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Is Home Advantage Diminished When Competing Without Spectators? Evidence From the Israeli Football and Basketball Leagues

Authors' contribution:

A) conception and design of the study
B) acquisition of data
C) analysis and interpretation of data
D) manuscript preparation
E) obtaining funding

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Abstract

Sports spectators are one of the factors that affect home advantage. The outbreak of the COVID-19 pandemic created unique conditions under which most of the leagues in the world played matches without crowds for over six months. This situation facilitated an analytical comparison of two different periods: before and during the coronavirus pandemic. The current study sought to examine home advantage in the Israeli sport domain in general, and specifically the impact of the absence of a crowd. The study consisted of 4,030 matches played in Israel's top football and basketball leagues, of which 3,589 took place with crowds from August 2015 to March 2020, while the others were held without spectators from May 2020 to February 2021. Descriptive and analyses of variance procedures indicated a home advantage independent of crowd size, density, geographic region, league level, and type of sport. However, higher-quality teams demonstrated a higher home advantage ratio for the goals conceded. The findings of the study indicate that in the Israeli context, the crowd plays less of a role in home advantage than other potential factors.

Key words: Home advantage, football, basketball, COVID-19, crowd, geographic region, crowd density

Introduction

Home advantage in sports refers to the superior performance of individual athletes and teams when playing at home rather than away (see Carron et al., 2005; Pollars, 2008). Home advantage is evident both in individual and team sports and has been reported in numerous studies since the mid-20th century (Gomez-Ruano & Pollard, 2022). This phenomenon in sports is well acknowledged and has been the topic of extensive research (Allen & Jones, 2014). In team sports leagues, such as basketball and football, the sports used in this study, home advantage is customarily identified by the fact that a team usually scores more points on its home field than at away games. Several factors contribute to home advantage. One prevalent explanatory factor is the potential impact of the crowd, such that the prevalence of home advantage is higher when more spectators are present (Nevill, Balmer, & Williams, 2002).

For the most part, games without spectators only take place under special circumstances that may include a penalty requiring a team to play without its fans, security issues, or matches held in remote locations. From this

perspective, the COVID-19 outbreak and the prohibition of gatherings created a unique situation in which professional sports matches were played without crowds for a year and a half. This made it possible to isolate the crowd factor and measure its impact on the extent of the home advantage factor.

On March 15, 2020, following the outbreak of the coronavirus pandemic, professional sports competitions in Israel were halted to prevent gatherings. A month and a half later, on May 30, 2020, the top Israeli leagues resumed playing, but without any crowds in the stands. Until March 2021, professional Israeli basketball and soccer continued as usual, but without the presence of spectators. Therefore, the aim of the current study is to examine the impact of the presence or absence of spectators on the level of home advantage in the top soccer and basketball leagues in Israel.

The Current State of Knowledge on Home Advantage

Since home advantage has been evident at all competitive levels and in all sports for over three decades (Pollard et al., 2017), researchers have proposed a wide variety of potential factors, including travel fatigue (Smith et al., 2000; Leatherwood & Dragoo, 2013), pressure on referees (Lowell et al., 2014), familiarity with field conditions and equipment (Moore & Brylinsky, 1995), physiology (Neave & Wolfson, 2003), tactics (Staufenbiel et al., 2015), and spectators (Agnew & Carron, 1994). The presence of spectators has attracted the most attention because it is perceived to be the factor with the most significant impact (Wolfson et al., 2005). The impact of the home crowd may be dependent on factors such as crowd size (Johnston, 2005), ratio between the crowd size and stadium capacity (Goumas, 2014), proximity to the pitch (Pollard, 2008), noise and cheering intensity (Fabrizio et al., 2020; Unkelbach & Memmert, 2010), and more. Nonetheless, this issue is still a matter of dispute because of the presence of many additional variables, such as the quality of the team (reflected in the size of the crowd), the personal qualities of the athletes and their ability to handle crowd pressure, and the importance of the crowd factor relative to other factors, especially considering the fundamental differences among types of sports.

Contrary to the sweeping inclusion of the crowd factor in every review of home advantage (Pollard et al., 2017), there are conflicting findings with respect to the extent of its impact. Pollard and Pollard (2006) examined the top leagues in Europe and found no differences in the degree of home advantage despite significant differences in the number of spectators for each team. Nevill and Holder (1999), in contrast, claimed that an increase in the number of spectators does indeed contribute to an increased home advantage, but even that is only up to a certain point. Ponzo and Scoppa (2018) also found that crowd size has an impact on the level of home advantage after controlling for travel distance and fatigue variables. Moreover, Inan et al. (2020) examined the top five leagues in Europe and found that larger crowd size and crowd density have a significant effect on the level of home advantage. The difficulty of measuring the crowd's contribution is related to a great extent to the difficulty of measuring the effect created by the crowd. The impact on players or referees, for example, depends on a variety of factors that were not measured, such as noise, outfit color, crowd songs, and signage. In other words, a small crowd may have a greater impact due to the nature of its cheering and behavior during the match. Therefore, matches without a crowd, sometimes referred to as *ghost games*, offer a better basis for testing the crowd's impact on the level of home advantage.

