


Impact of COVID-19 Pandemic on HOME Advantage in Different European Professional Basketball Leagues

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Abstract

Our purpose in this study was to examine the impact of the COVID-19 pandemic on home advantage (HA) in sports by comparing European professional basketball games in which spectators were present (pre-pandemic) with “ghost” games in which spectators were absent (during the pandemic). A secondary objective was to analyze how team ability interacted with HA by comparing HA affects pre-pandemic and during the pandemic in the context of differing team ability levels. We used Wilcoxon and Mann–Whitney U tests to identify HA through differences in home win percentages (HW%) between pre-pandemic and pandemic games. Additionally, we ran the Kruskal–Wallis test to identify HA and HW% differences between different team ability levels (high to low). Teams had higher HA and HW% pre-pandemic than during the pandemic. In turn, low level teams presented a higher HA compared to teams at other team ability levels. Thus, low level teams benefited more from playing at their home-court. However, low level teams showed lower HW% than medium and high team ability levels, showing that team ability is more important than HA in determining game outcomes.

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Keywords

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Introduction

The global COVID-19 pandemic, caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), created serious implications for the world of professional sports (Vaudreuil et al., 2021). One significant consequence has been the absence of fans during games (ghost games) played in the 2020–2021 season of most professional sports leagues (e.g., the United States National Basketball Association or NBA or the European Champions League in soccer). This context created a natural experiment for isolating the effect of fan attendance in professional sports.

The home advantage (HA) effect has often been discussed as a contributing factor to game outcome in both individual and team sports, including basketball (Gómez et al., 2007; Pollard & Gomez, 2007a; Pollard & Gómez, 2013b). It has been well established that the home team typically benefits by gaining some competitive edge and a higher chance of winning when playing at their home-court (Pollard & Gomez, 2007b; Vaudreuil et al., 2021). During a full season with a balanced schedule (i.e., each team playing against all scheduled teams at both home and away courts), the HA for the entire league can be computed as the percentage of home wins in relation to the total number of games played. In turn, for individual teams, HA can be measured by comparing a single team's home performance with its away performance (i.e., the percentage a single team's home wins in relation to all wins, both at home and away) (Pollard & Gomez, 2007b). This measure is always non-negative and varies from 0% (no games won at home) to 100% (no games won away), with a value of 50% representing an equal number of points won at home and away (i.e., no home advantage) (Almeida & Leite, 2021).

Past researchers have tried to identify modifying factors that help explain the HA phenomenon. Particularly, previous studies in basketball have shown that team ability (Pollard & Gomez, 2007b), region of the league, (Gomez Ruano & Pollard, 2011; Pollard & Gómez, 2013b), level of crowd support and referee bias (Fabian et al., 2021), travel fatigue/jet lag (Huyghe et al., 2018; Song et al., 2017), and psychological effects of expectations, familiarity, territoriality, specific rules, and tactical behaviors may all influence HA effects (Gómez et al., 2007; Gomez Ruano & Pollard, 2011; Pollard & Gómez, 2013b; Price & Yan, 2021; Fabian et al., 2021).

HA is known to depend on the level of team ability, with stronger teams performing well both at home and away, with teams of lower ability particularly prone to perform better at home than away (Pollard & Gomez, 2007b). Of note, team ability in prior research has typically been measured by a team's *total* wins during a season, meaning that this team ability measure overlaps with and includes the HA effect (Pollard & Gomez, 2007b). Referring to separate geographic regions of teams within a league, some researchers analyzed HA in 19 professional basketball leagues and showed high

HA variability between different countries, with Greece and Italy (66%), France (63%), and Spain (61%) all demonstrating higher HA values ($p < .05$) than the NBA as a whole (60%) (Pollard & Gomez, 2007b). In addition, other researchers found the HA in countries of the Balkan region of south-east Europe to be significantly higher than in countries from other European regions (Pollard & Gómez, 2013b). These authors concluded that there was an intense sense of territorial protection among players, crowds and referees in Balkan countries, due to the long history of conflict in the region and deep ethnic and religious rivalries there, resulting in an increased HA and a statistically higher chance of winning games played at home (Pollard & Gómez, 2013b).

