











Relationship between the occurrence of cards, playing position and situational variables in starter and non-starter players in the Brazilian soccer first-division championship

original paper

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ABSTRACT

Purpose. To evaluate the moderating effect of the match starting status in the association of playing position and situational variables with the occurrence of punitive cards during Brazilian first-division soccer matches over three consecutive seasons.

Methods. The present study evaluated 1,140 matches in three seasons of the Brazilian first-division soccer championship (2018, 2019 and 2020). This is a descriptive correlational study with a case-control design.

Results. Over the three seasons, 5,490 cards were distributed. Match starting status moderated the association of the outcome with the playing position, current and final ranking position, season, match exposure time and minutes played. The starter's midfield players were more likely (OR: 1.244, 95% CI: 1.155 to 1.341) to receive a card and forward players were less likely (OR: 0.912, 95% CI: 0.830 to 1.003) to receive a card than the defenders. The starter's players were less likely to receive a card in the 2019 (OR: 0.889, 95% CI: 0.822 to 0.961) and 2020 (OR: 0.827, 95% CI: 0.764 to 0.896) seasons than in the 2018 season. Their (OR: 0.776, 95% CI: 0.532 to 1.140) and the non-starter's (OR: 0.491, 95% CI: 0.210 to 1.272) players were less likely to receive a card when the match ended with goal difference (GD) ≥ 2 goals between the two teams. The non-starter's (OR: 1.136, 95% CI: 0.872 to 1.478) players received more cards when exposed to 25–50% of the total playing time. The match location was not associated with the occurrence of cards.

Conclusions. The association of playing position and situational variables with the occurrence of cards is moderated by the players' starting status (starter and non-starter) in the Brazilian first-division soccer championship.

Key words: referees, warnings, substitutes, team sport, football

Introduction

The role of the referee is to ensure that players follow the rules of the game, in order to protect the integrity of the match and the safety of players [1]. Historically, the rules of soccer (football) have been adapted and have undergone several changes. The card system was created by Ken Aston, an English ex-referee, and introduced by the Federation International Football Association (FIFA) in the 1970 Mexico World Cup [2]. Yellow cards are shown to players as warnings for dangerous

plays, unsportsmanlike behaviour, accumulation of fouls or strategic rule-breaking [3], while red cards are shown for the accumulation of two yellow cards, or more serious offences, such as excessively reckless challenges or violent conduct [1].

Since the introduction of the Video Assistant Referee (VAR) technology [4], a lower number of yellow cards has been observed [5]. The application of punitive cards has also been associated with many other factors such as the final ranking in the league [6], nationality [7], importance of players in the team [8], crowd

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density [9], match location [6, 9], match-half [10], final match outcome [11], different refereeing styles [6], and referee height [12].

Cultural and socioeconomic idiosyncrasies also play a key role in explaining the occurrence of cards in a soccer (football) match. The number of cards applied to players in countries from Central America (Guatemala, Nicaragua, and El Salvador) and South America (Bolivia, Uruguay, Colombia, and Paraguay) is higher than that observed in European countries [13]. This finding seems to be partly related to differences in the gross domestic product (GDP), human development index (HDI), number of homicides, and corruption index among countries [13], suggesting that the geographic area where the country is located and the local culture can directly influence the number of cards distributed [13]. In particular, winning teams received fewer yellow cards than losing teams during the 2019 FIFA Women's World Cup [14]. This finding is in opposition to data obtained from the 2017 Africa Cup of Nations (AFCON) [11]. In the leading five football leagues in Europe, also known as the 'big five', visitors receive more cards than home teams [6]. A recent study has found similar results in the Brazilian soccer league, although the number of yellow cards decreased during the pandemic [15]. These data highlight that other variables need to be considered in the analysis in order to better understand which factors may affect the occurrence of cards during a soccer match. The current body of scientific literature on this research topic is mostly derived from European countries, which suggests the need for further studies on different leagues in the world to provide a more comprehensive understanding of other cultural contexts.

To date, the association between playing position and situational variables and the occurrence of cards during the Brazilian first-division soccer championship over different seasons is still unknown. Based on the findings in the top five European leagues, visitors are more likely to receive cards, well-ranked teams at the end of the competition receive fewer cards, while midfielders are the players that receive the highest number of cards [6]. This information could be of fundamental relevance to coaches and players. For example, coaches and technical staff can better inform their players, providing clear guidance regarding the specific situations and contexts of the match in which players may be more vulnerable to receiving a card. In parallel, these data could assist players to become more conscious of how they should regulate their communication and behaviour on the field according to the various situations and contexts of the match.

