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Home Advantage in Football: Exploring Its Effect on Individual Performance

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Abstract: This study aimed to examine how playing at home affects individual football performance in the top five European leagues (LaLiga, Bundesliga, Serie A, Premier League, and Ligue 1) using offensive and defensive statistics. A secondary goal was to determine if these performance differences vary by field position. Offensive variables (season goals, assists, and key passes per game) and defensive variables (tackles, interceptions, and fouls per game) were analysed over eight seasons for 4337 players. Significant differences were found between home and away matches, particularly in goals ($p < 0.001$), assists ($p < 0.001$), and key passes ($p < 0.001$), all of which were higher at home. Defensive metrics like interceptions and fouls showed no significant differences, though tackles were higher away ($p = 0.013$). A positional analysis revealed that forwards and midfielders had significantly more goals ($p < 0.001$ for both) and assists ($p = 0.008$ for forwards, $p = 0.029$ for midfielders) at home. Defenders also had significantly more goals ($p < 0.001$) and assists ($p < 0.001$), while committing fewer fouls at home ($p = 0.005$). These findings suggest that playing at home significantly boosts individual performance, especially in offensive metrics. Coaches should adjust strategies based on if the match is at home or away, while considering individual player strengths and positions.

Keywords: home advantage; football; offensive; defensive; individual performance

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1. Introduction

The concept of home advantage (HA) in football has been extensively studied and documented in the scientific literature, with the first study published in 1977 [1]. Over the past few decades, interest in this area has grown significantly. Numerous studies in football have analysed the influence of playing at home or away in top-tier competitions, with the Premier League [2], La Liga, Ligue 1, Bundesliga, and Serie A standing out as the most prominent [3–6].

Pollard and Pollard initially defined HA as "the number of points won by the home team expressed as a percentage of all points obtained in matches" [7], a method later adopted in various studies [8]. However, Pollard and Gómez highlighted the challenges of calculating HA based on points or goals for individual teams, which necessitated adjustments, such as individualizing HA values for each team and accounting for team quality [9]. Later, Goumas refined the model by analysing UEFA Champions League teams

over 10 seasons (2003/04 to 2012/13), introducing the correlation of HA (independent of other teams' HA) with "away disadvantage" [10]. Although isolating the impact of each factor is challenging, several variables have been identified as potentially influencing HA, including crowd support, travel distance, familiarity with the stadium, referee decisions, territoriality, tactical choices, rule changes, and psychological factors. These variables are interrelated and often interact in complex ways [3,9,11].

Recent studies have found that the HA effect is more pronounced in sports with higher levels of physical contact, mainly due to crowd influence, which puts pressure on both the team and referees. Additionally, research has shown that HA is influenced by the league level [2,4,5,12]. A possible explanation is the higher attendance of supporters in top leagues compared to lower divisions [2,13–15]. As previously concluded, Inan attributed a significant impact to crowd support and stadium capacity in the five major European soccer leagues (Bundesliga, La Liga, Ligue 1, Premier League, and Serie A) between 2014 and 2019 [3]. Home teams performed particularly well in the Bundesliga, securing 70.45% of contested points (863 wins or draws). In La Liga and Ligue 1, the percentages rose to 71.65% and 71.51%, respectively. In the Premier League and Serie A, the percentages were 69.67% and 69.07%.

The influence of fans on all aspects of a match (home team, away team, referees, etc.) became especially evident during the COVID-19 restrictions, when games were played without fans, reducing HA to a minimum or even eliminating it, according to some authors [16–19]. Recent evidence points to referee decisions as the primary explanation for the HA effect [13]. One of the reasons HA decreased during COVID-19 was the lack of crowd influence on referees [20,21]. A study analysing the cognitive behaviour from a neuroscientific perspective found that referee experience influenced decision-making, as they sought to avoid negative feedback and pursue the "dopamine reward" [21].

Similarly, refereeing bias has been observed in yellow and red card distribution. In a study of European competitions (UEFA Champions League and UEFA Europa League) during the 2009–2010 and 2011–2012 seasons. Goumas found that away teams received 25% more yellow cards than home teams in the Champions League and 10% more in the Europa League [22]. The study concluded that the bias in favour of home teams in the Champions League was primarily due to larger crowd sizes. Boyko et al. analysed the goals, yellow cards (home = 1.1, away = 1.6), red cards (home expulsions = 0.06, away expulsions = 0.09), and penalties (home = 0.1, away = 0.05) in the Premier League, concluding that referees granted a greater advantage to home teams [23].

