

Increasing VO2 Max Through Circuit Training for Extracurricular Football Students at SMA Negeri 5 Soppeng

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ABSTRACT

This research aims to determine the effect of circuit training on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng. The population of this study were all students of SMA Negeri 5 Soppeng with a research sample of 20 students selected as a total population and a group division system using ordinal matching. The data analysis techniques used are descriptive, data normality tests, homogeneity tests, and t-tests using the SPSS program. The research results show that; There is an influence of circuit training on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng. Increase in VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng with an increase from an average score of 30.2500 to 44.3100.

Keyword: Exercise; Circuit Training; VO2 Max; Football

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INTRODUCTION

The game of football is a sport which takes one and a half hours or 2 x 45 minutes to play. During the hour and a half, players are required to constantly move or carry out various types of movements such as: running while dribbling the ball, running and then stopping suddenly, running while turning, kicking the ball, jumping, sledding, body bumping and sometimes colliding with an opposing player at high speed (Heri, 2017). Specifically regarding soccer playing techniques, namely all movements with or without the ball that are useful in the game (Akhmad & Suriatno, 2018). Football techniques are all movements with or without the ball that are necessary to develop maximum performance with minimum effort (Soleh & Hakim, 2019). Football is a team sport, meaning that teamwork is needed to be able to build attacks and score goals, as well as defend the goal so that the opposing team does not concede (R. R. Pratama, 2019). The basic techniques of playing football are: dribbling the ball, passing the ball, how to receive the ball, how to shoot the ball in a football game, training and applying certain tactics (Burhanuddin et al., 2022), practising good cooperation between players in a team and to improve the quality the physicality of the players (Fatikhaturun, 2020).



Football is a team game played by each team consisting of eleven players including a goalkeeper (Putra Maiza Rianda et al., 2020). Football is a very popular game because football is often played by athletes, adults and parents. Currently, the development of the game of football is very rapid, this is marked by the existence of football schools being established (Roesdianto & Widodo, 2020). The aim of the game of football is for each team or team to try to control the ball, put the ball into the opponent's goal as much as possible, and try to break the opponent's attacks to protect or guard the goal so that the ball does not get conceded (Erfayliana & Wati, 2020). The game of football is a team game that requires basic cooperation between team members, as one of the characteristics of the game of football (Ramadhan & Syafii, 2022). To be able to play football well and correctly, players master basic football techniques (Sari & Nurrochmah, 2021). To play football well, players are equipped with good basic techniques. Players who have good basic techniques tend to be able to play football well too (D. N. Pratama & Nurrochmah, 2022).

To improve football performance, many factors must be considered, such as infrastructure, quality coaches, talented players and regular competition and must be supported by adequate science and technology (Bryantara, 2016). An important factor in achieving football achievements is physical condition. The physical component plays a very important role in maintaining or increasing the degree of physical fitness (Maliki et al., 2017). A person's degree of physical fitness greatly determines their physical ability to carry out daily tasks (Hammad et al., 2020). The higher a person's degree of physical fitness, the higher their physical workability (Sudirman et al., 2022). In other words, his work results will be more productive if his physical fitness increases. Endurance is the ability to do work for a long period (Bayu, 2017). Endurance is always closely related to the length of work (duration) and work intensity. The longer the duration of exercise and the higher the work intensity that an athlete can do, the more it means they have good endurance. Endurance is the ability of a person's body to resist fatigue during activities (Mas & Faruk, 2013). Endurance is the ability to work or exercise for a long time without experiencing fatigue. Based on the energy system used, endurance can be divided into two, namely: (1) aerobic endurance, namely the ability of the heart and respiratory system to supply oxygen to the muscles to burn glycogen to become an energy source (Pranata, 2017), and (2) endurance anaerobic (lactic and alactic), namely the process of meeting energy needs in the body to burn glycogen to become a source of energy without the help of oxygen from outside (Setiawan, 2016). Endurance training aims to improve the athlete's ability to overcome fatigue during activities (Rahmad, 2016). Fatigue in question is tiredness both physically and psychologically. Endurance training will have an impact on the quality of the cardiovascular system, respiratory and circulatory systems. The main factor for success in sports training and competitions is influenced by the athlete's level of ability to inhibit the process of fatigue. Athletes who have good endurance will certainly be able to carry out activities without experiencing significant fatigue for a relatively long period (Mubarok & Ramadhan, 2019). Some of the advantages obtained by athletes who have good endurance abilities include that athletes will be able to (a) be able to determine the rhythm and pattern of play during competition, (b) be able to maintain or change the rhythm and pattern of play according to what is desired, and (c) have the power to fight tenaciously and don't give up easily during competition. Cardiorespiratory fitness is one of the most important components of physical fitness. By having cardiorespiratory fitness, a person can exercise daily activities without experiencing significant fatigue, besides that the heart and lungs can function optimally, so that heart disease can be avoided (Sinurat, 2019). Cardiorespiratory endurance is an appropriate indicator to describe a person's physical fitness status. Cardiopulmonary endurance is the capacity of the heart, lungs and blood vessels to function optimally when carrying out daily activities for a relatively long time without experiencing