Recently, the number of official substitutions during a soccer match was changed from three to five [1]. Given the consistent differences reported in the literature between starters and non-starters [16], it is important to investigate whether the match starting status (i.e., starter and non-starter) can moderate the association of playing position and situational variables with the occurrence of cards. It is well known that non-starters spend less time on the field and execute a higher number of high-intensity efforts than their starter teammates [5, 16–17]. Therefore, non-starter players can be involved in stronger duels and tackles against their opponents, making these players theoretically more susceptible to receiving a card than the starter players. From an empirical perspective, non-starter players are also fresher on the field and therefore may be in a somewhat out-of-the-game mood, especially concerning the referee and player relationships. During their interventions to the referee team, these players may communicate or behave in an unacceptable manner regarding the limits established by the referee up to that point in the match.

Regarding the discussions above, the present study aimed to evaluate the moderating effect of the match starting status in the association of playing position and situational variables [i.e., match exposure time and minutes played, match location, goal difference, match outcome, and ranking position (current and final)] with the occurrence of cards during the Brazilian first-division soccer championship over three consecutive seasons (2018, 2019, and 2020).

Material and methods

Data collection

Public data available at the official website of the Brazilian Football Confederation (CBF) (<https://www.cbf.com.br/>) were used as the source for this study. The present study collected data regarding the number of cards (yellow and red) distributed during Brazilian first-division soccer matches over three different seasons (2018, 2019, and 2020), which involved the participation of 27 different teams, with 14 participating in the three seasons, 8 participating in two seasons and 5 participating in only one season. The Brazilian first-division championship refers to the main league in the country, in which 20 teams play against each other in a balanced schedule during a regular season (i.e., 38 matches per team). In a single season, 380 soccer matches were played. Thus, a total of 1,140 soccer matches were analysed over the three seasons, yielding a total of 1,319 different players participating in these

three seasons. Since the data are publicly available on the official CBF website, this study did not require ethical approval or consent forms.

Study design and data analysis

This is a descriptive correlational study with a case-control design. The open-access match reports available on the CBF website were used to determine players who received a yellow or red card during each official match of the three seasons investigated in this study, excluding cards applied after the match ended. For the purpose of this study, yellow and red cards were not discriminated in the analysis because the number of red cards was relatively low ($n = 280$; 5.1%). The occurrence of cards in each match was analysed according to the playing position (outfield players and goalkeepers included), match location (away and home), goal difference (GD: 0, +1, and + 2 goals), match outcome, current (i.e., ongoing championship) and final (after the end of the championship) team ranking position, season, match exposure time, and number of minutes played. The moderator variable (match starting status) was divided into two different groups: starters and non-starters. Further details are described in Table 1.

Data analysis

Statistical analysis was performed using the R software, version 4.0.5. In order to observe the prevalence

of receiving a card among each category of variables, binary logistic regression analysis (crude and adjusted) was used to estimate odds ratios (OR) with their respective confidence intervals (95% CI). This analysis was chosen for this study due to the binary nature of the dependent variable (card issuance – yes or no) and the inclusion of both continuous and categorical independent variables. It makes it possible to predict the probability of card issuance based on various independent variables and helps identify significant associations while controlling for confounding variables that may influence the outcome. Crude analysis was performed taking into account the dependent variable (if the player received a card or not) and each of the independent variables. Thus, it was possible to verify the crude odds for each association tested. In the adjusted analysis, all independent variables (playing position, match location, GD, match outcome, current and final ranking position, season, match exposure time, and minutes played) were simultaneously included. Furthermore, the Chi-square test was used for hypothesis testing. Association was considered statistically significant when it reached a significance level of 0.05 ($p < 0.05$) and there was no overlap of the 95% CI.

Ethical approval

The conducted research is not related to either human or animal use.

Table 1. Description of moderator, dependent, and independent variables analysed in this study

Type	Variable	Description
Moderator variable	Match starting status	If the player started the match as starter (i.e., starting line-up player) or non-starter (i.e., substitute who entered the match between the first minute after it started and the last minute of the match).
Dependent variable	Cards	If the player received a card (0 = no; 1 = yes)
Independent variable	Playing position	Defenders (includes goalkeepers, central defenders, and fullbacks), midfielders, and attackers.
	Match location	If the team played at home or as a visitor.
	Goal difference	If the goal difference (GD) in the final match outcome was 0 goals, +1 goal, or +2 goals or more.
	Match outcome	If the team won, drew, or lost the match.
	Current ranking	The team's current ranking position at the time the match was played: 1 st to 4 th ; 5 th to 10 th ; 11 th to 16 th ; and 17 th to 20 th .
	Final ranking	Final ranking position of the team in the championship at the end of the season after all matches have been played: 1 st to 4 th ; 5 th to 10 th ; 11 th to 16 th ; and 17 th to 20 th .
	Season	Year in which the card was applied: 2018, 2019, or 2020.
	Match exposure time	If the player played: 1–25%, 25–50%, 50–75%, or > 75% of the total playing time.
	Minutes played	Total playing time of each player during the match.

