

Haruhiko Madarame^{1,*}**INCIDENCE AND SUCCESS RATES OF OFFENSIVE PLAYS IN 3X3 BASKETBALL: COMPARISONS BY STARTING ACTIONS AND AGE/SEX CATEGORIES****POJAVNOST IN USPEŠNOST OFENZIVNIH IGER V KOŠARKI 3X3: PRIMERJAVE PO ZAČETNIH AKCIJAH IN STAROSTNIH/SPOLNIH KATEGORIJAH****ABSTRACT**

This study compared offensive plays' incidence and success rates in 3x3 basketball by starting actions and age/sex categories (senior men, senior women, under-18 men, and under-18 women). One hundred and ninety-one games from the FIBA 3x3 Under-18 World Cup 2019 and the FIBA 3x3 World Cup 2019 were analyzed. Offensive plays were classified into three types according to their starting actions: check-ball offensive plays (CBOP), transition offensive plays (TOP), or offensive rebound offensive plays (OROP). Offensive plays resulting in a successful field goal or an earned free throw were considered successful. Pearson's chi-squared test was used to compare the success rates of offensive plays between starting actions and between categories. The Benjamini-Hochberg method was applied to ensure a significance level of 0.05. Cohen's *w* was calculated as an effect size for the chi-squared test. TOP occurred with the highest frequency (55.1-57.5% of the totals) in all four categories, followed by CBOP (28.1-31.2%) and OROP (11.9-14.7%). The success rates of OROP (39.2-49.2%) were significantly higher ($p < 0.05$, $w = 0.07-0.14$) than those of TOP (28.5-36.4%) and CBOP (32.1-35.0%) in all categories. Improving the success rate of TOP is crucial to increase the chance of winning a game because TOP accounts for more than half of the total offensive plays. While the incidence of OROP was the lowest among the three offensive plays, the success rate of OROP was higher than that of TOP and CBOP, indicating the importance of acquiring offensive rebounds in 3x3 basketball.

Keywords: game-related statistics, notational analysis, performance analysis, team sports

¹*Department of Sports and Physical Education, Shigakkan University, Obu, Japan*

IZVLEČEK

Ta študija je primerjala pogostost in uspešnost napadalnih iger v košarki 3x3 glede na začetne akcije in starostno/spolne kategorije (starejši moški, starejše ženske, moški do 18 let in ženske do 18 let). Analiziranih je bilo sto enaindevetdeset tekem s svetovnega prvenstva FIBA 3x3 do 18 let 2019 in svetovnega prvenstva FIBA 3x3 2019. Napadalne igre so bile glede na začetna dejanja razvrščene v tri vrste: napadalne igre z vračanjem žoge v igro (CBOP), napadalne igre s prehodom (TOP) ali napadalne igre z odbojem (OROP). Napadalne igre, ki so se končale z uspešnim zadetkom ali pridobljenim prostim metom, so se štete za uspešne. Pearsonov hi-kvadrat test je bil uporabljen za primerjavo uspešnosti napadalnih iger med začetnimi akcijami in med kategorijami. Za zagotovitev stopnje pomembnosti (0.05) je bila uporabljena metoda Benjamini-Hochberg. Cohenov *w* je bil izračunan kot velikost učinka za test hi-kvadrat. V vseh štirih kategorijah se je najpogosteje pojavil TOP (55.1-57.5 % vseh primerov), sledita CBOP (28.1-31.2 %) in OROP (11.9-14.7 %). Stopnje uspešnosti OROP (39.2-49.2 %) so bile bistveno višje ($p < 0.05$, $w = 0.07-0.14$) kot stopnje TOP (28.5-36.4 %) in CBOP (32.1-35.0 %) v vseh kategorijah. Izboljšanje uspešnosti TOP je ključnega pomena za povečanje možnosti za zmago na tekmi, saj TOP predstavlja več kot polovico vseh napadalnih iger. Čeprav je bila pogostost OROP med tremi napadalnimi igrami najmanjša, je bila uspešnost OROP višja od uspešnosti TOP in CBOP, kar kaže na pomembnost pridobivanja napadalnih odbojev v košarki 3x3.