We are aware of no studies of the impact of spectator absence (such as from the COVID-19 pandemic) on the HA effect during basketball games, but researchers have investigated a similar scenario during a stricter phase of response to the COVID-19 outbreak when all teams played in the same venue to create a protective “bubble” in which players would be better protected from infecting one another (Higgs & Stavness, 2021; Leota et al., 2021; Price & Yan, 2021). The 2020 NBA bubble was an isolation zone at Walt Disney World in Bay Lake, Florida, during the last eight games of the 2019–2020 regular season and throughout the 2020 NBA playoffs. Although the court was neutral, the NBA did make attempts to recreate the effects by putting the “home” team logo on the court and allowing the “home” team to play crowd noise and music to help teams feel at home. In turn, HA research during the NBA bubble found that “home teams,” seemed have more difficulties winning in this context than compared to normal conditions (Price & Yan, 2021). However, during this bubble, teams did not travel to each other’s stadiums, and HA has an alternate meaning. In the present study, using data from traveling teams but absent spectators, we analyzed the HA effect with its traditional meaning of games won at home in relation to all games won (both away and at home).

Hopefully, the extraordinary life-threatening global event that removed the presence of fans from the game will not persist for long or occur again. However, it is important to use this natural opportunity to isolate, within research on the HA effect, the HA effect of having fans present or absent from the HA effect of playing on a familiar court. Understanding how the presence of fans impacts game outcome will provide useful data for coaches to formulate tactical strategies (e.g., game plan, substitutions, use of time-outs) during home and away games. Therefore, our purpose in this study was to compare the impact of match play in European professional basketball with fan presence (pre-pandemic) and fan absence (during COVID-19 restrictions) to better understand the fan effect on game outcome. Our secondary objective was to analyze how team ability might modify the HA effect by (a) comparing the interaction between the HA effect and the team ability effect in both pre-pandemic games and games played during the pandemic. Our hypotheses were that (a) teams with low ability levels would have a higher HA during pre-pandemic play (with fans present) than in play during the pandemic (when fans were absent); and (b) during the pandemic (with fans absent)

teams with low ability level would have a higher HA effect than teams with medium and high ability levels.

Method

Sample

Data was collected from five different professional European national basketball leagues (Spanish Liga ACB, German Bundesliga (BBL), Italian Lega Basket Serie A (LBA), A1 Ethniki Greek League, Israeli Basketball Super League). The dataset included the last 15 seasons (from 2005-2006 season to 2020–2021) from professional basketball matches played under no-pandemic circumstances (i.e., in the presence of fans), professional games that were played without spectators due to the COVID-19 pandemic and professional games in which almost no spectators were presented.

The final sample consisted of matches from 5 European professional basketball leagues, including Spain, Germany, Italy, Greece, and Israel during the regular seasons. The dataset was split by teams that played during the pre-pandemic seasons, under normal circumstances ($N = 1163$) and teams that played post-pandemic seasons without spectators, due to the COVID-19 epidemic ($N = 77$).

Procedures

Data was extracted from the open access Web site www.flashscore.es. The variables gathered were: year of the season, country, home wins, away wins, total wins, total games played, and total games played at home. They were inputted into customized Microsoft Excel (version 16.0, Microsoft Corporation, Redmond, WA) spreadsheets for further analysis. After extraction, some basic calculations were carried out to calculate HA, percentage of home wins (HW%), team ability and pre-/post-pandemic games.

In basketball, where the outcome of a game is either a win or a loss, HA (%) was computed as the percentage of total number of home wins considering all win games (both at home and away). Thus, the HA for a team that won 10 games at home and 10 away would be $10/20 = 50\%$ (Gomez Ruano & Pollard, 2011; Pollard & Gomez, 2007b). This calculation was done for each team each season. HW% is the percentage of game wins at home considering all games played at home independently of the score outcome (Gomez Ruano & Pollard, 2011; Pollard & Gómez, 2013a). Team ability was quantified for each team each season as the winning percentage of the team at the end of the season; for example, for a team that won 30 games out of 36 total games, it would be $30/36 = 83.3\%$ (Gomez Ruano & Pollard, 2011). Using two-step cluster analyses for determining team ability, the sample was split into groups based on the winning percentage of the team at the end of the season, as shown in Table 1.

