

# The Effectiveness of Small Side Games in Increasing the $Vo_2Max$ Ability of Football Athletes

Reza Resah Pratama<sup>1,2,\*</sup>, Aprizal Fikri<sup>3</sup>, Johansyah Lubis<sup>1</sup>, Samsudin<sup>1</sup>, Widiastuti<sup>1</sup>, Arisman<sup>4</sup>, Muslimin<sup>5</sup>

<sup>1</sup>Physical Education Doctoral Program, Postgraduate, Universitas Negeri Jakarta, Indonesia

<sup>2</sup>Department of Physical Education and Health, Faculty of Teacher Training and Education, Universitas Sriwijaya, Indonesia

<sup>3</sup>Department Physical Education, Postgraduate, Universitas Bina Darma, Indonesia

<sup>4</sup>Department Sports Coaching Education, Faculty of Education, Universitas Mitra Karya, Indonesia

<sup>5</sup>Department Sports Education, Faculty of Social Humaniora, Universitas Bina Darma, Indonesia

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**Abstract** Small Side Game (SSG) is a form of exercise using a small arena with a smaller number of people. This exercise aims to support  $Vo_2Max$  ability in Football. The purpose of this study is to prove the effectiveness of SSG training in increasing  $Vo_2Max$  in football athletes at the Muara Enim Persime Club and the Palembang Football Unit Club. The method used is an experiment with the design of the pretest-posttest control group. The Experimental Group (GE) performed SSG exercises with a frequency of 4 times a week for 2 months. Control Group (GC) performed conventional exercises only without using variations in movement or equipment with the same frequency as the experimental group. The subjects in this study were 46 football athletes aged 15-17 years then divided into 2 groups, GE with 23 athletes and GC also with 23 athletes. The instrument used is the Yo-Yo Intermitten Recovery Test Level 1 test. Data analysis in this study used the SPSS V-24 tool to see the effectiveness of SSG on  $Vo_2Max$  ability. The results of data analysis showed that there was a fairly high increase in  $Vo_2Max$  ability compared to the Control Group with an average difference in Yo-Yo test data of 3.82. The findings of this study are that the variety of exercises performed is very effective compared to conventional exercises.

**Keywords** Exercise, Small Side Game,  $Vo_2Max$

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## 1. Introduction

Football is a sport that is very popular with the people of Indonesia. Therefore, it is natural that the existence of this football sport has received special attention by the government, so that its achievements are highly sought through various football clubs and football schools. Football is one of the most famous game sports in the world. The game of football is played in one field that is rectangular in shape and has a goal. Football is a simple game, and the secret of a good football game is to do simple things to the best of your ability, as well as a game that is done by kicking the ball, with the aim of scoring goals into the opponent's goal as much as possible [1].

There are many things that players must have to achieve achievements in football, both internal and external. The factors that are important for players to have are physical abilities, techniques, tactics, and psychology. These four components must be owned and mastered well by football players [2]. In addition, physical and technical abilities have a very close relationship [3]. Technical skills are one of the important aspects in the sport of football or one of the foundations for a person to be able to play football as well as a special way that can be realized to solve a task of

sports movement in practice based on the human condition as a whole [4]. Meanwhile, technique is also a certain model of movement, because the model is based on morphological, physiological and biomechanical states and the solving of movement tasks that are developed and applied rationally [5], as well as one of the indicators used to be able to play football. Through existing techniques, players can work together in a match [6]. In the nature of football, movement is adapted to the idea of the game of football in scoring as many goals as possible into the opponent's goal and defending one's own goal from conceding.

In modern football, the existence of technique is of great importance. Good mastery of techniques will help players be more effective and efficient in playing [7]. Therefore, mastery of basic techniques is needed by a football player. There are not only engineering skills that football players should possess but also balance, whether static, semi-dynamic, or dynamic [8]. So it is important for football players to master other elements that can help with good mastery of technical skills. Related to technical skills is divided into passing, dribbling, shooting, control, heading, feinting, goal keeper [4].

Some of the basic football technical skills outlined above should be taught as early as possible to football players. The process of practicing football should start by teaching players the various basic techniques necessary to deal with the conditions that arise in the actual match. Mastery of technical skills for an athlete is very necessary, because it is able to influence maximum achievement, of course, in a match. So that the process of training on basic techniques is important so that the goal can be achieved. One of them is by applying small side game exercises.

SSG training is a form of football training that aims to improve the possession of the ball and the skills of football players to be better [9]. SSG is a form of practice game played with fewer than eleven players and on smaller courts [10]. SSG exercises are widely used in football training due to their multifunctional nature including the ability to increase the intensity of play compared to matches with a full field, subsequently SSG exercises develop the content of specific playing tactics to be better [3].