Matches Without a Crowd

One of the most extensive studies of matches without a crowd prior to the COVID-19 era was conducted by Reade, Schreyer, and Singleton (2020). The study included 20 years of professional soccer matches that for various reasons were played without a crowd. The study's findings revealed that the level of home advantage decreased when a crowd was absent and included a disclaimer regarding the low prevalence of such matches and the identity of these teams. Nevertheless, it must be noted that these matches took place under special circumstances and were not played consecutively. Therefore, the 2019-2020 season and the beginning of the 2020-2021 season in the context of the pandemic are unique. This uniqueness offers fertile ground for research about crowd impact on home advantage and led to the publication of several studies on this topic, mostly on European soccer leagues.

Cueva et al. (2020) conducted the most extensive study during the COVID-19 era. The study examined 233,666 soccer matches played in 41 countries, of which 2,479 took place without a crowd. Considering all the possible factors resulted in a significant decrease in the level of home advantage, especially in the context of the decisions of referees, in which this advantage was completely nonexistent. In an additional study, McCarrik et al. (2020) analyzed the results of 2,552 matches without a crowd in 15 European leagues during the pandemic. The study considered the performance of teams and referees. The results indicated that the home team's performance (but not that of the away team) was significantly negatively affected when there was no crowd at the stadium, leading to a decrease in

the overall level of home advantage. The absence of a crowd also affected the referees, who issued fewer yellow cards and blew their whistles for fewer penalties against the away teams.

Alongside findings of a decrease in home advantage or the absence of any difference, some studies showed a reversal result of home advantage in matches without a crowd. In studying the German league, Tilp and Thaller (2020) reported a negative home advantage during COVID-19. The authors attributed this phenomenon to a fundamental change in habits and reliance on a supportive environment, as well as the away teams' high level of motivation to take advantage of the unique circumstances. Moreover, Dilger and Vischer (2020) analyzed the results of the German league before and during the pandemic and found a significant decline in the level of home advantage and the number of cards issued by referees to the visiting team. The findings of Sors et al. (2020) also indicated a reduction of home advantage and the absence of referee bias with respect to the number of points/goals scored, ball possession, and referee influence during games without a crowd. Thus, the researchers concluded that it is likely that crowd noise has the most impact on the performance of both referees and teams.

While these studies describe a significant decrease in the various components of home advantage, many studies did not find significant results, and some even found contradictory results. Benz and Lopez (2020) analyzed game results from 17 leagues in 14 countries. In 11 cases, home advantage decreased in the context of yellow cards and goals. On the other hand, a more than 80% probability of a decrease in home advantage (calculated by point count) was found in only four leagues (German, Greek, Austrian, and the second Italian league). The findings of this study indicated that while it was possible to demonstrate a significant decrease in some indicators, the decrease in the level of home advantage was not consistent, and in some cases, there was even an increase in the home effect. According to the authors, the lack of consistency among the leagues is evidenced not due to the absence of a crowd, but rather due to additional changes that took place during the COVID-19 era, mainly changes in training routines. Bryson et al. (2021) analyzed 17 leagues throughout Europe and found no significant decrease in the level of home advantage during the COVID-19 period. Another study of eight European leagues (Jimenez et al., 2021) demonstrated that it is impossible to determine whether the absence of a crowd affects the home team or, alternatively, whether the crowd has any impact on the competitive outcome, goals, or points. Indeed, while the study demonstrated a decrease in the number of points scored at home and an increase in those scored at away games in the premier leagues in Germany and Spain, and even a decrease in the number of goals scored at home in the Austrian league, it offered no common denominator or explanation for these differences. In this vein, Fisher and Haucap (2020) analyzed the top three soccer leagues in Germany. Their findings showed a decrease in the level of home advantage only in the first league, but not in the second and third leagues. The explanation given by the authors is that in the first league, a bigger crowd was in attendance than in the lower leagues in previous seasons, and therefore the absence of the crowd was more dramatic and had a more pronounced impact on the home advantage.

In a systematic review of articles on COVID-19 and home advantage, Leitner et al. (2021) concluded that non-crowd games (i.e., "ghost games") have a considerable impact on this phenomenon. According to the authors, this effect is attributed to the referee's bias and lack of emotional support conveyed by the fans – both relate to the players' and referees' decision-making under pressure. As Dilger and Vischer (2020) suggested, several factors should be considered when measuring home advantage, such as playing style, running distance, pass accuracy, ball possession, and tackles achieved. Nonetheless, they mainly focused on match outcomes and goals scored for each team. We examined the home advantage phenomenon in non-crowd games in two sports, basketball and football. We measured game wins, losses, draws, goals scored and conceded, and additional mediating variables such as crowd size, density, geographic region, and league level.