Pre-pandemic period (presence of the spectators) includes all games played during regular seasons since 2005/2006, excluding 2020–2021 season and post-pandemic (absence of the spectators) includes the period considering all games played during the regular season of 2020–2021, where the attendance of fans during games were forbidden.

Table 1. Cluster Analysis Identifying Group Means for Team Ability Levels.

Measure	Low Ability	Medium Ability	High Ability
Team ability (%)	32.85	55.27	80.22
Sample size (N)	524	507	209
Proportion of samples (%)	42.3%	40.9%	16.9%

Note: Team ability presented as mean for each group; sample size indicates the number of team samples included across all seasons.

Statistical Analysis

We presented means (*Ms*), *SDs* (*SDs*) and coefficient of variation (% CV) of the playing period (pre-pandemic and post-pandemic) and team ability (high level, medium level, and low level) of HA and HW%. We used Kolmogorov Smirnov normality test to check the normal distribution of variables. We carried out Wilcoxon–Mann–Whitney U Test to identify mean differences between pre-pandemic and post-pandemic periods for HA and HW%. In addition, we reorganized the data by team ability in order to perform Wilcoxon–Man–Whitney U testing, using HA and HW% as variables to test playing period as a grouping variable. Moreover, we performed the Kruskal–Wallis test to identify significant differences between team ability levels (High to Low) for HA and HW%. We used the Statistical Package for the Social Sciences for Windows (SPSS, version 23, IBM Corp, Armonk, NY) and JASP (JASP Team (2020). JASP (Version 0.12.2) programs to run the statistical analyses.

Results

Descriptive statistics (*Ms*, *SDs*, and % CV) of HA (pre-pandemic, post-pandemic, high level, medium level, and low level) and HW% (pre-pandemic, post-pandemic, high level, medium level, and low level) are presented in [Table 2](#).

Comparison of means for HA (pre-pandemic and post-pandemic) and HW% (Pre-pandemic and post-pandemic) are presented in [Table 3](#).

[Figure 1](#) represents a comparison of the means between both periods (pre-pandemic and post-pandemic) for HA. The Wilcoxon–Mann–Whitney U test revealed statistically significant differences between periods ($p < 0.001$). Moreover, [Figure 1](#) shows a higher mean HA pre-pandemic when compared to post-pandemic ($M_{HA \text{ pre-pandemic}} = 63.11$; $M_{HA \text{ post-pandemic}} = 56.97$).

[Figure 2](#) shows mean differences between pre- and post-pandemic period for HW%. Statistical analysis showed significant differences between periods ($p = 0.018$). Furthermore, [Figure 2](#) also reveals higher values during pre-pandemic versus post-pandemic seasons ($M_{HW\% \text{ pre-pandemic}} = 61.70$; $M_{HW\% \text{ post-pandemic}} = 56.04$). However, as seen in [Figure 2](#), there was high variability in both periods.

The Wilcoxon–Mann–Whitney U test comparing HA means (pre-pandemic vs. post-pandemic) and HW% means (pre-pandemic vs. post-pandemic) for all three team

Table 2. Means, Standard Deviations, and Coefficients of Variance for HA and HW% by Playing Period and Team Ability Level.

			M	SD	% CV
HA	Period	<i>Pre-pandemic</i>	63.11	12.03	19.07
		<i>Post-pandemic</i>	56.97	10.74	18.85
	Team ability levels	<i>High Level</i>	55.78	4.63	8.30
		<i>Medium Level</i>	61.97	8.60	13.88
		<i>Low Level</i>	66.23	15.21	22.97
HW%	Period	<i>Pre-pandemic</i>	61.70	20.50	33.22
		<i>Post-pandemic</i>	56.04	20.82	37.15
	Team ability levels	<i>High Level</i>	89.00	8.48	9.52
		<i>Medium Level</i>	68.18	10.93	16.03
		<i>Low Level</i>	43.72	13.94	31.88

Table 3. Wilcoxon and Mann–Whitney U Tests Comparing HA and HW% by Playing Period.