Ključne besede: statistični podatki povezani z igro, analiza tekem, analiza uspešnosti, ekipni športi

Corresponding author:* Haruhiko Madarame, Department of Sports and Physical Education, Shigakkan University 55 Nakoyama, Yokonemachi, Obu, Aichi 474-8651, Japan

E-mail: madarame@sgk.ac.jp

<https://doi.org/10.52165/kinsi.29.2.40-49>

INTRODUCTION

3x3 is among the disciplines of basketball that debuted as an Olympic sport at the Tokyo 2020 Olympic Games (Snoj, 2021b). The basic concept of 3x3 basketball is similar to that of traditional 5-on-5 basketball: breaking through the defense by passing and dribbling, and shooting at the basket. However, there are some differences in game structures between 3x3 and 5-on-5 basketball due to the fact that 3x3 has only one basket and several different rules (Table 1).

Table 1. Main differences between 3x3 and traditional 5-on-5 basketball.

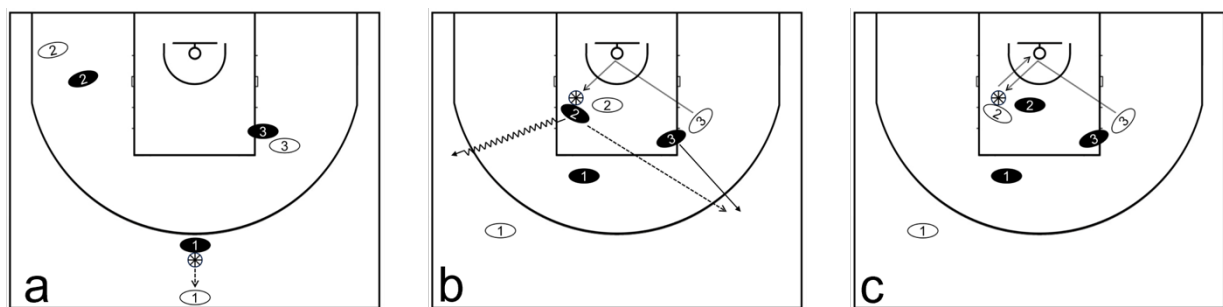
	3x3	Traditional 5-on-5
Number of baskets	One	Two
Number of players on the court	Three players for each team	Five players for each team
Scoring rules	One point for a successful free throw or a successful field goal attempted from inside the arc	One point for a successful free throw Two points for a successful field goal attempted from inside the arc
	Two points for a successful field goal attempted from outside the arc	Three points for a successful field goal attempted from outside the arc
Game duration	One period of 10 min	Four periods of 10 min
Shot clock	12 sec	24 sec
How the game is restarted following a dead-ball situation	Check-ball	Inbounding the ball from outside the court
Clearing the ball	The new offensive team that gains possession of the ball inside the arc must return the ball behind the arc by passing and/or dribbling before attempting a field goal.	No need to clear the ball
How the ball is played by the non-scoring team following a successful field goal or a last free throw by the opposing team	Picking up the ball inside the court and clearing the ball before attempting a field goal	Inbounding the ball from outside the end line

From a tactical point of view, one of the crucial differences is starting actions of offensive plays. Offensive plays in 3x3 basketball can be classified into three types according to their starting actions: check-ball offensive plays (CBOP), transition offensive plays (TOP), or offensive rebound offensive plays (OROP).

CBOP is an offensive play that starts from a check-ball (passing the ball from the defensive player to the offensive player at the top of the arc at the start of a game or when restarting from a dead-ball situation) (Figure 1a). The play check-ball does not exist in 5-on-5 basketball. Since CBOP starts from a dead-ball situation, offensive teams have enough time to prepare for the offense and can execute well-organized plays. In contrast, TOP consists of offensive plays when

the offensive team gains possession of the ball while it is in play: picking up the ball inside the court after a successful field goal or a free throw by the opposing team, securing a defensive rebound, or stealing the ball from the opposing team. TOP requires advanced decision-making abilities because there is less time to prepare for the offense. In addition, the rules state that if a transition occurs inside the arc (most of the time, it does occur inside the arc), the new offensive team must return the ball behind the arc before attempting a field goal (Figure 1b). This action is called “clearing the ball” and is specific to 3x3 basketball. Finally, OROP is an offensive play that starts with an offensive rebound. There is no difference between 3x3 and 5-on-5 basketball in OROP because attempting a field goal without clearing the ball is allowed after an offensive rebound (Figure 1c).

