

# The effect of circuit training on increasing vo2 max capacity in sports education students at Universitas Negeri Padang

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## ABSTRACT

*The aim of this research is to determine the effect of providing circuit training methods on increasing VO2 Max capacity in sports education students at Universitas Negeri Padang. This research used an experimental research design with data analysis techniques using the t test with the prerequisites of the Normality Test, Homogeneity Test. The instrument used in this research is Bleep Test. This research was conducted for 2 months from the beginning of the test to the post test. The subjects in this research were all students taking physical fitness courses registered in the odd semester of the 2023/2024 student year, totaling 99 people. From the entire population, Samples were taken from the population using simple random sampling technique. This technique is the best for producing a representative sample, and the research results can be generalized to the population which gives equal opportunities to members of the population so that a sample of 34 people is obtained. From the results of the data analysis that has been carried out, it shows that there has been an increase in the Multistage Fitness Test score between the initial test (Pre-Test) and the final test (Post-Test) with an average of 3.65 and the results of the analysis using the t test obtained tcount (5.79) > table (2.042), Based on the results of this research it can be concluded that there is an influence of the circuit training method on increasing aerobic endurance (VO2 Max) with a percentage of 10.7%, meaning that the circuit training method can increase the VO2 Max capacity of Universitas Negeri Padang Sports Education Students*

**Keywords:** circuit training method, VO2 Max capacities

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## INTRODUCTION

Based on observations during physical fitness lessons in the Sports Education department, it was found that students lacked endurance in carrying out activities, especially during the lecture process in the field. This can be seen when students carry out activities in the field, many of them experience various injuries and get tired easily, apart from that, first year students have never had their VO2 Max measured, so students' endurance is still lacking. Endurance levels can be measured by assessing a person's VO2 Max. VO2 Max is the maximum amount of oxygen that can be used to carry out intense physical activity ([Ginting et al., 2023](#)). In this case, it can influence student enthusiasm in carrying out learning. In previous research, aerobic endurance was carried out in students who were predominantly athletes, but aerobic endurance (VO2 Max) also plays an important role for all sports education students.

Physical activity is very important to balance other activities so that students have good physical fitness. With the large number of academic activities carried out by children, it is also psychologically burdensome for them and if this continues to happen then over time the student's condition will increasingly decline and eventually become sick. To overcome this, of course cooperation is needed between all interested parties, including the government, educational practitioners and the community.

Physical fitness is a person's ability to carry out daily tasks easily, without feeling excessively tired and having remaining or reserve energy to enjoy their free time and for urgent needs ([Mohamad et al., 2021](#); [Rahmawati A.Y, 2020](#); [Rahmawaty, 2020](#)). Physical fitness is the condition of a person's body, which have an important role in daily activities or activities. Physical fitness is a medium for encouraging physical growth, motor skills, psychological development, knowledge and reasoning, appreciation of values (mental, emotional, sportsmanship, spiritual and social attitudes), as well as habituation to a healthy lifestyle which leads to stimulating growth and development of physical quality. and balanced psychology ([Arifin Z, 2018](#)). Physical fitness is very important for students, especially new students, it is necessary to develop physical fitness as a basis for carrying out other activities because students who have a high level of physical fitness will be able to carry out their learning and playing activities well without significant fatigue, and their bodies will remain fresh when they stop doing activities and at rest.

Students in the Physical Education study program are students who are involved insports with a capacity of 60% practical lectures. To optimize the implementation of learning both theoretically and practically and reduce the risk of injury which often occurs in the field, every student needs to have good physical fitness. Therefore, every new student needs to prepare their physical fitness, because every semester they will undergo lectures in the field. Practical lectures are practical applications of sports that contain physical activities in accordance with the sports branch courses being studied. Thus, the quality of physical activity carried out by physical education students exceeds the average for students in general ([Annas, 2014](#)). A good level of physical fitness will be an important point for students to study effectively and efficiently. "Physical fitness is the body's ability to carry out activities without experiencing significant fatigue" ([Iswahyudi et al., 2020](#)). On the other hand, a low level of fitness will become an obstacle in carrying out daily activities, because the physical condition cannot meet all the needs in carry out these activities.

