Original Article

The home-court advantage in NCAA Division-I men's basketball

DIMITRIJE CABARKAPA[1], MICHAEL A. DEANE[1], ANTHONY B. CICCONE[2], GRANT T. JONES[1], DAMJANA V. CABARKAPA[1], ANDREW C. FRY[1]

[1]*Jayhawk Athletic Performance Laboratory – Wu Tsai Human Performance Alliance. Department of Health, Sport and Exercise Sciences. University of Kansas. Lawrence, United States of America*

[2]*Department of Exercise Science and Outdoor Recreation. Utah Valley University. Orem, United States of America*

ABSTRACT

The purpose of the present study was to examine the differences in game-related statistics between home and away games at the NCAA Division-I level of men's basketball competition. The data scraping technique was used to obtain publicly available box scores during the 2018-19 competitive season. Throughout this period, 2181 home and 2205 away box scores were randomly selected across 353 teams, regardless of the winning or losing game outcome. The findings of the present study revealed that the game-related statistics influenced by the game location, listed in descending order of magnitude, were: assists (AS), personal fouls (PF), field-goal percentage (FG%), free-throw attempts (FTA), blocks (BL), defensive rebounds (DRB), turnovers (TO), steals (ST), and three-point shooting percentage (3P%). During home games, the teams tended to display better decision-making processes (i.e., more AS and ST, and less TO), defensive performance (i.e., more DRB and BL), shooting efficiency (i.e., greater FT% and 3P%), and minimize tactical errors (i.e., less PF and more FTA). Overall, these findings suggest that playing on a home-court provides a significant advantage in securing the desired game outcome and provides insight into what game-related statistics contribute most to this effect.

Keywords: Performance analysis of sport, Coaching, Statistics, Sport.

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Corresponding author. *Director of Basketball Research, Jayhawk Athletic Performance Laboratory – Wu Tsai Human Performance Alliance, University of Kansas, Robinson Center 308E, 1301 Sunnyside Avenue, Lawrence, KS 66045, United States of America.*
E-mail: dcabarkapa@ku.edu
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INTRODUCTION

Basketball is one of the most popular sports played on various levels of international competition. It is a fast-paced game in which each player, regardless of playing position, is required to possess fundamental basketball-specific skills such as passing, shooting, rebounding, dribbling, and the ability to play defence. Thus, to objectively quantify the quality and efficiency of a single player as well as the overall team's performance, coaches, scouts, and sports scientists commonly rely on quantitative analyses of game-related statistical parameters (e.g., field-goal percentage, defensive rebounds, turnovers, blocks) to improve offensive/defensive strategies, optimize the recruitment process, and identify areas for further improvement.

A considerable amount of scientific literature has been focused on quantitative analysis of game-related statistics capable of distinguishing winning from losing game outcomes (Cabarkapa et al., 2022; Conte et al., 2018; Garcia et al., 2013; Ibanez et al., 2009; Lorenzo et al., 2010; Trninic et al., 2002). Lorenzo et al. (2010) found that turnovers and assists in close games (i.e., the difference in score ≤9 points), and two-point field goals and defensive rebounds in balanced games (i.e., final score difference between 10 and 29 points) were variables that discriminated winning and losing teams in the Under-16 European Championships. When examined at the National Collegiate Athletic Association (NCAA) Division-I level of competition, winning teams were likely to have a higher number of defensive rebounds and steals, made and attempted free-throw shots, and three-point shooting percentage (Conte et al., 2018). Garcia et al. (2013) have found that winning teams during the regular season competitive period in the ACB Spanish Basketball League dominated in defensive rebounds, successful two-point and three-point field goals, and assists. Moreover, defensive rebounds emerged as a prominent performance parameter associated with securing the desired game outcome during the post-season competitive period (Garcia et al., 2013; Trninic et al., 2002). Similar observations were made in a recently conducted study where field goal percentage and defensive rebounds were found to be two key game-related statistics capable of discriminating between winning and losing game outcomes during both regular and post-season competitive periods at the National Basketball Association (NBA) level of basketball competition (Cabarkapa et al., 2022). Furthermore, it is interesting to note that besides superior scoring capabilities, NBA teams are likely to be more successful when all players, regardless of team status (i.e., starters or non-starters), commit themselves to passing the ball (Melnick, 2001).

Unlike the aforementioned research studies, the impact of game location (i.e., home vs. away) on game-related statistics remains underexamined in the scientific literature, especially on the NCAA and NBA level of basketball competition. To the best of the authors' knowledge, only a few studies have been focused on addressing this issue (Garcia et al., 2009; Gomez et al., 2008). Home games in the ACB Spanish Basketball League were differentiated from away games by more successful two-point field goals, dunks, blocks, and assists (Garcia et al., 2009). Also, another study conducted at the same level of professional basketball competition found that winning teams were differentiated from losing teams during home games by a greater number of defensive rebounds and assists, and during away games by more successful two-point and fewer unsuccessful three-point field goals alongside with a greater number of defensive rebounds and assists (Gomez et al., 2008).