Results

Over the three seasons, 5,490 cards were distributed, of which 4,052 (73.8%) and 1,438 (26.2%) cards were due to reckless fouls and other offences, respectively. The majority of cards were applied when the match was tied (42.9%) and towards the end of the match (i.e., 60–90 min and additional time in the 2nd half) (51.9%). Figure 1 shows the frequency distribution of positions according to the match starting status, along with the distribution of cards for each playing position (1A: Starter $p < 0.001$; Non-starter $p < 0.001$; 1B: Starter $p < 0.001$; Non-starter $p < 0.001$).

Binary logistic regression analysis

The relative frequency of players who received a card was higher for starters (86.3%) than for non-starters (13.7%) (Table 2). In the crude analysis (Table 3), the association between the occurrence of a card and the independent variables (i.e., playing position, season, match exposure time, and minutes played) differed for the starters and non-starters. Compared to defender players, starter forward players were less likely (OR: -11%) to receive a card, while starter midfielder players were more likely to receive a card (OR: 22.4%). No

association was identified between the occurrence of a card and playing position for non-starter players. Starter players were less likely to receive a card during the 2019 (OR: -12%) and 2020 (OR: -19.6%) seasons than in the 2018 season, while the likelihood for non-starter players receiving a card occurred regardless of season. Regarding the match exposure time, while no association was observed for starter players, non-starter players who played for $\leq 25\%$ of the total playing time were less likely (OR: -65.3%) to receive a card than non-starter players who played more than three quarters of the match. The crude analysis showed that the likelihood of a non-starter player receiving a card increases by 24% for each ten minutes played. In addition, starter and non-starter players were less likely to receive a card when the GD between the two teams was ≥ 2 goals (OR_{Starter}: -16.1%; OR_{Non-starter}: -21%) than when the match finished tied. No significant association was observed between the occurrence of a card and the other remaining independent variables (i.e., match location, current and final ranking position, and match outcome) for both starter and non-starter players.

In the adjusted analysis (Table 4), the occurrence of a card was significantly associated only with match exposure time and minutes played for non-starter players. It was observed that non-starter players who played between 25% and 50% of the total playing time were more likely (OR: 129.5%) to receive a card than players in other match exposure time categories. In the adjusted analysis, the likelihood of a non-starter player receiving a card increased by 29% for each ten minutes played. For starter players, the occurrence of a card was significantly associated with the current ranking ($p = 0.041$), final ranking ($p = 0.007$), playing position ($p < 0.001$), and season ($p < 0.001$). During the championship, players from teams ranked from 11th and 20th at the time of the match were more likely (OR_{11th–16th}: 18.3%; OR_{17th–20th}: 18.3%) to receive a card than those from top-ranked teams (i.e., the first four positions). Conversely, when the final ranking position of the team was considered, players from teams that finished the championship between the 5th and 20th positions were less likely (OR_{5th–10th}: -14.1%; OR_{11th–15th}: -19.5%; OR_{16th–20th}: -16.6%) to receive a card than those from teams that finished at the top of the ranking (i.e., 1st to 4th position). Starter midfielder players were more likely (OR: 24.4%) to receive a card than starter defender players. Starter players were less likely to receive a card during the 2019 (OR: -11.1%) and 2020 (OR: -17.3%) seasons than in the 2018 season.

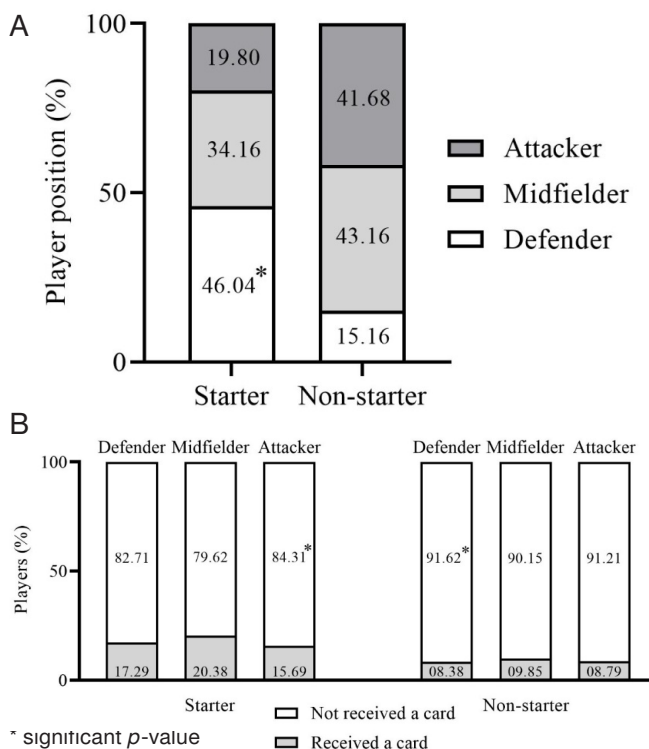


Figure 1. Application of cards according to playing position (A) and match starting status (B)