		M Rank	Sum of Ranks	Mann–Whitney U	Wilcoxon W	Z	p
HA	<i>Pre-pandemic</i>	632.36	735,437.50	30,979.500	33,982.500	−4.536	<0.001
	<i>Post-pandemic</i>	441.33	33,982.50				
HW%	<i>Pre-pandemic</i>	626.70	728,854.50	37,562.500	40,565.500	−2.371	0.018
	<i>Post-pandemic</i>	526.82	40,565.50				

ability levels are presented in Table 4. Regarding the comparison of pre- and post-pandemic periods at each level, results showed significant differences for high team ability level (HA $p = 0.009$; HW% $p = 0.006$), medium team ability level (HA $p = 0.002$; % wins at home $p = 0.012$) and low team ability level (HA $p = 0.002$; HW% $p = 0.001$) for both variables. In addition, Figure 3 revealed that, at each team ability level, HA during pre-pandemic was higher than HA during post-pandemic (High ability level $M HA_{pre-pandemic} = 56.11$, High ability level $M HA_{post-pandemic} = 52.87$; Medium level $M HA_{pre-pandemic} = 62.33$, Medium level $M HA_{post-pandemic} = 56.96$; Low level $M HA_{pre-pandemic} = 66.78$, Low level $M HA_{post-pandemic} = 59.06$) and the same was true for HW% (High level $M HW\%_{pre-pandemic} = 89.45$, High level $M HW\%_{post-pandemic} = 82.69$; Medium level $M HW\%_{pre-pandemic} = 68.54$, Medium level $M HW\%_{post-pandemic} = 63.04$; Low level $M HW\%_{pre-pandemic} = 44.14$, Low level $M HW\%_{post-pandemic} = 37.12$).

The Kruskal–Wallis test comparing team ability levels (high vs. medium vs. low) for HA and HW% are presented in Table 5. Results showed significant differences when comparing within levels for both variables (HA $p < 0.001$; HW% $p < 0.001$). Furthermore, Figure 4 revealed higher HA for low level teams ($M = 66.23$) than for medium

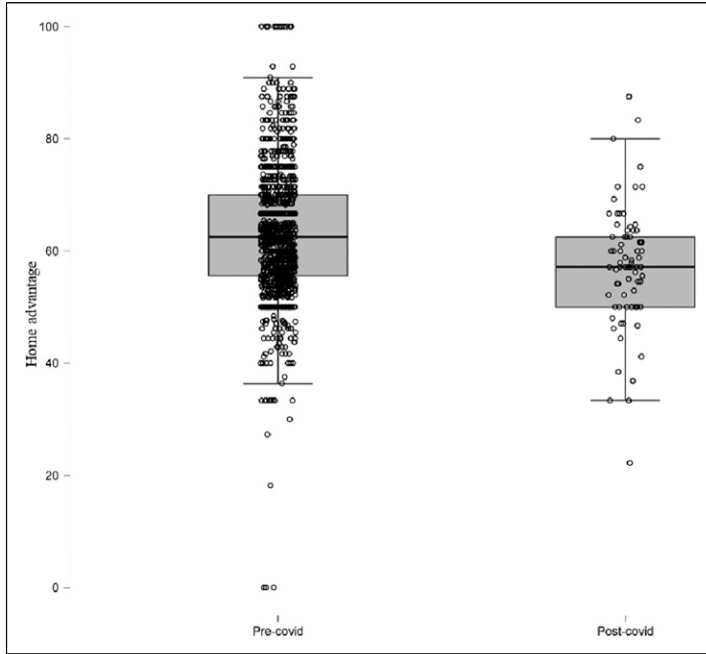


Figure 1. Comparative Analysis of HA Between Both Periods (Pre Pandemic and Post Pandemic)

level teams ($M = 61.97$) and high-level teams ($M = 55.78$). However, regarding HW%, [Figure 5](#) showed high team ability level ($M = 89.00$) to be greater than medium team ability level ($M = 68.18$) and low team ability level ($M = 43.72$).

