

DIFFERENCES IN GAME-RELATED STATISTICS BETWEEN WINNING AND LOSING TEAMS IN NCAA DIVISION-II MEN'S BASKETBALL

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ABSTRACT

Knowing how to design training regimens and modify offensive and defensive strategies to accurately resemble on-court competitive demands can help the team secure the winning game outcome. Thus, the purpose of the present study was to examine differences in game-related statistics between winning and losing teams at the National Collegiate Athletic Association (NCAA) Division-II level of men's basketball competition and determine which performance parameters have the greatest impact in differentiating between winning and losing game outcomes. The data scraping technique was used to obtain publicly available box scores during the 2018-19 competitive season. The total number of games examined in the present investigation was 4630. The findings of the present study indicate that winning teams: a) made more field-goal and three-point shots; b) attempted and made more free-throw shots; c) attained superior free-throw, two-point, and three-point shooting efficiency; d) accumulated more assists, steals, blocks, and offensive, defensive, and total rebounds; e) had fewer turnovers and personal fouls. Moreover, field-goal percentage, defensive rebounds, and assists showed to be the top three game-related statistics capable of discriminating winning from losing game outcomes on the NCAA Division-II level of competition, accounting for 17.0%, 12.7%, and 12.6% of the total percentage of the explained variance, respectively.

Keywords: sport, coaching, performance, offence, defense, college

INTRODUCTION

Basketball is one of the most popular international sports played on a broad spectrum of competitive levels (e.g., amateur, professional). Quantitative analysis of game-related statistics allows coaches and sports scientists to obtain a deeper insight into performance parameters that differentiate winning from losing game outcomes. Hence, knowing how to design training regimens and modify offensive and defensive strategies to accurately resemble on-court competitive demands can help the team secure the winning game outcome.

A considerable amount of scientific literature has been directed toward the quantitative

analysis of game-related statistics that discriminate between winning and losing game outcomes at various professional levels of basketball competition (Cabarkapa et al., 2022; Csataljay et al., 2009; Csataljay et al., 2012; Garcia et al., 2013; Gomez et al., 2008; Ibanez et al., 2008; Sampaio et al., 2003; Trninic et al., 2002). When examining 870 games played over six years in the Spanish Basketball League (LEB1), Ibanez et al. (2008) found that assists, steals, and blocks were three performance parameters with the greatest impact in determining the team's season-long success. In a similar investigation focused on analyzing 306 regular-season games played during the 2007-2008

competitive season at ACB Spanish Basketball League, Garcia et al. (2013) found that winning teams were capable of attaining a greater number of assists, defensive rebounds, and made two-point and three-point shots. Interestingly, defensive rebounds were found to be the only game-related statistic in which winning teams dominated during the post-season competitive period (Garcia et al., 2013). Similar observations were made by Trninic et al. (2002) when investigating differences in game-related statistics between winning and losing teams during the European Club Championship (i.e., Final Four) over an eight-year span. Defensive rebounds were shown to be a performance parameter with the greatest discriminative power in favor of winning teams, followed by a number of free-throw and three-point made field goals (Trninic et al., 2002). Moreover, when examining differences between the teams based on the number of points scored at the end of the game, Gomez et al. (2008) found that winning outcomes during close games (i.e., final score difference ≤ 12 points) were best determined by a number of defensive rebounds and during unbalanced games (i.e., final score difference < 12 points) by a number of made two-point field goals, defensive rebounds, and assists. Likewise, a recently published study found that two key performance parameters capable of differentiating winning from losing game outcomes at the National Basketball Association (NBA) level of competition were field-goal percentage and defensive rebounds during both regular and post-season competitive periods (Cabarkapa et al., 2022).

Contrary to the previously mentioned research reports, there is a limited amount of scientific literature focused on quantitative analysis of game-related statistics on the amateur level of basketball competition (Conte et al., 2018; Lorenzo et al., 2010). It has been found that turnovers and assists had the most

incredible power in discriminating winning from losing teams in the Under-16 European Championship during close games (i.e., final score difference < 9 points) and made two-point shots and defensive rebounds during balanced games (i.e., final score difference between 10-29 points; Lorenzo et al., 2010). In addition, when examining games played during a 2013-2014 season at the National Collegiate Athletic Association (NCAA) Division-I level of competition, Conte et al. (2018) found that winning teams were likely to have higher three-point shooting efficiency and very likely to have a higher number of made and attempted free-throw shots.