Table 2. Number of cards distributed according to match location, goal difference, current and final ranking position, playing position, match outcome, and season in starter and non-starter players

	Starter	Non-starter	Total	<i>p</i> -value
Match location	4,738 (86.30%)	752 (13.70%)	5,490 (100.00%)	0.804
Home	2,285 (41.62%)	359 (6.54%)	2,644 (48.16%)	
Away	2,453 (44.68%)	393 (7.16%)	2,846 (51.84%)	
Goal difference				0.769
0 goals	1,354 (24.66%)	221 (4.03%)	1,575 (28.69%)	
1 goal	2,143 (39.03%)	343 (6.25%)	2,486 (45.28%)	
2 goals or more	1,241 (22.60%)	188 (3.42%)	1,429 (26.03%)	
Current ranking				0.826
1 st to 4 th	996 (18.14%)	164 (2.99%)	1,160 (21.13%)	
5 th to 10 th	1,340 (24.41%)	213 (3.88%)	1,553 (28.29%)	
11 th to 16 th	1,448 (26.38%)	218 (3.97%)	1,666 (30.35%)	
17 th to 20 th	954 (17.38%)	157 (2.86%)	1,111 (20.24%)	
Final ranking				0.363
1 st to 4 th	962 (17.52%)	140 (2.55%)	1,102 (20.07%)	
5 th to 10 th	1,402 (25.54%)	224 (4.08%)	1,626 (29.62%)	
11 th to 16 th	1,402 (25.54%)	220 (4.01%)	1,622 (29.54%)	
17 th to 20 th	932 (16.98%)	168 (3.06%)	1,100 (20.04%)	
Playing position				< 0.001 *
Defender	2,101 (38.27%)	105 (1.91%)	2,206 (40.18%)	
Midfielder	1,830 (33.33%)	345 (6.28%)	2,175 (39.62%)	
Attacker	807 (14.70%)	302 (5.50%)	1,109 (20.20%)	
Match outcome				< 0.735
Loss	1,789 (32.59%)	291 (5.30%)	2,080 (37.89%)	
Draw	1,343 (24.46%)	217 (3.95%)	1,560 (28.42%)	
Win	1,606 (29.25%)	244 (4.44%)	1,850 (33.70%)	
Season				< 0.001 *
2018	1,707 (31.09%)	230 (4.19%)	1,937 (35.28%)	
2019	1,569 (28.58%)	216 (3.93%)	1,785 (32.51%)	
2020	1,462 (26.63%)	306 (5.57%)	1,768 (32.20%)	
Match exposure time				< 0.001 *
> 75%	3,920 (71.40%)	16 (0.29%)	3,936 (71.69%)	
50–75%	580 (10.56%)	134 (2.44%)	714 (13.01%)	
25–50%	214 (3.90%)	346 (6.30%)	560 (10.20%)	
1–25%	24 (0.44%)	256 (4.66%)	280 (5.10%)	

* significant *p*-value

Discussion

The current study examined the moderating effect of match starting status on the association of playing position and situational variables with the occurrence of cards during matches of the Brazilian first-division soccer championship over three full seasons (2018, 2019, and 2020). The main findings were: (i) match starting status moderated the association between outcome (i.e., occurrence of a card) and playing position, current and final ranking position, season, match exposure time, and minutes played; (ii) starter mid-

field players were more likely to receive a card and starter forward players were less likely to receive a card than starter defenders; (iii) starter players were less likely to receive a card in the 2019 and 2020 seasons than in the 2018 season; (iv) starter and non-starter players were less likely to receive a card when the match ended with $GD \geq 2$ goals between the two teams than when GD was zero; and (v) the match location was not associated with the occurrence of a card.

Our data showed that the occurrence of cards was relatively higher in starter (86.3%) than in non-starter (13.7%) players. This is likely related to the longer time

Table 3. Crude regression model examining the association between the occurrence of cards, playing position, and situational variables according to the player's starting status (starters and non-starters).

