

Limited evidence for differences in the home advantage between genders and age groups in Dutch elite field hockey

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Research on the home advantage suggests that men typically benefit more from playing at home than women and that the home advantage increases with age. However, these studies are typically based on popular sports with high data availability like soccer and rarely include comprehensive data on women and underage athletes. Therefore, to address this gap, this study examined whether these patterns also hold for Dutch elite field hockey – a sport highly similar to soccer but rarely examined. We analyzed the number of points won and goals scored for a total of 6,880 games from five seasons of the highest league for the U14, U16, U18, and seniors played between 2018 and 2023. While we found evidence for the home advantage for both men and women, despite small effect sizes, there were no significant gender differences. However, the differences that approached significance favored the women at the U16 and U18 level. Additionally, we did not observe significant changes in the home advantage with increasing age. These findings suggest that sport-specific patterns exist for the home advantage with regards to gender difference and maturation effects.

KEY WORDS: Learning, Performance, Professionalization, Social Facilitation, Women Sports.

Introduction

The home advantage is a well-established phenomenon in sports and typically describes the tendency of teams to win over 50% of their matches at home under a balanced schedule (Courneya & Carron, 1992). This favoring effect of one's home turf is common across different types of sports and mostly researched in soccer, basketball, and volleyball (Pollard et al., 2017).

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Other sports – like field hockey, which is one of the most popular team sports in the Netherlands – have not been thoroughly examined with regards to the home advantage. Instead, most research has focused on popular sports played in Europe and Northern America due to the open accessibility of rich datasets without explicitly testing whether the commonly observed patterns in this data generalize across sports. Moreover, the dominance of these sports in the home advantage literature is largely limited to retrospective analyses of senior-level competitions for men (Leite, 2023), despite the limited data that exists, which suggests that men benefit more from playing at home than women (Pollard & Gómez, 2014; Pollard et al., 2017). This necessitates proper examinations of the home advantage in both genders, ensuring that the unique dynamics and potential differences between men and women are thoroughly investigated. Furthermore, even less is known when the tendency to win more frequently at home emerges. Only few exceptions have monitored and demonstrated the development of the home advantage from the youth level to the senior level (e.g., Staufienbiel et al., 2016). Clarifying the developmental pathways of the home advantage could indicate how the gender differences that we commonly observe at the senior level emerge. Therefore, this study aims to examine whether the gender differences between men and women as well as the development of the home advantage with increasing age commonly derived from soccer also extend to elite field hockey.

Gender differences in the home advantage

Although both men and women benefit from playing on their home field, Pollard et al. (2017) demonstrated that the home advantage is stronger for men across a variety of sports. For example, in soccer, men were observed to win 56.54% of all points at home, while women won only 53.75% of points at home. However, the study was only able to compare five of the 15 sports due to the lack of research on home advantage with women's sports teams. Specifically, the authors demonstrated men in field hockey win 53.18% of the points when playing at home without any comparison to women. Given these gaps in the existing literature, further investigation is required to draw firm conclusions on whether the gender differences in the home advantage indeed generalize to other sports. Studies that include data on both male and female athletes are therefore essential to expand our understanding of these dynamics (Walton et al., 2022). That is, even though soccer and field hockey are very similar with regards to the basic elements of the sports (i.e., an 11 vs. 11 team invasion game with the aim to score goals against the opposition),

the generalization of the gender difference is yet to be tested explicitly. If even such similar sports do not exert the same patterns, general conclusions about the home advantage should be reconsidered with caution.

In general, the home advantage is driven by several factors. These factors were originally sorted into four overarching categories by Nevill and Holder (1999) which were later extended by five additional ones (Pollard & Gómez, 2014): crowd, travel, learning rules, referee or judging bias, familiarity with local conditions, territorial protection (see also Neave & Wolfson, 2003; Furley et al., 2018), special tactics, and psychological factors. The *Home Advantage Model* (HAM) by Bilalić et al. (2021) further complements these considerations by suggesting that home advantage is not only explained by objective, physical factors such as travel or sport-specific rules. Instead, it also involves cognitive biases and social interactions that influence how players and teams perceive and engage with the game environment. These biases affect not just the perception of performance, but also the social dynamics within the sport, which may vary between individuals and teams.

Overall, most of the factors are arguably highly similar between men and women, such as travel or sport-specific rules, as they are inherent part of the sport. However, the HAM model can offer additional insights, particularly by highlighting the psychological and social dimensions of home advantage, which may manifest differently for men and women. For example, the influence of spectators or the perceived “territorial protection” can be perceived differently by male and female athletes, which can lead to differences in the extent of the home advantage.

