

Game location influences basketball players' performance across playing positions

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Abstract

Home advantage in sport has been the subject of much empirical work, although the causes underlying this effect are still unclear. In team sports such as Basketball, available literature has analyzed home versus away performances at a team level. The present study investigated the presence of home advantage at the level of the individual player's position. It also attempted to identify a subset of game-related statistics that could discriminate home and away performances according to each player's position. To achieve these aims, archival data were obtained from 225 games for the 2004-2005 Euroleague. Players were subdivided so that the "point guards" and "offguards" were pooled as guards ($n=493$), the "small forwards" and "power forwards" were grouped as forwards ($n=485$) and the centres ($n=233$). A 2×3 (game location: home and away; playing position: guards, forwards and centres) factorial MANOVA followed by a discriminant analysis was performed. For the guards, the discriminant function was significant and the game-related statistics that differentiated most home and away performances were the successful two point field-goals, defensive rebounds, assists, steals, blocks and committed fouls. The forwards' home and away performances were discriminated by successful free-throws, assists, steals, blocks and committed fouls. The function for centres was non significant. Results suggested a differential effect of home advantage in basketball players by role in the team, with guards from home teams playing more assertively, whereas in away teams forwards played more assertively. These results provide initial evidence to support a position specific approach when preparing for home and away games in team sports.

Introduction

In previous years, home advantage has been extensively investigated across very wide contexts all over the world (for a review see Nevill and Holder, 1999). Available research has not adequately explained this phenomenon, although it is undeniable that competing in the home field increases the probability of success. Theoretical explanations for this phenomenon are many and varied, including biological-based theories of territoriality, social psychology drive theories, social cognitive theories and sociological theories of community celebration (for a review see Courneya and Carron, 1992). According to Courneya and Carron (1992) there is no evidence in the literature to support strongly any theoretical explanation over another; therefore they provided a conceptual framework to incorporate constructs from several possible interpretations. This conceptual framework has served as a catalyst for home advantage research in the past decade and was recently revisited and restructured by Carron, Loughhead and Bray (2005). Briefly described, the framework incorporates five major components: (i) game location, representing the performance site (home versus away); (ii) game location factors, representing conditions that impact on teams' home versus away performance, such as crowd factors, learning/familiarity factors, travel and rule factors; (iii) critical psychological and physiological states; (iv) critical behavioural states exhibited by competitors and coaches; and (v), performance outcomes, divided into primary (fundamental level, such as free-throw percentage in basketball), secondary (intermediate, such as points scored in basketball) and tertiary (outcome measure, win-loss ratio).

In the game of Basketball, researchers have reported that 64% of the games played in leagues with balanced schedules are won by the home teams (Courneya and Carron, 1992). Particularly in the National Basketball Association from the USA, home advantage has recently been examined and has currently levelled off at about 60% (Pollard and Pollard, 2005).

Research that related game location to competitors' critical behavioural states through primary performance outcomes is scarce and limited to the studies conducted by Varca (1980) and Silva and Andrew (1987). These authors aimed to identify the game-related statistics that best seemed to explain why home teams win more games. Varca (1980) studied home advantage in college basketball (n=90 games) and hypothesised that home teams outperformed visiting teams in functional aggression (defined as any behaviour intended to dominate or intimidate an opponent, measured by the following game-related statistics: rebounds, steals, blocks and steals). The results supported the hypothesis because home teams outperformed visiting teams in rebounds, blocks and steals, while visiting teams committed more fouls. With the same research aim, Silva and Andrew (1987) found that the number of rebounds, turnovers, field-goal percentages and committed fouls accurately discriminated between home and away college team performances (n=420 games).

Despite their importance, these two studies need to be added to regarding analyzed game-related statistics, by including the successful and unsuccessful three point field-goals and by separating defensive and offensive rebounds, as suggested in more recent studies (Sampaio and Janeira, 2003; Sampaio, Godoy and Feu, 2004). Additionally, available research on the differences between home and away performances is limited to team analysis; however it seems possible that home advantage influences individual player performance according to their specific positions. For example, rebounding involves securing an inside position and entails strong physical contact. On the other hand, steals and blocked shots represent an aggressive defence and contribute to intimidating opponents and disrupting their offensive play (Varca, 1980). Steals and the rebounds are assertive behaviours in that they involve risk, which may lead to greater frequency in home performances rather than away performances. A missed steal or a missed blocked shot usually results in a committed foul. The fouls can be considered a measure of a team's defensive assertiveness because they

require physical contact and often result from violating rules in an attempt to dominate the opponents.