Values are presented as odds ratio and 95% confidence interval (95% CI)

	Starter			Non-starter		
	Crude OR (95% CI)		<i>p</i> -value	Crude OR (95% CI)		<i>p</i> -value
Match location						
Home	1			1		
Away	1.060	(0.994;1.131)	0.073	1.081	(0.929;1.260)	0.314
Goal difference						
0 goals	1			1		
1 goal	1.035	(0.958;1.118)	< 0.001 *	1.017	(0.849;1.221)	< 0.018*
≥ 2 goals	0.839	(0.769;0.915)		0.790	(0.642;0.971)	
Current ranking						
1 st to 4 th	1			1		
5 th to 10 th	1.026	(0.935;1.125)	0.654	0.951	(0.766;1.182)	0.690
11 th to 16 th	1.053	(0.961;1.154)		0.914	(0.737;1.136)	
17 th to 20 th	1.055	(0.954;1.166)		1.036	(0.821;1.308)	
Final ranking						
1 st to 4 th	1			1		
5 th to 10 th	0.954	(0.870;1.046)	0.510	1.062	(0.850;1.332)	0.525
11 th to 16 th	0.937	(0.854;1.028)		1.019	(0.815;1.279)	
17 th to 20 th	0.983	(0.889;1.087)		1.176	(0.925;1.497)	
Playing position						
Defender	1			1		
Midfielder	1.224	(1.140;1.315)	< 0.001 *	1.195	(0.950;1.514)	0.183
Attacker	0.890	(0.813;0.974)		1.053	(0.833;1.339)	
Match outcome						
Loss	1			1		
Draw	1.007	(0.928;1.091)	0.086	0.980	(0.810;1.182)	0.133
Win	0.929	(0.861;1.003)		0.842	(0.703;1.007)	
Season						
2018	1			1		
2019	0.880	(0.814;0.951)	< 0.001 *	0.912	(0.747;1.113)	0.361
2020	0.814	(0.752;0.881)		0.876	(0.731;1.052)	
Match Exposure Time						
75–100%	1			1		
50–75%	0.962	(0.868;1.064)	0.703	0.874	(0.523;1.537)	< 0.001 *
25–50%	1.006	(0.854;1.179)		0.679	(0.415;1.173)	
1–25%	1.158	(0.833;1.578)		0.347	(0.212;0.602)	
Minutes played	1.001	(0.999;1.003)	0.478	1.024	(1.020;1.029)	< 0.001 *

raw analysis significance $p < 0.2$

significance adjusted analysis $p < 0.05$

* significant p -value

OR – Odds Ratio

Table 4. Adjusted regression model examining the association between the occurrence of cards, playing position, and situational variables according to the player's starting status (starter's and non-starter's).

Values are presented as odds ratio and 95% confidence interval (95% CI)

	Starter			Non-starter		
	Adjusted OR* (95% CI)		<i>p</i> -value	Adjusted OR* (95% CI)		<i>p</i> -value
Match location						
Home	1		0.216	1		0.491
Away	1.044	(0.975;1.117)		1.058	(0.902;1.241)	
Goal difference						
0 goals	1		< 0.001 *	1		0.024*
1 goal	0.958	(0.657;1.406)		0.620	(0.266;1.605)	
≥ 2 goals	0.776	(0.532;1.140)		0.491	(0.210;1.272)	
Current ranking						
1 st to 4 th	1		0.041 *	1		0.660
5 th to 10 th	1.116	(0.999;1.246)		0.885	(0.681;1.152)	
11 th to 16 th	1.183	(1.050;1.333)		0.834	(0.631;1.106)	
17 th to 20 th	1.183	(1.031;1.358)		0.878	(0.639;1.209)	
Final ranking						
1 st to 4 th	1		0.007*	1		0.812
5 th to 10 th	0.859	(0.768;0.962)		1.112	(0.845;1.467)	
11 th to 16 th	0.805	(0.712;0.909)		1.080	(0.803;1.456)	
17 th to 20 th	0.834	(0.724;0.962)		1.165	(0.831;1.631)	
Playing position						
Defender	1		< 0.001 *	1		0.057
Midfielder	1.244	(1.155;1.341)		1.284	(1.014;1.638)	
Attacker	0.912	(0.830;1.003)		1.100	(0.866;1.408)	
Match outcome						
Loss	1		0.165	1		0.568
Draw	0.888	(0.609;1.303)		0.607	(0.260;1.574)	
Win	0.925	(0.851;1.005)		0.978	(0.803;1.190)	
Season						
2018	1		< 0.001 *	1		0.381
2019	0.889	(0.822;0.961)		0.871	(0.712;1.066)	
2020	0.827	(0.764;0.896)		0.907	(0.755;1.091)	
Match exposure time						
75–100%	1		0.470	1		0.006*
50–75%	1.030	(0.878;1.208)		1.686	(0.920;3.233)	
25–50%	1.136	(0.872;1.478)		2.295	(1.110;4.960)	
1–25%	1.309	(0.904;1.864)		1.983	(0.818;5.015)	
Minutes played	1.003	(0.999;1.007)	0.184	1.029	(1.018;1.042)	< 0.001 *

* The model was adjusted for match location, goal difference, current and final ranking position, playing position, match outcome, season, match exposure time, and minutes played.