SG exercises provide a high stimulus in the improvement of physical condition and improvement of playing techniques, as well as its highly recommended use for the training of young football players [11] such as speed, agility, dribbling, passing and reception [12]. The exercise method of SSG is most widely used and innovative for training, since simultaneously many skills are used and

resemble the conditions at the time of the actual match.

SSG is part of the football practice method that is developing at this time. His practice uses a small field with fewer players [9]. This method emphasizes the real gaming experience. The reason is that you touch the ball a lot, your ball skills will increase, the energy used will be more efficient, get more opportunities to play the ball, have more chances to score goals, develop the mentality of competing to be strong [13]. His form of training focuses on a specific moment, so a coach must be able to create situations so that the desired moment occurs continuously [3].

This SSG is relevant to the situation in the game. The modified form of practice of the number of players and the size of the field (from 11v11 to 3v3) increases a lot of action (technical skills). In addition, players are required to always be active in a narrower area, making players have to make decisions faster and execute them [14]. The fewer the number of players, the more often the player engages in engineering actions [15]. Since the number of players and play area is limited, there is less time to make decisions, thus pushing players more to cognitive skills [16].

In the SSG 3 vs 3 situation, the available space or game area becomes limited, encouraging players to move more aggressively [17]. SSG 3 vs 3, will allow for more challenges in 1 vs 1 situations. Young players that participate in SSG 3 vs 3 have more opportunities to perform skills such as dribbling, passing, and shooting compared to participation in small side games 5 vs 5 [18]. The SSG with a 3 vs 3 format is great for increasing the individual participation of players during matches compared to larger formats.

Football is a sport with a long duration, which is 2x45 minutes even in certain situations plus 2x15 minutes. With a very long duration, it needs to be supported by excellent durability from the player. Good endurance will help players keep fighting in the match. One indicator that states good durability is the good ability of  $\text{VO}_2\text{Max}$ .  $\text{VO}_2\text{Max}$  is a representative of the player's aerobic endurance ability [19].  $\text{VO}_2\text{Max}$  is defined as the highest oxygen absorption that can be achieved during dynamic exercise with large muscle groups [20]. The amount of Oxygen processed in the athlete's body at the time of work or training is maximum [21]. It is very important to increase the ability of  $\text{VO}_2\text{Max}$  so that aerobic endurance capacity remains good, not only for athletes but also ordinary people [22]. There is a double advantage in terms of building a large  $\text{VO}_2\text{Max}$  which is that it has the provision and creation of energy to move indefinitely, has a very fast recovery period so that athletes can work for a long time without experiencing significant fatigue.

## 2. Materials and Methods

This study used an experimental method with the experimental group (GE) performed SSG exercises with a frequency of 4 times a week for 2 months. Control group (GC) performed conventional exercises only without using variations in movement or equipment with the same frequency as the experimental group. In this study, as many as 23 Persime Muara Enim players aged 15-17 years as an experimental group and 23 PS. Palembang players aged 15-17 years as a control group, GE with 23 athletes and GC also with 23 athletes. The instrument used is the Yo-Yo Intermitten Recovery Test Level 1 test [23] [24]. Data analysis in this study used the SPSS V-24 tool to see the effectiveness of SSG on  $Vo^2Max$  ability.

**Table 1.** Research Design

Group	Pretest	Treatment	Posttest
Experiment	O	X	O
Control	O	C	O

**Table 2.** Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Pre-Test Experiments	23	10.30	27.80	38.10	33.7261	3.32350	11.046
Post-Test Experiments	23	11.70	28.90	40.60	36.2174	3.14059	9.863
Pre-Test Control	23	8.90	27.30	36.20	32.0217	2.41284	5.822
Post-Test Control	23	8.80	27.70	36.50	32.4000	2.35642	5.553
Valid N (listwise)	23						

Based on the table above, there are differences in scores from the initial test and the final test in the categories of Range, mean, variance, standard deviation, maximum value, minimum value, and the number of experimental classes and control classes.

Based on the results of the Kolmogorov-Smirnov normality test after testing, the results are normally distributed due to the significance value (Sig 0.129/0.200) > 0.05. As described in the following table:

**Table 3.** Tests of Normality

Class	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
Pre-Test Experiments	.160	23	.129	.916	23	.056
Post-Test Experiments	.114	23	.200 <sup>*</sup>	.947	23	.255
Pre-Test Control	.068	23	.200 <sup>*</sup>	.980	23	.908
Post-Test Control	.090	23	.200 <sup>*</sup>	.977	23	.840

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Thus, because the data is normally distributed, it is continued using parametric statistics, as follows:

**Table 4.** Paired Samples Test

	Paired Differences						t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1 Pre-Test Experiments - Post-Test Experiments	-2.49130	1.03173	.21513	-2.93746	-2.04515	-11.580	22	.000	
Pair 2 Pre-Test Control - Post-Test Control	-.37826	.17044	.03554	-.45197	-.30456	-10.643	22	.000	

