Improved VO_{2Max} : The Effectiveness of Basic Soccer Training at a Young Age

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Abstract The skill in managing the ball is a skill that must be possessed by every football player, but if the player has a low VO_{2Max} , then the player will not be able to compete at the international level. Therefore, we need a training method to improve VO_{2Max} soccer players, in order to sustain the skills that they have. Therefore, the purpose of this study is to look at the differences between the two training methods aimed at improving VO_{2Max} soccer players. This research is a quantitative quasi-experimental research with post-test control group design. With a total of 76 participants, which are divided into two groups, namely the experimental group who are trained using basic techniques of efficient football and the control group using conventional training. All data obtained are searched for mean, min, max, and standard deviation and the difference between the two methods using independent sample t-test. There are differences between the two training methods in improving VO_{2Max} players. It was found that using effective soccer training methods had a difference of 12,963 to conventional training in improving VO_{2Max} players.

Keywords Effective Training Methods, Soccer, VO_{2Max}

1. Introduction

Modern football style requires physical fitness or physical fitness and VO_{2Max} in particular. A talented soccer player may not be able to play a good and satisfying game if he is physically unfit and cannot maintain his physical fitness continuously [1, 2]. The style of modern football is also increasingly demanding the ability to play the ball in high skills. These soccer characteristics involve the speed of pressure from the opposing player when a player is controlling the ball. The high pressure on the player who

controls the ball makes the player does not have enough space to freely play the ball. In such conditions, players are required to have the ability to escape from the control of opponents, protect the ball so that it remains in control, and collectively arrange attacks through fast passes and directed in the condition of the ball remains in the mastery of the team (ball possession) [3, 4]. The game of football is a sport that is prerequisite with skills. Even so, the functional movement patterns in the game of football which are known as "ball technique" skills can be divided into eight, namely: 1) kicking; 2) stop the ball (ball control); 3) carrying the ball (dribbling), 4) heading (heading); 5) feinting; 6) seize the ball (tackling); 7) throw-in; and 8) goal keeper [5]. Therefore, in football, high VO_{2max} and skills are needed to compete at the international level. Because, if you only have the skills or skills in managing a good ball, but do not have a high VO_{2max} , then these players will not be able to compete at international and professional levels.

A good maximal consumption of oxygen or VO_{2Max} clearly illustrates that a person's level of physical fitness also has VO_{2Max} and good physical fitness in an athlete or soccer player can prevent or minimize the possibility of injury. Theoretically a consideration for coaches if most players have relatively less physical value compared to opponents then it is not possible to choose the type of total play (power) football but it is better to choose the classic type [6-9]. The duration of the soccer game 2x45 minutes is a soccer game where the movements when playing on the field are very complex and varied so that they require cruising capabilities throughout the game. For this reason, in addition to having excellent physical fitness, a soccer player should have a high aerobic capacity [10-12]. In connection with this indicator the KONI Center for Sports Sciences (PIO) sets a minimum standard of 60cc maximum aerobic ability for national team soccer players [13]. From this standard of physical ability, most soccer clubs are allegedly not capable enough to apply contemporary soccer

styles. VO_{2Max} 's ability and player's skill level has a causal relation to the player's condition.

According to Kent (1994) the maximum aerobic capacity or VO_{2Max} is the maximum amount of oxygen that a person can breathe from air to then transport and use it in tissues [14]. According to Fox (1984), the maximum aerobic power is determined by factors: a) the function of the heart, lungs and blood vessels; b) the process of delivering oxygen to the tissue by erythrocytes involving heart function, blood volume and the number of red blood cells in terms of transfer of blood from inactive tissue to active muscle [15]. Then the maximum oxygen volume is one of the important factors to support athletes' achievements, especially in sports which are considered to have strength. The criteria for achieving maximal aerobic capacity as applied in the measurement of maximum aerobic capacity are: a) the occurrence of fatigue; b) the pulse rate is greater than 190 beats per minute; c) the respiratory exchange ratio is greater than 1, and d) the level of lactic acid in the blood exceeds 100 mg percent [16]. This criterion is used as a basis for assessing the measurement objectivity and requirements of a test. Maximum aerobic ability (VO_{2Max}) of a football player will support more intensive work and the ability to execute skills in high pressure situations from opposing players. Modern soccer style as described in theoretical studies requires physical fitness or physical fitness and VO_{2max} in particular [17]. During the 2 x 45 minutes of football matches the players ran an average of about eight to 13 kilo meters, running short distances and running mid-speed in turn (intermittent). A talented soccer player may not be able to play a good and satisfying game if he is physically unfit and cannot maintain his physical fitness continuously [18].

