

The Effect of Relay Exercise of 30 Meters and Relays of 40 Meters on Increasing Maximum Aerobic Capacity (VO2 Max) Badminton Players of PB Jaya Raya Satria



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ABSTRACT: This study aims to determine the effect of exercise R 30 and R 40 on increasing VO2 Max badminton players PB Jaya Raya Satria. This study uses an experimental method with a "two groups pre-test-post-test design" design. The population in this study were PB badminton players. Jaya Raya Satria, totaling 18 people. Sampling in this study was done by random sampling, totaling 16 male athletes. The instrument used is a multistage fitness test. This test has a validity of 0.72 and a reliability of 0.81. Data analysis used t-test with a significance level of 5%. The results showed that (1) There was a significant effect of R 30 training on increasing VO2 Max of badminton players PB Jaya Raya Satria, with a t-count value of 8.571 > t-table 2.365, and a significance value of 0.000 < 0.05. (2) There is a significant effect of R 40 training on increasing VO2 Max of badminton players PB Jaya Raya Satria, with a t-count value of 5.835 > t-table 2.365, and a significance value of 0.001 < 0.05. (3) There is no significant difference between exercise R 30 and R 40 on the increase in VO2 Max of badminton players PB Jaya Raya Satria, with a t-count value of 0.041 < t table = 2.145 and sig, 0.968 > 0.05.

KEYWORDS: relay distance 30 meters, 40 meters, VO2 Max

INTRODUCTION

Badminton is a sport game. Badminton can be played by all walks of life, from children, teenagers to adults. Both men and women can play badminton. Therefore, badminton provides a real role in the life of the wider community. Badminton in Indonesia has been known for a long time, so badminton is a sport that is quite popular among the people of Indonesia. Badminton is an individual game, and can be played by one person against one person, or two people against two people. This game uses a racket as a bat and a cock as a subject to be hit (Pratomo, Sugiharto, & Subiyono, 2013: 1). There are several components that determine the achievement of high achievement in achievement sports, namely the state of sports facilities, the state of the competition, the psychological state of the athlete, the state of the athlete's skill ability, the state of the athlete's physical ability, the state of the body constitution and the state of tactical/strategic ability (Irwanto & Romas, 2019): 1).

Physical ability is one of the most dominant components in achieving sports achievements. Sports achievements will not be separated from the elements of physical condition, technique and tactics. An athlete really needs the quality of strength, endurance, flexibility, speed, agility, and good movement coordination. These aspects are needed to be able to move and react well during the game. Physical and technical development are training programs that are the main targets in the formation of skilled badminton. As stated by Poole (2008: 129), that "exercise aims to make the body in a fit condition, because the strokes made in the badminton game will not be useful enough if it is not followed by developed conditioning". Through a well-programmed physical training process,

Based on the author's observations and observations from PB Jaya Raya Satria on December 20-27, 2019 the players did not have good enough stamina, so almost every match experienced fatigue. Of all the athletes who did the exercise, it seemed that they were tired so that their performance while playing was getting worse when the athlete hit lobs and smashes. Some of the athletes interviewed admitted that they experienced fatigue during training. This can also be seen when competing in the first set is still stable, but in the second set the athletes are already experiencing fatigue, so that the athlete's concentration on the match is not good. In addition to technical factors, this is also influenced by energy to increase the ability of the whole body to

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always move at a moderate to fast tempo, which is quite long. So far, the training at Jaya Raya Satria has also focused more on technical training, such as smash and other hitting techniques. Less exercise that leads to physical exercise, especially aerobic endurance. The exercise applied in this study is the R 30 and 40 meter exercise method. Relay training (relay running), is a continuous run or relay race is one of the running race numbers in athletic competitions which are carried out alternately or in chains.

Aerobic endurance is a very important physical factor, which determines the achievement of an athlete, because good endurance an athlete will be able to apply techniques and tactics to the maximum, so that with excellent endurance abilities the opportunity to achieve achievements will be easier. The main factor of success in training and sports competitions is influenced by the level of the athlete's endurance ability, so a person's good endurance ability will be able to do his job to the fullest. Good physical endurance is the maximum ability to meet oxygen consumption which is indicated by the maximum oxygen volume level (VO2 Max). VO2 Max is the maximum amount of oxygen in milliliters that can be used in one minute per kilogram of body weight. Based on the background that has been stated above, the researchers are interested in conducting research with the title "The Effect of 30 Meter Relay Exercise and 40 Meter Relay on Increasing VO2 Max of Badminton Players PB Jaya Raya Satria".