Method

Sampling of Games

The sample used in this study included all matches played during six seasons in the following three leagues: the Football Premier League, National Football League, and Basketball Super League. Out of a total of 4,030 matches, 3,589 matches were played with a crowd present, and the rest were played without a crowd.

Data Extraction

The following categorical data were extracted for each match: teams playing, location, season, score, number of goals or baskets scored, number of goals or baskets conceded, and number of spectators (for games in which a crowd was present). The data were extracted from the published data of the Israel Football Association's website

(www.football.org.il) and the Israel Basketball Super League's website (basket.co.il). To verify the accuracy of the information, the data were compared to the information presented on the Sport5 website (Sport5.co.il).

Assessing Home Advantage

Home advantage was measured using three variables: (1) *level of general home advantage*, (2) *goals/baskets scored,* and (3) *goals/baskets conceded.* All three variables were measured using the method established by Pollard (1986), in which a team's home outcomes over one season are compared to its overall outcomes that year. The current research corpus necessitated adaptations to this calculation method because the number of home and away matches for each team sometimes differed due to the playoff games. To manage this situation, the three home advantage variables were measured as a percentage: the average of points (goals or baskets) scored at home relative to the total of these measurements at home and away. For example, in a particular season, Hapoel Haifa scored an average of 1.8 points at home (A) and an average of 1.4 points away (B). Therefore, the level of home advantage was A/(A+B) = 0.5625. A result of 50% indicates a lack of home advantage, and as the percentage rises, the level of home advantage rises as well.

Confounding Variables

Apart from the home advantage indicators, the analysis also included additional variables which may have affected the home advantage outcomes. The first was geographic location – whether the team was in the Israeli periphery (South and North) or in a large city (in Gush Dan, the biggest Israeli metropolitan area, or in one of the other large cities – Jerusalem, Haifa, or Beer Sheva). Several studies pointed to differences in the level of home advantage attributed to geographic and cultural differences (Pollard, Prieto, & Gomez, 2017; Pollard & Gomez, 2009). The average attendance for each team was extracted to examine the impact of crowd size on the home advantage. The final variable considered in the analysis was the ranking of the team at the end of the season, which reveals the most about the teams' quality and points to the association between team strength and home advantage (Pollard & Gomez, 2007; Allen & Jones, 2014).

Statistical Analyses

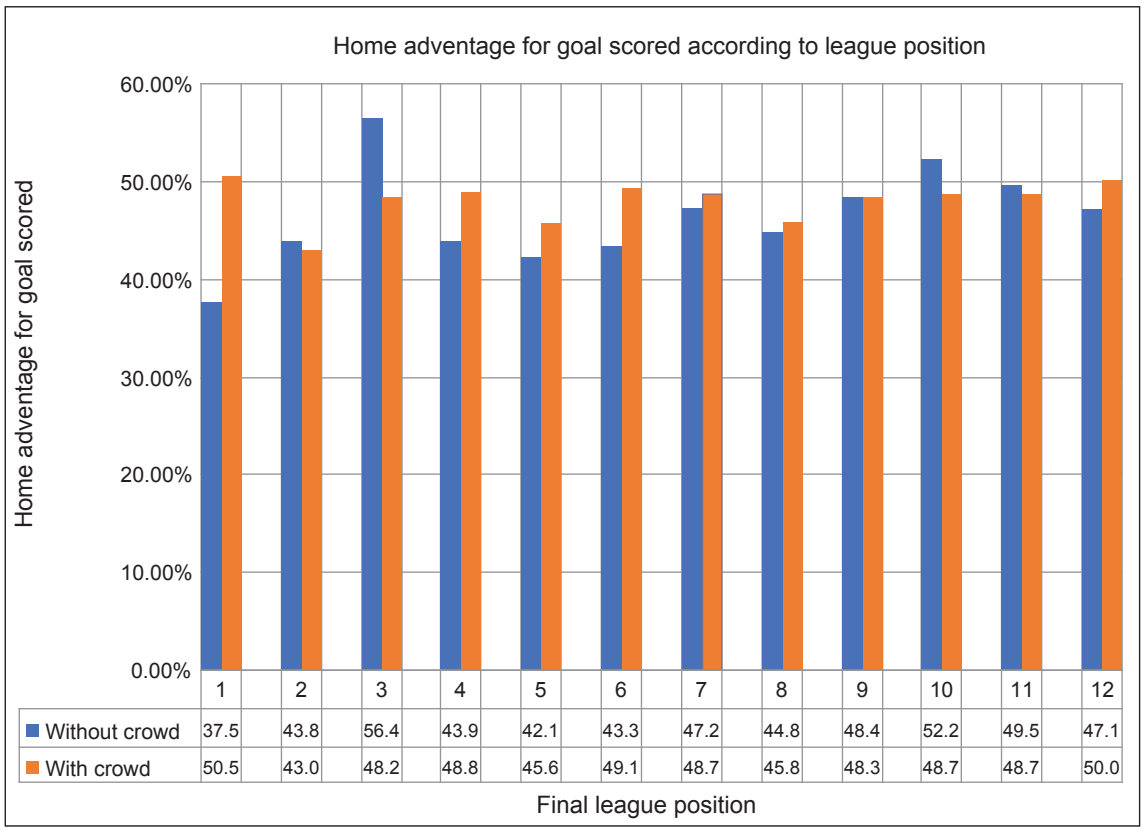
Descriptive analyses were performed for each of the three home advantage variables. In addition, two-way ANOVAs were performed separately for each of the three home advantage indicators (e.g., points gained, goals conceded, and goals scored). For each analysis, the team's performance (ranking of the team) was considered as the first independent factor, and the crowd presence/absence or type of league (football or basketball) was considered as the second factor. Finally, the three home advantage determinants were subjected to a series of one-way ANOVAs considering geographical location, league type, presence/absence of spectators, and the average attendance separately as independent factors. The significant results are presented in the figures.