VO_{2Max} is the body's ability to consume oxygen maximally during activity and training [19-22]. The maximum volume of oxygen that can be consumed during continuous and gradually increasing intensive exercise, mainly uses the aerobic process. It is calculated in ml/kg/min using specific laboratory tests or field tests [23-25]. The maximum amount of oxygen that can be consumed during intense physical activity until fatigue finally occurs [26]. Many theories and literature explain the needs of VO_{2max} a football player. The average oxygen uptaken for international soccer teams ranges from 55 to 68 ml/kg/min [27], 48-62 ml/kg/min [28]. Professional 56.5 ml/kg/min; Amateur 55.7 /kg/min [29], VO_{2max} football players aged 22-28 years are for men 54 ml/kg/min - 64 ml/kg/min and girls 50 ml/kg/min - 60 ml/kg/min [21]. While Taylor (2016) states in football, the best players can reach VO_{2max} levels of 65-70 ml/kg/min, depending on their age, level of individual performance and position on the pitch. A VO_{2max} of 60-62 ml/kg/min is already considered to be a decent reserve for a footballer and more so for players aged 16-17 years [25].

The need for VO_{2max} and endurance is quite a lot in football games, requiring coaches to design training

models that can improve VO_{2max} . In soccer the training model that is designed should be more specific and use a ball. Ideally exercises to increase endurance and VO_{2max} should be done using a ball [30-33]. Improving the physical condition of soccer, players should use specific exercises, such as small side games, soccer technique training, and ball-specific position training [34, 35]. High-intensity training in the form of special soccer games such as small side games and soccer training drills can increase aerobic capacity (VO_{2max}) [36]. The application of training methods for endurance, strength, speed must always be specific to football [37].

Based on the theories that have been put forward then a new form of VO_{2max} training is made which is based on basic soccer training techniques. Usually, VO_{2max} increases soccer players with high-intensity exercises in the form of special soccer games such as small side games [36]. However, researchers develop a method to improve the VO_{2max} of under 18 soccer players, namely by practicing effective basic soccer techniques. Usually the basic football training technique, is an exercise that is usually done to improve soccer's basic technical skills. But in this study, it is modified into exercises to improve VO_{2max} . Implementation in this exercise is exactly like ordinary technical training, so that players do not feel bored which has been a problem for coaches in doing VO_{2max} training. This dive practice only runs with the specified duration of time changing to the basic form of technical training in soccer. The basic elements of football techniques such as passing, ball control, dribbling and shooting are used as media for training to increase VO_{2max} by modifying several items, which include intensity in doing, volume in doing, number of sets and recovery in training. Modifications are made based on the principles of training and the imposition of training on the physical condition of football. On the basis of all that, the purpose of this study is to look at the effectiveness of basic soccer training techniques in improving VO_{2max} young soccer players.

Therefore, the aim of this study is to look at the effectiveness of the basic techniques of effective soccer training as well as the difference in using other techniques to improve VO_{2Max} soccer players. With the following research questions

1. What is the effectiveness in conducting basic soccer technical training methods effectively in VO_{2Max} soccer players?
2. Is there a difference between using effective basic soccer training methods in VO_{2Max} and conventional techniques for improving VO_{2Max} soccer players?

2. Materials and Methods

This research is a quasi-experimental study with a post-test control group design. That is done to investigate causal hypotheses about causes that can be manipulated by comparing one or more experimental groups that are

treated with one comparison group that is not treated [38]. The design of this study is applied because it is in accordance with the objectives of the study, where the aim is to find out whether there is a difference between the practice of basic effective soccer techniques and other techniques to improve VO_{2Max} soccer players. This research uses descriptive statistics in the form of mean, min, max, and standard deviation and uses inferential statistics. The inferential statistics used are independent sample t-tests.