Thus, to bridge a gap in the scientific literature, the purpose of the present study was to examine the differences in game-related statistics between home and away games at the NCAA Division-I level of men's basketball competition.

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MATERIALS AND METHODS

Procedures

The data scraping technique was used to obtain publicly available NCAA Division-I game-related statistics (https://stats.ncaa.org/contests/scoreboards) during the 2018-19 season via ParseHub software (North York, ON, Canada). Throughout this competitive period, 2181 home and 2205 away box scores were randomly selected across 353 teams, regardless of the winning or losing game outcome. The following 13 game-related statistics (i.e., team averages) were included in the data analysis procedures: field goals attempted (FGA), field goal shooting percentage (FG%), 3-point shots attempted (3PA), 3-point shooting percentage (3P%), free-throws attempted (FTA), free-throw shooting percentage (FT%), offensive rebounds (ORB), defensive rebounds (DRB), assists (AS), steals (ST), blocks (BL), turnovers (TO), and personal fouls (PF).

Statistical analysis

All statistical analyses were conducted with R software (Version 4.2.1, PBC, Boston, MA, USA) via RStudio (Version 2022.7.2.576, Vienna, Austria). First, separate linear models were used to quantify the effect of game location (i.e., home vs. away) on each game-related statistic, where home vs. away was the independent variable, and game-related statistics were the dependent variables. This allowed for model residuals to be checked for normality via Q-Q plots prior to deciding if any data transformations were necessary. ORB, TO, ST, and BL residuals deviated from a normal distribution at the tails. A square root transformation improved the residual normality of the aforementioned variables, and FT% were filtered to only include games where at least 10 free throws were attempted by the team. It should be noted that the sample sizes were very large that dramatic improvements in normality at the tails had a trivial impact on the difference between pre-transformed and post-transformed data or filtered R^2 values (all < .005). Therefore, for the purpose of interpretability, means, standard deviations (SD), and mean difference confidence intervals were analysed and reported as non-transformed data. However, R^2 values and R^2 confidence intervals for ORB, TO, ST, and BL were calculated using square root transformed data. R^2 confidence intervals of FT% were calculated using the filtered data and all other data were not transformed or filtered. R^2 confidence intervals were calculated using a percentile bootstrap where data was sampled with replacement (Wickham et al., 2019) from the original data set 1,000 times and each sample was equal in size to the original sample. The alpha level was set at $p < .05$.

RESULTS

For FT%, there were 2061 observations of home box scores and 1930 observations of away box scores. For all other variables, there were 2181 observations of home box scores and 2205 observations of away box scores. Game-related statistics that were significantly affected by the game location (i.e., home vs. away), in descending order of magnitude were: AS, PF, FG%, FTA, BL, DRB, TO, ST, and 3P%. Also, no significant effect of the game location on game-related statistical parameters was present for FGA, ORB, FT%, and 3PA. See Table 1.

DISCUSSION

The findings of the present study reveal that game-related statistics were significantly impacted by the game location (i.e., home vs. away). The performance parameters with the greatest impact, listed in descending order of magnitude, were AS, PF, FG%, FTA, BL, DRB, TO, ST, and 3P%, while no statistically significant effects were observed for FTA, ORB, FT%, and 3PA.

Table 1. Mean (SD), home vs. away confidence interval (H vs. A CI), R^2, and R^2 confidence interval (R^2 CI) for assists (AS), personal fouls (PF), field goal shooting percentage (FG%), free-throws attempted (FTA), blocks (BL), defensive rebounds (DRB), turnovers (TO), steals (ST), three-point shooting percentage (3P%), field goals attempted (FGA), offensive rebounds (ORB), free-throw shooting percentage (FT%), three-point shots attempted (3PA).