Figure 1. Examples of a check-ball (a), a transition offensive play requiring clearing the ball (b), and an offensive rebound offensive play (c) in 3x3 basketball.



a: Passing the ball from the defensive player (black team) to the offensive player (white team) at the top of the arc at the start of a game or when restarting from a dead-ball situation. b: The defensive player #2 (black team) got a defensive rebound of a missed shot by the offensive player #3 inside the arc. The new offensive team (black team) must return the ball behind the arc by passing and/or dribbling before attempting a field goal. c: The offensive player #2 (white team) got an offensive rebound of a missed shot by the offensive player #3. The white team can attempt another shot without clearing the ball.

Comparing CBOP and TOP, the former seems easier to execute a planned offensive play because it has time to prepare before attacking. However, the same is true for defensive teams because they also have time to prepare before the play. On the other hand, in the case of TOP, offensive teams may not have sufficient time to prepare before attacking, but they have the advantage of being able to attack before the defensive team is fully prepared.

The number of studies on 3x3 basketball has been increasing in recent years (Boros et al., 2022; Conte et al., 2019; Erčulj et al., 2019; Ferioli, Conte, et al., 2023; Ferioli, Rampinini, et al., 2023; Figueira et al., 2022; Madarame, 2023; McGown et al., 2020; Montgomery & Maloney, 2018). However, to the author’s knowledge, only one study (Ortega et al., 2021) has analyzed offensive plays by classifying them by starting actions. The study by Ortega et al. (2021) is

valuable in understanding 3x3 offense, as it analyzed not only the starting action of the offensive play but also other details of the play, such as the area of the court where the play was executed and the number and types of passes made before attempting a shot. However, the study is limited in its generalizability because it only analyzed four games. In addition, while Ortega et al. (2021) only analyzed senior men's games, previous studies on 3x3 basketball have reported age and/or sex differences in game-related statistics (Erčulj et al., 2019; Ferioli, Conte, et al., 2023; Madarame, 2023) or in physical demands (Ferioli, Rampinini, et al., 2023; Štirn et al., 2022). Therefore, this study aimed to compare offensive plays' incidence and success rates in 3x3 basketball by starting actions and age/sex categories.

METHODS

A play-by-play database of 191 games from the FIBA 3x3 Under-18 World Cup 2019 and the FIBA 3x3 World Cup 2019 was created through a notational analysis. While the total number of games was 192 (48 games in each category), one game from the under-18 women's tournament was not included in the analysis due to the lack of official game footage before 3:02 remaining in the game. An experienced researcher coded each play chronologically using a specially designed Microsoft Excel spreadsheet while viewing the publicly accessible game footage on the FIBA 3x3's official YouTube channel (<https://www.youtube.com/fiba3x3>). If it was impossible to identify a play from the footage (e.g., the camera wasn't following it), it was classified as "unclear" and excluded from the analysis. Offensive plays were classified into three types according to their starting actions: TOP, CBOP, or OROP. Offensive plays resulting in a successful field goal or an earned free throw were considered successful.

After a minimum interval of one month from the initial measurement, eight games (two from each category) were randomly selected using the R function "sample" to assess intra-rater reliability. The plays from these games were then re-coded, and Cohen's kappa was calculated using the R function "kappa2" in the "irr" package, resulting in a value of 0.985.

Statistical analyses were performed using R version 4.0.5 for Windows (R Core Team, 2021). Pearson's chi-squared test (the R function "assocstats" in the "vcd" package) was used to compare the success rates of offensive plays between starting actions and between categories. When performing the chi-squared test, the CBOP data were limited to plays in which the shot clock was reset to 12 seconds, ensuring that the remaining time on the shot clock did not affect the results. The Benjamini-Hochberg method (Benjamini & Hochberg, 1995) was applied using

the R function “p.adjust” to ensure a significance level of 0.05. Cohen’s w (Cohen, 1988) was calculated as an effect size for the chi-squared test ($w < 0.10$, trivial; $w = 0.10-0.29$, small; $w = 0.30-0.49$, medium; $w \geq 0.50$, large).

