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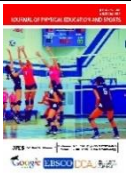

The Effect of Exercise Method and Body Mass Index on Time Exhaustion, Lung's Vital Capacity and VO_2Max

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Abstract

The aims of this study are (1) to analyze the differences in the effect of the Exercise Method on Time Exhaustion, Lung's Vital Capacity and VO_2Max (2) to analyze the differences in the effect of Body Mass Index (BMI) on Time Exhaustion, Lung Vital Capacity and VO_2Max (3) to analyze the interaction of the method exercise and Body Mass Index (BMI) on Exhaustion Time, Lung Vital Capacity and VO_2Max. This research is quasi-experimental research with Pretest-Posttest Control Group design, using observation data collection-techniques, questionnaires. The data analysis technique used in this research was descriptive analysis, classical assumption test and hypothesis testing. The results showed that; (1) there is a difference in the effect of the Exercise Method on Time Exhaustion, Lung Vital Capacity and VO_2Max with F count > F table and a significance value of 0.000 < 0.05, (2) there is a difference in the effect of Body Mass Index (BMI) on Time Exhaustion, Vital Capacity Lung and VO_2Max, with F count > F table and significance value 0.000 < 0.05 (3) analyzed the interaction of Exercise Method and Body Mass Index (BMI) on Time Exhaustion, Lung Vital Capacity and VO_2Max, with Q count > Q table.

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INTRODUCTION

Sport is an interesting field of study so that many sports circles devote their attention, Sport as a scientific study, sport has three scientific dimensions, namely ontology, epistemology and axiology. In the study of axiology, science is examined from the point of view of the use of science. A science has use value if it is able to change behavior and can direct users in a better direction (Setiyawan, 2017).

Sport has now become a part of human activity, and its development is sought to improve health, fitness, recreation, education and health achievement, fitness, recreation, education and achievement (Aditia, 2015).

Giriwijoyo and Sidik (2012: 18) explain that the goals of sport can be distinguished into achievement, recreation, education and improving the quality of health. One of the most basic strategies in an effort to realize human resources, especially in the field of sports, is to focus attention and orientation on sports development as early as possible, namely by coaching and developing sports for the younger generation from an early age (Lilik, 2007).

Sport is also a form of efforts to improve human quality which is directed at the formation of character and personality, high discipline and sportsmanship, increasing achievements that can evoke a sense of national pride (Pradipta, 2014).

The phenomenon that occurs at this time, many people have heart disease and obesity, which are diseases that arise due to lack of movement in their daily lives and arise due to unhealthy eating patterns.

Obesity is known to be a risk factor for the emergence of various degenerative diseases such as heart disease and stroke (Thomsen, 2015) (Haley, 2016). These diseases are the biggest cause of death for the world's population. The results of the 2013 Basic Health Research show that the prevalence of the Indonesian population is 15.4% obese. The prevalence of obesity in adult women (>18 years) increased by 18.1% from 2007 (13.9%) to 32.9% (Sofa, 2018: 229).

There are many ways that can be done to build an ideal body, one of which is by exercising regularly. Regular exercise will have a direct effect on achieving the degree of physical fitness. Physical fitness is one of the requirements in human life to refer to optimal health, namely physical, emotional, and mental as well as increasing work productivity. The higher the level of physical fitness.

Excellent or high physical fitness conditions also provide strength to a person's heart and lung endurance. On the other hand, an unfit body condition will cause physical fatigue or what is called time to exhaustion (Nujjiya, 2015).

There needs to be proper exercise to improve the quality of the body. The quality of cardiopulmonary endurance is expressed by VO_2Max, which is the maximum amount of oxygen that can be consumed in units of Ml/kg BW/Minute (Sharkley, 2011). Thus, physical exercise is needed that involves several components of physical fitness with the correct training method, including circuit training, interval training. Circuit training is a form of interval physical exercise in which there is a combination of strength and aerobic exercise to train physical strength and flexibility (Rahima, 2017).

These exercises can also be used in several types of sports, both team and individual sports. In badminton, good aerobic endurance or high VO_2Max is highly prioritized, because badminton requires strong energy and endurance to play.