Results

At the outset, we tested the notion that home advantage would manifest differently in the three leagues (e.g., elite soccer, first league soccer, elite basketball) and in the presence/absence of a crowd with respect to the teams' quality. A two-way ANOVA was performed separately for each of the three home advantage indicators (e.g., points gained, goals conceded, and goal scored). For each analysis, the team's performance was considered the first independent factor, and the crowd presence/absence or type of league was considered as the second factor.

The analysis revealed that the presence/absence of a crowd did not affect any of the three home advantage indicators ($p > .05$). However, a team status X crowd presence/absence significant interactional effect on goals scored emerged, $F(22,228) = 2.25$, $p < .0.1$. This interaction is presented in Figure 1. In most of the cases, the percentage of goals scored was lower in the absence of a crowd except for the teams in 2nd, 3rd, and 10th places. An additional main effect was that of crowd presence/absence on the percentage of goals conceded, $F(2,216) = 3.47$, $p < .03$. Figure 2 demonstrates that the percentage of goals conceded when the crowd was present was 0.89% higher than when the crowd was absent.

The descriptive analysis pertaining to the three components of home advantage is shown in Figure 3. It revealed that across all seasons, geographical locations, leagues, and sports types, as well as crowd presence/absence, the home advantage determined by the percentage of points gained and percentage of goals scored was slightly above 50% (52.47% and 51.30%, respectively), and the percentage of goals conceded was 48.23%. One-way analysis of



	1	2	3	4	5	6	7	8	9	10	11	12
Without crowd	37.5	43.8	56.4	43.9	42.1	43.3	47.2	44.8	48.4	52.2	49.5	47.1
With crowd	50.5	43.0	48.2	48.8	45.6	49.1	48.7	45.8	48.3	48.7	48.7	50.0

Figure 1. Means of the percentage of goals scored as a function of the teams' final placement at the end of the season