While the *HAM model* by Bilalić et al. (2021) highlights the cognitive and social factors that contribute to home advantage, there are also biological influences at play that may help explain potential gender differences. Specifically, on a psychoendocrinological level, hormonal difference between men and women may explain the difference in the home advantage. Men have been found to display higher levels of testosterone when playing at home (Neave & Wolfson, 2003, Carré et al., 2006). The surge in testosterone occurs when defending one’s “turf” and is associated with increased self-confidence and competitiveness (Carré et al., 2006). However, these studies have only included men in their samples (or not specified any gender distribution). Thus, it cannot be ruled out that the same hormonal changes also occur in women independent of the different baseline levels.

A second, more pronounced factor, is the difference in crowd size. Despite increasing crowd sizes at women sporting events in recent years, there is still a large difference in the average attendance between men and women sports (Valenti et al., 2020). Anderson et al. (2012) showed that the home

crowd and comfortable surroundings are perceived by players as the most important components of home advantage. The home advantage has been shown to increase when crowd density (i.e., number of seats that are occupied compared to the total number of seats available in a stadium) increases, partly due to feelings of social support (Smith, 2003). Crowd attendance, particularly when they are supportive rather than hostile, can help athletes to reach peak performance on well-learned tasks (Zajonc, 1965). Research has shown that players' technical, tactical, and physical performances will suffer in the absence of fan support (Wang & Qin, 2023). In addition, the crowd also impacts referees and coaches. Due to the larger number of spectators in men's sport, refereeing decisions may be swayed more in the favor of the home team for men than for women (Boyko et al., 2007; Neville et al., 2002). Furthermore, coaches choose for more offensive tactics when playing at home, providing greater courage and more dominant playing styles (Staufenbiel et al., 2015). Despite all the evidence supporting the role of the crowd, it should be noted that the home advantage persists (with few exceptions) when spectators are not allowed to attend (e.g., Hill & Van Yperen, 2021). Overall, there seem to be both biological and social factors that would predict a larger home advantage for men than women. However, such inferences may be insufficient and require empirical validation. Therefore, it is essential to test whether these observed differences genuinely reflect underlying trends or are merely the result of data gaps (Cowley et al., 2021; Martínez-Rosales et al., 2021).

THE DEVELOPMENT OF THE HOME ADVANTAGE

The increasing facilitative effect of crowds with increasing skill level indicates that the factors that drive the home advantage do not remain stable over time but develop as athletes mature. For instance, while FC Barcelona's first team competes in a stadium capable of accommodating 99,354 spectators, its younger teams play in a venue with a maximum capacity of only 15,276. These structural changes of the sport alongside the overall improvement in skill level during the development of athletes should become visible in the game outcome given that this mimics the definition of the home advantage (Courneya & Carron, 1992). To examine the potential development of the home advantage, Staufenbiel et al. (2016) examined the differences between various age groups (i.e., U9, U11, U13, U15, U17, and U19) of male soccer players from different competition levels. The study showed that the home advantage increased from 52.26% in the U9 group in an almost linear

trend to 59.13% on the senior level. This trend was also paired with the players' belief that they would benefit from playing at home which was present in young children and became more pronounced as they matured.

Apart from skill levels and increasing crowd sizes, athletes also develop an increasing awareness of and familiarity with their regular sporting environment. The familiarity with local conditions is a particularly strong driver of the home advantage when large differences between the different playing areas exist (Balmer, 2001). Furthermore, the developing athletes also become familiar with playing at home and away per se. The maturation study by Staufenbiel et al. (2016) also suggests that this might be because youths learn more the potential advantage they have when playing at home. Thus, the home advantage seems to be a ubiquitous phenomenon that gains strength with the maturation process of athletes as it is associated with increasing skill level, which is further amplified by increasing crowd attendance. However, this conclusion is mainly based on data from soccer-specific studies, which typically focused exclusively on male participants. Thus, the question remains whether these findings extend to other sports and generalize across gender.