Therefore, to bridge a gap in the scientific literature, the purpose of the present study was to examine differences in game-related statistics between winning and losing teams at the NCAA Division-II level of men's basketball competition and determine which performance parameters have the most significant influence in discriminating between winning and losing game outcomes at that level of play.

METHODS

Procedures

Publicly available NCAA Division-II box scores for the 2018-2019 competitive season were obtained via data scraping technique (ParseHub, North York, ON, Canada) from <https://stats.ncaa.org> website. The following 18 variables (i.e., team averages) were acquired from the box scores across 4630 games: field goals made (FGM), field goals attempted (FGA), field goal shooting percentage (FG%), 3-point shots made (3PM), 3-point shots attempted (3PA), 3-point shooting percentage (3P%), free-throws made (FTM), free-throws attempted (FTA), free-throw shooting percentage (FT%), offensive rebounds (ORB), defensive rebounds (DRB), total rebounds (TBR), assists (AS), steals (ST), blocks (BL), turn-

overs (TO), personal fouls (PF), and points (PTS). Due to the public availability of the data, the Institutional Review Board's approval for conducting this project was not needed.

Statistical analysis

Descriptive statistics, means and standard deviations ($\bar{x} \pm SD$), were calculated for each dependent variable. Independent t-tests were used to examine statistically significant differences between winning and losing game outcomes. Cohen's *d* was used to calculate the measure of effect size (i.e., $d=0.2$ is a small effect, $d=0.5$ is a moderate effect, and $d=0.8$ is a large effect; Cohen, 1988). A complete model discriminant function analysis was used to examine the magnitude of the relative contribution of each game-related statistic and the ability to classify winning from losing game outcomes. To avoid the issue of multicollinearity (i.e., intercorrelation among two or more dependent variables), FTM, FGM, 3PM, TRB, and PTS were not included in the discriminant function analysis (e.g., $3P\% = 3PM/3PA \times 100\%$; Cabarkapa et al., 2022). Statistical significance

was set a priori to $p < .05$. All statistical analyses were completed with SPSS (Version 26.0; IBM Corp., Armonk, NY, USA).

RESULTS

Alongside scoring a greater number of PTS at the end of the game, winning teams at the NCAA Division-II level of men's basketball competition had a significantly greater number of FGM, 3PM, FTM, FTA, ORB, DRB, TRB, AS, ST, and BL, superior FG%, 3P%, and FT%, and fewer TO and PF when compared to the losing teams (i.e., all $p < .001$ except ORB where $p = .041$). However, no significant differences between winning and losing teams were observed in the number of FGA ($p = .620$) and 3PA ($p = .937$). See Table 1 for detailed results.

The discriminant function model was statistically significant ($\Lambda = 0.470$, $X^2_{[13]} = 6985.97$, $p < .001$) and capable of correctly classifying winning from losing game outcomes in 86.4% of cases. See Table 2 for standardized discriminant function coefficients, percentage of explained variance, and percentage of the total variance.

Table 1. Descriptive data ($\bar{x} \pm SD$) for game-related statistical parameters between the winning and losing game outcomes

Game-related statistics	Losing teams	Winning teams	Effect size
Field goals made	24.9 ± 4.5	28.9 ± 4.9*	0.850
Field goals attempted	59.9 ± 7.4	60.0 ± 7.8	0.013
Field goal percentage	41.7 ± 6.2	48.4 ± 6.2*	1.081
Three-point shots made	7.2 ± 3.0	8.8 ± 3.5*	0.491
Three-point shots attempted	22.5 ± 6.2	22.5 ± 6.4	0.001
Three-point shot percentage	31.8 ± 10.0	38.9 ± 10.5*	0.692
Free-throw shots made	12.4 ± 5.5	15.2 ± 6.3*	0.473
Free-throw shots attempted	17.7 ± 7.1	20.8 ± 8.0*	0.410
Free-throw shot percentage	69.6 ± 13.0	72.9 ± 12.0*	0.264
Offensive rebounds	10.1 ± 4.1	10.3 ± 4.1*	0.049
Defensive rebounds	23.4 ± 4.6	27.3 ± 5.0*	0.811
Total rebounds	33.6 ± 6.4	37.6 ± 6.7*	0.611
Assists	11.6 ± 3.8	15.1 ± 5.0*	0.788
Steals	5.9 ± 2.7	7.0 ± 3.3*	0.364
Blocks	2.6 ± 1.9	3.2 ± 2.2*	0.292
Turnovers	14.1 ± 4.5	12.6 ± 4.1*	0.348
Personal fouls	18.6 ± 4.7	17.0 ± 4.3*	0.355
Points	69.4 ± 11.3	81.9 ± 11.8*	1.082

Note: significantly different when compared to the losing team ($p < .05$).