Recently, Sampaio, Janeira, Ibáñez and Lorenzo (2006) reported several differences in playing performance between basketball guards, forwards and centres in three professional leagues (NBA - USA superior level, ACB - Spain intermediate level, LCB - Portugal inferior level). In the LCB league, centres and guards were discriminated mainly in terms of defensive tasks, with emphasis on blocks and defensive rebounds and a de-emphasis on unsuccessful three point field-goals. In the ACB level, centres and guards were discriminated by offensive tasks, with an emphasis on assists and three point field-goals - both successful and unsuccessful - and a de-emphasis on offensive rebounds. Finally, in the NBA league, guards and centres were discriminated by offensive tasks, with a greater emphasis on offensive rebounds and less emphasis on assists and unsuccessful three point field-goals. These results suggested that the players' game-related statistics varied according to playing position, probably because of well-established differences in the players' anthropometric characteristics that condition the distance they play from the basket. Also, it seems plausible that playing basketball in different positions on the court either creates the demand for different psychological traits or develops these traits in performers during practices and competition.

According to Bray and Martin (2003) the role that psychological states may play in home advantage is still little understood. Duffy and Hinwood (1997) found no differences in pre-performance anxiety reported by professional soccer players competing at home or away. Terry, Walrond, and Carron (1998) found that rugby union players had more positive mood profiles, lower state anxiety, and higher self-confidence prior to their home games compared to their away games. In the only study conducted in basketball, Thuot, Kavouras, and Kenefick (1998) found lower levels of state somatic anxiety and higher levels of self-

confidence when high school basketball players competed at home. In essence, the available studies seem to suggest that athletes experience more positive psychological states when competing at home versus away, thus being associated with superior home performances. No research has been conducted to understand this phenomenon at the level of the individual playing position. These different playing positions could be more or less susceptible to different types of home advantage. For example, players with more defensive responsibilities may be more susceptible to officiating bias, players who perform away from the basket may run more during the game, and therefore travel away from home may increase fatigue effects on their performance.

On the other hand, the centre position seems dominated by conditioning abilities such as blocking, fouling and rebounding; whereas the guards' position seems dominated by coordination abilities such as assists and three point field-goals (Krause and Pim, 2002).

Research on tasks performance influenced by the presence of an audience tends to demonstrate that tasks mastered essentially through power or stamina (conditioning-dominant) reveal performance increments in the presence of an audience (Strube, Miles and Finch, 1981; Beckmann and Strang, 1992). Regarding coordination-dominant and mixed abilities there is no clearly confirmed evidence of the audience effect (Strauss, 2002). Thus, it could be likely that supportive audiences (competing at home) may incrementally influence players' performances in conditioning-dominant tasks, whereas unfriendly audiences (competing away) may decrementally shape them in coordination-dominant and mixed tasks.

Therefore, it seems reasonable to expect that players' performance at a position level could be influenced by game location. In fact, Gayton, Brioda and Elgee (2001) stated that coaches prepare and select players according to game location and to their opponents. This idea suggests a need to improve knowledge of players' contributions to team performance in home and away games. To achieve this aim the present study investigated the presence of

home advantage to a players' position level and attempted to identify a subset of game-related statistics that could discriminate home and away performances according to each player's position.

Methods

Participants

Archival data were obtained from official boxscores for the 2004-2005 Euroleague. In that season, the championship was disputed in four different phases: 1) a regular season with the 24 teams distributed evenly by 3 groups competing in a balanced schedule (n=168 games); 2) the best 16 teams advanced to the next phase, were divided in four groups and played 48 games in a balanced schedule, 3) the top 8 teams played the quarterfinals playoff (n=9 games) and finally 4) a final four in a neutral court with the remaining 4 teams playing elimination games (n=2 games). For this study, we selected games from the three initial phases (n=225 games). The game-related statistics gathered were related to the individual player including: two and three point field-goal attempts (both successful and unsuccessful), free-throws (both successful and unsuccessful), defensive and offensive rebounds, blocks, assists, fouls, steals, turnovers and minutes played. These are all the variables available regarding this competition and all data were gathered by Euroleague professional technicians. The reliability coefficient obtained for the data was high ($r>0.92$).