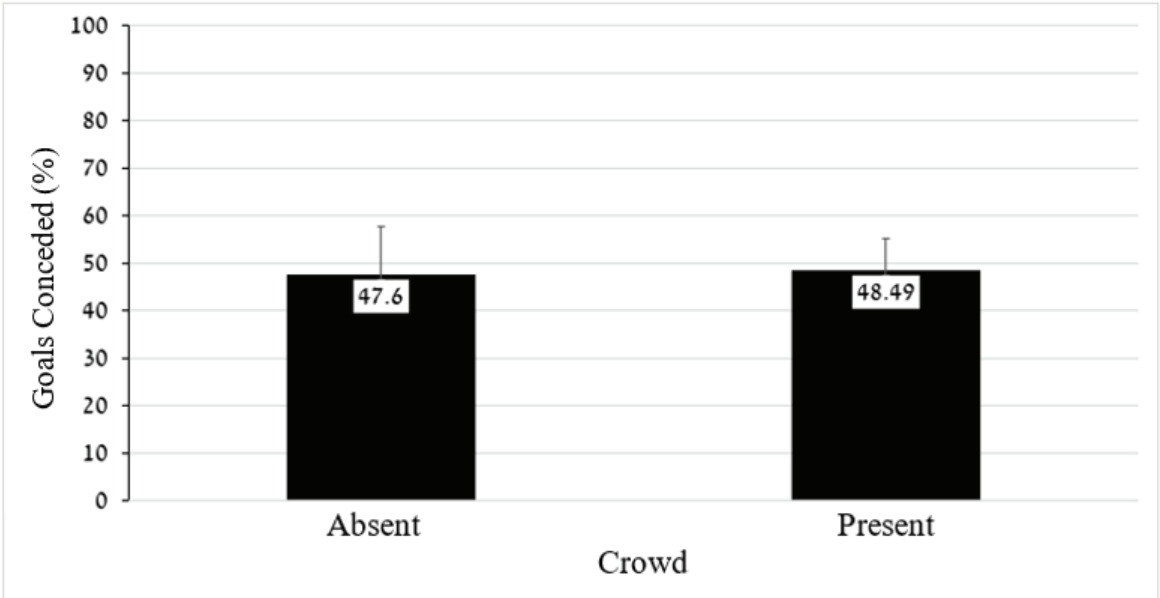


Figure 2. Means of the percentage of goals/baskets conceded (home vs away games) by crowd presence/absence

variance (ANOVA), which was applied to each of the home advantage components separately considering the team's league status at the end of the season, indicated a significant team status effect for goals conceded, $F(11,240) = 1.78$, $p < .05$, and for goals scored, $F(11,240) = 1.92$, $p < .04$, but not for points gained, $F(11,240) = 1.43$, $p = .16$, although the tendency to gain more home points remained.

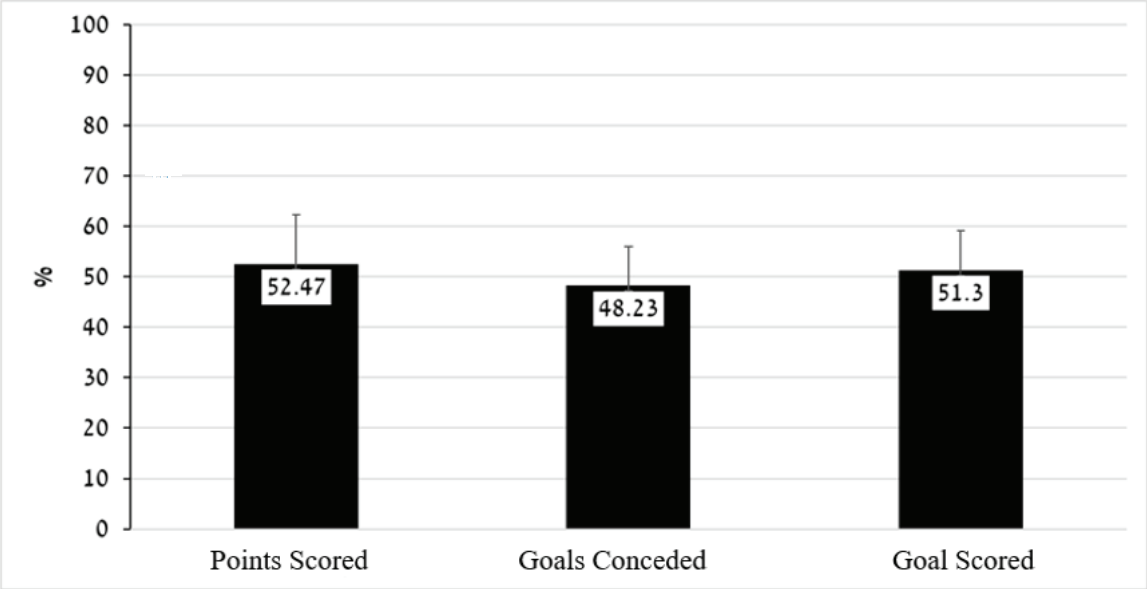


Figure 3. Home advantage in % for points scored, goals/baskets conceded, and goals/baskets scored

The descriptive data of these effects are shown in Figures 4a-c. Figure 4a demonstrates the home advantage in points gained by the teams in positions 1-12 in soccer and basketball. Except for teams in 12th place, the points gained decrease from the top teams to the lower teams. However, the decrease is small and remains slightly above 50% throughout the status leader. The descriptive data pertaining to the significant effects of goals conceded (Figure 4b) and goals scored (Figure 4c) show that a decline in the team's final status is associated with an increase in the team's conceded goals and a decrease in its home goals.

Finally, the three home advantage determinants were subjected to a series of one-way ANOVAs considering geographical location, league type, presence/absence of spectators, and the number of spectators separately as independent factors. The analyses revealed that for the effect of the number of spectators (three categories for soccer