Table 1. Posttest Non-Equivalent Control Group Design

Group	Treatment	Posttest
Experimental	Basic soccer effective training techniques	O ₁
Control	Conventional Training (small side games)	O ₂

The subjects in this study are soccer players aged U-18 years, total 76 people. In the experimental group there are 38 players and in the control group there are also 38 players. In the experimental group using the basic techniques of effective soccer training and in group control using conventional training. The sample collection technique uses a purposive sampling method. Purposive sampling is a sampling technique based on researchers' criteria [39]. The criteria in this study are players under the age of 18 years. Data collection procedures for referring [40], are explained in the figure 1.

Figure 1. Data Collection

Based on Figure 1, it is seen that the first activity carried out is applying effective basic soccer training techniques to improve VO_{2Max} players which are only done in the experimental group, then for the control group applying conventional exercises. After training is completed, the Yo - Yo IR test [40] is given to see if there are differences in VO_{2Max} players who use effective basic soccer training techniques or those who only use conventional training.

After the data is collected then the data is compiled, then the data is processed using the independent sample t-test analysis technique.

3. Results and Discussion

Research findings are explained in this section. The Mean, Min, Max, and Standard deviation, post-test results to show the impact of effective basic football training techniques on under 18 soccer players are presented in table 2 below.

From table 2, we can see that the experimental class has the highest VO_{2Max} value of 58.54 and the lowest of 44.8, while for the control group has a VO_{2Max} value of 51.53 for the highest, and for the lowest of 43.8. From this we can see that the use of training with the basic techniques of football is effective, more effective than the use of conventional training techniques. Although the standard for professional players under 18 is 54-64ml/kg/min [21]. However, this has not been able to strengthen the difference between the use of the training method, so inferential testing is done using an independent sample t-test, which can be seen in table 3.

From table 3 it can be seen that the value is obtained (t-arithmetic) with the value of t table. T-table values can be found in the t table with a significance value of 0.05 (2-sided test) with a degree of freedom (df) 76. In this study, the results for t table are 1.66515. Whereas the value of t arithmetic can be seen in table 3. (column t) which is 12.963. Hypothesis testing criteria if the value of t table is greater than t arithmetic, then there is no difference (Cramer, 2003). So, it can be concluded that there is a significant difference for VO_{2Max} players under 18 between the control group using conventional training techniques and the experimental group using effective soccer training techniques. It can be seen from table 3 that the average value of VO_{2Max} players is 2.51, which means that basic soccer training can effectively increase VO_{2Max} soccer players under 18.

Table 2. Gap scores of VO_{2Max} under 18 soccer players who use basic soccer training techniques effectively with conventional training

Group	Max	Min	Mean	SD
Experiment	58.54	44.8	49.64	2.51
Control	51.53	43.8	48.28	1.83

Table 3. Results of the Independent sample t-test for effective basic soccer training

	T	Df	Mean	Std. Deviation	95% confidence interval	
					Lower	Upper
Basic soccer effective training techniques	12.963	76	49.64	2.51	12.236	.4120
	12.963	96.321	48.24	1.83	11.935	.5615

Based on the results obtained (see table 2), Basic soccer effective training techniques are more effective than Conventional Training (small side games). That is because, on the basis of effective soccer training, researchers have modified their training, so as to improve the VO_{2max} of soccer players, such as in passing, ball control, dribbling and shooting, what is modified is an intensity in doing, volume in doing, number of sets and recovery in training, but the modifications made remain based on the principle of training the physical condition of football. From table 2, we can see that, the use of conventional methods can increase the VO_{2max} of the player by 51.53 ml/kg/min. Much different from the effective basic training technique, which is able to increase by 58.54 ml/kg/min VO_{2max} soccer players under 18, and it has entered the VO_{2Max} standard for young players. Because VO_{2max} standard young players are at 54-64 ml/kg/min [21].