Cardiorespiratory fitness or maximum oxygen transport ability (VO2 Max) is

known as maximum aerobic power ([Nugroho, 2021](#)). VO2 Max is the maximum amount of oxygen that can be consumed during intense physical activity until fatigue occurs and vo2max is expressed in liters/minute/kg body weight. VO2max can limit a person's cardiovascular capacity to VO2 Max and is considered the best indicator of aerobic endurance ([Nim, 2018](#)). VO2Max is very important for students, especially sports education students, because students who have a VO2 max level high will be able to carry out learning and playing activities well and without significant fatigue, and his body will remain fresh when he stops activities and when he rests. On the other hand, the VO2 max level low will be an obstacle in carrying out daily activities, because the physical condition cannot meet all the needs in carrying out these activities.

VO2 Max is a description of a person's aerobic ability or endurance which can be used as an indicator of excellent ability. This VO2 max volume is a level of body capability expressed in liters per minute or milliliters/minute/kg body weight ([Rustiawan, 2020](#)). The level of a person's VO2 Max is influenced by genetics, age, gender and body composition. Gender, after puberty women of the same age as men generally have a lower maximum oxygen consumption than men, to increase a person's VO2 Max, you can do several exercises, one of which is the circuit training method. Circuit training is a type of physical exercise that tends to be done sequentially and continuously. Circuit training is also often referred to as a short but effective exercise to do ([Purba, 2020](#)).

The advantage of circuit training is that various variations can be provided, both in the number of exercises and the target number of training completion times in one circuit and is able to eliminate boredom and boredom in carrying out the training process ([Bahtra et al., 2020](#); [Kusuma & Sugyanto, 2020](#)). Circuit training is a training system that can simultaneously improve the overall fitness of the body, namely the components of power, endurance, speed, flexibility, mobility and other physical components ([Ridwan, M. D., & Rohmat, 2016](#)).

Circuit training is defined as a training program or stage that consists of several stations or points where at each station/point the athlete must carry out a predetermined type of pattern, exercise and movement ([Fahrizqi et al., 2021](#)). Posts in circuit training must meet the elements of fitness. Therefore, circuit training forms are a combination of all physical elements, namely endurance, strength, speed and flexibility ([Rizhardi et al., 2021](#)). The forms of exercise are usually arranged in a circle. The activity of circuit training is doing a certain amount of exercise in the shortest possible time or doing as many exercises as possible in a certain period of time. Therefore, by only needing a relatively

short time we can train all components of our physical condition at the same time.

## METHODS

This research was carried out in the FIK UNP field in the odd semester of the 2023/2024 academic year. This research was carried out for 2 months, namely July to August 2023. This research used a quantitative type with pre-experimental methods. With a design for research use *one group pre-test post-test design*, namely experimental research carried out on an experimental group without a comparison group ([Fahrizqi et al., 2021](#)). With this design, the researcher made observations twice, the first was carried out before the experiment, which is called *pre-test*, then execute *treatment* or treatment, then conduct a second observation after *treatment* which is named *post-test* ([Effendi, 2013](#)).

The effect of treatment is measured from the difference between the initial measurement (T1) and the final measurement (T2) with the following scheme

T1 ----- X----- T2

Image caption: T1: Initial VO2Max test, (Herita Warni, Ramadhan Arifin, 2018), the experimental method is to determine whether there are consequences of something imposed on the subject under investigation. In other words, experimental research tries to examine whether there is a cause-and-effect relationship." Experiments are always with the intention of seeing the effects of a treatment.