Recognizing the many achievements that have been achieved by Indonesian athletes through badminton, schools do not want to be left behind in developing this sport. It can be seen that currently many schools are holding badminton extracurriculars. This is because there are many inter-school sports events such as POPDA, AKSIOMA, PORSEMA and other events that require that every school be required to participate in the event. The fact that happens is that schools that are able to create outstanding students to win

an event will indirectly make the school better known to the public and even increase the school's rating.

The results of the initial observations made, the researchers saw that the defeats that occurred to athletes and students occurred due to fatigue when playing. Student endurance tends to decrease so that it affects the accuracy of students' punches in playing. Researchers made observations on badminton extracurricular at MA Skills Al Irsyad, Gajah Subdistrict, Demak Regency, the results obtained that all extracurricular students participating in the exercise seemed to experience fatigue when playing. Fatigue occurs when the game enters the end of the second game.

The results of other observations made by researchers by interviewing several students admitted that they easily experience fatigue when entering the 2nd game, especially if there is a ruber game. In addition, the weight factor is not yet ideal which makes the movement in the field slower. It can be concluded that the badminton extracurricular training process for MA Skills Al Irsyad, Gajah Subdistrict, Demak Regency, the coach and participants, that what happened in the field was that when the match entered the second round, the participants/players experienced a drastic decrease in their physical condition. As a result, the goal of the game cannot be achieved.

All of this happened as a result of the coach's lack of observance in managing the training program that was carried out and not according to the training model with the goals to be achieved. Obviously it is very concerning if such conditions continue. In order for the training process carried out to run effectively and in accordance with its objectives, the physical condition exercise strategy used must be in accordance with the needs and characteristics of students and not boring. Because a coach will be able to design an exercise model for physical conditions well if it is not in accordance with the needs and does not have a clear goal. So, special treatment is needed that aims to increase VO_2Max, Body Mass Index (BMI) and Vital Lung Capacity of MA badminton extracurricular participants Al Irsyad Skills, Gajah District, Demak Regency. Researchers want to use the model of endurance training circuit training and interval training and Body Mass Index (BMI) to examine the effect of cardiopulmonary endurance, participants' vital lung capacity and exhaustion time. This model was chosen by the researchers to anticipate the short time available in increasing heart lung endurance, vital lung capacity, Body Mass Index (BMI), as well as measuring the level of fatigue produced by the badminton extracurricular participants MA Skills Al Irsyad, Gajah District, Demak Regency.

METHODS

This type of research is quasi-experimental because there is an element of manipulation, namely changing the usual situation systematically to a certain state and continuing to observe and control external variables that can affect the results of the study.

The design used in this study is the Pretest-Posttest Control Group design. In this design, three groups were selected randomly, then given a pretest to determine the initial state, the experimental group was given treatment, then given a posttest to determine the final results. With the results of the pretest and posttest, it is known whether there is a difference between the experimental group and the control group.

The population in this study were athletes/participants of the badminton extracurricular MA Skills Al Irsyad, Gajah District, Demak Regency, totaling 30 people.

The sampling technique in this study is Total Sampling. The reason for using this sampling technique is because the population is relatively small, and less than 100 people.

The number of samples in this study was as large as a population of 30 people, then the number of samples was divided into groups, each group consisting of group 1 using interval training

treatment and group 2 using cicuit training treatment.

This data collection method is defined as the use of methods to obtain information data and explanations needed in this research.

VO2Max measurement test. The test used in this study aims to obtain data about the value of the maximum oxygen volume (VO2Max). In this case using the Multistage Fitness Test.

Lung's vital capacity measurement test. Measurement of Lung Vital Capacity in this study using a spirometer

Body Mass Index (BMI) measurement test. Body Mass Index (BMI), was determined using an instrument weighing weight in kilograms (kg) and measuring height in centimeters (cm).

Data analysis techniques are a very important part of a study. In a study there are two types of data analysis that can be used, namely statistical analysis and non-statistical analysis. Statistical analysis is scientific methods applied to analyze, collect, compile, and present data in the form of numbers to answer research hypotheses (Hadi, 2014).

RESULTS AND DISCUSSION

The results of this study were obtained from 20 participants in the badminton extracurricular MA Skills Al Irsyad, Gajah District, Demak Regency, with the results of the study:

The test results of the One Sample Kolmogorov-Smirnov Test showed a significance value of 0.087 > 0.05. the researcher can conclude that all research variables are normally distributed. The results of the homogeneity test obtained a significance value of 0.956 > 0.05, which means that the data variance between groups is not significantly different or homogeneous.