Beyond crowd influence and refereeing decisions, other contextual factors contribute to HA. Location, distance, and altitude at which matches are played can also influence the HA effect. Although travel times have decreased due to advancements in transportation [24], a study of the Brazilian league observed a greater HA effect in teams from the north and south compared to those from central regions, possibly due to the effects of travel [11]. Altitude can also be a significant factor, as changes in atmospheric pressure and reduced oxygen levels impact performance [13,25]. Goumas previously concluded that teams from larger cities experience less HA due to shorter travel distances and the similarity of local field conditions (e.g., weather, altitude, and the presence of away supporters) [10].

Other factors influencing the magnitude of HA include kit colour, as teams wearing red tend to be more successful in competition, although no significant advantage is observed when playing at home [8]. Additionally, team skill and quality play a role, with higher-ranked UEFA teams, better standings, and more points associated with a greater HA effect [12].

While HA has been extensively studied at the collective level, there is a lack of research analysing HA at the individual level, as well as a limited understanding of how external

factors influence individual player performance [26]. From a psychological perspective, anxiety and lack of confidence, primarily experienced when playing away, have been shown to negatively affect performance. Conversely, positive emotions fuelled by the home crowd have been found to enhance performance [27].

From an individual perspective, player experience can offer an advantage in managing the pressure and HA effect caused by crowd support [28]. In men's football, studies have shown that players secrete higher testosterone levels when playing at home, which may be linked to physiological responses that enhance performance, such as increased intensity and greater motivation [29]. Additionally, heightened psychological activity has been observed when playing at home, including changes in emotions, mood, and pressure levels [30]. However, individual responses to the pressure of playing in front of a home crowd can vary significantly. For some players, it leads to increased motivation and improved performance, while for others, it created excessive pressure, resulting in a decline in performance (known as the home disadvantage) [13]. This variability highlights the importance of understanding individual differences in how footballers handle pressure and fan support during matches [27].

Related to the abovementioned, in a longitudinal study spanning seven seasons in the English Premier League, Bush et al. observed that some physical demands varied across players' positions [31]. Moreover, they analysed passing performance across different positions, concluding that central players improved their pass completion rate over time.

There are several reasons to study and analyse the influence of HA from an individual perspective, highlighting the need for further research in this area. Understanding this phenomenon enables professionals to identify biases based on data, as players tend to perform better when competing in their own stadium. This disparity in performance between home and away matches can significantly impact the tactical decisions made by coaches, players, and analysts [32].

Additionally, studying HA in football contributes to a deeper understanding of the psychological mechanisms that influence sports performance. Players often experience increased confidence, motivation, and concentration during home matches, largely due to crowd support and familiarity with the stadium environment [11]. Furthermore, analysing footballers' behaviour when competing at home or away allows for the development of strategies to minimize or maximize the impact of HA. This enables the implementation of technical–tactical concepts to counteract the HA, while home teams can make adjustments to further enhance their performance [32]. As a result, studying HA not only improves our understanding of individual performance in football but also has practical applications in strategic and tactical decision-making [32].

The primary goal of this study was to investigate the influence of HA on individual footballers' performance in the five major European leagues (La Liga, Bundesliga, Serie A, Premier League, and Ligue 1) based on offensive and defensive performance statistics. A secondary aim was to examine whether differences in individual player performance when playing at home or away vary significantly between different positions on the field (defence, midfielder, and forward). Additionally, it aimed to determine whether playing at home or away significantly affects individual player performance based on these positions.

It was hypothesized that, similar to findings on collective performance [2,14], individual player performance will improve across most of the analysed variables when playing at home compared to away. Additionally, as concluded by Bush et al. (2015), it was expected that defenders, midfielders, and forwards would show greater differences in individual performance between home and away matches. Specifically, forwards and defenders will show greater differences in performance between home and away matches [31].

