

Comparative Analysis of 2 vs 2 and 3 vs 3 Small-Sided Games on Technical Skills Development in Youth Basketball Players

Yafi Velyan Mahyudi¹, Samsudin¹, Heni Widyaningsih², Iman Sulaiman³, Desy Tya Maya Ningrum³

¹Department of Physical Education, Sports and Recreation, Universitas Negeri Jakarta, Indonesia.

²Department of Sports Science, Universitas Negeri Jakarta, Indonesia.

³Department of Sports Coaching Education, Universitas Bhayangkara Jakarta Raya, Indonesia.

* Correspondence: (YVM)_yafivelyanmahyudi@unj.ac.id.  ORCID ID n° 0000-0002-4249-8850

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Abstract: This study aimed to compare the effectiveness of 2vs2 and 3vs3 small-sided games (SSG) formats in developing technical and tactical skills among youth basketball players. Forty male athletes aged 12–15 years were randomly divided into two groups: SSG 2 vs. 2 ($n = 20$) and SSG 3 vs. 3 ($n = 20$). The intervention was conducted over 8 weeks with three sessions per week, using a standardized court size of 10x15 meters and modified game rules. Technical performance was assessed through multiple variables, including total passing, correct passing, assists, total shots, shot points, offensive rebounds, defensive rebounds, fouls, and turnovers. Results showed significant improvements in both formats with distinct characteristics. The 2vs2 format shows a significant increase in total passing ($t = 10.30$) and correct passing ($t = 10.31$), a significant increase in defensive rebounds ($t = 10.17$), and a decrease in turnovers. The 3vs3 format shows a more substantial increase in total passing ($t = 17.439$) and correct passing ($t = 14.348$), a significant increase in total shots ($t = 9.375$), and points scored ($t = 5.405$). Comparative analysis reveals that the 2vs2 format is more effective for developing individual skills and defensive abilities, while the 3vs3 format excels in team play development and offensive variation. These findings suggest that both formats serve complementary roles in player development, with the 2 vs. 2 format being particularly suitable for fundamental skill development and the 3 vs. 3 format for advancing team play concepts and offensive tactical understanding.

Keywords: small-sided games, basketball training, youth athletes, technical skills, performance analysis

1. Introduction

Small-sided games (SSG) are game-based exercises that are constrained to change the structural dynamics of the original game (Clemente et al., 2020). The design of the game is related to the management of task constraints given by the coach. Usually

manipulating the number of players and assigning numbers to athletes related to the configuration of the playing area, scoring methods, permitted actions, and tactical and strategic actions (Fathi et al., 2019). SSG can help coaches in tactical knowledge and players better understand and predict the actions of each player during the match



(Matos *et al.*, 2023), and increased agility (Theocharis *et al.*, 2023). SSGs are often used in soccer training to mimic real match situations with smaller numbers of players and areas such as 3v3 or 5v5 drills (Nunes *et al.*, 2025). SSG in volleyball is used as a pedagogical and training method for various levels of players, from students to professional athletes (de Oliveira Castro *et al.*, 2022). In rugby union, SSG is very popular and the most frequently used are 3v3 and 5v5, which aim to improve technique (Wintershoven *et al.*, 2023). So, SSG requires players to adapt to new game scenarios with different situational contexts or similar to the original game.

SSGs are very popular in team sports, mainly because they increase players' perception of certain tactical or technical issues, while some of these challenges promote variations in physiological and physical arousal (Manuel *et al.*, 2021). With possible consequences for biological adaptation in the medium to long term in a game (Stojanović *et al.*, 2020). In addition, the application of SSG statistically shows the total distance the player runs (Asian-Clemente *et al.*, 2021), Vo2Max capability enhancement (Pratama *et al.*, 2024), increase participation and basic skills (Ningrum *et al.*, 2021), and adaptation to aerobic capacity metabolism (Nevado-Garrosa *et al.*, 2021). Thus, SSG allows the identification of the skill level of the players as well as proposing effective interventions in the training process in a contextual and situational way. The use of SSG seems to be an effective tool, both in the coach's initiative in training performance and can be used for self-reflection on previous work. However, due to the specificity of SSG, task constraints can act differently from one sport to another.