Discussion

Our aim in the present study was to examine the impact of match play with an absence of fans (due to COVID-19 restrictions) on HA by comparing HA for games played pre- and post-pandemic in five professional basketball leagues in Europe. A secondary objective was to analyze the influence of team ability on home advantage by: (i) comparing HA for pre- and post-pandemic matches, and (ii) comparing different team ability levels. Our main findings were that (i) during the pre-pandemic HA and HW% were higher than during the post-pandemic seasons, meaning that the absence of spectators reduced the effect of HA; (ii) these significant HA and HW% differences between pre- and post-pandemic seasons were independent of team ability level; and (iii) low level teams presented a higher HA compared to medium and high team ability levels, though low ability level teams showed lower HW% than medium and high team ability levels.

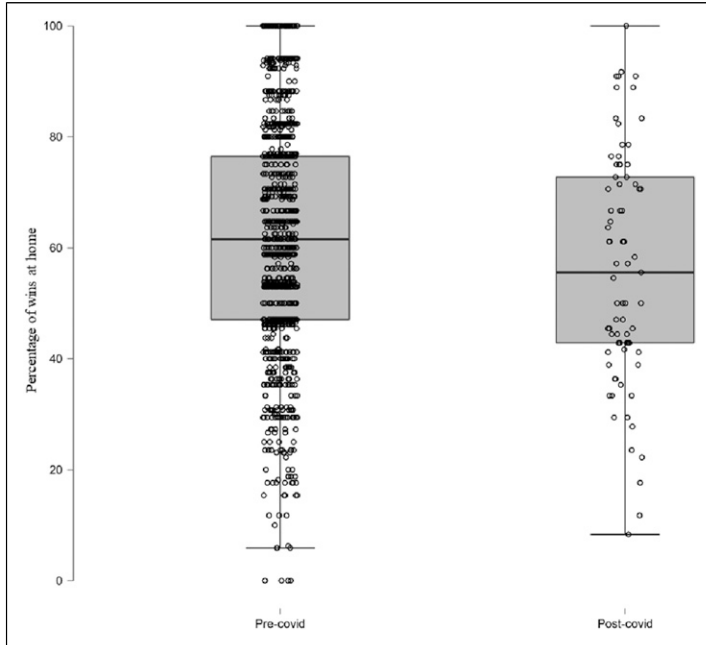


Figure 2. Comparative Analysis of Percentage HW Between Both Periods (Pre Pandemic and Post Pandemic)

Our finding of higher HA and HW% values in the pre-pandemic versus post-pandemic period suggested that the absence of spectators reduced the HA. Possibly, home teams missed an important familiar aspect when they played in their empty stadium without supporters. In fact, the away teams may have been less affected by external pressure in this context and then performed better than home teams (Tilp & Thaller, 2020). However, a recent soccer study showed that the HA decreased with the absence of the public, even if insignificantly. In turn, recent studies performed in American sports showed that HA was negatively impacted in the both the National Hockey League (NHL) and NBA during their strongly restricted COVID-19 playoffs, while there was no change in HA in Major League Baseball (MLB) and the National Football League (NFL) during their more weakly restricted COVID-19 seasons (Higgs & Stavness, 2021). NHL and NBA had much stricter COVID-19 bubbles in which teams did not travel to each other's stadiums, whereas MLB and NFL teams were allowed to travel to the opponent's venues, only with a restriction for fans to attend matches. This particular context suggests that the lack of travel and home city familiarity contributes to HA more than a home crowd effect (Higgs & Stavness, 2021). Regarding specific basketball studies that analyzed HA during the COVID-19 pandemic (Higgs & Stavness, 2021; Leota et al., 2021; Price & Yan, 2021), results showed that during NBA bubbles games (played in empty stadiums), home teams won less than

Table 4. Comparisons Between Teams of Varied Ability Levels on HA and HW% in Pre- and Post-Pandemic Playing Periods.