OR – Odds Ratio

that starter players spend on the field compared to their non-starter teammates. Considering these differences, the association between the occurrence of cards and independent variables was analysed in a stratified manner according to the match starting status (starters and non-starters).

A novel finding of this study was that the association between the occurrence of a card and playing position was moderated by the match starting status. Starter midfield players were more likely to receive a card than defenders, whereas forward players were less likely to receive a card than defenders. Our findings partly agree with data reported by Lussier et al. [18], in which forward players also received fewer cards than defenders. In contrast to our results, no significant difference was reported between midfielders and defenders for the number of cards received in the latter study cited [18]. The greater number of midfielders and defenders on the field could explain the lower likelihood of forward players receiving a card. In addition, the higher occurrence of cards for midfield players may be related to the fact that these players exhibited a higher number of fouls [19], mainly because they play in a region of the field in which many of the offensive and defensive actions are elaborated and in certain circumstances are stopped by means of a foul to prevent the attacking team's field progression.

Another relevant finding in our study is that non-starter players who played between 25–50% of the match were more likely to receive a card. Considering that most substitutions occurred after halftime or between 60 and 85 minutes of the match [16, 20], this finding suggests that players who entered the match at half-time and between 46 and 70 minutes were more vulnerable to receiving a card. This is likely related to three different aspects. First, non-starter players are generally introduced in the second half of the match, which is characterised by an increased occurrence of goal scoring [20] and a higher frequency of card distribution than the first half [10]. Second, it is well known that non-starter players perform more runs at high intensity [21–22], cover longer sprinting distances, and perform a higher number of sprints [17] than starter players. In particular, central midfielders, when introduced as substitutes, also accumulate higher distances at high-intensity when compared to an identical time period in which they completed a full match [22]. This higher game intensity, as observed for midfielders, could translate into stronger duels and tackles that could also result in reckless fouls and, in turn, a card being applied. In our study, the adjusted model regression indicated that non-starter midfielders were more likely to receive a card than non-starter defenders

(OR: 1.284; 95% CI: 1.014 to 1.638), although it should be observed that the p-value was close to statistical significance ($p = 0.057$). Third, as non-starter players are fresher than their starter peers when they are introduced into the match, they may show some unexpected behaviours regarding the game mood because they do not yet fully understand the limits set by the referee up to that point in the game.

It was also verified that the occurrence of cards was more frequent when the match result was a draw (i.e., GD was zero). Match running performance data derived from Brazilian soccer championships demonstrated that high-intensity running [23] and sprinting distances [24] were higher in matches that ended in a draw. The score balance during the match can result in a greater need to perform a higher number of high-intensity running and sprinting efforts to create more opportunities to score a goal and win the match. However, more intense and balanced matches may also be accompanied by a higher incidence of reckless plays and violent conduct, which could lead to greater card application in draw matches. In fact, while some studies found a higher number of fouls after drawing matches [11, 14], others did not [26]. Moreover, it has also been shown that more fouls are committed and yellow cards distributed during the knockout stage than in group-stage matches [26]. It could be expected that more balanced matches (i.e., facing high-error, similar-level opponents) resulted in more aggressive defensive actions to prevent the opponent from scoring a goal [26]. A recent study showed that wide midfield players committed more fouls in knockout stage matches [25], which is probably related to the tactical role of these players during the defensive pressure in order to regain the ball possession for their team [26].

Regarding the association between the occurrence of cards and competitive seasons, our results revealed that the occurrence of cards decreased from the 2018 season to the 2019 and 2020 seasons. This result can be attributed to the implementation of the VAR technology. This tool was only introduced from the 2019 season in the Brazilian first-division soccer championship. It is likely that players stopped committing certain fouls and unfair play actions in matches from 2019 onwards, becoming more cautious in order to avoid being checked by VAR [5]. Supporting our findings, a recent study analysed 1024 matches from the German (Bundesliga) and Italian (Serie A) first-division league and also demonstrated a drop in the number of off-sides (Bundesliga), fouls (Serie A), and yellow cards (Bundesliga and Serie A) in matches in which the VAR technology was available [5]. Additionally, the 2020 season was unique in that the Covid-19-induced empty

stadiums negated the home-field advantage, which may also have resulted in fewer fouls and, in turn, fewer cards distributed. For instance, Goumas [9] showed a higher level of bias in favour of home teams due to high crowd density. These results suggest that the absence of spectators caused by the COVID-19 pandemic may have influenced the foul marking bias and card application. The possibility of less intense games (due to the long training disruption caused by the COVID-19 pandemic) in the 2020 season should also not be ruled out, even with the implementation of the fourth and fifth substitution [1], which in turn may also have resulted in a lower number of rough plays and reckless actions. However, Leitner and Richlan [28] showed that the occurrence of cards in games without spectators during the COVID-19 pandemic (2019/20 season) was significantly increased compared to games with spectators (2018/19 season) in the main European leagues. These results contradict the findings of the current research, thus leading to the belief of the existence of cultural differences that should be taken into account [29]. It is interesting to observe that matches with or without VAR technology and spectators did not influence the occurrence of cards for non-starter players. Although substitutes received an increased number of cards from 2018 to 2020, an increase in the number of substitutions was also observed. Thus, the likelihood of a non-starter player receiving a card remained similar across the seasons.