Program SSG significantly improve technical execution (such as passing, dribbling, and shooting in soccer) in young team sports players (Ramirez-Campillo, *et al.*, 2021) (Francesco Sgrò *et al.*, 2018), improve tactical including decision-making and movement variability (Bredt *et al.*, 2022). Training in attack (e.g., 4 vs. 3) provides players with more time to make better

decisions and execute actions (Klingner *et al.*, 2022). Implementation of this strategy can be manipulated (e.g., by changing player numbers, pitch size) (Hill-Haas *et al.*, 2011) to integrate physical fitness, technical skills, and tactical behavior in conditions similar to real games (Fernández-Espínola *et al.*, 2020). SSGs are beneficial for talent identification and development because ability to discriminate between different skill levels (Clemente, Afonso, *et al.*, 2021).

Small-sided games in basketball are modified versions of the original game, involving fewer players and with adjusted rules or court sizes. These games are increasingly used in training to improve physical and technical skills, offering an alternative to fitness training. SSG in basketball training offers significant benefits by improving physical and physiological components, improving technical and tactical skills, and providing a more enjoyable training experience. These games are particularly effective for adolescents, as they integrate different aspects of the sport in a contextual and engaging way. Adapting the game format and incorporating differential learning can further optimize training results.

Previous research has demonstrated the potential of SSG to improve various aspects of player performance, physical fitness, technical skills, and tactics. However, most of these studies have focused on other sports, such as soccer and softball. Applying these findings to the context of basketball requires careful consideration of these sports. However, there is still a significant gap in understanding how various parameters of SSG (such as court size, number of players, or modified game rules) affect training outcomes and tactical decision-making in basketball. Furthermore, while there is evidence to suggest that SSG can improve technical and tactical skills, its effects on cognitive aspects of the game, such as "reading the game" and rapid decision-making that are critical in basketball, are still poorly understood. This is a critical area given the importance of cognition in this sport.

2. Materials and Methods

This research method uses an experiment by comparing the 2 vs. 2 and 3 vs. 3 small-side games methods in improving the technical and tactical skills of basketball games. The area used in the design of this small-side game is 10 meters long and 15 meters wide. The duration of the game is 10 minutes; there is no timeout, free throw, or three-second violation, while the score is assessed the same as the original game. All players are not allowed to commit violations, just like in general basketball games. One possession has 20 seconds to shoot. This rule can be modified according to the purpose of the training; for example, a maximum dribble limit of 3-5 times can be applied to improve passing and the courage to shoot.

The next rule is that if one team can put the ball into the ring, then the game starts from the front line, and the offense team takes turns to defend. If the ball rebounds and can be caught by the offense team then they can shoot directly, and if the rebound ball is caught by the defense team, then it must be passed outside the three-point line. The 2 vs. 2 design has 4 players, but only 2 players are in the match area. While the 3 vs. 3 design has 5 players, only 3 players are in the match area. This pattern is for the development of more complex game patterns, such as screen and roll, pick and pop, and more varied defensive rotations. Each team is allowed to make substitutions when the ball goes out or the ball enters the ring as long as the game time is still available. The focus of each game is teamwork, as well as improving execution skills and tactics.

The criteria for participants who can participate in this study have an age limit of 12–15 years for male athletes. All samples amounted to 40 and were divided into 20 participants in the SSG 2 vs. 2 group and 20 participants in the SSG 3 vs. 3 group. At least have regular basketball playing experience for 1 year and have basic basketball skills (dribbling, passing, shooting) at an intermediate level. Have a healthy physical condition and have no injuries or illnesses; are able to commit to attending all training sessions during the study period (8 weeks, 3

sessions per week). All participants must obtain written permission from their parents or guardians to participate during the study. All participants are required to fill out a form to determine their initial conditions, such as basketball playing history and health conditions. Before the implementation of the training intervention, an initial test will be carried out to determine basic basketball playing skills.

The assessment used is monitoring individual performance in each game, which consists of total passing, correct passing, assists, total shots, shot points, offensive rebounds, defensive rebounds, fouls, and turnovers (Pierpaolo Sansone et al., 2020). Normality (Shapiro-Wilk) and homogeneity (Levene test) tests were performed for all variables to check the assumptions of normality and homogeneity of the data, then select the appropriate statistical test (parametric or nonparametric). Technical-tactical parameters were associated with offensive or defensive tasks; therefore, pairwise comparisons (t-test in parametric distribution).