Team Ability		Period	Rank		Sum of Ranks	Statistical Tests ^a			
			M			Mann-Whitney	Wilcoxon W	Z	P
High Level	HA	Pre-pandemic	108.15		20,873.00	936.00	1072.00	-2.62	0.009
		Post-pandemic	67.00		1072.00				
	HW %	Pre-pandemic	108.27		20,896.00	913.00	1049.00	-2.73	0.006
		Post-pandemic	65.56		1049.00				
Medium level	HA	Pre-pandemic	258.99		124,055.50	4316.50	4722.50	-3.17	0.002
		Post-pandemic	168.66		4722.50				
	HW %	Pre-pandemic	257.92		123,545.50	4826.50	5232.50	-2.50	0.012
		Post-pandemic	186.88		5232.50				
Low level	HA	Pre-pandemic	267.76		131,469.00	5520.00	6081.00	-3.07	0.002
		Post-pandemic	184.27		6081.00				
	HW %	Pre-pandemic	268.24		131,703.50	5285.50	5846.50	-3.35	0.001
		Post-pandemic	177.17		5846.50				

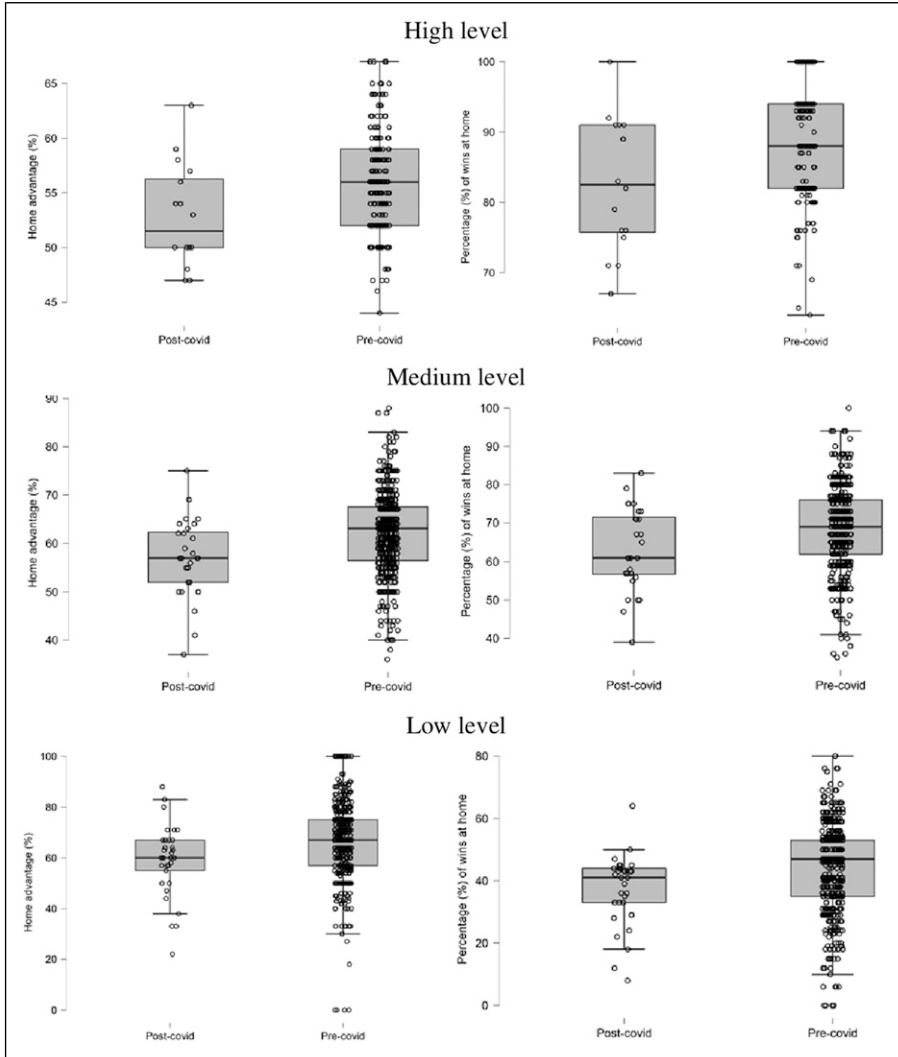


Figure 3. Comparative Analysis (pre- vs post- pandemic) of HA and WH% for Each Team Ability Level