The final ranking in the Brazilian first-division soccer championship presented a significant association with the occurrence of cards. Top-ranked teams received more cards than bottom-ranked teams. Contrary to our data, Sapp et al. [6] pointed out that in the five major European leagues, the more cards received, the worse the team's ranking at the end of the championship. When the current ranking was considered, teams that started the match at the bottom of the ranking were more likely to receive cards. Collectively, these results show how cultural differences can influence the marking of fouls and unsportsmanlike conduct [6, 29].

Unlike previous studies [6, 8], the match location showed no association with the occurrence of a card when the other situational variables were controlled. This finding may suggest that the advantage of home teams has been decreasing over time.

From a practical perspective, our data could help coaches and technical staff to better understand how the playing position and situational variables influence the occurrence of a card in line with the player's starting status (starter and non-starter). This information can be used by coaches to help develop the be-

havioural and emotional skills of their players to avoid unnecessary fouls and yellow and red cards because these variables are related to competitive failure [30]. Referees can also obtain relevant practical information for their preparation and for interventions during the match. For example, referees could provide more preventive feedback to players in duels for the ball in match draw situations in order to restrain reckless actions and ensure player physical integrity. Some limitations of this study can be highlighted, such as the 2020 season not having the presence of spectators, the fact that only one competition in a single country was analysed, the number of foreign players was not accounted for, as well as the playing style of teams and coaches. Additionally, the number of fouls for each team was not counted. Another possible limitation refers to changes in team rankings between years, even though 14 teams remained the same.

Conclusions

The study findings elucidate substantial associations among the investigated variables, including playing position, goal difference, current and final ranking, and match exposure duration, with regard to the probability of incurring punitive cards among professional football players. Conversely, no significant correlation was observed in relation to match location or final result. These outcomes imply that the application of cards is subject to the influence of contextual and situational factors during a football match, emphasising the necessity of considering such factors when formulating the strategic approach of a football team throughout the season.

Disclosure statement

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Conflict of interest

The authors state no conflict of interest.

References

1. FIFA. Soccer Rules 2020/2021 [in Portuguese]. Rio de Janeiro: Manoel Serapião Filho; 2020.
2. Červený J, van Ours JC, van Tuijl MA. Effects of a red card on goal-scoring in World Cup football matches. *Empir Econ*. 2018;55:883–903; doi: 10.1007/s00181-017-1287-5.
3. Greve HR, Rudi N, Walvekar A. Strategic rule breaking: time wasting to win soccer games. *PLoS One*. 2019; 14(12):e0224150; doi: 10.1371/journal.pone.0224150