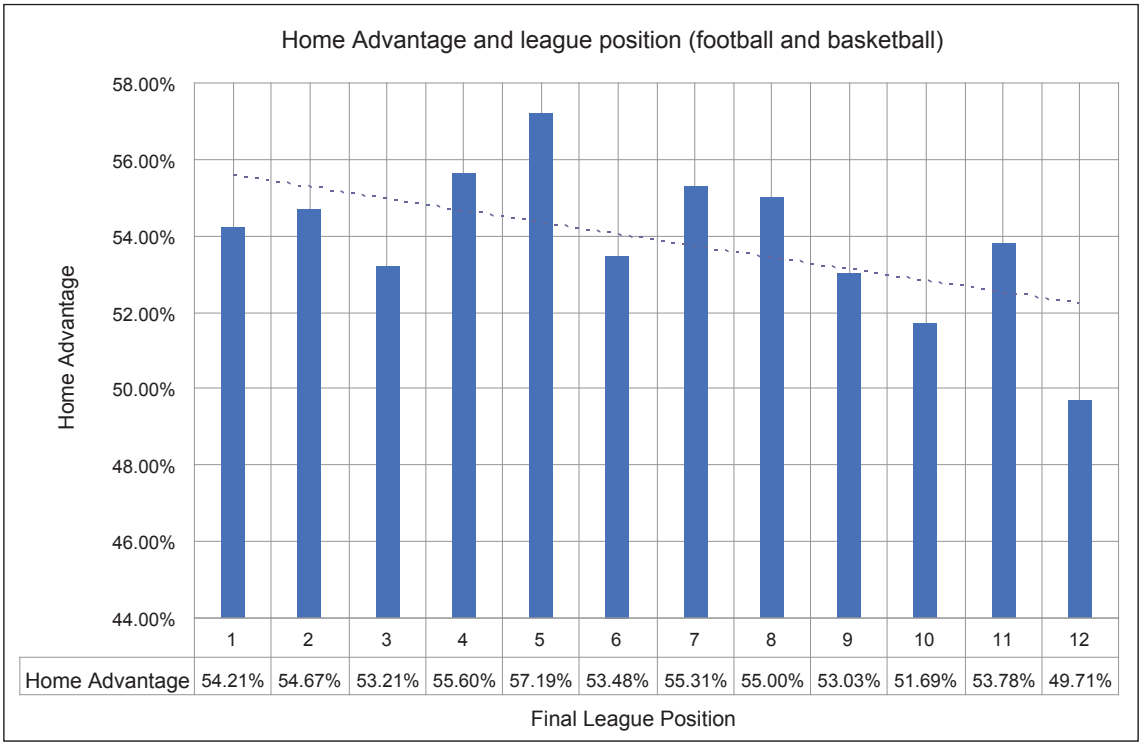
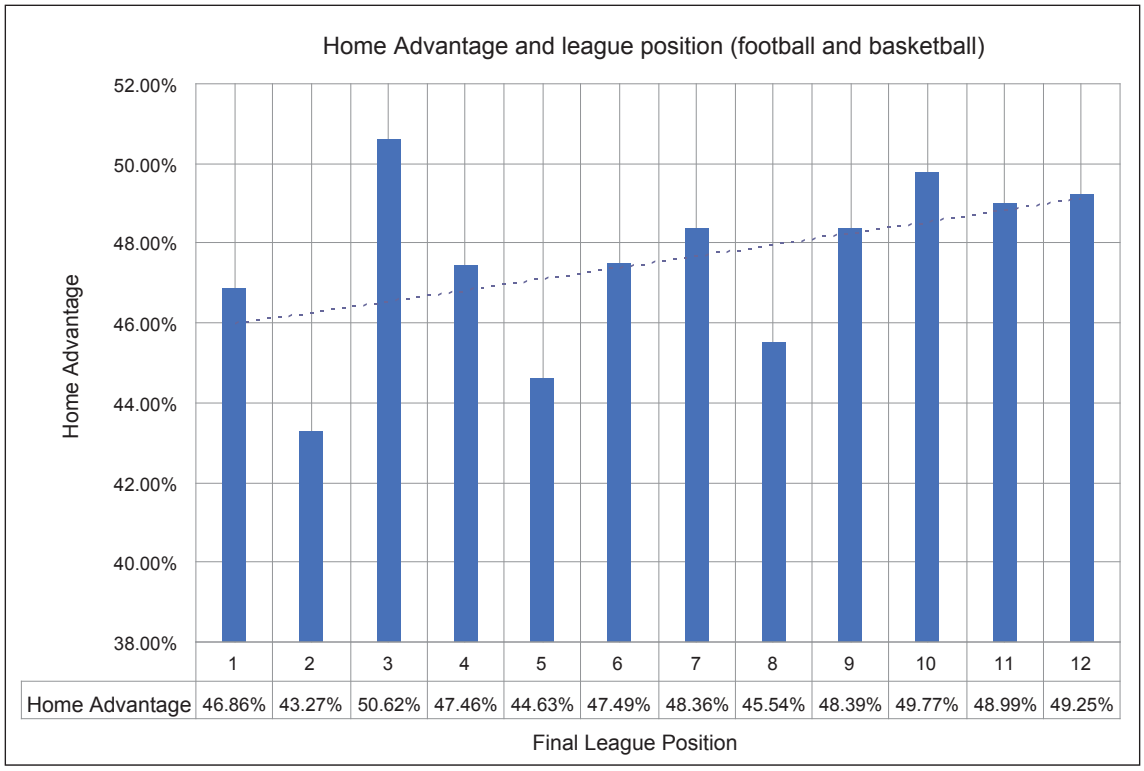
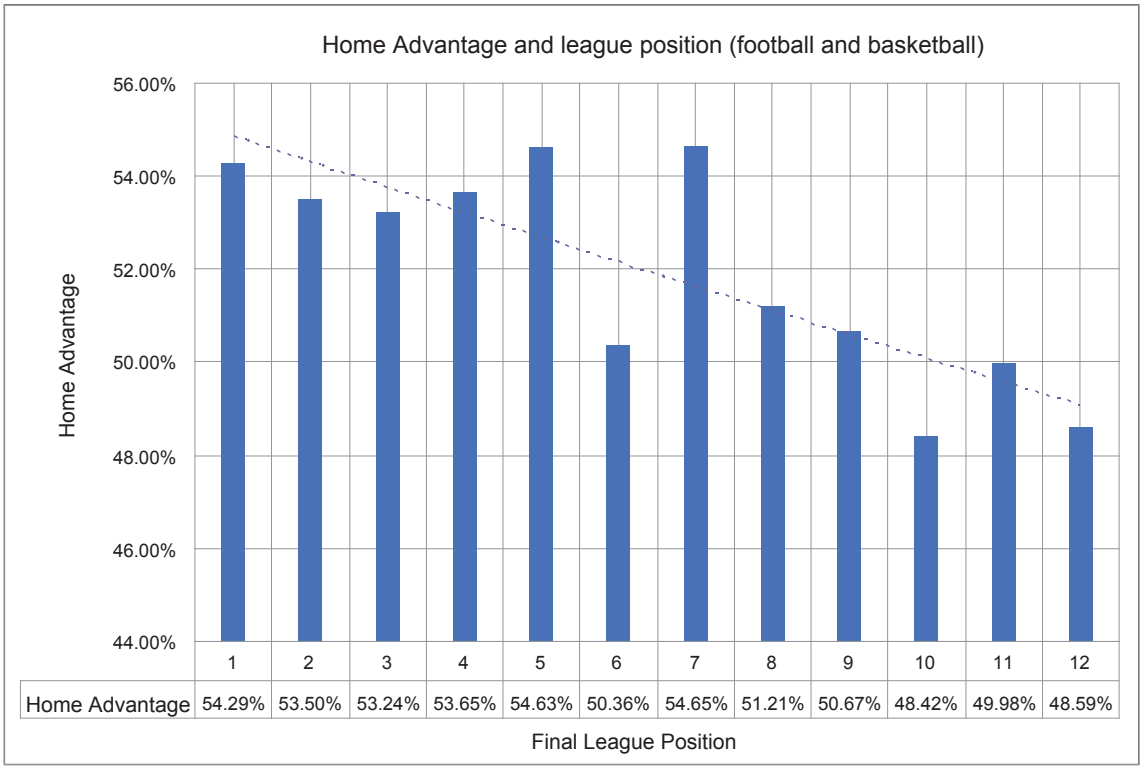