Variable	Home	Away	H vs. A CI	R^2	R^2 CI
AS*	14.3 (4.2)	12.2 (4.5)	-2.3 – -1.8	0.054	0.043 – 0.067
PF*	16.7 (4.4)	18.8 (4.6)	1.6 – 2.2	0.043	0.033 – 0.055
FG%*	45.5 (7.0)	42.9 (7.2)	-3.0 – -2.2	0.032	0.023 – 0.042
FTA*	20.5 (7.9)	17.8 (7.1)	-3.2 – -2.3	0.032	0.023 – 0.043
BL*	3.9 (2.9)	2.9 (2.0)	-1.1 – -0.8	0.031#	0.021 – 0.041#
DRB*	26.0 (5.1)	24.4 (5.1)	-1.9 – -1.3	0.024	0.016 – 0.033
TO*	12.6 (3.9)	13.4 (4.2)	0.5 – 1.0	0.009#	0.004 – 0.015#
ST*	6.4 (2.9)	5.9 (2.8)	-0.6 – -0.3	0.006#	0.002 – 0.012#
3P%*	35.3 (10.6)	33.7 (10.6)	-2.2 – -1.0	0.006	0.002 – 0.012
FGA	57.6 (6.9)	58.0 (7.0)	0.0 – 0.8	0.001	0.002 – 0.011
ORB	10.1 (3.9)	9.9 (3.8)	-0.4 – 0.0	<0.001#	<0.001– 0.003#
FT%	70.3 (12.3)	70.1 (13.3)	-1.0 – 0.5	<0.001$	<0.001 – 0.003$
3PA	22.4 (5.9)	22.3 (6.0)	-0.4 – 0.3	<0.001	<0.001 – 0.001

*Note: *significant home vs. away effect. #square root transformed R^2 values. $filtered out games with less than 10 FTA. ($p < .05$).*

In basketball, a greater number of AS has been used as an indicator of superior team cohesiveness, decision-making process, and experience (Ibanez et al., 2008; Melnick, 2001). Our data suggest that the away-played games were depicted by a significantly lower number of AS. This may be attributed to the aggressive defence employed by the home team to disrupt the opponents' offensive strategies (Gomez et al., 2008). An increase in defensive pressure may force the opponent to remain in ball possession deeper into the 30-second shot clock and/or increase the difficulty of the ball movement, which can eventually result in a lower number of AS. Likewise, improper reading of the defence while passing a ball to a teammate can result in a TO and/or ST for the opposing team (Garcia et al., 2013). Although smaller in magnitude, the results obtained in the present study found that away games had a significantly greater number of TO and fewer ST, which may also be a consequence of increased defensive pressure applied by the home team.

Overall, the previously mentioned findings suggest that home teams have higher chances of securing the desired game outcome by attaining better tactical discipline and offensive control, alongside minimizing risk for error (i.e., more AS and ST, and less TO; Trninic et al., 2002). On the other hand, it is important to mention that another possible reason for the observed difference in the number of AS between home and away games may be due to the subjective interpretation of this performance parameter by a basketball statistician at the scoring table. By definition, an AS is rewarded to the player who makes a pass that directly leads to a scored field goal (i.e., two-point or three-point; Melnick, 2001). Due to the fast pace of the game, it is likely that this game-related statistic remains accidentally forgotten as variables such as FTA, DRB, ORB, and 3PA are naturally prioritized and have a greater value when quantifying the team's performance efficiency. Also, AS is one of the last game-related statistics that is entered into a scoring sheet. This presents an additional opportunity for accidental error by a basketball statistician when quantifying the exact number of AS, especially for the away teams.

The game-related statistic with the second largest magnitude observed in the present study was PF. When examining games played in the ACB Spanish Basketball League, no difference in committed and received

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PF was noted between home and away games (Garcia et al., 2009), which is contrary to the findings of the present study. Our results indicated that away-played games had a significantly greater number of PF than games played on the home-court. This discrepancy may be attributed to the differences in the expertise levels of the participants (i.e., professional vs. collegiate). Professional players were found to start and maintain higher levels of defensive concentration throughout the game when compared to amateur players (Ibanez et al., 2009). Based on these findings, we can assume that the lack of ability to maintain the optimal defensive concentration of the amateur players, such as the ones competing at the NCAA Division-I level of basketball competition, may ultimately result in committing more PF. When combined with the previously mentioned game-related statistics indicating superior tactical discipline and offensive control (i.e., more AS, ST, and less TO) of the home team, the players may be more prone to committing PF during away games to stop an opponent from creating a scoring advantage. Moreover, as a consequence of committing more PF, the opposing team is awarded with more FTA, which is another finding observed in the present investigation. Attempting free-throw shots is an uncontested scoring opportunity that can be advantageous in securing the winning game outcome (Cabarkapa et al., 2022; Conte et al., 2018; Csataljay et al., 2012). Therefore, combining a greater number of PF committed by the opposing team that results in more FTA creates an additional home-court advantage.

Another possible explanation for the greater number of PF observed during the away games may be attributed to social/environmental influence. PF is a game-related statistic that often results in a greater number of FTA for the opposing team, and is to a greater extent under the referee's control. Although further research is warranted on this topic, it is a stereotypical belief that referees tend to call more PF on the opposing team during home games, especially during non-conference games when teams from higher leagues are hosting teams from lower leagues (e.g., Atlantic Coast Conference vs. Northeast Conference). While referees do not have allegiance with any of the teams in the league, it is possible that the crowd, athletes, and coaches' reactions influence their decisions when making PF calls. For example, if a referee calls a questionable PF on the home team during the home game, they are likely to get confronted. Previous research has found that collective protests and spectators' booing present a significant home-court advantage (Greer, 1983). In addition, a recently published study found that the decisions of basketball referees with high anxiety levels may be influenced to a greater extent by external factors such as crowd noise (Sors et al., 2019). Although the findings of the present investigation imply on a possible existence of referees' bias toward calling PF in a favour of the home team that ultimately results in more FTA, it is important to mention that this is said without challenging the reputations of the officials, but rather to denote the impact of social influence/environment and its magnitude.