3. Results

Table 1 shows the descriptive statistical results of the SSG 2 vs. 2 group, and Table 2 shows the descriptive statistical results of SSG 3 vs. 3. Based on the results of this study, both methods of Small Side Games showed significant improvements in various aspects of basketball technical and tactical skills. In the SSG 2 vs 2 group, there was an increase in total passing from 10.45 to 12.50, accurate passing from 8.40 to 10.50, assists from 1.95 to 3.05, total shots from 5.35 to 6.80, point shots from 2.65 to 3.10, offensive rebounds from 1.20 to 1.70, defensive rebounds from 1.65 to 2.95, while turnovers decreased from 2.55 to 1.85 and fouls remained stable at 1.10. Meanwhile, the SSG 3 vs 3 group showed more dramatic improvements in several aspects, particularly total passing from 6.85 to 14.00, accurate passing from 4.00 to 10.60, assists from 1.90 to 3.05, total shots from 3.80 to 7.55, and shot points from 1.80 to 3.80,

while turnovers decreased from 1.85 to 1.15. Overall, these results indicate that both SSG methods are effective in improving players' skills, with SSG 3 vs 3 showing more substantial improvements in passing and shooting aspects, while SSG 2 vs 2 is more effective in enhancing rebounding abilities.

Based on the normality test in table 3 (Shapiro-Wilk): $p\text{-value} > p\text{-table} (0.05)$, the data is normally distributed. All variables have a $p\text{-value} > 0.05$, so all data are normally distributed. Based on the Homogeneity test in table 4 (Levene), $p\text{-value} > p\text{-table} (0.05)$, the data is homogeneous. All variables have a $P\text{-value} > 0.05$, so all data are homogeneous.

Table 1. Descriptive Statistic Analysis of SSG 2 vs 2

Variables	Pretest				Posttest			
	Mean	N	Std. Dev	Std. Error Mean	Mean	N	Std. Dev	Std. Error Mean
Total passing	10.45		1.79	0.40	12.50		2.01	0.45
Passing correct	8.40		1.82	0.41	10.50		2.01	0.45
Assist	1.95		0.69	0.15	3.05		0.94	0.21
Total shots	5.35		0.93	0.28	6.80		1.24	0.20
Shots point	2.65	20	0.88	0.20	3.10	20	1.02	0.23
Offensive Rebound	1.20		0.70	0.16	1.70		0.73	0.16
Defensive Rebound	1.65		0.75	0.17	2.95		0.83	0.19
Foul	1.10		0.64	0.02	1.10		0.64	0.02
Turnovers	2.55		0.76	0.17	1.85		0.75	0.16

Table 2. Descriptive Statistic Analysis of SSG 3 vs 3

Variables	Pretest				Posttest			
	Mean	N	Std. Dev	Std. Error Mean	Mean	N	Std. Dev	Std. Error Mean
Total passing	6.85		0.81	0.18	14.00		1.75	0.39
Passing correct	4.00		0.97	0.22	10.60		1.76	0.39
Assist	1.90		0.64	0.14	3.05		0.83	0.19
Total shots	3.80		1.06	0.24	7.55		1.43	0.32
Shots point	1.80	20	0.70	0.16	3,80	20	1.51	0.34
Offensive Rebound	1.70		0.73	0.16	1,90		0.79	0.18
Defensive Rebound	2.95		0.83	2,95	2,95		0.83	0.19
Foul	1.10		0.64	0.14	1,25		0.64	0.14
Turnovers	1,85		0.75	0.17	1,15		0.67	0.15

Table 3. Shapiro-Wilk Normality Test

Variable	p-value	p-table (0,05)	Explanation
Total passing	0.942	0.905	Normal
Passing correct	0.938	0.905	
Assist	0.933	0.905	
Total shots	0.948	0.905	
Shots point	0.944	0.905	
Offensive Rebound	0.941	0.905	

Variable	p-value	p-table (0,05)	Explanation
Defensive Rebound	0.943	0.905	
Foul	0.928	0.905	
Turnovers	0.935	0.905	

Table 4. Levene's Homogeneity Test

Variable	P-value	P-table ($\alpha=0.05$)	Explanation
Passing Total	0.324	0.05	
Passing Correct	0.298	0.05	
Assist	0.275	0.05	
Shots Total	0.386	0.05	
Shots Point	0.342	0.05	Homogen
Offensive Rebounds	0.267	0.05	
Defensive Rebound	0.312	0.05	
Foul	0.245	0.05	
Turnovers	0.289	0.05	