RESULTS

The total counts and percentages of offensive plays in each category are shown in Table 2. TOP occurred with the highest frequency in all four categories, followed by CBOP and OROP. The ratios of the three offensive plays were similar across categories, ranging from 55.1 to 57.5% for TOP, 28.1 to 31.2% for CBOP, and 11.9 to 14.7% for OROP.

Table 2. Total counts and percentages of offensive plays in each category.

		Men		Women	
		Senior	Under-18	Senior	Under-18
TOP	Count	1968	2102	2056	1984
	%	57.5	57.2	57.5	55.1
CBOP	Count	1018	1030	1094	1124
	%	29.7	28.1	30.6	31.2
OROP	Count	439	540	427	495
	%	12.8	14.7	11.9	13.7

TOP, transition offensive play; CBOP, check-ball offensive play; OROP, offensive rebound offensive play.

The success rates of OROP were significantly higher than those of TOP and CBOP in all categories ($p < 0.05$, $w = 0.07-0.14$) (Tables 3 and 4). However, there was no difference between the success rates of TOP and CBOP ($p = 0.07-0.96$, $w = 0.00-0.04$) (Tables 3 and 4).

Table 3. Success rates of offensive plays by starting actions and age/sex categories.

		Men		Women	
		Senior	Under-18	Senior	Under-18
TOP	Successful	717	728	639	565
	Unsuccessful	1251	1374	1417	1419
	Success rate (%)	36.4	34.6	31.1	28.5
CBOP	Successful	301	298	318	293
	Unsuccessful	569	566	591	620
	Success rate (%)	34.6	34.5	35.0	32.1
OROP	Successful	216	263	202	194
	Unsuccessful	223	277	225	301
	Success rate (%)	49.2	48.7	47.3	39.2

TOP, transition offensive play; CBOP, check-ball offensive play; OROP, offensive rebound offensive play.

Table 4. Results of pairwise comparisons of success rates between starting actions.

		TOP vs. CBOP		TOP vs. OROP		CBOP vs. OROP	
		p	w	p	w	p	w
Men	Senior	0.45	0.02	0.00*	0.10†	0.00*	0.14†
	Under-18	0.96	0.00	0.00*	0.12†	0.00*	0.14†
Women	Senior	0.07	0.04	0.00*	0.13†	0.00*	0.12†
	Under-18	0.08	0.04	0.00*	0.09	0.02*	0.07

TOP, transition offensive play; CBOP, check-ball offensive play; OROP, offensive rebound offensive play. * $p < 0.05$; †small effect size ($w = 0.10-0.29$).

The success rates of CBOP did not differ among the categories ($p = 0.30-0.96$, $w = 0.00-0.03$) (Tables 3 and 5). While the effect sizes were trivial, the success rates of TOP were significantly higher in the men's than in the women's tournaments ($p < 0.05$, $w = 0.04-0.09$) (Tables 3 and 5). The success rates of OROP were significantly lower in the under-18 women's tournament than in the other three categories' tournaments ($p < 0.05$, $w = 0.08-0.10$) (Tables 3 and 5).

Table 5. Results of pairwise comparisons of success rates between categories.

	TOP		CBOP		OROP	
	p	w	p	w	p	w
Senior men vs. U18 men	0.35	0.02	0.96	0.00	0.94	0.01
Senior men vs. Senior women	0.00*	0.06	0.94	0.00	0.72	0.02
Senior men vs. U18 women	0.00*	0.09	0.37	0.03	0.01*	0.10†
U18 men vs. Senior women	0.03*	0.04	0.94	0.01	0.80	0.01
U18 men vs. U18 women	0.00*	0.07	0.39	0.03	0.01*	0.10†
Senior women vs. U18 women	0.12	0.03	0.30	0.03	0.03*	0.08

TOP, transition offensive play; CBOP, check-ball offensive play; OROP, offensive rebound offensive play. * $p < 0.05$; †small effect size ($w = 0.10-0.29$).

DISCUSSION

This study compared offensive plays' incidence and success rates in 3x3 basketball by starting actions and age/sex categories. The results showed that TOP occurred with the highest frequency, followed by CBOP and OROP. The incidence of each type of offensive play is not constant across all games because it depends on the number of fouls, violations, and offensive rebounds. Overall, however, similar ratios were observed in all four categories. This result

indicates that increasing the success rate of TOP, which occurs most frequently, is essential for winning a game.

