

## Speed play training toward changes hematocrit value and cardiorespiration basket athlete

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### Abstract

The purpose of this study was to determine the effect of regular exercise with the speed play method in increasing cardiorespiratory capacity and blood hematocrit levels in Pinisi basketball athletes. The research method used was the one-group pre-post test design experiment. The instruments used in this study were the Multistage Test (MFT) for cardiorespiratory and hct meter to measure blood hematocrit levels. This study found that the percentage of blood hematocrit after the intervention of the speed play training method for the Pinisi basketball athletes was 44.94% higher than the average hematocrit level before being given the speed play training method for the Pinisi basketball athletes, which was 41.64%. There was a change with an average value of 3.3% per 100 mg of blood, meanwhile the average cardiorespiratory capacity after the implementation of the speed play training program in Pinisi basketball athletes was 43.49 ml/kg/minute, which means an increase from the average capacity cardiorespiratory training before being given speed play training in pinisi basketball athletes of 40.95 ml/kg/minute experienced an average change of 2.54 ml/kg/minute.

**Keywords:** speedplay, hematocrite, cardiorespiration.

### INTRODUCTION

An athlete's readiness to compete may be seen from good posture, interest and talent in certain sports and supported by a good training program. But in various health studies at this time, it turns out that athlete readiness is not enough just with a good exercise program because a good exercise program doesn't always give birth to a potential athlete if the excellent metabolism does not support it and physiological condition of the athlete, also require an assessment of biomarkers of the athlete's physiological response which indicates an athlete is ready to be

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measured phenotypically through his body composition and physiological response to an exercise intervention (Ezagouri et al., 2019). By involving the measurement of biomarkers of the athlete's physiological response, a coach can assess readiness to carry out an exercise program without ignoring the athlete's health. One of the biomarkers that can be measured for a positive response to a form of exercise is an increase in the number of red blood cells within normal limits, which can be seen from the hematocrit level. The hematocrit shows the percentage ratio of red blood cells to the volume of blood in plasma, which, if too low or too high, can indicate certain conditions such as anaemia or dehydration (Gordeuk et al., 2019; Velghe et al., 2019).

Exercise can lead to more optimal endurance and respiratory muscle strength so that the capacity of the lungs also increases (Mazzeo & Liccardo, 2019), so that more oxygen is expected to be accommodated by red blood cells, which are bound by blood protein haemoglobin, for further use in energy production (Sano & Goto, 2019). Hematocrit itself compares the number of red blood cells with the overall blood volume calculated in percentages. Another positive impact obtained from sports activities is an increase in the ability of the respiratory muscles, which will be able to overcome obstacles to the flow of respiratory air. This condition ultimately results in an increase in air volume. Sports is a very important thing for everyone to do. Because by exercising, we are physically and mentally healthy and can improve the health of a better life. Exercise is a series of regular and planned physical movements to maintain motion (which means sustaining life) and increase movement ability (which means improving the quality of life) (Giriwijoyo & Sidik, 2012).

At present, almost all sports have realized the importance of physical preparation and technical preparation. A sportsman, besides being mature in mastering techniques, tactics and strategies, must be able to know how good his physical fitness is. One of the most important components of physical fitness related to health is cardiorespiratory endurance. Endurance of the heart-lung, or called cardiorespiratory is the functional ability of the lungs and the heart to supply oxygen to the

muscles for a long time (Irianto, 2019). The load capacity of air by the lungs is 4500 ml - 5000 ml or 4½ up to 5 litres of air (Putra et al., 2020). Cardiorespiratory endurance is also called aerobic capacity. The most objective assessment commonly used is to calculate the maximum intake of O<sub>2</sub> (VO<sub>2</sub>max) (Rusdiana, 2020). Someone who has good lung and heart resistance will not get tired quickly after doing a series of work, while a hematocrit is a red blood cell count that is calculated by the percentage per 100 mg of blood, the value is between 40-50% for adult men, and 26-44% for adult women (Kalezi, 2020). Many activities in training the endurance of the heart and lungs that can be done include speed play. Cardiac, pulmonary quality is expressed by VO<sub>2</sub>Max, which is the maximum amount of oxygen that can be consumed in units of ml/KgBB/minute. In basketball games, the ability of a good aerobic endurance or high VO<sub>2</sub>Max is needed because basketball requires good energy and endurance in the game (Machado et al., 2021).

