total effectiveness, corroborating findings from other studies (9, 11, 18, 19). According to Sarmiento and collaborators (2016), approximately 73% of the occurrences of goals were identified from attempts that occurred in region A (ultra-offensive zone). However, the authors investigated only plays with goal-scoring (18), whereas the present study investigated overall offensive plays. Reaching zone A increased the chances of achieving a goal by more than 17 times compared to other regions of the court, despite the number of shots in this zone accounting for only 37% of goals. This value is close to that reported in the 2010 FIFA Futsal World Cup, where 35% of shots with goal-scoring occurred in the same zones reported in the present study (11). Although, zones A and B increased the odds of goal-scoring, maintaining the ball possession in these zones (except for penalty), did not increase the odds ratio of scoring a goal in next play. Finishes in zone D had the second-highest probability (after regions A and B) of achieving a goal. A probable explanation for this finding is related to the fact that zones A and B are considered finishing zones, while zone D is considered a creative zone (9), and for this reason, zone D presented lower defensive pressure.

The results of the present study bring insights into general contextual situations that can increase or decrease the odds ratio of scoring a goal in home competitions. In the present study, the athletes played in a more favorable situation, excluding the home-away effect on game outcome, and standardizing data sampling. However, caution should be taken in extrapolating results for situations in away-home games. Emphasizing possession might not be as effective in creating goal-scoring opportunities as previously hypothesized. The results suggest that positioning players in specific areas of the field that are statistically more favorable for taking shots may increase the odds ratio of scoring a goal. This could help coaches and athletes to train more effective strategies for shooting and defense. Future studies are necessary to investigate the effectiveness of ball possessions in home-away games, where other contextual situations are present, such as the absence of a crowd, sleep impairment, and fatigue. Another important issue to be addressed in future studies is the patterns of effectiveness of ball possessions in female athletes and different athletes' categories and competitive levels.

Despite the perception of coaches about different situations that could increase chances of goal effectiveness, we concluded that shooting from the ending zones was more important for goal scoring than the restarting ball in-game and maintenance of ball possession. The end zones A, B, and D resulted in significant increases in goal-scoring. None of the investigated contextual variables could explain the odds ratio of maintaining ball possession. Under most common situations of 5 vs. 5 players on the court, offensive actions should target shooting as close as possible to the opponent's goal, especially in opportunities with no opponent pressure.

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