Figure 4a. Home advantage in % for points/baskets scored and final league position



	1	2	3	4	5	6	7	8	9	10	11	12
Home Advantage	46.86%	43.27%	50.62%	47.46%	44.63%	47.49%	48.36%	45.54%	48.39%	49.77%	48.99%	49.25%

Figure 4b. Home advantage in % for goals/baskets conceded and final league position



	1	2	3	4	5	6	7	8	9	10	11	12
Home Advantage	54.29%	53.50%	53.24%	53.65%	54.63%	50.36%	54.65%	51.21%	50.67%	48.42%	49.98%	48.59%

Figure 4c. Home advantage in % for goals/baskets scored and final league position

and basketball) on the percentage of goals conceded, none of the factors affected any of the home percentage determinants. The significant effect, $F(2,280) = 2.25$, $p < .01$, revealed that the mean percentage of moderate crowd attendance resulted in a higher percentage of goals conceded than when a large or small crowd was present.

Discussion

The findings of this study show that home advantage exists in the top soccer and basketball leagues in Israel. This advantage is reflected in points gained, goals scored, and goals conceded. It should be noted that the total level of home advantage measured in this study (52.47%) is 5% lower than the world average in soccer and even lower than the Israeli average of 58.03% in the 1998-2004 seasons as measured in Pollard's earlier study (2006). The lower home advantage level emerging in this study reflects a gradual decline in home advantage over the years (Pollard & Pollard, 2005). The second reason is that during these years, the VAR system was introduced to assist referees. Therefore, referees' mistakes were reversed following a review of the event. The use of VAR reduced the scope of referee bias, and consequently reduced the home advantage in soccer (Hen et al., 2020).