One form of endurance training that can be applied to basketball athletes is the speed play training method (Irvan et al., 2018; Stokes et al., 2020). Have got a Roaner who created the method of speed play training from Sweden. The increase in hematocrit levels through physical activity occurs along with changes in plasma volume associated with physical exercise. These changes result in a relative decrease in oxygen concentration in the arterial blood, thereby stimulating erythropoiesis or the formation of red blood cells (Dolan et al., 2010). Speed play is a form of exercise that can increase cardiorespiratory capacity and speed in the form of exercise that is also fun (Beato et al., 2021). Speed play training technique is an endurance training system that can build and maintain one's body condition so that it can be applied to almost all sports, especially those that require endurance. Speed play and aerobic exercise with continuous movement and interval speed, exercise with speed play technique is a form of exercise that is fun and beneficial in increasing athletes' strength and aerobic capacity (Arede et al., 2020). The speed play method or often called the method of playing speed, which distinguishes speed play of high intensity and low intensity. Speed

play is a running activity such as a hollow sprint carried out with several forms of physical activity and different intensities such as walking, jogging, sprinting, and continued walking back. (Young et al., 2021). The principle of speed play training is to run with various variations.

## METHOD

This study consists of 3 variables, one independent variable and two dependent variables to be measured. This research is conducted with a pre-experimental method, a research activity carried out to find a causal relationship between variables (Arikunto, 2019). This study involved 37 male basketball athletes with an age range of 19-22 years. Due to the limited number of subjects in the study, a total sample was taken from the entire population. This study uses a simple design, The one-group pre-posttest. Speed play routine exercise for nine weeks, with a frequency of 3 times a week. The duration of the interventions is between 6 and 12 weeks (Corte de Araujo et al., 2012). Before being given treatment, measurements were taken (pre-test), then given treatment, and at the end of the activity or after being given treatment, a re-measurement (post-test) was carried out. Measurement of hematocrit levels is carried out using an hct meter by taking a blood sample from the sample's fingertip and measuring cardio capacity measured by MFT. The results obtained from the pre and post-test measurements will be compared to assess changes in the measured variables after the intervention is given (Anshori & Iswati, 2019).

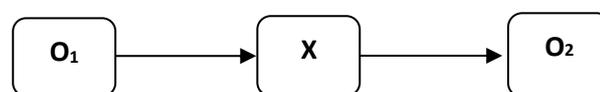


Figure 1. One group pre-post test design

Annotation :

- O<sub>1</sub> : Measurement of HCt and cardiorespiratory before intervention
- X : Intervention with speed play exercises
- O<sub>2</sub> : Measurement of HCt and cardiorespiratory after intervention

To test the normality of the data used Kolmogorov Smirnov. The test criteria, if the statistical significance of the calculated price is more significant than  $= 0,05$ , the data is normal. To calculate the difference in the data before the intervention and after the intervention, paired t-test was used, if the statistical significance of the calculated price is greater than  $= 0,05$ , the data is significant. The data analysis technique using SPSS program.

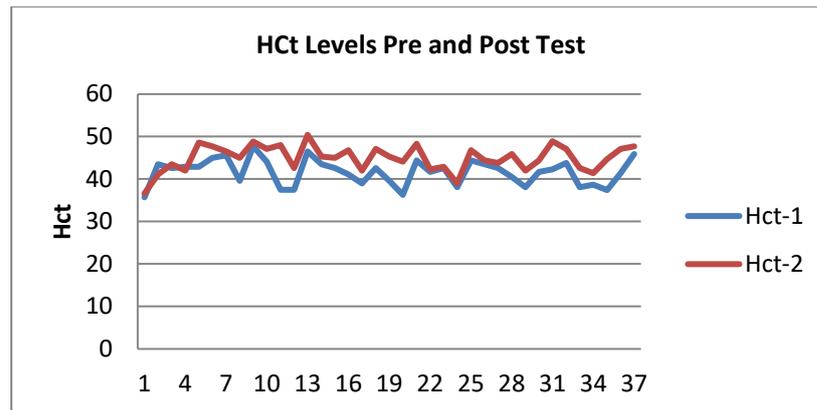
## RESULT

The hypothesis proposed in this study needs to be tested and proven through empirical data obtained in the field through tests and measurements of the variables studied, then the data will be processed statistically. Because the data group only consists of pre and post data, the analytical test used is the Paired T-test.

**Table 1.** The levels of change hematocrit

Hematokrit Level	N	Mean	Std. Deviation	P
Hct_pre	37	41.64	3.02	< 0.001
Hct_post	37	44.94	2.99	

Based on the table.1, the results show that the average hematocrit level after giving the speed play method on the phinisi basketball team (44.94%) is higher than the average hematocrit level before intervention the speed play method is given on the phinisi basketball team (41.64%). The results of the analysis used a paired T-test with a level of confidence ( $\alpha = 0.05$ ). Based on the test, the results obtained with a value of  $P < 0,001$  ( $p < 0,05$ ) then  $H_0$  is rejected. So it can be concluded that there are a difference in mean Hct (Hematocrit) levels, hematocrit is the number of red blood cells in blood plasma which is calculated in percent, before and after the application of the speed play method to the phinisi basketball team or in other words there is the effect of applying the speed play method to the increase in hematocrit levels of the Phinisi basketball team.