significant fatigue (Anggraeni & Wirjatmadi, 2019). Cardiorespiratory endurance is the heart's ability to supply oxygen for muscle work over a long period. Cardiopulmonary endurance or cardiorespiratory endurance is a condition where a person's heart can work with heavy loads during certain work. Maximum aerobic capacity is expressed as VO2 Max (Sugiarto & Rahmatullah, 2019). Aerobic capacity essentially describes the amount of motor ability (motor power) of an athlete's aerobic process. Maximum oxygen volume capacity (VO2 Max) is the fastest tempo at which a person can use oxygen during exercise (Putra & Dinata, 2019). The greater the VO2 Max capacity, the greater the ability to carry heavy workloads and the faster physical fitness will recover after the hard work is finished (Ferry & Welis, 2019).

Based on several opinions above, the author concludes that cardiorespiratory fitness is the most important component of physical fitness among other components of physical fitness (A. W. P. Pratama & Rismayanthi, 2018). Cardiorespiratory fitness is the maximum ability of the heart and lungs to transport oxygen and blood to all body tissues to carry out activities for a long time. Maximum aerobic capacity or VO2 Max is the fastest tempo at which a person can use oxygen during exercise (Maqsalmina, 2007). A high VO2 Max has an important role in sports that require endurance. Athletes who do not have a good VO2 Max will be very visible in matches on the field, these players will experience a decrease in stamina, strength and concentration (Bramasko & Kafrawi, 2016), as well as making many basic mistakes which can be detrimental to the athlete himself and of course to the contingent. (Pemgalih & Huriyati, 2007). So VO2 Max is very necessary to support the success of players in completing a match in one match to continue the next match (Puspaningtyas et al., 2015). For extracurricular football students at SMA Negeri 5 Soppeng to get a good VO2 Max, they must do regular physical exercise 3-5 times a week. Apart from being useful for improving physical fitness, the physical component is the main program in developing players to excel in a sport. Soppeng 5 Public High School students who have good physical components will avoid the possibility of injury which usually often occurs if someone does heavy physical work, besides that it will help in achieving achievements in their sport.

In the Soppeng 5 Public High School football extracurricular program, the training provided aims to help players improve their skills, physical condition and achievements as much as possible. Because the sport of football requires good endurance when undergoing training or matches. To have high aerobic endurance capabilities, a high VO2 Max level is also needed (Busyairi & Ray, 2018). The high and low levels of VO2 Max are influenced by several supporting components such as the ability of the heart, lungs, blood quality, blood vessels and the ability of skeletal muscles to consume oxygen (Abraham, 2014). If one of these components has low ability, it will affect the VO2 Max level (Hutama & Yuliasrid, 2017). The circuit method usually consists of several items (kinds) of exercises that must be done within a certain time. After completing one training item, immediately move to another item, and so on until all training items have been completed, so it is said that you have done one circuit. Circuit training is a sequence of exercises with one type of activity at each post between 4-12 posts. Athletes are free to start training from anywhere. For this reason, in arranging the sequence of training items, efforts are made to increase muscle targets alternately. This means that the muscles that are subjected to training loads alternate with each training item. Circuit training is an exercise consisting of several training stations, where exercises are carried out. One training circuit is declared complete if someone has completed the training at all stations according to the prescribed dose and time, in short, it is one form that is done in one round, and during one round there are several stations. Circuit training is one way that can simultaneously improve the overall fitness level of our body which includes basic biomotor components. So circuit training is