METHODS

This type of research is a quasi-experimental research. According to Arikunto (2016: 272) experimental research is research that is intended to determine whether or not there are consequences for the subject who is subjected to treatment. The research design used was "two groups pre-test-post-test design", This research was conducted in PB. Jaya Raya Satria. The study was carried out on January 27-7 February 2020. This research was conducted 16 times face to face conducted 3 times in 1 week, namely on Monday, Wednesday, and Friday. The exercise is Exercise R 30, which is a form of running exercise consisting of four people with a distance of 30 meters. Exercises are carried out with an intensity of 80%, 30 repetitions, 1 minute recovery, 3 minute intervals, and increasing sets every week. The exercise was carried out for 16 meetings. Likewise with the R 40 exercise, which is a form of running exercise consisting of four people with a distance of 40 meters. Exercises are carried out with an intensity of 80%, 40 repetitions, 1 minute recovery, 3 minute intervals, and increasing sets every week.

The exercise was carried out for 16 meetings. The population in this study were PB badminton players. Jaya Raya Satria, totaling 18 people. Sampling in this study was done by random sampling, amounting to 16 male athletes. Group A was treated with the R 30 exercise method and group B was given the R 40 exercise method. The instrument in this study was a multistage fitness test. This test has a validity of 0.72 and a reliability of 0.81 (Sukadiyanto, 2011: 39). The multistage running test is a test by running back and forth over a distance of 20 meters (Sukadiyanto, 2011: 49). The instrument in this study is a multistage fitness test. This test has a validity of 0.72 and a reliability of 0.81 (Sukadiyanto, 2011: 39). The multistage running test is a test by running back and forth over a distance of 20 meters (Sukadiyanto, 2011: 49). The instrument in this study is a multistage fitness test. This test has a validity of 0.72 and a reliability of 0.81 (Sukadiyanto, 2011: 39). The multistage running test is a test by running back and forth over a distance of 20 meters (Sukadiyanto, 2011: 49). The data that will be collected in this study is pre-test data obtained from the number of athletes' abilities to perform multistage fitness test tests before the sample is given treatment, while post-test data will be obtained from the number of athletes' abilities to perform multistage fitness tests after the sample is treated. Furthermore, the research must meet several criteria, namely, normality test, homogeneity test and hypothesis testing.

RESEARCH RESULTS

The sample in this study were PB Jaya Raya Satria badminton players, totaling 16 athletes. The description of the sample in this study is presented in the following table:

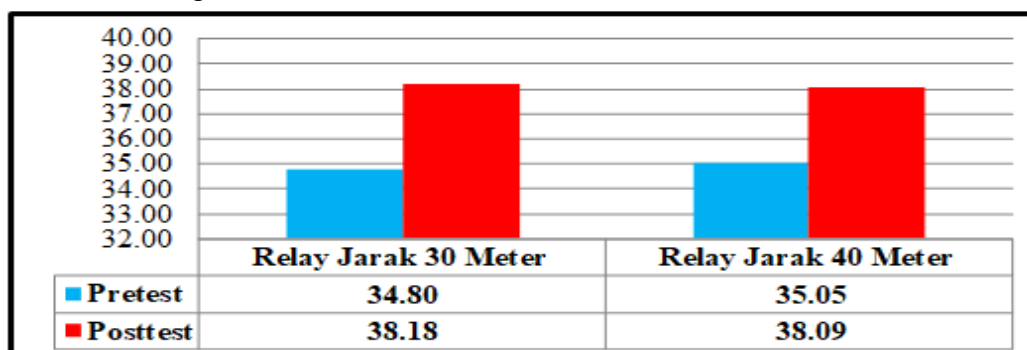


Figure 1. Bar Diagram of Pretest and Posttest VO2 Max Exercise Groups R 30 (A) and R 40 (B)

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From the data above, to make it clearer the difference between the pretest and posttest VO2 Max badminton players PB Jaya Raya Satria training group R 30 (A) and R 40 (B)

Table 1. Summary of Normality Test Results

Group	<i>p</i>	Sig.	Description
PretestGroup A	0.933	0.05	Normal
PosttestGroup A	0.987	0.05	Normal
PretestGroup B	0.780	0.05	Normal
PosttestGroup B	0.880	0.05	Normal

From the results of table 1 above, it can be seen that all data have a *p* value (Sig.) > 0.05, so the variables are normally distributed. Since all data are normally distributed, the analysis can be continued with parametric statistics.