4. IFAB. Laws of the game. 2022. Available from: <https://www.theifab.com/laws/latest/video-assistant-referee-var-protocol> [28.12.2022].
5. Lago-Peñas C, Rey E, Kalén A. How Does Video Assistant Referee (VAR) modify the game in elite soccer? *Int J Perform Anal Sport*. 2019;19(4):646–653; doi: 10.1080/24748668.2019.1646521.
6. Sapp RM, Spangenburg EE, Hagberg JM. Trends in Aggressive play and refereeing among the top five European soccer leagues. *J Sports Sci*. 2018;36(12):1346–54; doi: 10.1080/02640414.2017.1377911.
7. Pope BR, Pope NG. Own-nationality bias: Evidence from UEFA champions league football referees. *Econ Inq*. 2015;53(2):1292–1304; doi: 10.1111/ecin.12180.
8. Gómez MÁ, Lago C, Gómez MT, Furley P. Analysis of elite soccer players' performance before and after signing a new contract. *PLoS One*. 2019;14(1):e0211058; doi: 10.1371/journal.pone.0211058.
9. Goumas C. Home advantage and referee bias in European football. *Eur J Sport Sci*. 2014;14(s1):243–249; doi: 10.1080/17461391.2012.686062.
10. Chiminazzo J, Mascara D, del Vecchio F. Descriptive study of the distribution of goals, fouls and cards in Campeonato Paulista 2008 – Série A1 [in Portuguese]. *Rev Bras Futsal Futeb*. 2013;5(15):80–87.
11. Kubayi A, Toriola A. Match performance indicators that discriminated between winning, drawing and losing teams in the 2017 AFCON Soccer Championship. *J Hum Kinet*. 2020;72:215–221; doi: 10.2478/hukin-2019-0108.
12. Mccarrick D, Brewer G, Lyons M, Pollet TV, Neave N. referee height influences decision making in British Football Leagues. *BMC Psychol*. 2020;8:4; doi: 10.1186/s40359-020-0370-4.
13. Poli R, Ravenel L, BESSON R. Global study of penalty cards in professional football. CIES Football Observatory Monthly Report. 2022;57. Available from: <https://www.football-observatory.com/IMG/sites/mr/mr57/en/> [03.12.2022].
14. Kubayi A, Larkin P. Technical performance of soccer teams according to match outcome at the 2019 FIFA Women's World Cup. *Int J Perform Anal Sport*. 2020;20(5):908–916; doi: 10.1080/24748668.2020.1809320.
15. Couto BP, Sayers MGL. Crowd social pressure in the Brazilian soccer league: testing home advantage and referees' bias during the COVID-19 pandemic. *Int J Sport Exerc Psychol*. 2023;21(4):673–688; doi: 10.1080/1612197X.2022.2084763.
16. Hills SP, Barwood MJ, Radcliffe JN, Cooke CB, Kilduff LP, Cook CJ, et al. Profiling the responses of soccer substitutes: a review of current literature. *Sports Med*. 2018;48(10):2255–2269; doi: 10.1007/s40279-018-0962-9.
17. Dalen T, Lorås H. Monitoring training and match physical load in junior soccer players: starters versus substitutes. *Sports*. 2019;7(3):70; doi: 10.3390/sports7030070.
18. Lussier J, Kim JW, Magnusen MJ, Kim KT. Card collection: an examination of whether yellow and red cards affect base salary under Major League Soccer's Salary Cap. *Int J Sports Sci Coach*. 2022;17(1):161–168; doi: 10.1177/17479541211011294.
19. De Luca G, Schokkaert J, Swinnen J. Cultural differences, assimilation, and behavior: player nationality and penalties in football. *J Sports Econom*. 2015;16(5):508–530; doi: 10.1177/1527002513495876.
20. De Moraes GA, Soares VN, Chiminazzo JGC. Temporal analysis of goals scored in futsal: a comparison of two models. *Hum Mov*. 2022;23(4):63–9; doi: 10.5114/hm.2022.108319.
21. Bradley PS, Lago-Peñas C, Rey E. Evaluation of the match performances of substitution players in elite soccer. *Int J Sports Physiol Perform*. 2014;9(3):415–424; doi: 10.1123/IJSP.2013-0304.
22. BRADLEY PS, NOAKES TD. Match running performance fluctuations in elite soccer: indicative of fatigue, pacing or situational influences? *J Sports Sci*. 2013;31(15):1627–1638; doi: 10.1080/02640414.2013.796062.
23. Aquino R, Carling C, Palucci Vieira LH, Martins G, Jabor G, Machado J, et al. Influence of situational variables, team formation, and playing position on match running performance and social network analysis in Brazilian professional soccer players. *J Strength Cond Res*. 2020;34(3):808–817; doi: 10.1519/JSC.0000000000002725.
24. Augusto D, Brito J, Aquino R, Figueiredo P, Eiras F, Tannure M, et al. Contextual variables affect running performance in professional soccer players: a brief report. *Front Sports Act Living*. 2021;3; doi: 10.3389/fspor.2021.778813.
25. Yi Q, Yang J, Wang X, Gai Y, Gómez-Ruano MÁ. Interactive effects of situational variables regarding teams' technical performance in the UEFA Champions League. *Front Psychol*. 2022;13; doi: 10.3389/fpsyg.2022.781376.
26. Yi Q, Gómez-Ruano MÁ, Liu H, Zhang S, Gao B, Wunderlich F, et al. Evaluation of the technical performance of football players in the UEFA Champions League. *Int J Environ Res Public Health*. 2020;17(2):604; doi: 10.3390/ijerph17020604.
27. Almeida C, Ferreira AP, Volossovitch A. Effects of match location, match status and quality of opposition on regaining possession in UEFA Champions League. *J Hum Kinet*. 2014;41:203–214; doi: 10.2478/hukin-2014-0048.
28. Leitner MC, Richlan F. No Fans–no pressure: referees in professional football during the COVID-19 pandemic. *Front Sports Act Living*. 2021;3; doi.org/10.3389/fspor.2021.720488.
29. Webb T, Dicks M, Thelwell R, Kamp JVD, Rix-Lievre G. An analysis of soccer referee experiences in France and the Netherlands: abuse, conflict, and level of support. *Sport Manage Rev*. 2020;23(1):52–65; doi: 10.1016/j.smr.2019.03.003.
30. Almeida C. What Performance-related variables best differentiate between eliminated and qualified teams for the knockout phase of UEFA Champions League? *Sport Perform Sci Rep*. 2018;1.