Players were subdivided into guards (point guards and offguards, n=493 cases), forwards (small forwards and power forwards, n=485 cases) and centres (n=233 cases). This grouping was based on the groupings used in studies by Ackland, Schreiner and Kerr (1997), Spurgeon, Spurgeon and Giese (1981) and Sampaio et al. (2006). All players participated in a range of 7-12 games and those players who participated in any game for less than one game period (ten minutes) duration were excluded from the analysis.

The guards are usually the smallest players on the team. They are expected to run the team's offensive strategies, by controlling the ball and making sure that it gets to the right players at the right time. Their passing skills and court vision are essential, so their performance is often measured more by their assists than by their scoring. However, they should have an effective field-goal and should be a scoring threat from three point range.

The forwards are often well-balanced between power-oriented and shooting-oriented players. They are usually expected to be aggressive when pursuing rebounds and score most of their points near the basket.

The centres are often the tallest players on the team, and they are preferred to have high muscle and body mass. Their position requires using height to score and defend closer to the basket.

Data analysis

In order to compare the game-related statistics in home and away games in each of the three positions, each player's results were divided by that player's duration on court, resulting in derived rate variables. A 2x3 factorial MANOVA was employed to test for significant differences within game location performances (home and away) and between the three playing positions (guards, forwards and centres). Subsequently, discriminant analysis was performed in order to determine which of the obtained variables are more useful in predicting court location performance. The discriminant analysis is considered to be robust with derived rate variables (Norušis, 1993). The interpretation of the obtained discriminant function was based on examination of the structure coefficients greater than $|0.30|$, meaning that variables with higher absolute values had a powerful contribution to discriminate between groups (Tabachnick and Fidell, 2007). Validation of discriminant models was conducted using the leave-one-out method of cross-validation (Norušis, 1993). Cross-validation analysis was used

in order to understand the usefulness of discriminant functions when classifying new data. This method involves generating the discriminant function on all but one of the participants ($n-1$) and then testing for group membership on that participant. The process is repeated for each participant (n times) and the percentage of correct classifications generated through averaging for the n trials. The statistical analyses were performed using SPSS software release 13.0 and significance was set at $\alpha=5\%$. Bonferroni adjustment was used to correct for multiple tests.

Results

In the 2004-2005 Euroleague season the home teams won 66% of the games. The means and standard deviations for home and away game-related statistics in each group of basketball players are presented in Table 1.

Table 1 near here

The factorial MANOVA yielded a statistically significant effect for the interaction between game location and playing position $F_{28, 1174}=1.86, P<0.001$. For guards, univariate one-way ANOVA identified statistically significant differences between home and away defensive rebounds ($F=4.76, P<0.05$), assists ($F=7.49, P<0.01$) and committed fouls ($F=5.71, P<0.05$). On the other hand, successful free-throws ($F=4.12, P<0.05$), steals ($F=6.87, P<0.01$), blocks ($F=9.38, P<0.01$) and committed fouls ($F=8.21, P<0.01$) were the game-related statistics that differentiated forwards' performances in home and away games. No statistical significant differences were identified between centres' home and away performances.

In the discriminant analysis $\chi^2=23.5$ was obtained for the guards ($P<0.01$) and $\chi^2=28.9$ for forwards ($P<0.01$). The obtained function for centres was non significant ($\chi^2=10.0$ $P>0.05$). Table 2 contains the structure coefficients that describe the game-related statistical profiles that differentiate home and away performances for guards and forwards. The structure coefficients quantify the potential of each game-related statistic to maximize differences between means amongst home and away performances. The larger the magnitude of the coefficients, the greater the contribution of that game-related statistic to the discriminant function. For guards, the discriminant function reflected an emphasis on successful two point field-goals, defensive rebounds, assists, steals, blocks and committed fouls (see Table 2). The forwards home and away performances were discriminated by successful free-throws, assists, steals, blocks and committed fouls.

Table 2 near here

The leave-one-out test summarizes the ability of the discriminant functions to correctly classify the players in their respective positions. This analysis provided an overall percentage of successful classification of 58.6% for guards and 57.9% for forwards.

Discussion

The purposes of this study were to investigate if game location influenced players' performances across playing positions and identify a smaller subset of game-related statistics that could discriminate players' home and away performances. The selected sample of game-related statistics from Euroleague players ensured that all actions were performed against the best quality of opposition in all games. The Euroleague is a competition restricted to the best European teams in crowded indoor arenas (attendance averaged around 5000 people per

game), with great distances between home and away locations. This competitive context made it more likely that differences between players' home and away performances could be understood.