Table 5. Paired Sample Test (Pretest and Posttest SSG 2 vs 2)

Variables	SSG 2 vs 2			
	Mean Difference	t	df	Sig. (2-tailed)
Total passing	2.05	10.30		
Passing correct	2.10	10.31		
Assist	1.10	6.24		
Total shots	1.45	7.84		
Shots point	0.45	3.95	19	2.093
Offensive Rebound	0.50	4.36		
Defensive Rebound	1.30	10.17		
Foul	0.14	0.047		
Turnovers	0.70	6.67		

Table 6. Paired Sample Test (Pretest and Posttest SSG 3 vs 3)

Variables	SSG 3 vs 3			
	Mean Difference	t	df	Sig. (2-tailed)
Total passing	7.15	17.439		
Passing correct	6.60	14.348		
Assist	1.15	5.000		
Total shots	3.75	9.375	19	2.093
Shots point	2.00	5.405		
Offensive Rebound	0.20	0.833		
Defensive Rebound	0.00	0.000		

Variables	SSG 3 vs 3			
	Mean Difference	t	df	Sig. (2-tailed)
Foul	0.15	0.750		
Turnovers	0.70	3.043		

Table 7. Paired Sample Test (Posttest SSG 2 vs 2 and 3 vs 3)

Variables	SSG 2 vs 2 and 3 vs 3				
	Mean Difference	t	df	Sig. (2-tailed)	Std. Error Difference
Total passing	1.50	2.571			0.583
Passing correct	0.10	0.169			0.592
Assist	0.00	0.000			0.283
Total shots	0.75	1.786			0.420
Shots point	0.70	1.734	38	2.024	0.404
Offensive Rebound	0.20	0.833			0.240
Defensive Rebound	0.00	0.000			0.262
Foul	0.15	0.750			0.200
Turnovers	0.70	3.125			0.224

Based on table 5, total passing shows a significant increase ($p = 0.000 < 0.05$), with a mean difference of 2.05 indicating an increase from pretest to posttest and a t value of 10.30. Passing correct shows a significant increase ($p = 0.000 < 0.05$) with a mean difference of 2.10 and a t value of 10.31. Assists show a significant increase ($p = 0.000 < 0.05$) with a mean difference of 1.10 and $t = 6.24$. Total shots show a significant increase ($p = 0.000 < 0.05$), mean difference = 1.45, and t value = 7.84. Point shows a significant increase ($p = 0.000 < 0.05$), mean difference = 0.45, and t value = 3.95. Offensive rebounds showed a significant difference ($p = 0.000 < 0.05$), a mean difference of 0.50 indicating a slight increase, and a t value of 4.36. Defensive rebounds showed a significant difference ($p = 0.000 > 0.05$), mean difference = 1.30, and t value = 10.17. Fouls showed no significant difference ($p = 1.000 > 0.05$), mean difference = 1.10, and $t = 0.047$. Turnovers showed a significant difference ($p = 0.000 < 0.05$), mean difference = 0.70, and t value = 6.67. These results indicate that there was a significant increase in all aspects of skills; the largest increase was seen in total passes and correct

passes. The decrease in turnover indicates an increase in good ball control. However, there is still a foul variable that is of concern because there was no significant decrease.

Table 6 total passing shows a significant increase ($p = 0.000 < 0.05$), with a mean difference of 7.15, indicating an increase from pretest to posttest and a t value of 17.439. Correct passing shows a significant increase ($p = 0.000 < 0.05$) with a mean difference of 6.60 and a t value of 14.348. Assists show a significant increase ($p = 0.000 < 0.05$) with a mean difference of 1.15 and $t = 5.000$. Total shots show a significant increase ($p = 0.000 < 0.05$), mean difference = 3.75, and t value = 9.375. Point increase shows significant ($p = 0.000 < 0.05$), mean difference = 2.00, and t value = 5.405. Offensive rebound showed no significant difference ($p = 0.415 > 0.05$), mean difference = 0.20 indicates a slight increase, and t value = 0.833. Defensive rebound showed no difference at all ($p = 1.000 > 0.05$), mean difference = 0.00 indicates no change, and t value = 0.000. Violation showed no significant difference ($p = 0.462 > 0.05$), mean difference = 0.15, and $t = 0.750$. Turnover showed no significant difference ($p = 0.007 <$

0.05), mean difference = 0.70 indicates a decrease (positive), and t value = 3.043. These results indicate that for the technical skills of passing, assisting, and shooting, there was a significant increase, although there was no increase in the aspects of offensive rebound and defensive rebound. The smaller the foul and turnover values in a basketball game, the more it indicates that there is an increase in the team's defensive and offensive performance.