THE CURRENT STUDY

The aim of the current study is to examine whether the gender differences between men and women as well as the development of the home advantage with increasing age commonly found in soccer also extends to field hockey. Specifically, research has shown that men tend to benefit more from playing at home than women (Pollard et al., 2017) and that the home advantage increases as athletes mature (Staufenbiel et al., 2016). However, most of this research is based on insights from soccer-specific studies with strongly imbalanced gender distributions, focusing primarily on professional athletes. Thus, we provide a first assessment of the generalizability of these findings with a highly similar sport (i.e., field hockey). This study aims to address the existing research gap and extend the focus to a broader athlete demographic. First, it will investigate the home advantage phenomenon in Dutch field hockey in general terms. Subsequently, the study will analyze gender-specific differences and the progression of home advantage in Dutch field hockey, tracing its development from youth levels to elite adult athletes. Building on previous findings across various sports, our first hypothesis posits that there is a home advantage in field hockey at the elite level regardless of gender (*Hypothesis 1*). Our second hypothesis posits that men exhibit a stronger

home advantage than women (*Hypothesis 2*). Our third hypothesis posits that the home advantage intensifies as athletes progress from youth to adulthood (*Hypothesis 3*). Furthermore, we explored whether the expected gender differences are also present when comparing different age groups of boys and girls.

Method

DATA

The data of this research was provided by the Royal Dutch Hockey Federation (KNHB) and contains the match outcomes of the highest leagues in Dutch field hockey for males and females at the U14, U16, U18, and senior level (see for all data <https://doi.org/10.34894/B3QFZT>). In the Netherlands, field hockey is organized into various skill categories for both youth (boys and girls) and adult (men and women) divisions. This study includes only the highest competitive level within each age group. In the senior category, the “Hoofdklasse” represents the highest level of competitive field hockey, comprising the top 12 clubs in the country and is comparable to the “Eredivisie” in football regarding its elite status. For youth teams, only the top level within each age category is considered. Within each age group, there are typically 16 to 24 teams competing at the highest level, divided into two to four leagues. These leagues are equally competitive and represent the highest skill tier in the country for each respective age group and season. Note that younger age groups do not compete in a comparable, structured league system. All data refers to the 2018/2019–2022/2023 season and consists of 6,880 games in total (for a distribution per age group, see Table I).

TABLE I
Overview Of The Number Of Games Per Age Category by season

		Season					Total
		2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	
Men	U14	330	33	0	330	150	843
	U16	337	24	0	240	240	841
	U18	338	119	0	336	336	1129
	Senior	132	90	133	132	132	619
Women	U14	330	37	0	330	150	847
	U16	336	25	0	240	240	841
	U18	336	122	0	336	336	1130
	Senior	132	102	132	132	132	630

Note. Due to the COVID-19 pandemic, the number of games was reduced in the 2019/2020 season, while the 2020/2021 season was fully canceled for the juniors.

MEASURES AND DATA ANALYSIS

We used the match outcome data to calculate the number of points won by the home and away teams per match. Per game, a team can either earn zero points (i.e., a loss), one point (i.e., a tie), or three points (i.e., a win). Because hockey follows a balanced schedule, all bilateral pairs of clubs play each other an equal number of times during the season. To determine the presence of a home advantage, we followed the guidelines by Pollard (1986) to calculate the relative home advantage by dividing the number points won at home by all points and multiplying this quotient by 100. The home advantage exists if more than 50% of the points were won by the home teams (Goumas, 2014).

In the first step of the analysis, we determined the existence of the home advantage through one-proportion tests, which indicate whether more than 50% of the points were won at home (Hypothesis 1). Due to the large number of games, significance tests for the home advantage are typically overpowered (Dufner et al., 2023; Sors et al., 2020; Sors et al., 2022). Therefore, for the first two hypothesis tests, which are based on very large samples sizes, we do not only consider the significance test but also examine the effect sizes, which should yield at least a small effect (Cohen's $H = 0.2$) as recommended by Sors et al. (2022). To test the gender differences in the home advantage (Hypothesis 2), we conducted proportion difference tests for the relative home advantage between men and women at the senior level. Our hypothesis is supported if we find a significantly larger relative home advantage for men. Furthermore, we conducted exploratory analyses to assess whether the gender difference also extends to all age groups (i.e., U14, U16, and U18), as well as when all age groups are combined, including the seniors. In order to test whether the home advantage increases as athletes mature (Hypothesis 3), we conducted a linear regression similar to Staufenbiel et al. (2016). Specifically, we expect to find a positive slope when regressing the proportion of points won on age (by category, U14, U16, U18, and senior). Given that we assume to find gender differences, we conducted separate regressions for each gender.

Results

Our first hypothesis stated the existence of the home advantage in field hockey in general. Thus, one-proportion tests were calculated. The results only partially supported the existence of the home advantage in field hockey. Specifically, the home teams won more than 50% of the points at home across all gender and age groups (see Table II). However, while all one-proportion tests reached significance, except for the women's senior level ($p = .362$), none of the tests exceeded the threshold for a small effect size ($H_s < 0.2$). Thus, the presence of the home advantage in field hockey was supported based by the 50% threshold, but not by statistical significance (*Hypothesis 1*).