Table 2. Summary of Homogeneity Test Results

Group	df1	df2	Sig.	Description
Pretest	1	14	0.656	Homogeneous
Posttest	1	14	0.888	Homogeneous

From table 2 above, it can be seen that the pretest-posttest values of sig. *p* > 0.05 so the data is homogeneous. Because all data are homogeneous, data analysis can be continued with parametric statistics

Hypothesis Test Results

The hypothesis in this study was tested using paired t test and independent t test using SPSS 20, the results of hypothesis testing are as follows:

Table 3. T-test Results of Pretest and Posttest VO2 Max Exercise Group R 30

Group	Average	Paired Samples Test				
		t ht	t tb	Sig.	Difference	%
Pretest	34.80	8,571	2,365	0.000	3.38	9.71%
Posttest	38.18					

From the results of the t-test in table 3 above, it can be seen that the t-count is 8.571 and the t-table (df 7) is 2.365 with a *p* significance value of 0.000. Because the t count is 8.571 > t table 2.365, and the significance value is 0.000 < 0.05, this result shows that there is a significant difference. Thus the alternative hypothesis (*H_a*) which reads "There is a significant effect of R 30 exercise on increasing VO2 Max of badminton players PB Jaya Raya Satria", is accepted.

Table 4. T-Test Results of Pretest and Posttest VO2 Max Exercise Group R 40

Group	Average	Paired Samples Test				
		t ht	t tb	Sig.	Difference	%
Pretest	35.05	5,835	2,365	0.001	3.04	8.67%
Posttest	38.09					

From the results of the t-test in table 4 above, it can be seen that the t count is 5.835 and the t table (df 7) is 2.365 with a *p* significance value of 0.001. Because t count 5.835 > t table 2.365, and a significance value of 0.001 < 0.05, this result indicates that there is a significant difference. Thus the alternative hypothesis (*H_a*) which reads "There is a significant effect of R 40 exercise on increasing VO2 Max of badminton players of PB Jaya Raya Satria", is accepted.

Table 5. VO2 Max t-test for the R 30 (A) and R 40 (B) exercise groups

Practice Group	Percentage	Independent Samples Test			
		t ht	t tb	sig,	Difference
R30	9.71%	0.041	2.145	0.968	0.087
R 40	8.67%				

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From the table of t-test results in table 13 above, it can be seen that the t-count is 0.041 and the t-table ($df = 14$) = 2.145, while the significance value of p is 0.968. Because t arithmetic $0.041 < t$ table = 2.145 and $sig, 0.968 > 0.05$, it means that there is no significant difference. Thus, the null hypothesis (H_0) which reads “There is no significant difference between the R 30 and 40 meters training on increasing the VO2 Max of badminton players PB Jaya Raya Satria, is accepted. Based on this, it shows that there is no significant difference between the R 30 and R 40 exercises on the increase in VO2 Max of badminton players PB Jaya Raya Satria.

DISCUSSION

Based on the t-test analysis conducted, several things can be known to draw conclusions. The research results are discussed in detail as follows:

1. The effect of R 30 exercise on increasing VO2 Max

Based on the results of the study, it showed that there was a significant effect of R 30 exercise on increasing the VO2 Max of badminton players of PB Jaya Raya Satria, which was 9.71%. Supported by the results of Permana et al (2018: 1) research showing that the speed of students has increased from before being given speed training (file relay) this is evidenced by the tcount value of 9,345 which is greater than the ttable value of 1,833. It can be said that this speed exercise (file relay) is very suitable to be given to students in order to increase their speed, so that students can improve their achievements in basketball extracurricular activities. Relay exercise used in this study includes training with the type of interval training. Interval training is very influential on VO2 Max as long as it is still in the correct portion and conditions. The applicable provisions must also be observed carefully to avoid overtraining. Interval training is an important way of including training in an overall training program. According to Bompa & Haff (2015: 69), 1:3 interval training is done by running at an optimal speed of 30 meters then the travel time will be multiplied by 3 for the rest time. Athletes are required to rest completely without doing activities. After the rest period is over, the athlete immediately repeats the 30-meter run and is repeated continuously for the specified repetitions.

Over the last few decades, interval training has become one of the most common physical conditioning methods used in endurance sports (Pandey & Verma, 2016: 134). Although interval training is considered to be able to increase the endurance of athletes, this method requires manipulation in terms of distance, duration, repetition, rest time, and actions at rest to suit certain sports (Turner & Stewart, 2014: 11). Deol & Singh (2013: 1) showed that interval training significantly increased aerobic capacity. Pattyn et al. (2017: 329) explains that aerobic interval training and continuous training increase the oxygen uptake capacity in the body, thus automatically increasing aerobic endurance significantly with an exercise program for 6 weeks. Interval training is the most versatile method of increasing endurance. Interval training is carried out with higher intensity with complete rest periods. Previous research has shown that small sided games and interval training (generic running, continuous training, and high intensity interval training) are effective in increasing aerobic endurance in professional soccer players. Harsono (2015: 156) reveals "interval training is an exercise system that is interspersed with intervals in the form of periods of rest".