2. Materials and Methods

2.1. Participants

A total of 5984 players from the top five European leagues (LaLiga, Bundesliga, Ligue 1, Premier League, and Serie A) were analysed over 11 seasons (2009/2010 to 2022/2023). The database includes all matches from each domestic league, except for the seasons affected by attendance restrictions due to the pandemic (2019/20, 2020/21, and 2021/22) [18,33]. To ensure robust and meaningful data, we excluded players who participated in less than 40% of the matches during the season. This threshold serves as an indicator of sustained involvement throughout the season, thereby minimizing the influence of players affected by long-term injuries or other extended absences. Furthermore, we excluded players who accumulated less than 85 min of playing time to mitigate potential biases in the data distribution across variables. This criterion ensures a more reliable comparison by minimizing the impact of outliers with insufficient participation. Goalkeepers were also excluded from the database due to the differing demands compared to on-field players [34,35]. After applying the exclusion criteria, the database comprised 1455 outfield players (defenders: 833 (57%); midfielders: 413 (28%); forwards: 209 (15%)) and 169 teams (LaLiga: 36 (21%); Premier League: 39 (23%); Ligue 1: 34 (20%); Bundesliga: 26 (15%); Serie A: 34 (20%)).

2.2. Procedures

For this study, data were collected in April 2024 from the open-access website whoscored.com. "https://www.whoscored.com/ (accessed on 18 April 2024)". To address the secondary goal of the study, player positions (defender, midfielder, and forward) were assigned using the open-access website transfermarkt.es (accessed on 18 April 2024). The study variables (Table 1) were categorized into two dimensions: offensive variables (assists, goals, and key passes) and defensive variables (number of interceptions, tackles, and fouls). Data collection employed web scraping techniques using Python 3.12.3, along with the pandas and pickle libraries for data organization. Automated navigation through the website was facilitated by Selenium and its driver for the Google Chrome browser. A web scraping script was developed specifically using whoscored.com to acquire the data. The data were organized using Python 3.12.3 and subsequently stored in a Microsoft Excel spreadsheet (version 16.0, Microsoft Corporation, Redmond, WA, USA) for further analysis.

Table 1. Variables' definitions.

Dimension	Variable	Definition
Offensive variables	Assists	A decisive pass that directly leads to a goal. The player providing the assist is the one who makes the final touch before a teammate scores. This variable is showed as assists per season.
	Goals	The number of goals scored by a player per season.
	Key Passes	A key pass is an important or decisive pass that contributes to the development of an attacking play. It breaks defensive lines, creates a clear goal-scoring opportunity, or facilitates the construction of a dangerous goal opportunity. This variable is showed as key passes per match.
Defensive variables	Number of interceptions	An interception occurs when a player stops or intercepts a pass made by an opponent. This variable is recorded as interceptions per match.
	Tackles	An action in which a player attempts to take the ball from an opponent by physically intervening with a clean and legal tackle. This is recorded as tackles per match.
	Fouls	Infringement of the rules of the game determined by the referee. This includes illegal charges, pushing, holding, or hard and dangerous tackles. It is recorded as the number of fouls per match.

2.3. Statistical Analysiss

Since the data did not follow a normal distribution, as indicated by the Kolmogorov–Smirnov tests, offensive and defensive variables are presented as medians and interquartile ranges (IQRs) categorized by whether players were at home or away and by position. Comparisons of each offensive and defensive variable based on team location (home or away) and playing positions (defender, midfielder, and forward) were conducted using descriptive analysis tests (including sample size, mean, median, and standard deviation (SD) and Mann–Whitney U tests, respectively. The effect size (ES) was calculated using Biserial Correlation and interpreted according to the following criteria: trivial = $\leq$0.20; small = 0.20–0.59; moderate = 0.60–1.19; large = 1.20–1.99; or very large = $\geq$2.00 [36]. The significance level for all statistical tests was set at $p < 0.05$. Both descriptive analyses and inferential tests were performed using the open-source statistical software Jamovi (version 2.3, Sydney, Australia).

3. Results

The descriptive analysis of individual footballers' performance (*Tackles*, *Inter*, *Fouls*, *Goals*, *Assists*, and *KeyP*) based on team location (home vs. away) is presented in Table 2, while the performance comparison based on playing position (defender, midfielder, and forward) when playing at home or away is shown in Figure 1.

Table 2. Descriptive statistics of the variables *Tackles*, *Inter*, *Fouls*, *Goals*, *Assists*, and *KeyP*.