The importance of DRB for securing the winning game outcome has been well documented in the scientific literature (Cabarkapa et al., 2022; Conte et al., 2018; Csataljay et al., 2009; Csataljay et al., 2012; Trninic et al., 2002). More specifically, playing solid defence that allows a team to get more DRB is of crucial importance for winning games on the home-court (Gomez et al., 2008). Every additional DRB takes away a chance for the opposing team to obtain an ORB, and in that way reduces the overall number of scoring opportunities and second-point chances (Cabarkapa et al., 2022). Our results indicate that teams' DRB performance tends to be better during home than away games. Interestingly, no difference in the number of ORB was detected, suggesting that the teams were equally pursuing second-point scoring opportunities, regardless of the game location. In addition, games played on the home-court were characterized by a greater number of BL. More BL during a game prevents the opponent from having uncontested scoring opportunities and it is used as an indicator of better rim protection. Ibanez et al. (2008) have found that a greater number of BL was one of the top-three performance parameters determining the season-long success in the LEB1 Spanish Basketball

League. Altogether, a greater number of DRB and BL implies better perimeter and inside defensive performance during games played on the home-court.

Shooting efficiency is one of the key game-related statistics discriminating winning from losing teams on various competitive levels (Cabarkapa et al., 2022; Csataljay et al., 2012; Trninic et al., 2002). The team that shoots better is most likely to secure the desired game outcome. The findings of the present study indicate that teams during games played on the home-court were capable of attaining better shooting efficiency within and beyond the three-point line (i.e., greater FG% and 3P%). This may be primarily attributed to their ability to generate more open scoring opportunities (i.e., more AS) as well as minimize errors in the decision-making process on the offense (i.e., less TO). Interestingly, Varca (1980) found no significant differences in FG% when examining 90 games played in the NCAA Division-I South-eastern Conference, although the mean value was approximately 2.5% greater in a favour of home team advantage. Also, in the same investigation, no difference in FT% was found based on game location, which is in the agreement with the results of the present study (Varca, 1980). A possible explanation for the discrepancy in the findings regarding the FG% may be attributed to changes in the basketball style of play and/or regulations over the last 40 years (e.g., addition of a three-point line, offensive strategies), while the FT rules stayed unchanged for over a century. Moreover, it is important to note that no significant differences were found in FGA and 3PA between home and away games. These findings suggest that teams during games played on the home-court did not attempt more two-point and three-point shots, they were just capable of attaining superior shooting efficiency. Although this topic warrants further investigation, it is possible that a decrease in FG% and 3PT% observed in away played games may be attributed to social/environmental influence such as crowd, athletes, and coaches' reactions that may prevent the player from properly focusing and executing shooting motion to the best of their ability.

To our knowledge, this is the first study that has examined differences in game-related statistics between home and away games at the NCAA Division-I level of competition. While results offer beneficial information that coaches, scouts, and sports scientists can use to improve offensive/defensive strategies, optimize the recruitment process, and identify areas for further improvement, this study is not without limitations. The quantitative analysis did not consider differences in game-related statistics between non-conference and conference games and was based on a single-season analysis. Future research needs to examine if the observed differences based on a game location remain persistent within each conference, as well as examine if these findings apply to different levels of basketball competitions (e.g., NBA, NCAA Division-II).

CONCLUSION

The game-related statistics influenced by the game location, listed in descending order of magnitude, were AS, PF, FG%, FTA, BL, DRB, TO, ST, and 3PT%. The teams during home games tended to display better decision-making processes (i.e., more AS, ST, and less TO), defensive performance (i.e., more DRB and BL), shooting efficiency (i.e., greater FT% and 3P%), and minimize tactical errors (i.e., less PF and more FTA). Overall, these findings suggest that playing games on a home-court provides a significant advantage in securing the winning game outcome and provides insight into what game-related statistics contribute most to this effect.

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AUTHORS CONTRIBUTIONS

Conceptualization, D.C. and M.A.D.; methodology, D.C. and M.A.D.; formal analysis, A.B.C.; data curation, G.T.J.; writing-original draft preparation, D.C., M.A.D., and D.V.C.; writing-review and editing, D.C., D.V.C., and A.C.F.

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No potential conflict of interest were reported by the authors.

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