Comparisons of TOP success rates among the categories showed no age difference. However, there were sex differences: the success rates of TOP were significantly higher in the men's than in the women's tournaments. This result is unexpected because it would be more convincing to assume an age difference rather than a sex difference, given that TOP requires advanced abilities in decision-making and execution. For example, a previous study on 5-on-5 basketball reported that the number of assists per 100 possessions, considered an indicator of decision-making abilities, increases in an age-dependent manner (Madarame, 2018). This study could not specify the cause of the sex difference in the success rates of TOP. It should be noted, however, that while there were significant sex differences, the effect sizes were trivial. In addition, the absence of sex differences in the success rate of CBOP suggests that women can still improve their success rates of TOP.

Comparing CBOP and TOP, the former seems easier to execute a planned offensive play because it starts from a dead-ball situation. In addition, when comparing the success rates, the present study limited the CBOP data to plays in which the shot clock was reset to 12 seconds: offensive teams were able to use the entire 12 seconds to attack the basket. In contrast, while offensive teams can use 12 seconds in TOP, they cannot use the entire 12 seconds to attack the basket in most cases because they have to clear the ball before attacking the basket. However, no category showed a significant difference in success rates between CBOP and TOP. This result suggests that CBOP does not benefit only one side, offensive or defensive teams. Ortega et al. (2021) reported the incidence and success rates of offensive plays by classifying offensive plays into six types according to starting actions: after a basket, check-out, steal, ball interception, defensive rebound, or offensive rebound. The number of offensive plays analyzed by Ortega et al. (2021) was 315. When multiplying the number of plays by the reported incidence and success rates and recalculating the success rates as in the present study, the success rates of TOP and CBOP were 43.9% and 34.1%, respectively, in which TOP outperforms CBOP by ten percentage points. Since the previous study included only four games in the analysis, it is possible that the characteristics of chosen games or a particular team strongly influenced the results.

The success rate of OROP was significantly higher than that of CBOP and TOP in each category. This result is in line with Ortega et al. (2021), in which the success rate of offensive

plays after an offensive rebound was the highest among the six starting actions. The highest success rate of OROP is likely because OROP usually starts from under the basket. Having the ball under the basket increases the chances of making a successful field goal or drawing a foul. In 5-on-5 basketball, placing at least one offensive player who does not go for an offensive rebound is prevalent to prevent a fast break of the opponent team. However, since there is only one basket in 3x3, it is recommended that all offensive players go for an offensive rebound (Snoj, 2021a). Acquiring offensive rebounds is valuable because it increases the number of offensive plays. In addition, the high success rate in OROP indicates the importance of acquiring offensive rebounds. While significant differences were observed in each category, the effect sizes were trivial in the under-18 women's tournament. A comparison of OROP success rates among the categories also showed that the success rate in the under-18 women's tournament was significantly lower than that in the other categories. A previous study has shown that the success rate of paint shots was significantly lower in under-18 women than in senior men, senior women, and under-18 men (Madarame, 2023). While OROP does not always result in a paint shot, the lower success rate of paint shots may partly explain the lower success rate of OROP in under-18 women.

Although this study analyzed a substantial number of offensive plays in 3x3 basketball, if there is a limitation, it is that the data were collected from only one tournament for each category. Future studies collecting data from multiple tournaments for each category would increase generalizability.

CONCLUSION

Improving the success rate of TOP is crucial to increase the chance of winning a game because TOP accounts for more than half of the total offensive plays. The success rate of TOP was lower in the women's than in the men's tournament; however, the absence of sex differences in the success rate of CBOP implies that women can still improve their success rate of TOP. While the incidence of OROP was the lowest among the three offensive plays, the success rate of OROP was higher than that of TOP and CBOP, indicating the importance of acquiring offensive rebounds in 3x3 basketball.

Acknowledgments

This work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research (C) (Grant Number 21K11348).

Declaration of Conflicting Interests

The author has no conflicting interests to declare.