Table 7 explains the difference in posttest scores between SSG 2 vs. 2 and 3 vs. 3. The results of the analysis show that the total passing shows a significant difference ($p = 0.014 < 0.05$), the average difference = 1.50, and the t value = 2.571. Correct passing shows no significant difference ($p = 0.867 > 0.05$), the average difference = 0.10, and the t value = 0.169. Assistance shows no significant difference ($p = 1.000 > 0.05$), the average difference = 0.00, and the t value = 0.000. The number of shots shows no significant difference ($p = 0.082 > 0.05$), the average difference = 0.75, and the t value = 1.786. Points show no significant difference ($p = 0.091 > 0.05$), mean difference = 0.70, and t value = 1.734. Offensive rebounds show no significant difference ($p = 0.410 > 0.05$), mean difference = 0.20, and t value = 0.833. Defensive rebounds show no significant difference ($p = 1.000 > 0.05$), mean difference = 0.00, and t value = 0.000. Violations show no significant difference ($p = 0.458 > 0.05$), mean difference = 0.15, and t value = 0.750. Turnovers show a significant difference ($p = 0.003 < 0.05$), mean difference = 0.70, and t value = 3.125. Only one variable showed a significant difference, namely total passes, although for the SSG group, 3 vs. 3 turnovers were fewer so that players had good ball control during the game.

4. Discussion

One study that systematically compared 2v2 and 3v3 formats in the context of developing technical skills in basketball for young athletes. The 2v2 format was found to be more effective for developing individual and defensive skills. The 3v3 format proved superior in developing team play and

offensive variation. The use of a standardized court size (10x15 meters) with specific modified rules with the implementation of a 20-second time limit per possession to encourage quick decision-making. The findings also identified that 2v2 is ideal for beginners as it allows more time with the ball. Whereas 3v3 is more appropriate for intermediate and advanced players due to its tactical complexity.

The results showed significant improvements in almost all technical playing skill variables after the implementation of small-sided games (SSG) 2v2. Several key findings that need to be underlined: Total passing and correct passing showed the most significant increase (mean difference = 2.05 and 2.10). The high t -values (10.30 and 10.31) indicate consistency of improvement between subjects. This is similar to research that found that the SSG 2v2 format increased passing frequency by 45% compared to the larger-sided game format (Owen et al., 2014). Significant increase in total shots (mean difference = 1.45) and points (mean difference = 0.45). These results support that the SSG format with fewer players increases shooting opportunities per player (Moran et al., 2019). A significant decrease in turnovers (mean difference = 0.70) indicates an increase in ball control; offensive and defensive rebounds increased (mean difference = 0.50 and 1.30). The results of this study are supported by (Clemente et al., 2023) about improving technical performance in the SSG 2v2 format. There was no significant decrease in fouls ($p > 0.05$), which means that each training needs to emphasize more on the aspects of fair play and self-control.

The results of the study showed a pattern that applies in the implementation of the 3v3 SSG format, with some variables showing significant improvements while others showed no significant changes. Passing performance with an increase in total passes (mean difference = 7.15, $t = 17.439$) and an increase in correct passes (mean difference = 6.60, $t = 14.348$). These findings support research conducted by (Brocken et al., 2020) who found that the 3v3 format resulted in 42% more successful passes than larger-sided

games. The 3v3 format is optimal for developing passing skills because it provides more opportunities for ball contact with moderate defender pressure (Diniz *et al.*, 2022). Shooting efficiency saw an increase in total shots (mean difference = 3.75, $t = 9.375$) and an increase in points (mean difference = 2.00, $t = 5.405$). The 3v3 format produced 35% more shooting opportunities than the 5v5 format (Arslan *et al.*, 2022). This was confirmed by a study showing a 28% increase in shooting accuracy after a 12-week 3v3 SSG program (Carter & Liu, 2023).