Interval training is widely used in the field of sports training and consists of repetitions followed by rest intervals with complete or incomplete recovery depending on the goals of the sports training. Since the recovery period provides time for physiological adaptation, duration is a very important part of interval training. A very short recovery period does not allow the body to recover enough to perform the next interval of work at the desired intensity. On the other hand, a very long recovery period allows the body to recover too much and some of the training effect will be lost. The duration of the recovery period depends on the length of the work interval and the specific energy system being trained. During the process of sports training, there are changes in one or another biomotor or physiological variable of the athlete. Interval training can be an effective way of increasing an athlete's lactate threshold, i.e. increasing the threshold at which lactate starts to build up in the blood. Lactate threshold has been shown to be a significant performance determinant for long-distance running events. that is, increasing the threshold at which lactate begins to build up in the blood. Lactate threshold has been shown to be a significant performance determinant for long-distance running events. that is, increasing the threshold at which lactate begins to build up in the blood. Lactate threshold has been shown to be a significant performance determinant for long-distance running events.

2. The effect of R 40 exercise on increasing VO2 Max

Based on the results of the study, it showed that there was a significant effect of R 40 exercise on increasing VO2 Max of badminton players of PB Jaya Raya Satria, which was 8.67%. Interval training is very appropriate to improve physical quality. According to Sukadiyanto (2011: 65), the interval training method is the right method in improving the physical condition of

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athletes. Interval training prioritizes giving intervals (rest) between sets, with activities such as running and/or swimming. For example, interval training can be done by running – resting – running – resting and so on. This happens because the interval training program used is in accordance with the recommendations of Bompa & Haff (2015: 143), namely the training method that is included in the aerobic interval training. This interval training method predominantly uses the aerobic energy system, so it is in accordance with the objectives of this study. Deol & Singh (2013: 2) showed that interval training significantly increases aerobic capacity. These results indicate that this method positively improves aerobic endurance ability after the initial and final tests. Indrayana (2012: 1) states that the advantages of interval training are being able to know the exact load, being able to see progress faster (increasing energy and conditions that can be done efficiently) ”.

This interval method has several advantages for both the coach and the athlete. The purpose of rest intervals is for recovery after doing work. Recovery is required after doing high-intensity work during exercise. Having a rest or recovery interval between work has several benefits or advantages. Rest periods are very important between workouts. Rest periods provide an opportunity for athletes to recover between repetitions of motion. Recovery is done after doing work or high-intensity exercise during exercise. In its implementation, the athlete does the number of swimming according to the instructions from the coach and at a certain time the athlete is given the opportunity to rest. The rest given can be used for relaxation or given correction from the coach. Thus the athlete's condition will recover, besides being able to recognize or observe the time limit when doing swimming, so that on the next occasion the athlete's time limit is included in the training program made by the coach.

3. Comparison of exercise R 30 and R 40 to increase VO2 Max

Based on the results of the analysis, it shows that there is no significant difference between exercise R 30 and R 40 on the increase in VO2 Max of badminton players PB Jaya Raya Satria, with a t count value of $0.041 < t \text{ table} = 2.145$ and $\text{sig}, 0.968 > 0.05$. This means that both types of exercise can increase the VO2 Max of badminton players PB Jaya Raya Satria. This is in accordance with the opinion of Bompa & Haff (2015: 51), that training given regularly for 6-8 weeks will get certain results where the body adapts to the given training. VO2 Max closely related to cardiovascular endurance.³ The amount of individual VO2 Max can be measured from the amount of movement ability performed. The ability to move is the result of the body's ability to produce energy that comes from exercise or called metabolism and the supply of oxygen obtained by the muscles to contract. The body's ability to produce energy occurs through anaerobic mechanisms (without using O₂) and aerobic mechanisms (using O₂). The heavier the intensity of the movement, the greater the need for oxygen in the body. The need for oxygen in the body due to the intensity of movement causes the body to compensate with an increase in the cardiovascular system, namely an increase in heart rate, dilatation of coronary blood vessels, an increase in stroke volume and an increase in the strength of heart contractions, this causes an increase in stroke volume. The body that experiences an increase in VO2 Max adapts to the contraction of the heart during exercise. The increase in the effectiveness of the heart pump after being given a continuous and physiologically continuous training load causes the heart muscle to adapt so that the strength of the heart in pumping blood increases more than before exercise. The performance of the heart becomes better so it can provide sufficient oxygen supply throughout the body, which can be measured by measuring the pulse after exercise.