In contrast to previous studies in Israel (see Levental, 2015; Pollars, 2006), attendance, crowd density, geographic region, league level, and type of sport failed to impact home advantage. This could be explained by the fact that in Israel, the number of spectators at games is relatively small, and there are only negligible cultural and geographic differences among the various teams.

While these variables failed to affect home advantage, the findings of this study indicate that team ranking (an indication of a team's quality) has a significant impact on two home advantage measures, the percentage of goals conceded and the percentage of goals scored, although not on the general level of home advantage. In other words, the better a team is, the more goals it scores and the fewer goals it concedes at home matches compared to away matches. Nevertheless, the match results in terms of points gained remained unchanged. A stronger home advantage associated with teams possessing a higher skill level corresponds with findings reported in earlier studies (Madrigal & James, 1999). Better teams attract more spectators, which may influence the players and the referees. In addition, a team that plays in the home field of a superior team adopts more defensive tactics.

Moreover, in cases where an inferior team is leading during a match, players wish to maintain the score and gain points. In this context, Staufenbiel, Lobinger, and Strauss (2015) found that the location of the match (home or away) affects coaches' tactical decisions as an expression of their expectations and goals. In other words, the awareness of home advantage influences coaches' decisions with respect to tactics, and thus in practice affects home advantage.

With respect to the matches played before and during the COVID-19 pandemic, the findings show that the presence or absence of a crowd did not influence home advantage levels. Since the absence of a crowd at the stadiums failed to change home advantage, we conclude that the presence of spectators has a low impact on home advantage relative to other factors. As noted in other studies, the absence of crowds at stadiums during the COVID-19 period had a different impact in different countries and even in different leagues within the same country. Benz and Lopez (2020) explain the negligible impact of the crowd by more significant processes that took place simultaneously during COVID-19, and mainly by the change in teams' training regimens. In this regard, Fischer and Haucap (2020) claimed that a decrease in home advantage levels due to the absence of crowds occurs only in the case of a significant decline – that is, mostly for teams accustomed to high attendance numbers. This explanation is appropriate for the Israeli league as well, where the average attendance is low compared to the top leagues in Europe and the rest of the world.

Despite the lack of a significant change in the level of home advantage, the absence of crowds did affect the number of goals conceded. This finding indicates that the crowd influences the efforts a team invests in defense compared to its efforts in offense. Two reasonable assumptions are that the home crowd places substantial pressure on its team's defensive players and exerts a generally negative influence on the defense, and that home teams attack more and expose themselves to counterattacks when spectators are present.

The current study revealed a significant interaction between team quality (ranking) and the presence of a crowd on the home advantage level in the area of goals conceded. When the crowd was absent, teams that were ranked higher at the end of the season had conceded relatively fewer goals at home than at away matches. Superior teams usually have more fans accompanying them to away matches. The crowd's presence at away games creates an additional commitment to the defensive game. When the matches were played without a crowd, the teams of a lower ranking, which would typically receive less support from the crowd, did not demonstrate any change in the number

of goals conceded. Finally, the descriptive findings indicate that the home advantage in terms of goals conceded is higher for teams with a large spectator base or a small spectator base than for teams with a medium-sized spectator base. In the absence of preliminary theoretical explanations, we assume that this is related to the quality of the team and to tactical aspects in which teams tend to continue the offensive move when they play at home against inferior teams and play a more defensive game against superior teams on their home field. On the other hand, teams with a medium-sized spectator base do not face either of these two situations.

Conclusion

This study sought to examine the impact of the absence of a crowd on home advantage in elite soccer and basketball in Israel. The findings of the study demonstrate that while home advantage exists in all the leagues examined with respect to all three measures – goals scored, goals conceded, and number of points – it is not affected by variables such as crowd size, density, geographic area, league level, or type of sport. Furthermore, even the COVID-19 period, during which all matches took place without a crowd in attendance, did not bring about a significant change in the home advantage phenomenon. In other words, with respect to the examined case, the presence of spectators in the stands does not affect home advantage, even when there are no spectators at all or when there are many or few spectators. These findings suggest that considering the marginal contribution of spectators, other factors may influence home advantage, such as the factor of the perceived quality of the rival team that emerged from the current study.

These findings point to a couple of practical implications. First, they highlight the significance of the local aspect of sports culture. While the home advantage phenomenon is constant across the globe, the differences between the various leagues show that the magnitude of each factor is embedded in the local setting. Second, in the Israeli context, the absence of a crowd has an economic effect instead of an impact on performance. These findings can therefore be a tool for decision-makers, such as when considering necessary adjustments for situations in which crowd reduction is required for safety or security reasons.

Ethics approval and informed consent
The study did not include human participants.

Competing interests
The authors declare no competing interests.

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