### 3. Result & Discussion

#### 3.1. Result

Based on the output of Pair 1 obtained the sig value. (2-tailed) of  $0.000 < 0.05$ , it can be concluded that there is a difference in the average VO<sub>2</sub>Max results for the Pretest experimental class with the experimental Posttest (Small Side Game). Then at the output of Pair 2, a sig value is obtained. (2-tailed) of  $0.000 < 0.05$  then it can be concluded that there is a difference in the average VO<sub>2</sub>Max results for the control class Pre-test with Post-test control (conventional) but not significant. So, there is a significant influence of the pre-test and post-test Small Side Game on Endurance in football. To see more clearly the average results of exercises before and after the Small Side Game method, it can be seen in the following table:

**Table 5.** Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test Experiments	33.7261	23	3.32350	.69300
	Post-Test Experiments	36.2174	23	3.14059	.65486
Pair 2	Pre-Test Control	32.0217	23	2.41284	.50311
	Post-Test Control	32.4000	23	2.35642	.49135

Then continued with the homogeneity test which obtained the following results;

**Table 6.** Test of Homogeneity of Variance

		Levene Statistics	DF1	DF2	Sig.
VO <sub>2</sub> max Results	Based on Mean	2.765	1	44	.103
	Based on Median	2.237	1	44	.142
	Based on Median and with adjusted df	2.237	1	41.950	.142
	Based on trimmed mean	2.578	1	44	.115

The results of the analysis above show that the significance value (Sig) on the Based on Mean ( $0.103 > 0.05$ ) can be concluded that the experimental and control post-test class data are homogeneous. Thus, one of the conditions of the independent sample t-test has been met.

**Table 7.** Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
VO <sub>2</sub> max Results	Equal variances assumed	2.765	.103	4.663	44	.000	3.81739	.81870	2.16742	5.46736
	Equal variances not assumed			4.663	40.809	.000	3.81739	.81870	2.16377	5.47102

Based on the independent sample t-test above, the significance value (2-tailed) is  $0.000 < 0.05$ , then Ho is rejected and Ha is accepted. That is, there is a significant difference between the results of the VO<sub>2</sub>Max test in football that applies small side game training and conventional training. For more details, find out the average (mean) post-test experimental class and post-test control class in the statistical table below:

**Table 8.** Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
VO <sub>2</sub> max results	Post-Test Experiment (Small Side Game)	23	36.2174	3.14059	.65486
	Post-Test Control (Conventional)	23	32.4000	2.35642	.49135

More details can be seen in the following histogram;