The population in this study were all students taking physical fitness training courses registered in the odd semester of the 2023/2024 academic year with 4 classes totaling 99 people. Samples were taken from the population using simple random sampling technique. This technique is the best for producing a representative sample, and the research results can be generalized to the population which gives equal opportunities to members of the population so that a sample of 34 people is obtained. The data collection technique used is by using instruments *multistage fitness test (bleep test)* namely by measuring the variables contained in this research ([Fitriyansyah et al., 2021](#)). Data analysis techniques use descriptive and inferential statistics with the t test formula.

## RESULT AND DISCUSSION

### *Result*

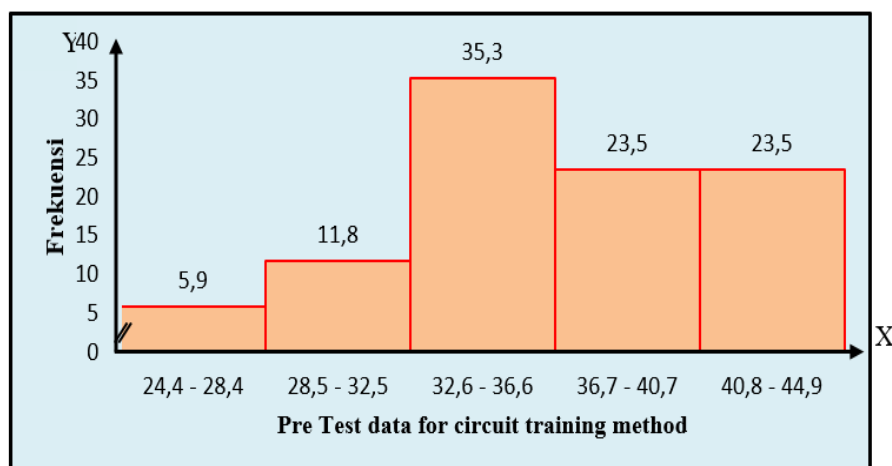
Based on the results of the initial test data analysis (*Pre-Test*) Capacity level *VO2 Max* through *Multistage Fitness Test* aged 13-19 years in students taking physical fitness

courses with a sample size of 34 people, the highest score was 44.9 and the lowest score was 24.4, mean 35.97, median 36.4, mode 37.5, standard deviation 5.33 and variance 28.40. For greater clarity, the test result data is presented in the form of a data frequency distribution table as follows:

**Table 1.**Data from Pre-Test Multistage Fitness Test Circuit Training Method results

NO	Pre-Test scores for the circuit training method	frequency	
		Absolut	Relative (%)
1	24,4 - 28,4	2	5,90%
2	28,5 - 32,5	4	11,80%
3	32,6 - 36,6	12	35,30%
4	36,7 - 40,7	8	23,50%
5	40,8 - 44,9	8	23,50%
Amount		34	100%

Based on table 1 above, of the 34 people who took part in the Circuit Training Method, 2 people (5.9%) had an interval class of 24.4 - 28.4, 4 people (11.8%) had an interval class of 28.5 - 32.5, had an interval class 32.6 - 36.6 as many as 12 people (35.3%), interval class 36.7 - 40.7 as many as 8 people (23.5%), and for interval class 40.8 - 44.9 as many as 8 people (23.5%). For more details, bar diagram of initial data results *Multistage Fitness Test* Before being given the Circuit Training Method, it can be seen in Figure 1 below:



**Figure 1.** Histogram of Results Data *Pre-Test Multistage Fitness Test* Circuit Training Method

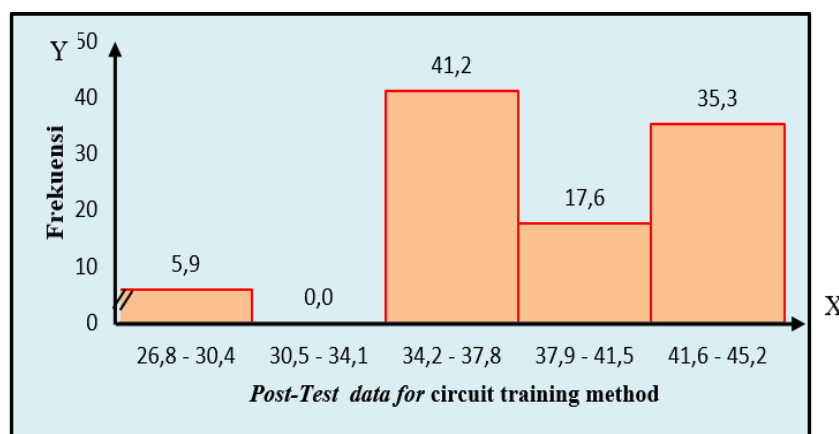
Based on the results of the final test data analysis (*Post-Test*) VO2 Max Capacity level via *Multistage Fitness Test*aged 13-19 years among students taking physical fitness

courses with a sample size of 34 people, the highest score was 45.2 and the lowest score was 26.8, mean 39.62, median 38.2, mode 35.7, standard deviation 6.35 and variance 40.31. For greater clarity, the data from this test are presented in the form of a data frequency distribution table as follows:

**Table 2.** Results Data *Post-Test Multistage Fitness Test* Circuit Training Method Group

NO	Pre-Test scores for the circuit training method	frequency	
		Absolut	Relative (%)
1	26,8 – 30,4	2	5,90%
2	30,5 – 34,1	0	0%
3	34,2 – 37,8	14	41,20%
4	37,9 – 41,5	6	17,60%
5	41,6 – 45,2	12	35,30%
Amount		34	100%

Based on table 2 above, of the 34 people who took part in the Circuit Training Method, 2 people (5.9%) had an interval class of 26.8 - 30.4, 0 people (0%) had an interval class of 30.5 - 34.1. ), interval class 34.2 - 37.8 as many as 14 people (41.2%), interval class 37,9 – 41,5 as many as 6 people (17,6%), and for interval class 41.6 - 45,2 as many as 12 people (35.3%). For more details, bar chart of final data results *Multistage Fitness Test* After being given the Circuit Training Method, it can be seen in Figure 2 below:



**Figure 2.** Histogram of Results Data *Post-Test Multistage Fitness Test* Circuit Training Method

From the data classification displayed, it can be seen that there has indeed been an increase in VO2 Max capacity for sports education students using the Circuit Training Method. This is visible in the results *Post- Test* where each interval class experiences an

increase in results *Pre-Test* previously. Apart from that, based on calculation data per individual, it shows that there is an increase in *VO2 Max Capacity*, every student has experienced very good improvement. This increase is based on the interval class shown in table 2 above.

### ***Discussion***

The discussion of the results of this research is intended as an illustration to make it easier to draw conclusions from the research results. In an effort to increase *VO2 max Capacity*, then given the practice. In this case the training given is using the Circuit Training Method. In carrying out research to obtain data, a preliminary test was first carried out (*Pre-Test*). This initial test aims to see initial abilities. From the results of the data analysis that has been carried out, it shows that there has been an increase in value *Multistage Fitness Test* between initial tests (*Pre-Test*) and final test (*Post-Test*) which has been done. This can be seen where the average score was 35.97 in the initial test and after being given the Circuit Training Method treatment there was an increase in the average score of 39.62. In implementing this Circuit Training Method, training is carried out over 16 meetings. The training station consists of 6 stations, then at each training station students carry out training movement tasks that have been previously determined and are carried out continuously, and are interspersed with active rest for 30-60 seconds before continuing to the next training station with a progressive increase in training load. which have been prepared previously in the training program.