REFERENCES

- Benjamini, Y., & Hochberg, Y. (1995). Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, 57(1), 289-300. <https://doi.org/https://doi.org/10.1111/j.2517-6161.1995.tb02031.x>
- Boros, Z., Toth, K., Csurilla, G., & Sterbenz, T. (2022). A Comparison of 5v5 and 3x3 Men's Basketball Regarding Shot Selection and Efficiency. *International Journal of Environmental Research and Public Health*, 19(22). <https://doi.org/10.3390/ijerph192215137>
- Cohen, J. (1988). The Effect Size Index: w. In *Statistical Power Analysis for the Behavioral Sciences* (pp. 216-226). Routledge.
- Conte, D., Straigis, E., Clemente, F. M., Gómez, M.-Á., & Tessitore, A. (2019). Performance profile and game-related statistics of FIBA 3x3 Basketball World Cup 2017. *Biology of Sport*, 36(2), 149-154. <https://doi.org/10.5114/biolSport.2019.83007>
- Erčulj, F., Vidic, M., & Leskošek, B. (2019). Shooting efficiency and structure of shooting in 3 × 3 basketball compared to 5v5 basketball. *International Journal of Sports Science & Coaching*, 15(1), 91-98. <https://doi.org/10.1177/1747954119887722>
- Feroli, D., Conte, D., Scanlan, A. T., & Vaquera, A. (2023). Technical-Tactical Demands of 3 × 3 International Basketball Games According to Game Outcome, Player Sex, and Competition Phase. *The Journal of Strength & Conditioning Research*, 37(2), 403-412. <https://doi.org/10.1519/jsc.0000000000004282>
- Feroli, D., Rampinini, E., Conte, D., Rucco, D., Romagnoli, M., & Scanlan, A. (2023). Physical demands during 3×3 international male and female basketball games are partially impacted by competition phase but not game outcome. *Biology of Sport*, 40(2), 377-387. <https://doi.org/10.5114/biolSport.2023.116012>
- Figueira, B., Mateus, N., Esteves, P., Dadeliené, R., & Paulauskas, R. (2022). Physiological Responses and Technical-Tactical Performance of Youth Basketball Players: A Brief Comparison between 3x3 and 5x5 Basketball. *Journal of Sports Science & Medicine*, 21(2), 332-340. <https://doi.org/10.52082/jssm.2022.332>
- Madarame, H. (2018). Age and sex differences in game-related statistics which discriminate winners from losers in elite basketball games. *Motriz: Revista de Educação Física*, 24(1), e1018153. <https://doi.org/10.1590/s1980-6574201800010001>
- Madarame, H. (2023). Age and Sex Differences in Shot Distribution and Accuracy in International 3x3 Basketball Tournaments. *Montenegrin Journal of Sports Science and Medicine*, 12(1), 11-16. <https://doi.org/10.26773/mjssm.230302>
- McGown, R. B., Ball, N. B., Legg, J. S., & Mara, J. K. (2020). The perceptual, heart rate and technical-tactical characteristics of 3 × 3 basketball. *International Journal of Sports Science & Coaching*, 15(5-6), 772-782. <https://doi.org/10.1177/1747954120930916>

Montgomery, P. G., & Maloney, B. D. (2018). 3x3 Basketball: Performance Characteristics and Changes During Elite Tournament Competition. *International Journal of Sports Physiology and Performance*, 13, 1349-1356. <https://doi.org/10.1123/ijsp.2018-0011>

Ortega, E., Ortín, M., Giménez-Egido, J. M., & Gómez-Ruano, M. (2021). Technical-Tactical Performance Indicators During the Phases of Play in 3x3 Basketball. *Revista de Psicología del Deporte (Journal of Sport Psychology)*, 30(2), 187-194. <http://mail.rpd-online.com/index.php/rpd/article/view/366>

R Core Team. (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.

Snoj, L. (2021a). Fundamentals and Principles. In *3x3 Basketball: Everything You Need to Know* (pp. 198-214). Meyer & Meyer Sport (UK) Ltd.

Snoj, L. (2021b). The Rise of 3x3 and Its History. In *3x3 Basketball: Everything You Need to Know* (pp. 34-72). Meyer & Meyer Sport (UK) Ltd.

Štirn, I., Brišnik, T., & Erčulj, F. (2022). Vertical load assessment in men and women 3x3 basketball. *Kinesiology Slovenica*, 28(1), 5-18. <https://doi.org/10.52165/kinsi.28.1.5-18>