	Team Location	N	Mean	Median	SD
Tackles	Away	2108	1.93	1.9	0.88
	Home	2229	1.86	1.8	0.88
Inter	Away	2108	1.79	1.7	0.92
	Home	2229	1.74	1.7	0.91
Fouls	Away	2108	1.11	1.1	0.53
	Home	2229	1.09	1	0.54
Goals	Away	2108	1.18	0	2.28
	Home	2229	1.84	1	3.23
Assists	Away	2108	0.95	0	1.45
	Home	2229	1.23	1	1.71
KeyP	Away	2108	0.65	0.4	0.62
	Home	2229	0.8	0.6	0.74

The data in Table 2 show that a higher number of *Tackles* per match is recorded when playing away (mean = 1.93 away vs. 1.87 home; median = 1.90 away vs. 1.80 home; SD = 0.88 away vs. 0.89 home). As for the *Inter* variable per match, it is slightly higher when playing away as well (mean = 1.79 away vs. 1.74 home; median = 1.7 away vs. 1.7 home; SD = 0.92 away vs. 0.91 home). For the *Fouls* variable, the data show slightly higher values for away teams (mean = 1.12 away vs. 1.10 home; median = 1.10 away vs. 1.00 home; SD = 0.53 away vs. 0.54 home). In the *Goals* variable, home players have a higher average and SD (mean = 1.18 away vs. 1.85 home; median = 0.00 away vs. 1.00 home; SD = 2.28 away vs. 3.23 home). *Assists* are also higher in home matches (mean = 0.95 away vs. 1.23 home; median = 0.00 away vs 1.00 home; SD = 1.45 away vs. 1.72 home). Finally, *KeyP* is more numerous in home matches as well (mean = 0.65 away vs. 0.80 home; median = 0.40 away vs. 0.60 home; SD = 0.63 away vs. 0.75 home.

In Figure 1, a box plot is shown for each variable and position, where the median, first and third quartile, and outliers of each variable are represented. In relation to the comparison of playing at home or away, Table 3 presents a study of the statistical significance of the results shown. Specifically, for each variable, the value of the statistic, the *p*-value, and the ES are displayed.