Table 2. *Standardized discriminant function coefficients and percentage of explained and total variance for game-related statistical parameters*

Game-related statistics	Standardized coefficients	Percentage of total variance	Percentage of explained variance
Field goal percentage	0.508	19.7	17.0
Defensive rebounds	0.380	14.7	12.7
Assists	0.376	14.6	12.6
Three-point shot percentage	0.325	12.6	10.9
Free-throw shots attempted	0.192	7.5	6.4
Steals	0.173	6.7	5.8
Turnovers	0.170	6.6	5.7
Fouls	0.161	6.2	5.4
Blocks	0.146	5.7	4.9
Free-throw shot percentage	0.121	4.7	4.1
Offensive rebounds	0.020	0.8	0.7
Field goals attempted	0.005	0.2	0.2
Three-point shots attempted	0.001	0.0	0.0
Total		100	86.4

DISCUSSION

The findings of the present study indicate that winning teams at the NCAA Division-II level of men's basketball competition had a greater number of FGM, 3PM, FTM, FTA, ORB, DRB, TRB, AS, ST, and BL, superior FG%, 3P%, and FT%, and fewer TO and PF when compared to the losing teams. Overall, these findings support the notion that winning teams tend to display superior offensive and defensive performance, including better tactical discipline, and minimize unnecessary mistakes that would jeopardize their chances of securing the desired game outcome. In addition, it is essential to note that the FG%, DRB, and AS, have shown to be the top three game-related statistics in differentiating winning from losing teams, accounting for 17.0%, 12.7%, and 12.6% of the total percentage of the explained variance, respectively (i.e., 42.3% combined).

While no significant difference in FGA and 3PA was observed between winning and losing teams, winning teams had a greater number of FGM and 3PM, as well as superior FG% and 3P%. These findings emphasize the importance of shooting efficiency for securing the winning game outcome, both from with-

in and beyond the three-point line. The team that successfully executes offensive strategies and accumulates more made shots within the approximately same number of shooting attempts has a higher chance of securing the desired game outcome. The importance of shooting efficiency for securing winning game outcomes has been well documented in the scientific literature on various levels of basketball competition (e.g., collegiate and professional; Conte et al., 2018 Csataljay et al., 2012; Lorenzo et al., 2010). Winning teams had fewer unsuccessful and more successful two-point shooting attempts across 122 games played at the Under-16 European Championship, while no significant differences were observed in three-point shooting performance (Lorenzo et al., 2010). By using retrospective video analysis to investigate 20 close games (i.e., final score difference between 1-9 points) played at the NCAA Division-I level of competition, Conte et al. (2018) found that winning teams were likely to attain superior 3P%, alongside a greater number of 3PA. In addition, similar observations were made by Csataljay et al. (2012) when examining 26 regular season games played at a top

level of professional basketball competition in Hungary, where winning teams displayed better two-point and three-point shooting efficiency throughout all quarters. Although the aforementioned research reports solidify the importance of shooting efficiency for securing the winning game outcome, certain discrepancies may be attributed to the number of games included in the statistical analysis (e.g., 4630 vs. 20) as well as the competitive level examined in each of these investigations (e.g., NCAA Division-II vs. professional). Also, it is important to note that FG% and 3P% accounted for 17.0% and 10.9% of the total percentage of explained variance (i.e., 27.9% combined), further highlighting the importance of shooting efficiency for securing the desired game outcome, regardless of the shooting distance.

Alongside better mid- and long-range shooting performance, our results indicate that winning teams at the NCAA Division-II level of competition had superior free-throw shooting performance compared to the losing teams (i.e., more FTM and greater FT%). Identical observations were made by Csataljay et al. (2009) when examining games played at the professional level of basketball competition during the post-season competitive period. While winning teams had a significantly greater number of FTM and FT%, one of the key game-related statistics differentiating winning from losing teams during close games (i.e., final score difference between 1-9 points) was FT% (Csataljay et al., 2009). Moreover, despite not having a statistically significant contribution to the discriminant function model, the winning teams tended to attain a greater number of FTM during the regular season competitive period at ACB Spanish Basketball League during both balanced (i.e., final score difference ≤ 12 points) and unbalanced games (i.e., final score difference between 12-

28 points; Garcia et al., 2013). Besides having superior FT%, it is also important to note that winning teams were capable of securing more FTA, which directly translates to additional uncontested scoring opportunities. These observations are in agreement with Conte et al. (2018), who found that winning teams at the NCAA Division-I level of men's basketball competition were very likely to have a greater number of FTA. A possible explanation for these findings may be attributed to a greater number of PF committed by the opposing team. Usually, PF is awarded to a player due to inadequate defensive position and/or when trying to stop the opponent from creating a scoring advantage. Previous research has found that starters, as more experienced players, tend to commit fewer fouls than non-starters, implying that they have better defensive performance (Sampaio et al., 2006). Similarly, we can assume that losing teams tend to gather more PF due to a greater number of defensive mistakes, which allows the winning team to have more FTA and ultimately jeopardizes their chances of securing the desired game outcome.