in normal conditions (with fans present) (Price & Yan, 2021). Thus, the HA did not completely disappear in empty stadiums (Fabian et al., 2021). In addition, some authors pointed out that crowd support influences referee’s criteria (Goumas, 2014) which might be another factor contributing to HA and HW% differences between pre-pandemic and post-pandemic periods.

Table 5. Comparisons of HA and HW% Across Team Ability Level.

		M Rank	Kruskal–Wallis H	Df	p
HA	High Level	352.03	174.61	2.00	<0.001
	Medium Level	609.69			
	Low Level	738.04			
HW%	High Level	1101.84	859.68	2.00	<0.001
	Medium Level	751.06			
	Low Level	302.19			

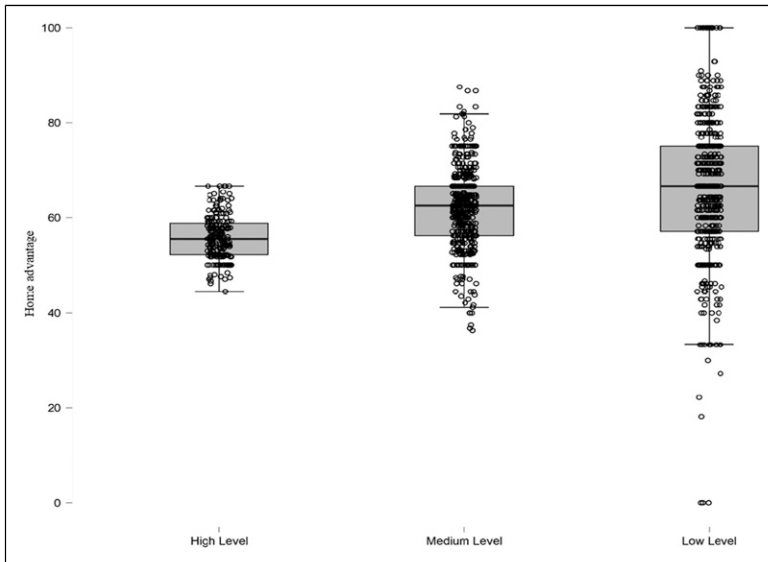


Figure 4. Comparative Analysis of HA Between All Three Team Ability Levels (High, Medium, Low)

Our finding of significant HA and HW% differences between these periods at each team ability level, with higher HA and HW% in the pre-pandemic than post-pandemic seasons at each team ability level are in opposition with our main hypothesis, as we only expected this result for teams with low team ability levels. Thus, our results highlight advantages for playing at home with the presence of spectators for all teams, independently of team ability level, perhaps not only related to crowd presence but also to factors such as familiarity with the court, the absence of travel fatigue (Clarke & Norman, 1995), and psychological factors that might include team identity or territoriality (Gomez Ruano & Pollard, 2011).