**Figure 2.** Hct Values Change Graph

Based on the graph, the hematocrit level after being given the speed play training method was higher than the hematocrit level before or in other words, the speed play method increased the hematocrit level of the Pinisi basketball athletes.

**Table 2.** Changes in cardiorespiratory capacity athletes

Kadar VO2 Max	N	Mean	Std. Deviation	P
VO2 Max_pre	37	40.95	6.31	< 0.001
VO2 Max_post	37	43.49	7.14	

Based on the table.2, it can be seen that the mean cardiorespiratory capacity after giving the speed play method on the pinisi basketball team (43.49) is higher than the average cardiorespiratory capacity before giving the speed play method to the pinisi basketball team (40.95). The analysis results used the T-paired test with a level of confidence ( $\alpha = 0,05$ ). Based on the test, the results obtained with a value of  $P < 0,001$  ( $p < 0,05$ ) then  $H_0$  is rejected. So it can be concluded that there is a difference in mean cardiorespiratory capacity before and after the intervention of the speed play method on the pinisi basketball team or in other words, there is the influence of the application of the speed play training method has a positive effect on increasing the athlete's cardiorespiratory capacity.

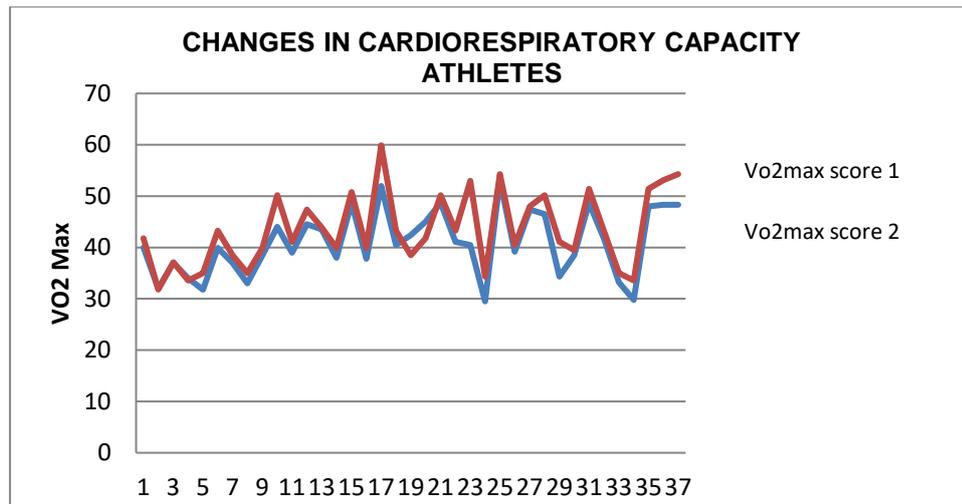


Figure 3. Cardiorespiratory Athletes Change Graph

Based on the graph, the cardiorespiratory level after being given the Speedplay method was higher than the cardiorespiratory level before or in other words, the speed play method increased the cardiorespiratory level of the Pinisi basketball athletes.

## DISCUSSIONS

This study purpose of analyzing how the speed play exercise model can be a training model that can improve cardiorespiratory (VO<sub>2</sub>max) ability, in this research, we involved 37-male basketball athletes from the Pinisi UNM team, who, after taking the initial haemoglobin hematocrit data and cardiorespiratory abilities were then given a speed play training program.3.times a.week.and the final results are measured after the 8th week. The output achieved as a result of our studies activities shows that the average hematorial level (red blood cell count / 100mg) after giving the speed play training method to the phinisi basketball team (44.94%) is higher than mean hematocrit level before the method speed play training on the phinisi basketball team (41.64%) there was an average increase of 3.3% in every 100 mg of blood, the output achieved as a result of our research activities showed that the average hematocrit level (red blood cell count / 100mg) after giving the speed play training method to the phinisi basketball team (44.94%) was higher than the average hematocrit level before method speed playing

training on the phinisi basketball team (41.64%) an average increase of 3.3% for every 100 mg of blood, so it can be concluded that the speed play training method applied for nine weeks with a frequency of 3 times a week can stimulate cell formation, red blood cells about 3.3% within normal limits. Endurance exercises such as speed play will make the heart grow bigger so that it has a bigger capacity and a stronger pulse (stroke volume). This happens because during exercise, there is an increase in oxygen demands in inactive muscles, more nutrients are used, metabolic processes are accelerated, and metabolic waste is produced. With regular speed play exercises, there will be responses, such as increasing myocardial contractility, increasing cardiac output and stimulating the formation of new red blood cells to meet the oxygen needs of muscles and a whole active body. In another study, which is in line with this study, it has been shown that exercise can improve anaemia because it increases total Hb and Hct, which increases oxygen-carrying capacity. The underlying mechanisms proposed to come primarily from the bone marrow include stimulated erythropoiesis with hematopoietic bone marrow hyperplasia, exercise-induced enhancement of the hematopoietic microenvironment, and hormone cytokine-accelerated erythropoiesis (Hu & Lin, 2012).