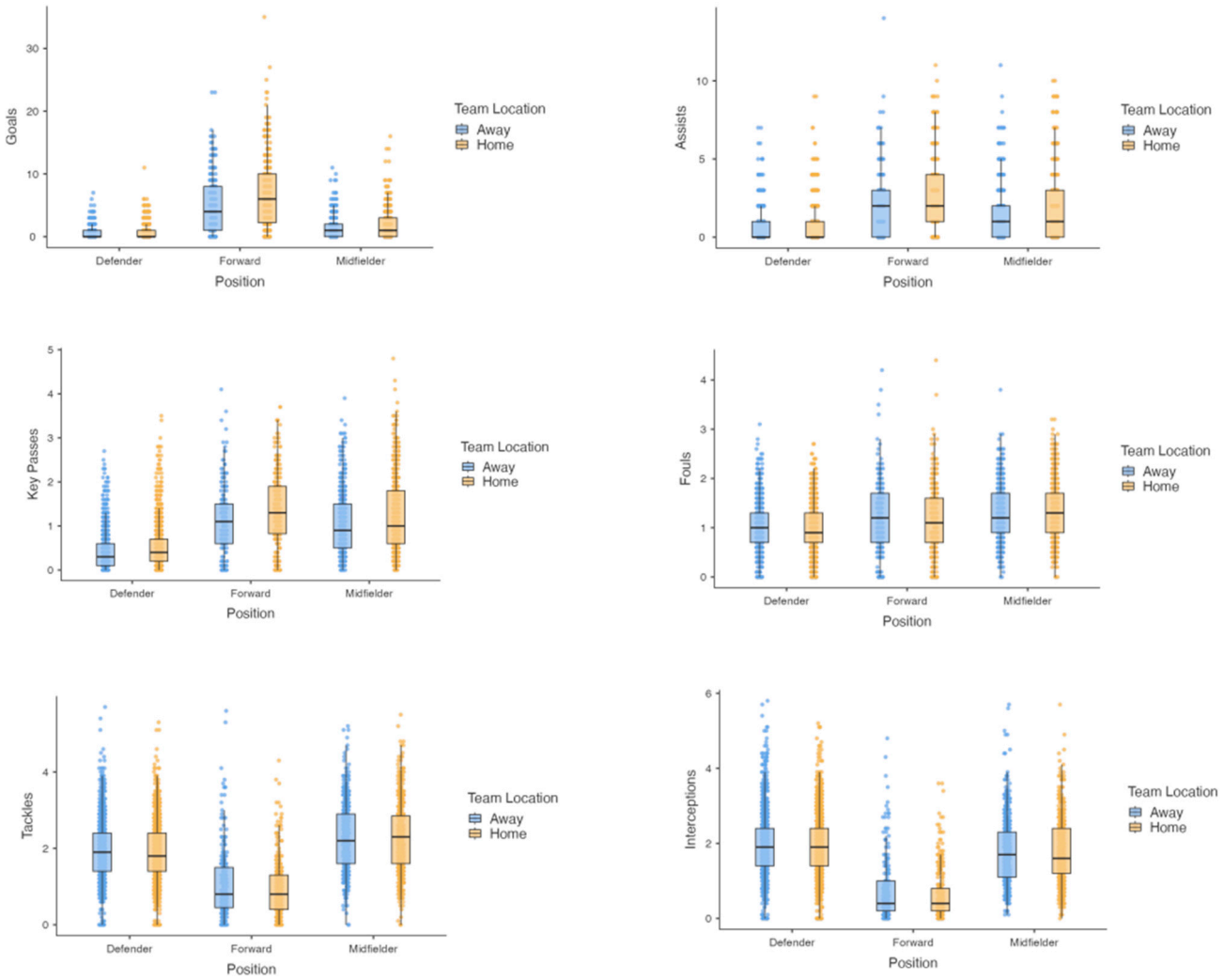

Figure 1. Comparison of home vs. away statistics for *Tackles*, *Inter*, *Fouls*, *Goals*, *Assists*, and *KeyP* by position.

Table 3. Mann–Whitney U test for *Tackles*, *Inters*, *Fouls*, *Goals*, *Assists*, and *KeyP* along positions.

		Statistical	*p*	ES (Interpretation)
Tackles	Stricker	29,074	0.389	0.04 (trivial)
	Midfielder	134,676	0.918	0.00 (trivial)
	Defender	942,471	0.081	0.03 (trivial)
Inter	Stricker	29,158	0.418	0.04 (trivial)
	Midfielder	133,006	0.654	0.01 (trivial)
	Defender	966,478	0.536	0.01 (trivial)
Fouls	Stricker	29,547	0.573	0.02 (trivial)
	Midfielder	129,378	0.231	0.04 (trivial)
	Defender	919,318	0.005	0.06 (trivial)
Goals	Stricker	24,216	**<0.001**	0.20 (trivial)
	Midfielder	111,977	**<0.001**	0.17 (trivial)
	Defender	848,845	**<0.001**	0.13 (trivial)
Assists	Stricker	26,301	0.008	0.13 (trivial)
	Midfielder	124,942	0.029	0.07 (trivial)
	Defender	893,186	**<0 .001**	0.08 (trivial)
KeyP	Stricker	25,062	**<0.001**	0.17 (trivial)
	Midfielder	119,877	0.002	0.11 (trivial)
	Defender	854,860	**<0.001**	0.12 (trivial)

Note: In the text, bold is used to indicate a statistically significant value.

The results obtained from the Mann–Whitney U test (Table 3) explain that there are significant differences in player performance based on whether they play at home or away. Notably, significant differences were observed in the offensive variables of *Goals* ($p < 0.001$; ES = 0.14; trivial) and *Assists* per season ($p < 0.001$; ES = 0.09; trivial) and *KeyP* ($p < 0.001$; ES = 0.11; trivial) per match, being higher when playing at home. In terms of defensive variables, such as *Inters* and *Fouls* per match, no significant differences were found; however, *Tackles* per match had a significantly higher value when playing away ($p = 0.013$; ES = 0.04; trivial).

The results in Table 3 explain whether there are significant differences for the variables *Tackles*, *Inter*, *Fouls*, *Goals*, *Assists*, and *KeyP* based on whether the player plays in the forward, midfielder, or defender position. No significant differences were found for the variables *Tackles* and *Inter* when playing at home or away. For the fouls variable, significantly higher differences were found for defenders when playing away ($p = 0.005$; ES = 0.06; trivial). Notably, the *Goals* variable per season was significantly higher when playing at home for all three positions (forwards: $p < 0.001$, ES = 0.20, trivial; midfielders: ES = 0.17, trivial; and defenders: ES = 0.13, trivial). The *Assists* variable per season was also significantly higher for forwards ($p = 0.008$; ES = 0.13; trivial), midfielders ($p = 0.029$; ES = 0.07; trivial), and defenders ($p < 0.001$; ES = 0.08; trivial). Lastly, *KeyP* was also significantly higher for forwards ($p < 0.001$; ES = 0.17; trivial), midfielders ($p = 0.002$; ES = 0.11; trivial), and defenders ($p < 0.001$; ES = 0.12; trivial).