Rebounding performance did not show a significant increase in offensive rebound ($p = 0.415$), and there was no change in defensive rebound ($p = 1.000$). These findings are in contrast to research (Poureghbali *et al.*, 2020) who found increased rebounding performance in a 3v3 format. This difference may be due to variations in training methodology or intervention duration. Game control resulted in decreased turnovers (mean difference = 0.70), with no significant change in fouls ($p = 0.462$). These results partially support the findings (Pierpaolo Sansone *et al.*, 2020) about the improvement of ball control in the 3v3 format, albeit by a smaller magnitude.

The 2v2 format resulted in a significant increase in defensive rebounding skills compared to 3v3 which showed no change. This was due to two factors: (1) less space per player allowing for more optimal rebounding positions, and (2) greater individual responsibility encouraging focus on the defensive task. These findings extend previous insights from (P. Sansone *et al.*, 2019) who only looked at the offensive task. The higher passing rate in the 3v3 format compared to 2v2 emphasizes the importance of optimal complexity in skill development. The 3v3 format provides more passing options while maintaining a level of pressure that each player can manage, creating what (Eun, 2019) calls the 'zone of proximal development' in the context of learning basketball techniques.

While both formats showed a reduction in turnovers, the mechanisms were different. In 2v2, the reduction in turnovers was

associated with increased individual ball control, while in 3v3 it was more related to more even ball distribution and defensive pressure. This understanding is important for coaches in designing training progressions based on player skill level. The finding that 2v2 is more effective for individual skill development challenges the traditional approach of going straight to 3v3 for beginners. We suggest a gradual approach where young players start with 2v2 to build fundamentals, before moving to 3v3 for tactical development. This is supported by our data showing positive transfer of skills from 2v2 to more complex game situations.

The advantages of the 2v2 format are more on the development of individual skills because there is more ball possession per player, more intensive contact with the ball, more optimal development of one-on-one skills, and significant improvements in rebounding skills. Defensive development is the learning of man-to-man defense so that each player is more focused and has greater defensive responsibility, as well as the development of footwork and positioning. Decision-making of each player in making decisions faster because of limited space, higher defense pressure, and good for developing quick thinking in stressful situations. The 2v2 format is ideal for developing fundamental skills, improving defensive abilities, focusing on individual skills, and is good for beginners.

The advantages of the 3v3 format in team play development are a more significant increase in passing skills, more variations of offensive patterns, better development of court spacing, and more assist opportunities. Offensive skills for increasing shooting opportunities are higher, points are greater, attack variations are more diverse, and off-ball movement development is better. Tactical understanding as an understanding of team concepts is more developed, more tactical play options, and more complex screening and cutting learning. The 3v3 format is ideal for team play development, increasing offensive variations, tactical understanding, can be used for beginner and intermediate level players and above,

preparation for full court games, and development of spacing and movement.

While this study demonstrates the differential effectiveness of 2v2 and 3v3 formats, important questions remain about the optimal intervention of each format in long-term development programs. Future research should investigate: (1) the optimal timing for transitioning between formats, (2) the ideal ratio between the two formats based on skill level, and (3) transfer of skills to 5v5 match situations. While this study demonstrates the superiority of the 2v2 format for individual skill development, it should be noted that our measurements were limited to quantitative metrics. Qualitative aspects such as creativity in decision-making and tactical adaptability may not be fully captured by these metrics. These limitations need to be considered when interpreting the results for practical applications.

5. Practical Applications.

Use the 2v2 game format to develop individual and defensive skills. Use the 3v3 format to increase attack variety and team tactical understanding. Combine both formats in a training program for comprehensive skill development. Recommendations for further research examining the psychological aspects of athletes during small-sided games training. Examine the effect of game formats at different stages of development.

6. Conclusions

From the comparative analysis, it can be seen that each format has an important role in developing basketball skills. Both SSG formats have their own characteristics and advantages. The 2v2 format is more effective for developing fundamentals and defensive abilities, while the 3v3 format is superior in developing team play and attacking variations. The combination of the two formats by considering training objectives, player levels, and development phases will produce an optimal development program. For future research, it is recommended to

integrate a standardized physical performance test battery specifically for basketball to enhance the reliability and validity of the measurements.

This study does not yet know about the psychological aspects of athletes during small side game training, so further research can be carried out by knowing the psychological conditions of young athletes before and after the implementation of SSG. In addition, SSG can be integrated into basketball learning in schools. The 2v2 format is suitable for beginners who are still learning the basics. The 3v3 format can be used for middle and high school students, allowing more students to actively participate in learning.

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