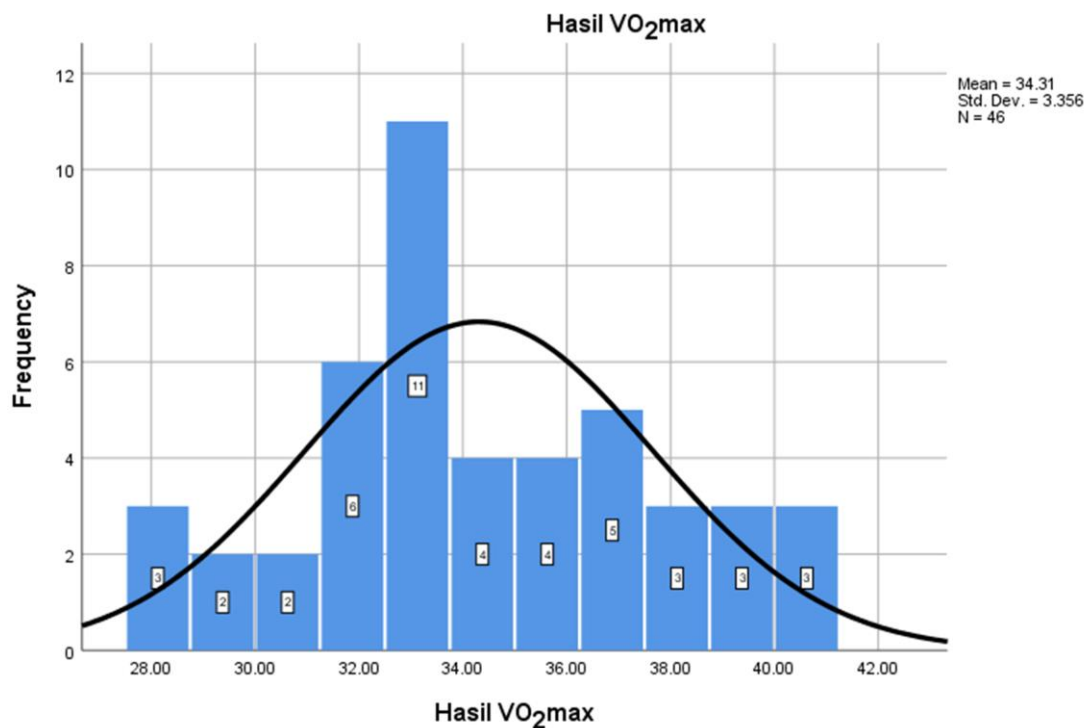


Figure 1. Histogram of VO<sub>2</sub>Max Results

### 3.2. Discussion

In soccer, there is a close relationship between VO<sub>2</sub>Max and athlete performance [25]. High VO<sub>2</sub>Max indicates that the athlete's body has the ability to supply oxygen more efficiently to his muscles during intense physical activity. This can increase endurance, allowing players to maintain the speed and quality of their movements throughout the game [26]. In addition, the high VO<sub>2</sub>Max also contributes to faster recovery ability after intensive effort, so players can recover better between sets or training sessions. This is important in soccer, where players often perform sprints, changes in direction, and repetitive physical activity at high intensity. In addition to VO<sub>2</sub>Max, speed, endurance, and strength quality are also important in football [27]. Increased speed helps players run, dribble, and react quickly to game situations. Good endurance allows players to maintain their performance throughout long matches. The quality of strength, such as muscle strength and explosive power, also plays an important role in situations such as physical duels and hard kicks [28]. To increase VO<sub>2</sub>Max and other aspects related to soccer performance, interval training involving a combination of cardiovascular exercise and strength training can be very beneficial [29].

Such exercises can improve cardiorespiratory capacity, speed, endurance, and strength quality, as well as help players adapt to the physical demands of a soccer game. VO<sub>2</sub>Max has significant relevance for football players. Here are some reasons why VO<sub>2</sub>Max is important in the

context of endurance, football is a sport that requires players to move constantly during long games. High VO<sub>2</sub>Max allows the body to produce energy efficiently by using oxygen. This helps players in maintaining a high level of endurance during the game, so that they can stay in optimal performance at all times [30][31].

Fast recovery, high VO<sub>2</sub>Max also means faster recovery after intensive effort [32][33]. In football, players often perform sprints, run long distances, and participate in physical duels [34]. The ability to recover quickly between such activities is essential so that players can maintain their performance throughout the game. Speed, high VO<sub>2</sub>Max is also associated with increased speed [35]. Soccer players with good VO<sub>2</sub>Max tend to have the ability to move faster and chase the ball more effectively [36]. Better speed allows players to create chances, avoid opponents, and make greater contributions in matches [37] [38].

Thus, VO<sub>2</sub>Max has an important role in determining the level of cardiorespiratory fitness and performance of football players. The high VO<sub>2</sub>Max level allows players to have better endurance, fast recovery and higher speed, and better power quality. Therefore, exercises that lead to an increase in VO<sub>2</sub>Max and other related aspects become important in the development of better soccer players.

Various systems working together produced the successful soccer performance. An approach that enables the simultaneous measurement of both intra-individual and inter-individual contributions to soccer performance should be utilized to track soccer development [39]. Since

the 1960s, Small sided games (SSG) have been a part of the soccer coaching lexicon, with the earliest articles discussing their use to teach the fundamentals of play by simulating technical and tactical game situations [40]. Small-sided games could play a big part in the situation currently used as a useful way of training because of the multiple benefits achieved [29]. These types of games combine technical, tactical and physiological training [41]. Small side games and targeted ball exercises can improve aerobic and anaerobic endurance as well as the development of technical and tactical movements [42]. Sports like small-sided soccer games that include high-intensity training can gain  $\text{VO}_2\text{max}$  [43]. Small side games are one of the particular exercises to raise  $\text{VO}_2\text{max}$  [44]. Small-sided games (SSGs) are useful for developing your cardiovascular endurance in soccer [45]. Small side games merely improve fitness markers like speed, power, and cardiovascular endurance, there is no difference between the increase in movement and small side game training [46]. Throughout the competition season, additional aerobic exercise only marginally boosts running speed at lactate threshold, demonstrating the value of SSG as a training method to raise average  $\text{VO}_2\text{max}$  [47]. SSG improvements in  $\text{VO}_2\text{max}$  of approximately 7–11% use HIIT interventions [48]. Small-sided games play an important role in increasing  $\text{VO}_2\text{Max}$  of football players [49][50][51].

#### 4. Conclusions

According to the results of data analysis, it was concluded that there was a significant influence of Small Side Game exercises; This exercise is very effective compared to conventional exercises. Therefore, this method is very suitable for football athletes to improve their football playing skills as a breakthrough so that the resulting  $\text{VO}_2\text{max}$  results also get maximum results in supporting the physical ability of the endurance component in football games. In this study, the limitations of the study only included small side game components and the sample size was not too large so that the research results could not be generalized. Meanwhile, there are recommendations for further researchers to develop more in a broader context as well as other forms of exercise.

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