4. Discussion

The aim of this study was to examine the differences in individual player performance when playing at home versus away, as well as to compare performance across different positions within the playing system. To accomplish this, individual statistics for six variables (three defensive and three offensive) were analysed for all players in the five major European football leagues spanning from the 2009–2010 season to the 2022–2023 season, excluding those affected by COVID-19.

Significant differences were observed between home and away matches across the three offensive variables analysed (*Goals*, *Assists*, and *Key Passes*). These findings are consistent with recent results by Magni et al., who analysed offensive performance variables in the UEFA Champions League [37]. This notable trend may be attributed to factors such as crowd influence and players' familiarity with the home playing field and environment [9]. Additionally, teams playing at home often adopt a more aggressive and offensive approach, driven by the psychological boost of home support and a desire to dominate the game. This home-field advantage can lead to higher levels of confidence, resulting in greater attacking play, more shots on goal, and creative passing. In contrast, no significant differences were found for tackles, interceptions, and fouls, conflicting with the studies by Boyko et al. [23] and Avugos [13]. The lack of variation in these defensive variables could suggest that defensive responsibilities are more consistent regardless of venue, with teams focusing equally on protecting their goal, whether at home or away.

The secondary objective of this study was to determine whether significant differences in player performance existed based on position. The results indicate that forwards, midfielders, and even defenders score significantly more goals, provide more assists per season, and register more key passes per match when playing at home [23]. This finding reinforces the objective advantage of playing at home, with factors such as fan support and familiarity with the environment likely contributing to increased confidence and motivation at the individual level [29].

For midfielders and forwards, no significant differences were found in tackles, interceptions, or fouls, likely due to their reduced involvement in defensive tasks in critical

areas for preventing goal-scoring opportunities. However, defenders commit a higher number of fouls when playing away, which may be influenced by the crowd's effect on the referee's decision-making, as well as on defenders' decision-making in one-on-one situations [13,20,21].

The findings from this study suggest that HA significantly impacts individual player performance across all positions on the field, reinforcing theories about HA's influence and the tactical adjustments required when competing at home or away [3,6,9,14]. These insights could shape match strategy planning, enabling coaches to tailor tactics based on the match location and player roles. With one of the largest and most diverse samples, spanning numerous players, leagues, and seasons, this study provides robust and meaningful results.

The current study presents several limitations that should be considered when interpreting the results. The first limitation is that the manuscript relies on a single data source without cross-referencing it with others. This approach may introduce potential biases or limit the generalizability of the findings, and future research could benefit from incorporating multiple data sources to validate and enrich the results. In addition, it does not account for potentially influential factors such as weather conditions, the tactics or skill level of the opposing team, or the overall context of the match [9,38]. Future research should incorporate these variables to provide a more comprehensive understanding of how and why player performance varies based on team venue, league, and competition levels. Moreover, future investigations could incorporate specific goalkeeper variables to analyse the HA effect in this position.

The practical applications of this study are varied and can positively impact the management and performance of professional football teams. First, coaches can adapt their game strategies based on whether they are playing at home or away, leveraging the understanding that players generally have a competitive edge at home. Moreover, they can make more informed decisions knowing that away defenders tend to commit more fouls, increasing the risk of accumulating cautions and potential send-offs. Additionally, this study's findings can aid in optimizing player selection and management, as well as in designing training sessions that reflect the specific demands of an upcoming match. By incorporating exercises that simulate the conditions players are likely to encounter based on match location, coaches can better prepare their teams for the challenges ahead.

5. Conclusions

This study highlights significant differences in the goals, assists, key passes, and fouls committed between home and away matches across player positions. Forwards and midfielders perform better offensively at home, while defenders commit more fouls away. These findings emphasize the influence of HA on performance and positional dynamics. Coaches should tailor strategies based on match location, accounting for player roles and strengths, such as increasing freedom for forwards when playing at home, assuming fewer defensive risks when playing away, or adopting more defensive technical–tactical strategies when playing as visitors. Risks in transitions could also be reduced by fostering defensive blocks and coverages, working on set-piece actions, and having the forwards adopt more conservative roles. On the other hand, when playing at home, more offensive technical–tactical strategies could be adopted, such as high pressing, support from midfielders when attacking, and more direct and vertical styles of play. A detailed analysis of both team and opponent performance is recommended to address variations in home and away conditions. Future research should consider additional factors, such as opponent level, tactics, weather, and player fitness, to refine our understanding of HA and its impact on football performance.