very helpful in repairing or maintaining and improving the components of physical condition. The circuit training program is carried out with 8 training stations. Each training station consists of an exercise that is done for 45 seconds, and the exercise repetitions are between 15-20 times, the rest time in one station, before moving to the next station is 1 minute or less. This circuit training does not mean that it is only given for short training periods, but can also be given at the beginning of the training season, or in the following training season as a variation to eliminate training boredom. Circuit training is a training program that combines several training items to carry out an exercise to be less boring and more efficient. The forms of circuit training include physical conditioning exercises: 1) muscle strength training, 2) speed training, 3) agility training, 4) endurance training, and so on. In various tasks or all forms of training, of course, some principles must be considered to achieve the objectives of the training carried out. The aim of circuit training is basically to combine several forms of exercise to improve several physical components gradually, systematically and continuously (Kusuma, 2017). The physical condition of players plays an important role in supporting increased performance in a sport. Improving a player's physical condition is determined by the quality of training. Meanwhile, the quality of training will have a positive effect on the player's performance. If a player's physical condition is good, they will more quickly master the movement techniques they are learning/training, because physical condition supports their movement abilities in sports so they can complete training or matches without experiencing significant fatigue.

METHODS

The type of research carried out is experimental research. According to Sudaryono, Margono and Rahayu (2013) said: "Experimentation is the only research method that can truly test hypotheses regarding causal relationships." The variables that want to be studied are a) The independent variable (independent variable), namely Circuit training, and b) The dependent variable (Dependent variable), namely the Increase in VO2 Max. According to Abdullah (2015): "Population is a collection of units whose characteristics (characteristics) will be studied, and if the population is too large, then the researcher must take a sample for research." Starting from the definition above, a meaning is drawn that all objects that have certain characteristics are termed a population. So, the population in this study is all students of SMA Negeri 5 Soppeng who take part in football extracurricular activities with a population of 20 students. Thus, based on the above considerations from this concept, the sample used in this research was 20 extracurricular football students at State High School 5 Soppeng. The sampling technique is "Total Population". The Circuit Training Program is:

- Post 1: Skipping/jumping rope for 30 seconds (students jump using the rope provided)
- Post 2: 30-second shuttle run (students run back and forth by touching the boundary line that has been given)
- Post 3: Sit-ups 30 seconds (students from sleeping position with legs pulled and bent, hands behind head then elbows alternately touching knees)
- Post 4: Go up and down the bench for 30 seconds (students are in front of the bench then jump on the bench with one leg then alternately put their feet on the bench then get off the bench with alternate legs.)
- Post 5: Deer jump with a distance of 20 meters (standing up straight then jumping up and down as high as possible with bent knees touching the chest, done continuously without stopping).
- Post 6: Squat trush 30 seconds (stand then jump straight up and squat, put your arms on the floor, throw your legs straight back, squat back and jump)

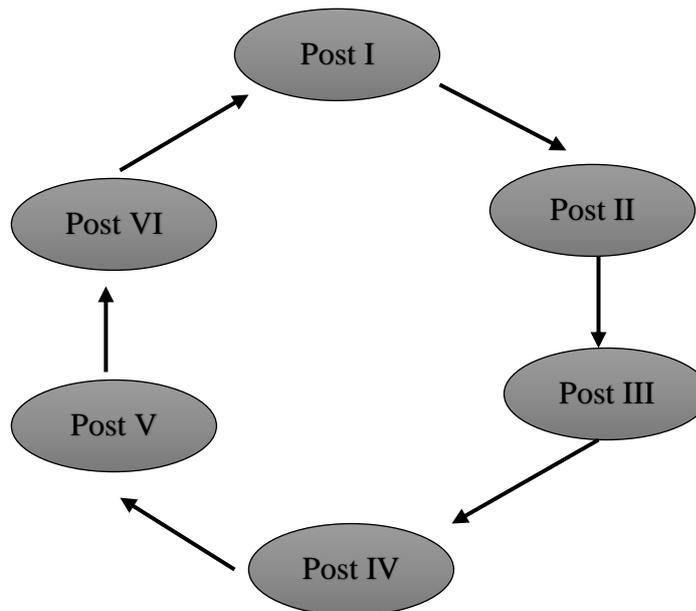


Figure 1.
 A series of exercises for each post

The collected data needs to be analyzed descriptively and inferentially to test research hypotheses. The description used in this research is as follows: Descriptive data analysis is intended to obtain a general overview of the data which includes total value, range, average, standard deviation, minimum value, and maximum value. Financial analysis is used to test research hypotheses using the t-test. Overall statistical data analysis used generally uses computer analysis and the SPSS version 20.00 program with a significance level of 95% or $\alpha = 0.05$.