The Circuit Method is a form of exercise that can improve capacity *VO2Max* simultaneously the whole of the body, namely the elements *power*, endurance, strength, agility, speed, and other physical components ([Rizhardi et al., 2021](#)). Where the implementation of this program consists of six stations and at each station there are 5 and 6 students who carry out the types of exercises that have been determined at each station. One training circuit is said to be complete if the student has completed the training at all stations according to the training dose that has been determined. The Circuit Training Method is a combination of all components including: power, endurance, speed, flexibility, and other components ([Relida et al., 2022](#)). The forms of exercise are arranged in a circle and consist of several stations and *items* The training is also adjusted to the needs to be achieved, which in this research is a form of capacity *VO2Max* building training UNP sports education student. Circuit training can build *VO2 Max Capacity* is effective and structured, aiming to develop and improve Capacity *VO2*

Max relating to strength, speed and endurance. Based on the explanation above, it is clear that circuit training has a significant effect on increasing capacity VO<sub>2</sub> Max students simultaneously and are encouraged to program this exercise into the learning process to support student work performance.

In implementing the Circuit Training Method, the researcher refers to the training program instructions and training principles that have been prepared and supported by theoretical studies such as: a) training frequency 3 times a week, b) number of sets 2-3 times, c) consisting of 6 training posts, d) training intensity between 50-80% DNM, e) training duration is around 10-30 minutes with the duration of each post between 15-30 seconds, f) rest interval between sets lasts approximately 2 minutes with *recovery* between post changes is 30-60 seconds and the training load increases progressively ([Pranata & Kumaat, 2022](#)). Final tes (*Post-Test*) carried out after going through the training process was proven to increase compared to the initial test (*Pre-Test*). These findings prove that the Circuit Training Method has a significant influence on increasing capacity VO<sub>2</sub>Max UNP sports education student. Based on the findings above, it is clear that the Circuit Training Method has a significant effect on increasing the degree of capacity VO<sub>2</sub>Max UNP sports education student.

Apart from that, VO<sub>2</sub> Max increases in the Circuit Method has an effect on cardiovascular endurance and can strengthen respiratory muscles, this provides great benefits for maintaining heart and lung fitness, and the Circuit Method involves 3 variables at once, namely intensity, repetitions and duration. The body's response due to continuous exercise will stimulate the brain center and will provide feedback signals to the center of cardiovascular in the brain stem which will cause muscle perfusion and increased cardiac output to increase blood in the arteries and will increase pulmonary ventilation, respiration, dilation of vessels. blood in oxygen exchange ([Relida et al., 2022](#)).

In this circuit method the teacher can arrange a variety of exercises, save time and tolerate individual differences. So the heart of a person or student who exercises regularly is larger. Thus the pulsating blood volume will increase. By increasing the volume of blood per beat, to meet the need for oxygen and get rid of carbon dioxide the heart does not need to pump at a high frequency and the hemoglobin level in the blood will also increase. The results of the discussion above are in accordance with the results of existing relevant research regarding circuit training exercises to increase heart and lung capacity or VO<sub>2</sub> Max. Capacity Increase VO<sub>2</sub> Max with the application of the Circuit Method because this method provides opportunities for students to take part in training activities in the



learning process, there are exercises in groups and helping each other and working together to become the best group can improve students' physical abilities. Furthermore, with competitions, students will be more serious when practicing in groups according to the game forms provided at each post.

## CONCLUSION

Based on the research results that have been presented, it can be concluded that the application of circuit method training has an influence on increasing the VO2 max capacity of Sports Education students at Universitas Negeri Padang. By conducting this research, it is hoped that it will provide additional scientific knowledge about the relationship between circuit training and increasing VO2 Max capacity, this can be seen in how the body's physiological response to the type of exercise given. Then, it is also necessary to carry out further research regarding the effect of this circuit method training on increasing VO2 Max capacity so that it will produce broader and in-depth experimental study results regarding this research topic. For future researchers themselves, this research can be used as input and comparison material, if in the future researchers want to raise similar problems.

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