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Abbreviations

The following abbreviations are used in this manuscript:

COVID-19	Coronavirus Disease 2019
HA	Home Advantage
Inter	Interceptions
UEFA	Union of European Football Associations
KeyP	Key Passes

References

1. Schwartz, B.; Barsky, S.F. The Home Advantage. *Soc. Forces* **1977**, *55*, 641–661. [CrossRef]
2. Peeters, T.; van Ours, J.C. Seasonal Home Advantage in English Professional Football; 1974–2018. *Economist* **2021**, *169*, 107–126. [CrossRef]
3. Inan, T. The Effect of Crowd Support on Home-Field Advantage: Evidence from European Football. *Ann. Appl. Sport. Sci.* **2020**, *8*. [CrossRef]
4. Marek, P.; Vávra, F. Comparison of Home Advantage in European Football Leagues. *Risks* **2020**, *8*, 87. [CrossRef]
5. Pollard, R.; Gómez, M.A. Comparison of Home Advantage in Men's and Women's Football Leagues in Europe. *Eur. J. Sport. Sci.* **2014**, *14*, S77–S83. [CrossRef]
6. Saavedra García, M.; Gutiérrez Aguilar, O.; Fernández Romero, J.J.; Sa Marques, P. Measuring Home Advantage in Spanish Fotball (1928–2011). *Rev. Int. Med. Cienc. Act Fís. Deporte* **2012**, *15*, 181–194.
7. Pollard, R.; Pollard, G. Long-Term Trends in Home Advantage in Professional Team Sports in North America and England (1876–2003). *J. Sports Sci.* **2005**, *23*, 337–350. [CrossRef]
8. Allen, M.S.; Jones, M.V. The Home Advantage over the First 20 Seasons of the English Premier League: Effects of Shirt Colour, Team Ability and Time Trends. *Int. J. Sport. Exerc. Psychol.* **2014**, *12*, 10–18. [CrossRef]
9. Pollard, R.; Gómez, M.A. Components of Home Advantage in 157 National Soccer Leagues Worldwide. *Int. J. Sport. Exerc. Psychol.* **2014**, *12*, 218–233. [CrossRef]
10. Goumas, C. Modelling Home Advantage for Individual Teams in UEFA Champions League Football. *J. Sport. Health Sci.* **2017**, *6*, 321–326. [CrossRef]
11. Pollard, R.; Cd, S.; Nc, M.; Pollard, R. Vantagem Em Casa No Futebol No Brasil: Diferenças Entre Clubes e Efeitos de Distância de Viagem. *Braz. J. Soccer Sci.* **2008**, *1*, 3–10.
12. Garcia, M.S.; Aguilar, O.G.; Marques, P.S.; Tobio, G.T.; Fernández Romero, J.J. Calculating Home Advantage in the First Decade of the 21th Century UEFA Soccer Leagues. *J. Hum. Kinet.* **2013**, *38*, 141–150. [CrossRef] [PubMed]
13. Avugos, S. Home Advantage and the Influence of Officiating Decisions. *Sci. J. Sport Perform.* **2024**, *3*, 188–219. [CrossRef]
14. Marek, P.; Vávra, F. Home Team Advantage in the English Premier League. *Metod. Zv.* **2020**, *17*, 55–76. [CrossRef]
15. Ramchandani, G.; Millar, R.; Wilson, D. The Relationship between Team Ability and Home Advantage in the English Football League System. *Ger. J. Exerc. Sport Res.* **2021**, *51*, 354–361. [CrossRef]
16. Almeida, C.H.; Leite, W.S. Professional Football in Times of COVID-19: Did the Home Advantage Effect Disappear in European Domestic Leagues? *Biol. Sport.* **2021**, *38*, 693–701. [CrossRef]