The second hypothesis stated that men show stronger tendencies for the home advantage than women. The proportion difference tests did not yield significant differences between the genders (see Table II). Interestingly, the tests that approached significance (U16 and U18) yielded a larger relative home advantage for women. Therefore, we did not find evidence supporting the hypothesis (*Hypothesis 2*).

TABLE II
Relative Home Advantage For Men And Women And The Comparison Between Genders Per Age Group.

					Senior	Combined
	Statistics	U14	U16	U18	53.00	55.80
3Gender	<i>n</i>	2440	2399	3196	1747	9782
	<i>p</i>	< .001	< .001	< .001	.006	< .001
	<i>H</i>	0.148	0.109	0.109	0.060	0.116
	%	56.73	58.07	57.73	50.42	56.24
Women	<i>n</i>	2406	2378	3201	1769	9754
	<i>p</i>	< .001	< .001	< .001	.362	< .001
	<i>H</i>	0.135	0.162	0.155	0.008	0.125
Difference	<i>p</i>	.648	.067	.065	.126	.536
	<i>H</i>	0.013	0.053	0.046	0.050	0.009

Our third hypothesis posited that the home advantage increases as the athletes mature. Our regression analysis revealed a non-significant negative relationship between age group and proportion of points won for both men ($\beta = -0.946$, $t(1,2) = -4.096$, $p = .055$) and women ($\beta = -0.693$, $t(1,2) = -1.359$, $p = .307$). This means that, in contrast to our hypothesis, the data suggests that the relative home advantage declines as athletes mature, albeit the trend not being significant (*Hypothesis 3*).

Discussion

Past research on the home advantage has repeatedly pointed out that men tend to benefit more from playing at home than women (e.g., Pollard et al., 2007). Furthermore, the home advantage has been found to increase as athletes mature (Staufenbiel et al., 2016). However, most of these tendencies were usually assessed on popular European and Northern American sports, especially soccer, and rarely included comprehensive data of women. Therefore, the aim of the current study was to examine whether the gender differences between men and women, as well as the development of the home advantage with increasing age, commonly found in soccer also extend to elite field hockey. To do so, we sampled match outcomes of several seasons of elite youth and senior field hockey from the Netherlands. While our results demonstrate that the home advantage exists in field hockey across both

gender and age groups, with respect to the 50% threshold for points won at home (Courneya & Carron, 1992), these effects were statistically very small. In fact, our results show that men at the senior level seem to win 53% of the points at home, a value resembling the findings of Pollard et al. (2017). In comparison, in soccer, men win between 57% (Pollard et al., 2017) and 67% (Jamieson, 2010) of the points at home.

Despite the sport-specific similarities between soccer and field hockey, the disparities in the home advantage on a professional level may, at least in part, be due to the crowd size present at these games. While every professional soccer team of the major competitions across the world plays in a large stadium, hardly any Dutch field hockey team plays in a comparable venue. Thus, the effects of social facilitation (Zajonc, 1965), coaches' tactical choices (Staufenbiel et al., 2015), and influence on the referee (e.g., Boyko et al., 2007; Neville et al., 2002) may be less pronounced in field hockey. Furthermore, it may be reasoned that the similarity of playing fields across the Netherlands as well as the relatively small size of the country, which reduces travel time and meaningful geographic differences, are also driving factors (Nevill & Holder, 1999; Pollard & Gómez, 2014). Future studies should explicitly explore these mechanisms and expand this data with different groups from different geographical locations to provide a detailed understanding on why these differences emerge.

Given that the relatively small and rather similar venues for field hockey games in the Netherlands apply to both men and women, the crowd size and familiarity with the environment may also explain the lack of evidence that men benefit from playing at home more than women. Specifically, in contrast to our second hypothesis, we did not find statistical evidence that men have a stronger relative home advantage than women. In fact, the trend seemed to favor the women in younger age categories (i.e., U16 and U18) albeit not being significant. This lack of evidence may be due to the relatively small differences in the home advantage in field hockey. Nevertheless, our findings suggest that the gender differences often reported in the literature may not hold across sports.