Regarding team ability levels, we found that low level teams presented a higher HA compared to that of other team ability levels (medium and high), supporting the idea

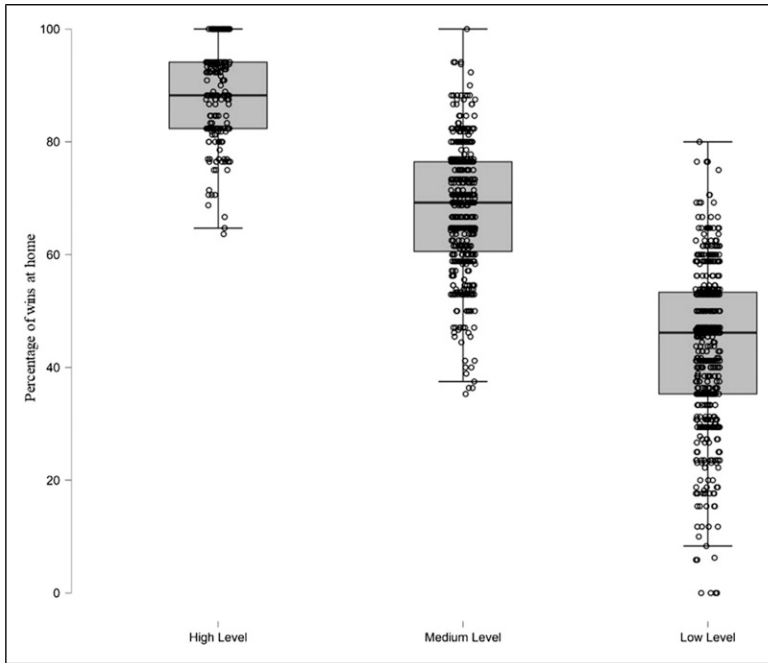


Figure 5. Comparative Analysis of HW% Between All Three Team Ability Levels (High, Medium, Low)

that low level teams benefit most and have a higher chance of winning in their home court. A possible reason for this finding is that team identity and a strong sense of being part of a cohesive local community aids in a team with low team ability level. In turn, low ability level teams are aware of the HA phenomenon and may give added importance to winning at home. Low level teams show lower HW% than medium and high team ability levels, indicating that a difference in ability outweighs the home advantage such that stronger teams are more likely to win both at home and away.

Our results have provided a more in-depth perspective on the HA phenomenon as a result of a natural experiment forced by the COVID19 pandemic. We were able to take advantage of an unusual manipulation of key variables in HA during an extraordinary global event that we hope to have been transient and unrecurrent. Our findings offer useful practical information for basketball coaches and clubs. First, as the presence of spectators is a key factor for all teams, independently of team ability level, it may be useful to elicit the presence of supporters when games are at home. Consequently, clubs should tailor different strategies to guarantee that they have full stadium occupancy at home. In turn, for away games, clubs should promote supporters' assistance in helping the away team feel at home. Second, the generally higher HA effect for low ability teams compared to medium and high ability teams should be considered when

preparing game strategies. For example, medium and high ability teams should avoid underestimating low ability teams who are playing on their home courts. Finally, as crowd noise has a relevant role in HA (Sánchez & Lavín, 2020; Sors et al., 2020), home teams might find strategies to enhance noise and thereby contribute to the dynamics that may determine game outcomes.

Limitations and directions for further research

Among the limitations of this study, HA is a multifactorial phenomenon, and we could not control for all relevant related variables such as travel fatigue, hostility of supporters, stadium capacity and occupancy, cultural differences between and within countries, or tactical preferences made by teams at home and away. In turn, because of the COVID-19 pandemic, we did not control for the fact that certain key players were sometimes unable to attend a few games. The influence of these additional variables on these results remains uncertain. Future research using complex multivariate statistical procedures might retrospectively examine these factors more completely to further refine our understanding of the home advantage phenomenon.

Conclusions

In the present study, we provided data in support of the influence of crowd support and contributed to literature touting a HA effect in professional basketball. The European teams we studied had higher HA and HW% during pre-pandemic than during post-pandemic periods of play, and this phenomenon was evident, independently of team ability level. Our data supported a general tendency for teams with low versus middle or high ability levels to experience a higher HA effect. However, the HW% of low ability level teams was lower than for medium and high ability level teams, showing that team ability level outweighed HA in determining game outcomes.

Author Contributions

Each contributor has played a role in at least two of the following areas: research concept and study design, literature review, data collection, data analysis and interpretation, statistical analyses, writing of the manuscript, or reviewing/editing a draft of the manuscript.

Declaration of Conflicting Interests

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