Our results suggested that game location could influence differently the performances of guards, forwards and centres. In existing research, the main causes of home advantage are believed to be crowd effects, travel, learning/familiarity and rules (see Nevill and Holder, 1999; Pollard and Pollard, 2005; Carron et al., 2005). In this case, these causes seem to have almost equally affected all players, because they all came from the same location, were all unfamiliar with the away environment and were all exposed to a similar crowd effect. However, because players' positions were different, and they are required to perform different tasks, it is possible that our results suggest a specific position-related home advantage. Available research on effects of an audience on conditioning- or coordination-dominant performance or mixed abilities is still controversial (Strauss, 2002). However, studies tend to demonstrate that conditioning-dominant tasks revealed performance increments in the presence of an audience (Strube, Miles and Finch, 1981; Beckmann and Strang, 1992), whereas there was no clear evidence of the audience effect in coordination-dominant abilities and mixed abilities (Strauss, 2002). According to the experiential knowledge of expert basketball coaches (Krause and Pim, 2002; Oliver, 2004), basketball playing positions contain tasks dominated by these performance components. This knowledge suggests that, the position of centre seems dominated by conditioning abilities such as blocking, fouling and rebounding; whereas the guards' position seems dominated by coordination abilities such as assists and three point field-goals. The forwards' position seems to fall in a middle point between guards and centres (mixed demands).

In essence, our results do not fit completely this theoretical background in terms of presence/absence of audience. Our rationale is that players who are competing in their home

field benefit from supporting audiences whereas competing away exposes them to critical audiences which can deteriorate performance. Therefore, it could be likely that supportive audiences may increase players' performances in conditioning-dominant tasks such as securing rebounds, blocking or committing fouls, whereas unfriendly audiences may decrease them in coordination-dominant and mixed tasks such as converting a three point field-goal or assisting to a field-goal. On the other hand, Nevill and Holder (1999) argue that the powerful effect of crowd noise is to influence officials' behaviour and therefore, the difference in performance could be a result of officiating bias. Further research is needed to understand the relative contribution of position demands and officiating bias to performance home and away by position in basketball.

An interesting feature of our results is the absence of significant differences in centres' home and away performances. These players are specialized in performing activities near the basket, such as attempting inside field-goals and mostly contributing to team defensive rebounding and blocking (Sampaio et al., 2006). Available research on team performance (Varca, 1980; Silva and Andrew, 1987) have analysed North-American college games with the following methodological differences: 1) ball possession is limited to 35 seconds whereas in the Euroleague is currently limited to 24 seconds; 2) the analysed variables did not split the defensive rebounds from the offensive rebounds neither the two point field-goals from the three point field-goals. Despite these differences, these two studies reported that home teams outperformed visiting teams in rebounds, blocks, steals, turnovers and field-goal percentages while visiting teams committed more fouls (Varca, 1980; Silva and Andrew, 1987). Our results suggested that centres do not contribute to these differences in team performance; thus, coaches should be aware that when playing away games the centres' performance might not differ much from home performances.

On the other hand, the guards' home and away performances were mainly discriminated by defensive game-related statistics (defensive rebounds, steals, blocks and committed fouls) and by successful three point field-goals and assists, which are game-related statistics that best represent offensive qualities. According to our results, guards exhibited the most differences between home and away performances. From an offensive perspective, these players control the transitions from defensive to attacking patterns and control the flow of these patterns. According to experiential knowledge of expert basketball coaches, it is plausible to assume that these are the players with higher concentration demands because they are required to decide the most suitable attacking patterns to each game context, and simultaneously to master ball-handling skills such as ball control and dribble penetration (e.g., Krause and Pim, 2002; Oliver, 2004). From the defensive perspective, the guards are the first line of defense with the role of defending the opponents' guards who are carrying the ball in the beginning of the offense (Krause and Pim, 2002; Oliver, 2004). Thus, because of their importance in these offensive and defensive situations to winning games, one can assume that these are the players subjected to a higher level of pressure (Trninić, Milanović and Dizdar, 1997; Ibáñez, Sampaio, Sáenz-López, Giménez and Janeira, 2003). In this way, it is possible that their performance could be most affected by more critical audiences, such as away crowds. Therefore, coaches should consider different strategies for home and away games, e.g., choosing attacking patterns that involve more the guards' participation in home games.