RESULTS AND DISCUSSION

Table 1.
 Results of descriptive data analysis

Exercise	Descriptive	Pre-Test	Post-Test
Circuit training	N	20	20
	Sum	605,80	835,50
	Mean	30,2900	41,7750
	Std. Deviasi	2,37640	3,72345
	Variance	5,647	13,864
	Range	8,30	13,70
	Min	26,00	34,30
	Max	34,30	48,00

Based on the summary of the results of the descriptive data analysis in **Table 1** above, it can be explained as follows: Results of descriptive data from circuit training pretests on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng, from 20 total samples obtained a total score of 605 .80. The average value obtained was 30.2900 with a standard deviation of 2.37640 and a variance value of 5.647. For the range value, it is obtained 8.30 from a minimum value of 26.00 and a maximum value of 34.30. The results of descriptive data from the final test (posttest) of circuit training on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng, from 20 samples obtained a total score of 835.50. The average value obtained was 41.7750 with a standard deviation of 3.72345 and a variance value of 13.864. The range value obtained is 13.70 from a minimum value of 34.30 and a maximum value of 48.00.

Table 2.
 Hasil uji normalitas data

Group	Kolmogorov Smirnov Statistics	P	α	Information
Circuit training	0,113	0,200	0,05	Normal

Based on this table, which is a summary of the results of data normality testing on each research variable, it can be described as follows: The results of testing data normality using the Kolmogorov-Smirnov Test, circuit training on increasing VO2 Max in soccer extracurricular students at SMA Negeri 5 Soppeng scores. The Kolmogorov-Smirnov test obtained 0.113 with a probability level (P) of 0.200 which is greater than the value of α 0.05. Thus, the circuit training data on increasing VO2 Max in extracurricular soccer students at SMA Negeri 5 Soppeng obtained follows a normal distribution or normal distribution.

Table 3.
 Hypothetical data processing results

Hypothesis	Mean	t-observation	t-table	P	α	Information
Pretest	30,2900	-11,181	2,093	0,000	0,05	Significant
Posttest	41,7750					

Summary of pretest and posttest data analysis on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng, using paired t-test on circuit training. It can be concluded that there is a significant influence in the circuit training group on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng. The t-observation value is -11.181 which is greater than the t-table value of 2.093 ($-11.181 > 2.093$) with a significant value of 0.000 which is smaller than α 0.05. So H_0 is rejected and H_1 is accepted, meaning there is a difference between the initial test (pretest) and the final test (posttest). Thus it can be concluded that there is a significant influence of the circuit training group on increasing VO2 Max in extracurricular soccer students at SMA Negeri 5 Soppeng. It can be proven that the average posttest score is higher than the pretest average score ($\mu_{A1B1} 30.2900 < \mu_{A1B2} 41.7750$) with a difference of 11.485. Thus, it can be concluded that there is a significant influence of the circuit training group on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng.

Discussion

To achieve the significance of the data results which have been verified in this research, they will be discussed further as follows: there is a significant influence of the experimental group (circuit training) on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng. According to the t-test results of the initial test data and final test data on the increase in VO2 Max in extracurricular soccer students at SMA Negeri 5 Soppeng in the experimental group (circuit training), it turns out that from the calculation results, it was obtained that the observation t value was greater than the t table value at the 95% significance level. This proves that the first hypothesis proposed is accepted at a significance level of 95%. The prediction that can be made is that by giving the experimental group training (circuit training) in a systematic programmed manner, it will be possible to increase the increase in VO2 Max. This proves that circuit training plays a role in increasing VO2 Max. According to McClenagle (1984): "Exercise can be defined as systematic participation in training aimed at increasing physical functional capacity and other endurance". The circuit training method in question is an exercise consisting of several

training stations, where the exercises are carried out. One exercise circuit is declared complete if a person has completed the exercise at all stations according to the prescribed dose and time. To produce an increase in VO2 Max, you need to practice using several training methods to produce students' VO2 Max endurance. Therefore, if a player or student never does any training then his VO2 Max endurance will not be able to develop. Thus, the experimental group (circuit training) has a significant influence on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng.

CONCLUSION

After researching the issue of the influence of circuit training on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng, the following conclusions were drawn: There is a significant influence of the circuit training group on increasing VO2 Max in extracurricular football students at SMA Negeri 5 Soppeng.

Based on the research results and conclusions above, suggestions that can be given are: For Extracurricular Coaches/Guardians: The results of this research can be used as a benchmark in preparing training programs, especially regarding material to improve the physical condition of football. For students; The results of this research can be used as motivation in pursuing your dreams of becoming a professional football player because by practicing diligently, enthusiastically and with a good training program, training can improve your physical condition, technique, tactics, and so on.

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