The effect of exercise on blood volume depends on the type of training, intensity, conditions and acclimatization in an area. Athletes who are able to pump most of their blood to working muscles during training will have a very large difference in arterial and venous blood content, because active muscles will absorb more oxygen from the blood than inactive tissues. To achieve good performance, good physical conditions are also needed, not apart from adequate preparation and physicality, it will be very difficult to develop training towards a good VO2 Max. Johe, (2013: 2) regarding VO2 Max stated that, “VO2 Max (also maximal oxygen consumption, maximal oxygen uptake, peak oxygen uptake, or maximal aerobic capacity) is the maximum capacity of an individual's body to transmit through the circulatory system and use oxygen in motor muscles.” Foster et al. (2015: 747) revealed that interval training programs can be adapted for almost every population and can be done anywhere at any time. Depending on individual abilities, the trainer can manipulate the intensity and duration of intervals, exercise modalities, sets and repetitions, and the intensity and duration of recovery between sets. In general, the duration of the interval is the main variable being manipulated. The relatively high intensity paired with the short recovery interval is considered very demanding. In contrast, low intensity is paired with long recovery intervals. This high-intensity interval training consists of a period of doing high-intensity sprints interspersed with a rest period, namely jogging, the treatment causes the body to effectively form and use energy from the anaerobic system. The addition of intervals helps remove metabolism from the muscles during periods of rest when high-intensity interval training is being performed by the body. These alternating exercise periods help the body increase the volume of oxygen consumed during exercise at maximum volume and capacity (VO2 Max) during exercise. Increased cardiovascular also occurs due to an increase in heart rate during exercise. An increase in heart rate

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during this exercise increases stroke volume. An increase in stroke volume and an increase in heart rate can cause an increase in cardiac output, which is the volume of blood ejected by the two ventricles per minute. This increase is accompanied by vasodilation of blood vessels to carry oxygen to active muscles (Willmore, et al. 2012: 39).

High-intensity training causes an increase in stroke volume so that there is a decrease in pulse rate while cardiac output remains, it is due to the efficiency of the heart muscle in supplying blood throughout the body. Heart rate efficiency is indicated by a decrease in pulse rate. Low-intensity exercise alternating between high-intensity exercise at interval training helps the body to remove metabolism from the muscles during periods of rest when high-intensity interval training is being performed by the body. These alternating exercise periods help the body increase the volume of oxygen consumed during exercise. Oxygen that goes to this active muscle breaks down lactic acid into energy again. 4 According to a study on high-intensity interval training conducted by Oliveira et al, Like other aerobic exercises, this high-intensity interval training improves muscle cell function, burns fat and increases lung capacity. 30 minutes of high-intensity interval training equals 90 minutes of low-intensity exercise. So that high-intensity interval training takes a shorter time to achieve fitness benefits (Hoeger & Hoeger, 2014: 58). The greater the VO₂ Max, the more efficient the respiratory system. (Chatterjee, 2015: 3), “higher oxygen consumption of an individual shows her/him more efficient cardio respiratory system”. Oxygen is one of the fuels needed by humans and one of the components needed by muscles for heavy or light activities. Every sport requires VO₂ Max to support in the match. One of the sports that require VO₂ Max is badminton.

In line with the above opinion, Nala (2011: 37), states that the training provided systematically, progressively and repeatedly will improve the body's organ systems so that physical appearance will be optimal. The training, which is done with a frequency of three times a week, is suitable for beginners and will result in significant improvements. Physical training that is applied regularly and measurably with sufficient doses and time, will cause changes in the ability to produce greater energy and improve physical appearance. Movements performed during exercise in a repetitive way will lead to the formation of conditional reflexes, learning to move, and the process of memorizing motion (Nala, 2011: 39). This research has been carried out to the maximum extent possible. however, it cannot be separated from the existing limitations, namely: 1) The sample is not in a dormitory so it is possible that there are those who practice alone outside of treatment; 2) In this study, very few subjects were studied, namely only badminton athletes at PB Jaya Raya Satria, totaling 16 athletes.

CONCLUSIONS

The exercises used in this study include training with the type of interval training. Interval training is very influential on VO₂ Max as long as it is still in the correct portion and conditions. The applicable provisions must also be observed carefully to avoid overtraining.

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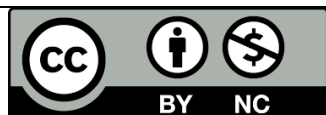
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