The forwards' home and away performances were discriminated by successful free-throws, assists, steals, blocks and committed fouls. Another interesting feature of these results is that their away performances were better than the home performances. This could have occurred because in away games guards are subjected to increased pressure from opponents and from the entire environment. Thus, this fact may lead the guards to choose offensive

patterns for other players to end and to pass more the ball and force the forwards to participate more in the game (the guards can pass the ball with more security to forwards). This observation should be noted by coaches in defining the team strategies and should be subject of further research.

In summary, our results led us to modify Varca's (1980) finding that home teams "play more aggressively on their territory", by concluding that the guards from home teams played more assertively, whereas in the away teams it was the forwards who played more assertively. These findings suggested that playing positions vary in their susceptibility to home advantage. These findings along with the fact that the home teams won a significantly higher percentage of games, suggested that the performance of guards is more critical in determining the outcome of a game. Therefore, the poorer performance of guards cannot be compensated for by an increase in the performance of a team's forwards.

Coaches could use these results to improve player selection and team preparation for the home and away games in the season. An interesting topic for further research would be to investigate whether game location influences players' performances across playing positions equally across the whole game, or if this effect changes in different phases of a game (i.e. the final phase or at the most critical moments). Also, this position specific effect of game location may be present in other team sports and should be investigated.

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Table 1

Game-related statistics	Guards		Forwards		Centre	
	Home	Away	Home	Away	Home	Away
Successful 2 pt field-goals	0.09±0.06	0.09±0.06	0.12±0.09	0.13±0.08	0.17±0.08	0.15±0.08
Unsuccessful 2 pt field-goals	0.08±0.06	0.08±0.06	0.12±0.08	0.11±0.07	0.12±0.07	0.12±0.08
Successful 3 pt field-goals	0.06±0.05	0.05±0.05	0.03±0.05	0.03±0.05	0.01±0.02	0.01±0.02
Unsuccessful 3 pt field-goals	0.10±0.06	0.10±0.06	0.05±0.06	0.05±0.05	0.02±0.03	0.01±0.02
Successful free-throws	0.10±0.10	0.10±0.09	0.08±0.07	0.09±0.08	0.11±0.10	0.11±0.10
Unsuccessful free-throws	0.02±0.03	0.02±0.03	0.03±0.05	0.04±0.05	0.04±0.05	0.04±0.06
Offensive rebounds	0.02±0.03	0.02±0.03	0.06±0.06	0.06±0.06	0.07±0.07	0.08±0.06
Defensive rebounds	0.08±0.06	0.07±0.05	0.12±0.08	0.13±0.08	0.15±0.08	0.16±0.09
Assists	0.11±0.07	0.09±0.07	0.05±0.05	0.06±0.06	0.05±0.06	0.04±0.05
Steals	0.06±0.04	0.05±0.04	0.04±0.04	0.05±0.05	0.04±0.06	0.04±0.04
Turnovers	0.06±0.05	0.07±0.05	0.06±0.05	0.07±0.05	0.06±0.05	0.07±0.06
Blocks	0.01±0.01	0.00±0.01	0.01±0.02	0.02±0.03	0.03±0.04	0.03±0.04
Committed fouls	0.09±0.05	0.08±0.04	0.12±0.07	0.10±0.06	0.14±0.07	0.13±0.07
Received fouls	0.13±0.08	0.13±0.07	0.12±0.08	0.13±0.08	0.14±0.08	0.14±0.09

Table 2

Game-related statistics	Guards	Forwards
Successful 2 point field-goals	0.07	-0.11
Unsuccessful 2 point field-goals	-0.03	0.18
Successful 3 point field-goals	0.34	-0.07
Unsuccessful 3 point field-goals	0.00	0.23
Successful free-throws	-0.11	-0.34
Unsuccessful free-throws	-0.14	-0.19
Offensive rebounds	-0.19	-0.00
Defensive rebounds	0.45	-0.21
Assists	0.50	-0.33
Steals	0.30	-0.45
Turnovers	-0.17	-0.05
Blocks	0.30	-0.54
Committed fouls	0.43	0.48
Received fouls	0.00	-0.29
Wilks' Lambda	0.90	0.84
Chi-square	23.5	28.9
<i>P</i>	<0.01	<0.01
Eigenvalue	0.14	0.19
Canonical correlation	0.25	0.34

The minus sign in the structure coefficients means that away performance was higher than the home performance.

Table Captions

Table 1. Descriptive results from the game-related statistics for each game location and playing position (values are mean \pm S.D. counts per minutes played).

Table 2. Discriminant function structure coefficients and tests of statistical significance.