Also, the *HAM model* can help explain these findings. According to *HAM*, home advantage is shaped not only by objective factors like crowd size and travel but also by cognitive and social biases that influence how athletes perceive and respond to their environment. These biases can be particularly relevant when considering differences between genders. While the crowd's size and support are known to influence male athletes more strongly due to the psychological benefits of defending one's home turf (as seen in soccer, Carré et al., 2006), the smaller crowds in field hockey may result in less pro-

nounced social and cognitive biases. This reduction in bias may contribute to the smaller home advantage observed in this study, as the psychological components emphasized in *HAM* (e.g., social support, referee bias) could be weaker in field hockey compared to sports like soccer, where these factors are more prominent.

The lack of meaningful difference in the home advantage between men and women is also reflected in the developmental trajectories across youth. Specifically, Hypothesis 3 argued, in line with the findings of Staufenbiel et al. (2016), that the home advantage would increase as athletes mature due to learning factors. However, our results indicate that for both men and women in field hockey the home advantage does not change in a statistically meaningful pattern as athletes mature. Moreover, the trend even indicated the opposite pattern in that the home advantage declined with increasing age. The fact that the impact of the home advantage drops with the transition to the senior level may be explained by the fact that coaches and staff are aware of this effect and can place countermeasures in the match preparation (e.g., tactics or improved travel arrangements). Moreover, research indicates that athletes' proficiency in utilizing coping mechanisms improves with age, suggesting that older athletes are more adept at managing stressors compared to their younger counterparts (Tamminen & Holt, 2012). According to Nicholls and Polman (2007), the effectiveness of coping depends on the number of coping strategies the athlete possesses and how capable a person is in applying these techniques in specific situations. Thus, as athletes mature and become more familiar to the differences between home and away games, they may develop effective strategies to cope with these demands. In other words, the exposure to stressful away games during the youth may foster functional adaptations, which in turn lead to higher performance under similar circumstances at the senior level (Hill et al., 2024). However, given that the home advantage in field hockey seems to be rather weak overall and the common gender differences do not hold for the sport within the Netherlands, we are cautious to generalize this trend to other sports. More thorough investigations of youth developments are warranted to draw a firm conclusion.

Strengths and limitations

This study investigates the home advantage in a relatively understudied sport – field hockey. Previous research has predominantly focused on soccer and other popular sports played in Europe and North America (Pollard et al., 2017). Consequently, this study extends the understanding of the home

advantage to additional sports. Furthermore, it addresses the gender data gap (Cowley et al., 2021; Martínez-Rosales et al., 2021) by including data from female leagues in the analysis. By examining athletes' developmental stages, from youth through multiple leagues to adult players, this study surpasses the current standard in the field. In doing so, it addresses several research gaps.

The current study has three major limitations. First, our conclusions are mainly based on the relative distribution of points. However, more indicators, such as referee sanctions, are frequently used to derive specific conclusions about the home advantage related to specific factors like the referee bias. Unfortunately, such data is not registered across all competitions and was therefore unavailable in this study. Second, we utilized a retrospective analysis of match outcomes. This means that we can provide little information into actual behavioral differences between home and away teams. For example, Staufenbiel et al. (2015) have pointed out that home teams may choose for more offensive tactics, while away teams take more cautious approaches. Thus, specific behavioral indicators (e.g., penalty kick performance, Zheng et al., 2023) may further clarify why the home advantage in field hockey is rather small. Furthermore, exclusively relying on match outcomes does not provide any insight into the perceptions and experiences of the athletes. It is reasonable to assume that these psychological factors differ between gender and change for athletes as they mature (Staufenbiel et al., 2016). Thus, future research may zoom in on the psychological factors despite potential null findings in match outcomes to provide a deeper understanding of gender differences and maturation effects. Third, our conclusions largely rely on effect size measures suggested by previous studies (e.g., Dufner et al., 2023; Sors et al., 2022). However, it may be argued that such statistical indicators are not particularly useful to determine the strength of the effect on actual competitions. Instead, future research may focus on the difference between the actual number of points won at home and away. Such a measure would reflect the actual units of measurement for performance in the sport rather than relying on statistical inferences. For example, if home teams win 6 points more at home than away (i.e., the difference of two wins), this difference may not yield a large effect size but can be meaningful for the final ranking of a team.

Conclusion

The aim of this study was to examine whether the gender differences between men women as well as the development of the home advantage with

increasing age commonly found in soccer also extend to elite field hockey. Our results indicated that neither the gender differences nor the maturation effect hold for elite hockey in the Netherlands. Moreover, while all tests were not significant, the findings indicated the opposite trends. Thus, sport-specific findings on the home advantage may not generalize, especially for sports like field hockey where the home advantage is relatively small to begin with.

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