While the average value of cardiorespiratory capacity after the intervention of the speed play exercise method was given to the phinisi basketball team (43.49 ml/kg/min.) Increased when compared to the average value of the cardiorespiratory capacity before the speed play exercise method intervention on the phinisi basketball team (40.95 ml/kg/min.), an average increase of 2.54 ml/kg/min. Speed play is a type of exercise that alternately combines fast and slow running speeds (Bashir & Hajam, 2017). This type of exercise is also known as interval running without a specific tempo and rest period. This exercise is known to train the athlete's ability to respond to continuous changes in speed and terrain. The main goal is to increase the ability of the body's ergosystems (Pratama & Kushartanti, 2018), including the respiratory and cardiovascular systems, through a process that is carried out

carefully and repeatedly by increasing the load gradually. In other research results it is said, speed play is an endurance training system that aims to build, restore or maintain one's body condition healthily to adapt well to all types of sports, especially a sport that requires endurance, as well as an adjustable training tempo so that it is proven to improve the cardio ability of the U-14 soccer students of SBB Baturetno (Pratama & Kushartanti, 2018).

Many factors are thought to improve fitness, including a greater respiratory and cardiovascular system maximum capacity, a greater heart, red blood cells, and hematocrit (Gouraud et al., 2021; Storz et al., 2019). In theory, speed play training is said to increase the volume of maximum lung oxygen (Irianto, 2019) so that, of course it will have an effect on increasing endurance, VO<sub>2</sub>max reflects lung, cardiovascular, and haematological conditions in oxygen delivery, as well as oxidative mechanisms of muscle activity. During the first minutes of exercise, oxygen consumption increases until finally a steady state is reached where oxygen consumption is in accordance with exercise requirements. Along with this steady state, there is also an adaptation of pulmonary ventilation, heart rate, and cardiac output (Ferretti et al., 2017; Fontolliet et al., 2021), where the oxygen consumption has reached its maximum value without being able to rise again even though this exercise is called vo<sub>2</sub> max. Oxygen consumption then decreases gradually along with the cessation of exercise because of the reduced oxygen demand. In theory, the value of VO<sub>2</sub>max is limited by cardiac output, the ability of the respiratory system to deliver oxygen to the blood, or the ability of the muscles to use oxygen (Beltrami et al., 2021). As such, VO<sub>2</sub>max is also a limitation of ability and is considered the best parameter for measuring one's ability (or cardiorespiratory). VO<sub>2</sub>max is the highest value in which a person can consume oxygen during exercise (Arimbi & Usman, 2020), and is a reflection of the cardiorespiratory and haematological elements of oxygen delivery and the oxidative mechanism of muscles. Someone with a good level of fitness has a higher value of VO<sub>2</sub>max and can do activities stronger than those who have low fitness and athletes who have

a good component endurance, besides being able to work longer and not easily experience fatigue, it can also be faster in recovering itself (Strasser & Burtscher, 2018).

For an athlete, the higher the endurance factor required in the branch (Çolak & Başkan, 2020; Muniroglu & Subak, 2018), almost every red blood cell contains a special oxygen-binding protein known as haemoglobin, so that when the percentage of red blood cells is in a state of It is expected that the physiological function of a person's body is also better at binding oxygen and transporting carbon dioxide to be removed from the body through the lungs. The higher the vo2 max that must be owned, haemoglobin is a protein in red blood that functions to bind oxygen molecules to be then distributed throughout the body's tissues (Premont & Stamler, 2020). Previously, it was known that hematocrit levels would affect a person's endurance ability (Damian et al., 2021; Zelenkova et al., 2018). So it can be said that someone who has a good hematocrit level of 40-54% hematocrit value for adult men or 38-46% for adult women or equivalent to haemoglobin levels whose levels range from 13-18 g/dl, will have a higher cardiorespiratory ability-good because the oxygen supply available is more. The speed play exercise method in various other supporting studies that have been described previously can be proven to give positive changes to both variables, namely hematocrit levels and cardiorespiratory ability.

## CONCLUSION

From the results of the analysis and discussion that have been described in the previous section, the results of the study of the effect of the speed play training method on increasing hematocrit levels and cardiorespiratory capacity (VO<sub>2</sub>max) are: There is a significant change from the application of the Speedplay training method to increasing the hematocrit value and cardiorespiratory capacity of pinisi basketball athlete.

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