The findings of the present study also indicate that winning teams are able to secure a greater number of DRB, ORB, and BL when compared to the losing teams. The importance of DRB as one of the key game-related statistics for securing winning game outcomes has been well documented in the previously conducted scientific literature on diverse competitive levels (Cabarkapa et al., 2022; Conte et al., 2018; Csataljay et al., 2009; Csataljay et al., 2012; Ibanez et al., 2009; Lorenzo et al., 2010; Trninic et al., 2002). Csataljay et al. (2012) have found that winning teams on a professional level of basketball competition during a regular season span had a significantly greater number of DRB when compared to the losing teams during both balanced (i.e.,

final difference in score between 6-11 points) and unbalanced games (i.e., final difference in score between 12 and 22 points). Moreover, identical findings were observed when investigating the same performance parameters during the post-season competitive period (Csataljay et al., 2009). Interestingly, the aforementioned research reports did not find statistically significant differences between winning and losing teams in ORB, which contradicts the findings of the present study. Despite the small effect size, our results indicate that winning teams tended to pursue more ORB opportunities than losing teams. When examining differences between three professional leagues (i.e., NBA, ACB, LCB), Sampaio et al. (2006b) have found that game-related statistics are influenced by differences in anthropometric characteristics associated with playing position. For example, centers in the NBA are larger in size when compared to other professional basketball leagues. They are highly specialized players dedicated to completing specific on-court tasks such as DRB and ORB. While further research is warranted on this topic, it is possible that the observed discrepancy related to the number of ORB may be attributed to players being more similar in size at the NCAA Division-II level of competition. Hence, having fewer players with specialized tasks and fewer position-specific differences may require coaches to modify offensive strategies and dedicate more players to pursue ORB in order to secure the winning game outcome (Csataljay et al., 2017). In addition, it should be noted that winning teams had significantly greater numbers of BL, indicating better rim protection. Ibanez et al. (2008) have found that BL was one of the three key game-related statistics that determined season-long success at the LEB1 Spanish Basketball League. Altogether, a greater number of DRB and BL

implies better inside and outside defensive performance that increases chances for securing the desired game outcome by minimizing the number of second-point and uncontested scoring opportunities.

Last but not least, the findings of the present study reveal that winning teams had more AS and ST, and fewer TO and PF when compared to the losing teams, which is in direct agreement with the observations made by Lorenzo et al. (2010) when analyzing games played in Under-16 European Championship. Although focused on examining differences between winning and losing teams at the NBA level of basketball competition, identical findings were observed in a recently published study by Cabarkapa et al. (2022). Overall, these performance parameters suggest that winning teams had the superior tactical discipline and were capable of minimizing unnecessary mistakes that would jeopardize their chances of securing the desired game outcome. Combined, TO, AS, ST, and PF accounted for 29.5% of the total percentage of the explained variance. Also, it should be noted that these performance parameters are not independent. Still, they are interconnected with all other game-related statistics that contribute to the team's ability to outperform the opponent and score a greater number of PTS at the end of the game. For example, the player is rewarded with an AS, when the pass that the player made led directly to a successful field-goal attempt (Melnick, 2001). A greater number of AS indicates that the team was capable of finding more open scoring opportunities that ultimately allow the team to attain greater FG%, which has been previously shown to be one of the key game-related statistics capable of discriminating between winning and losing outcomes on various competitive levels (Cabarkapa et al., 2022; Csataljay et al., 2009; Csataljay et al., 2013; Trinic et al., 2002).

While providing additional insight into game-related statistics that discriminate between winning and losing game outcomes at the NCAA Division-II level of competition, this study is not without limitations. While allowing for the collection of large data sets, such as the one in this investigation, the data scraping technique has its limitations regarding the accuracy of the data obtained from publicly available sources. Also, the game location (i.e., home vs. away), playing position, and the number of minutes played by each player were not included in the present analysis and warranted further investigation. In addition, future research should focus on examining if the findings of the present study remain the same for both conference and non-conference games played at different levels of collegiate competition.