17. Hill, Y.; Van Yperen, N.W. Losing the Home Field Advantage When Playing Behind Closed Doors During COVID-19: Change or Chance? *Front. Psychol.* **2021**, *12*, 658452. [CrossRef]
18. McCarrick, D.; Bilalic, M.; Neave, N.; Wolfson, S. Home Advantage during the COVID-19 Pandemic: Analyses of European Football Leagues. *Psychol. Sport. Exerc.* **2021**, *56*, 102013. [CrossRef]
19. Yi, Q.; Rascher, D.; Leitner, M.C.; Nomura, R.; Jp, N. Influence of Crowd Size on Home Advantage in the Japanese Football League. *Front. Sports Act. Living* **2022**, *4*, 927774.
20. Leitner, M.C.; Richlan, F. No Fans–No Pressure: Referees in Professional Football During the COVID-19 Pandemic. *Front. Sports Act. Living* **2021**, *3*, 720488. [CrossRef]
21. Zhang, L.; Zhang, H.; Li, S.; Ding, J.; Peng, Y.; Huang, Z. Influence Mechanism of the Home Advantage on Referees' Decision-Making in Modern Football Field—A Study From Sports Neuro-Decision Science. *Front. Psychol.* **2022**, *13*, 873184. [CrossRef]
22. Goumas, C. Home Advantage and Referee Bias in European Football. *Eur. J. Sport. Sci.* **2014**, *14*, S243–S249. [CrossRef] [PubMed]
23. Boyko, R.H.; Boyko, A.R.; Boyko, M.G. Referee Bias Contributes to Home Advantage in English Premiership Football. *J. Sports Sci.* **2007**, *25*, 1185–1194. [CrossRef] [PubMed]
24. Beckmann, N. Statistical Influence of Travelling Distance on Home Advantage over 57 Years in the Men's German First Soccer Division. *Ger. J. Exerc. Sport Res.* **2022**, *52*, 657–665. [CrossRef]
25. Van Damme, N.; Baert, S. Home Advantage in European International Soccer: Which Dimension of Distance Matters? *Economics* **2019**, *13*, 20190050. [CrossRef]
26. Furley, P.; Schweizer, G.; Memmert, D. Thin Slices of Athletes' Nonverbal Behavior Give Away Game Location: Testing the Territoriality Hypothesis of the Home Game Advantage. *Evol. Psychol.* **2018**, *16*, 1474704918776456. [CrossRef]
27. Kang, H.; Jang, S. Effects of Competition Anxiety on Self-Confidence in Soccer Players: Modulation Effects of Home and Away Games. *J. Mens. Health* **2018**, *14*, 62–68. [CrossRef]
28. Jiménez Sánchez, Á.; Lavín, J.M. Home Advantage in European Soccer without Crowd. *Soccer Soc.* **2021**, *22*, 152–165. [CrossRef]
29. Neave, N.; Wolfson, S. Testosterone, Territoriality, and the "Home Advantage". *Physiol. Behav.* **2003**, *78*, 269–275. [CrossRef]
30. Eklund, R.C.; Tenenbaum, G. Habit. In *Encyclopedia of Sport and Exercise Psychology*; SAGE Publications, Inc.: Thousand Oaks, CA, USA, 2014.
31. Bush, M.D.; Archer, D.T.; Hogg, R.; Bradley, P.S. Factors Influencing Physical and Technical Variability in the English Premier League. *Int. J. Sports Physiol. Perform.* **2015**, *10*, 865–872.
32. Staufenbiel, K.; Lobinger, B.; Strauss, B. Home Advantage in Soccer—A Matter of Expectations, Goal Setting and Tactical Decisions of Coaches? *J. Sports Sci.* **2015**, *33*, 1932–1941. [CrossRef] [PubMed]
33. Destefanis, S.; Addesa, F.; Rossi, G. The Impact of COVID-19 on Home Advantage: A Conditional Order-m Analysis of Football Clubs' Efficiency in the Top-5 European Leagues. *Appl. Econ.* **2022**, *54*, 6639–6655. [CrossRef]
34. Abbott, W.; Brickley, G.; Smeeton, N.J. Physical Demands of Playing Position within English Premier League Academy Soccer. *J. Hum. Sport Exerc.* **2018**, *13*, 285–295. [CrossRef]
35. Morgans, R.; Ceylan, I.H.; Radnor, J.; Ryan, B.; King, M.; Zmijewski, P.; Oliveira, R. Positional Training Demands in the English Premier League and English Championship. A Longitudinal Study across Consecutive Seasons. *Biol. Sport* **2025**, *42*, 21–28. [CrossRef]
36. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*; Routledge; Taylor & Francis: Oxfordshire, UK, 2013.
37. Magni, M.; Zago, M.; Vago, P.; Vandoni, M.; Carnevale Pellino, V.; Lovecchio, N. Technical Differences over the Course of the Match: An Analysis of Three Elite Teams in the UEFA Champions League. *Sports* **2023**, *11*, 46. [CrossRef]
38. Heuer, A.; Rubner, O. Fitness, Chance, and Myths: An Objective View on Soccer Results. *Interdiscip. Phys.* **2008**, *67*, 445–458. [CrossRef]