VO_{2Max} is the body's ability to consume oxygen maximally during activity and training [19-22]. The maximum volume of oxygen that can be consumed during continuous and gradually increasing intensive exercise, mainly using the aerobic process. It is calculated in ml/kg/min using specific laboratory tests or field tests [23-25]. The maximum amount of oxygen that can be consumed during intense physical activity until finally fatigue occurs [26]. Many theories and literature explain the VO_{2max} needs of a soccer player. The average oxygen uptaken for international soccer teams ranges from 55 to 68 ml/kg/min [27], 48-62 ml/kg/min [28]. professional 56.5 ml/kg/min; Amateur 55.7 ml/kg/min [29], VO_{2max} football players aged 22-28 years are for men 54 ml/kg/min - 64 ml/kg/min and girls 50 ml/kg/min - 60 ml/kg/min [21]. While Taylor (2016) states In football, the best players can reach VO_{2max} levels of 65-70 ml/kg/min, depending on their age, level of individual performance and position on the pitch. A VO_{2max} of 60-62 ml/kg/min is already considered to be a decent reserve for a footballer and more so for players aged 16-17 years [25].

The need for VO_{2max} and endurance is quite a lot in football games, requiring coaches to design training models that can improve VO_{2max} . In soccer the training model that is designed should be more specific and use a ball. Ideally exercises to increase endurance and VO_{2max} should be done using a ball [30-33]. Improving the physical condition of soccer players should use specific exercises, such as small side games, soccer technique training, and ball-specific position training [34, 35]. High-intensity training in the form of special soccer games such as small side games and soccer training drills can increase aerobic capacity (VO_{2max}) [36]. The application of training methods for endurance, strength, speed must always be specific to football [37].

Increasing VO_{2max} will improve player performance in matches such as distance traveled, intensity, number of sprints, and the amount of player involvement with the ball [30, 41]. Players with higher VO_{2max} increase the distance

traveled and increase their potential in influencing the final results of a football match [42]. Players who have large VO_{2max} have the supply and creation of energy to move without limits, have a recovery period that is very fast so that athletes can work long hours without experiencing significant fatigue [22].

Basic soccer training techniques or VO_{2max} exercises that use the ball as a medium have several advantages, including: 1) in addition to increasing VO_{2max} , it also improves the player's basic technical skills, because players will always be in contact with the ball, 2) eliminating player boredom in VO_{2max} training. Training using the ball will provide many variations of training, such as passing, ball control, dribbling, shooting, combination play and others so that players do not get bored in undergoing training. 3) facilitates the trainer in organizing and controlling the exercises. VO_{2max} exercises such as cross country, fartlek, intervals and circuits require the trainer to organize and always control the players to keep running, 4) increase the motivation of players in undergoing VO_{2max} training, because this exercise has an attraction in various forms of training.

Besides that Schlumberger (Fitness expert) explains "He sees the goals of soccer-specific endurance training as follows: 1) 90 to 120 minutes optimal performance readiness for all typical motion sequences in soccer, 2) Optimal capacity for high-intensity explosive performance in individual actions, 3) Optimal capacity for repeated high-intensity explosive performance for the duration of the game, 4) Maintaining the same intensity for a longer period of time, 5) Achieving a higher intensity within the same period of time, 6) Good cardiovascular capacity, 7) Good muscle metabolic function [43].

VO_{2max} training using the ball will provide an update on the soccer player's VO_{2max} training. There are many benefits and advantages of specific football training or physical training with ball [44-46]. So it is very important for the coach to provide physical training, especially VO_{2max} by using the ball as a medium. However, not only this exercise, maybe the trainer can modify or manipulate new forms of training so that more forms of training are available. This will certainly add a reference to the form of VO_{2max} training for soccer coaches.

4. Conclusions

Increasing VO_{2Max} young players under 18 is very important to do, and by having high VO_{2Max} it will support these players in a match. Because, if you only have good skills, but not supported by high VO_{2Max} , then these players cannot compete with other international players. Therefore, through training that applies the basic techniques of effective soccer training it can improve the VO_{2max} of young soccer players compared to conventional training. This can be seen from the calculated t value greater than t

table, and then there is a significant difference between the use of the two training models in improving $VO_{2\text{Max}}$ players. This exercise is very suitable for young players (youth), because in addition to improving $VO_{2\text{max}}$ is also able to improve the basic technical skills of football players. In addition, this exercise can increase motivation and eliminate players' boredom during the training process

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