CONCLUSION

In conclusion, winning teams at the NCAA Division-II level of men's basketball competition were capable of attaining a greater number of FGM, 3PM, FTM, FTA, ORB, DRB, TRB, AS, ST, and BL, superior FG%, 3P%, and FT%, and fewer TO and PF when compared to the losing teams. Moreover, the top three game-related statistics capable of differentiating winning from losing game outcomes were FG%, DRB, and AS, accounting for 17.0%, 12.7%, and 12.6% of the total percentage of the explained variance, respectively (i.e., 42.3% combined). Overall, these findings support the notion that winning teams tend to display superior offensive and defensive performance, including better tactical discipline and the ability to minimize unnecessary mistakes that would jeopardize their chances of securing the desired game outcome.

REFERENCES

- Cabarkapa, D., Deane, M.A., Fry, A.C., Jones, G.T., Cabarkapa, D.V., Philipp, N.M., & Yu D. (2022). Game statistics that discriminate winning and losing at the NBA level of basketball competition. *Plos One*, 17(8), e0273427.
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences* (2nd ed). Routledge, New York, NY.
- Conte, D., Tessitore, A., Gjullin, A., Mackinnon, D., Lupo, C., & Favero, T. (2018). Investigating the game-related statistics and tactical profile in NCAA division I men's basketball games. *Biology of Sport*, 35(2), 137-143.
- Csataljay, G., O'Donohue, P., Huges, M., & Dancs, H. (2009). Performance indicators that distinguish winning and losing teams in basketball. *International Journal of Performance Analysis in Sport*, 9(1), 60-66.
- Csataljay, G., James, N., Hughes, M., & Dancs, H. (2012). Performance difference between winning and losing basketball teams during close, balanced, and unbalanced quarters. *Journal of Human Sport and Exercise*, 7(2), 356-364.
- Csataljay, G., James, N., Hughes, M., & Dancs, H. (2017). Analysis of influencing factors behind offensive rebounding performance in elite basketball. *International Journal of Sports Science and Coaching*, 12(6), 777-781.
- Garcia, J., Ibanez, S.J., De Santos, R.M., Leite, N., & Sampaio J. (2013). Identifying basketball performance indicators in regular season and playoff games. *Journal of Human Kinetics*, 36, 161-168.
- Gomez, M., Lorenzo, A., Sampaio, J., Ibanez, S., & Ortega, E. (2008). Game-related statistics that discriminated winning and losing teams from the Spanish men's professional basketball teams. *Collegium Antropologicum*, 32(2), 451-456.

- Ibanez, S.J., Sampaio, J., Feu, S., Lorenzo, A., Gomez, M.A., & Ortega E. (2008). Basketball game-related statistics that discriminate between teams' season-long success. *European Journal of Sport Science*, 8(6), 369-372.
- Ibanez, S.J., Feu, S., Garcia, J., Parejo, I., & Canadas, M. (2009). Shot difference between professional (ACB) and amateur (EBA) basketball teams. Multifactorial study. *Revista de Psicologia del Deporte*, 18, 313-317.
- Lorenzo, A., Gomez, M.A., Ortega, E., Ibanez, S.J., & Sampaio, J. (2010). Game related statistics which discriminate between winning and losing under-16 male basketball games. *Journal of Sport Science and Medicine*, 9(4), 664-668.
- Melnick, M. (2001). Relationship between team assists and win-loss record in the national basketball association. *Perceptual and Motor Skills*, 92(2), 595-602.
- Sampaio, J., & Janeira, M. (2003). Statistical analyses of basketball team performance: understanding teams' wins and losses according to a different index of ball possessions. *International Journal of Performance Analysis in Sport*, 3(1), 40-49.
- Sampaio J, Ibanez S, Lorenzo A, Gomez M. (2006a). Discriminative game-related statistics between basketball starters and non-starters when related to team quality and game outcome. *Perceptual and Motor Skills*, 3(2): 486-494.
- Sampaio J, Janeira M, Ibanez S, Lorenzo A. (2006b). Discriminant analysis of game-related statistics between basketball guards, forwards and centres in three professional leagues. *European Journal of Sport Science*, 6(3), 173-178.
- Trninc, S., Dizdar, D., & Luksic, E. (2002). Difference between winning and defeated top quality basketball teams in final tournaments of European club championship. *Collegium Antropologicum*, 26(2), 521-531.

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