Table 1. F-Count Test Results

		F count	F table	Sig.
Interval dan Circuit Training	Time Exhaustion	5.665	4.35	.021
	Lung's Vital Capacity	8.511	4.35	.009
	Vo2max	6.982	4.35	.033
BMI	Time Exhaustion	10.270	4.35	.005
	Lung Vital Capacity	12.684	4.35	.002
	Vo2max	6.758	4.35	.040

Source: research data

There is a difference in the effect of the Circuit Training and Interval Training training methods on the Time Exhaustion of the badminton extracurricular members of MA Al Irsyad Skills, Gajah District, Demak Regency. The results showed that F count > F table or 5,665 > 4,35 and a significance value of 0.000 < 0.05. It can be interpreted that there is a difference in the effect of interval training and circuit training methods on time exhaustion. Time exhaustion is a term that is often used to describe someone in maintaining intensity during work (Lausen, 2007). Hopkins (2001) explains that time exhaustion relates fatigue time to power output and exercise duration. Nujjiya (2015) explains that one of the important indicators of fatigue is physical fatigue. Individual physical fatigue is characterized by increased heart rate and blood pressure, stomach disorders (gastrointestinal disorders), easily injured, easily physically tired, death, respiratory problems, sweating more often, headaches (migrants), cancer, muscle tension and sleep problems. such as difficulty sleeping, sleeping too much). Fatigue is a complex criterion that does not only involve physiological and psychological fatigue, but is dominant with a decrease in physical performance, a feeling of fatigue, a decrease in motivation, and a decrease in work

productivity (Putri, 2008: 9). The fatigue factor in a person is due to a decrease in work capacity and body resistance. Therefore, it can be concluded that time exhaustion is closely related to the components of a person's physical condition. One of them is muscle endurance, which is an important element in one's fitness (Mansur, 2010: 19).

There is a difference in the effect of the Circuit Training and Interval Training training methods on the Vital Lung Capacity of the badminton extracurricular MA Al Irsyad Skills participants, Gajah District, Demak Regency. The results showed that F table = 4.35, because F arithmetic > F table or 8.551 > 4.35 and a significance value of 0.000 < 0.05. It can be interpreted that there is a difference in the effect of interval training and circuit training methods on vital lung capacity. A person who is trained by physical exercise, if doing an activity has the ability to inhale more air and in a longer period of time, is also able to exhale more burning residue, because the muscles around his lungs have been trained to do the work. more (Siswanto, 2014). It can be concluded that increasing the vital capacity of the lungs requires proper training. Proper physical exercise is closely related to the intensity of exercise and duration of exercise. In doing exercise, the frequency of exercise should be carried out at least three times a week, both for health sports and for sports achievements. To improve fitness, you need to exercise 3-5 times per week (Pekik, 2004). a systematic process to improve the quality of athlete performance in the form of fitness, skills and energy capacity (Ambarukmi, 2007: 1).

There is a difference in the effect of the Circuit Training and Interval Training training methods on the VO2Max of the badminton extracurricular members of MA Al Irsyad Skills, Gajah District, Demak Regency. The results showed that F count > F table or 5,665 > 4,35 and a significance value of 0.000 < 0.05. It can be interpreted that there is a difference in the effect of interval training and circuit training methods on VO2Max. VO2Max or what is often referred to as aerobic fitness is the ability to consume the highest oxygen during maximum work expressed in liters/minute or ml/kg/min (Suharjana, 2013: 51). Vo2max is one component of a person's physical condition. Good VO2Max can be achieved by many training methods, including interval and circuit training. A person with a good VO2Max condition has more oxygen volume so that blood circulation is better, muscles get more oxygen and can do various activities without feeling tired. High VO2Max will be easier to adapt, not easy to pant in every activity. having a high VO2Max will be easier to absorb the training material given. On the other hand, students who have low VO2Max will easily experience fatigue, have difficulty adapting, have difficulty concentrating, because they have short breaths (easy to pant). Fatigue or decreased ability to breathe oxygen will have an impact on decreasing concentration in carrying out physical activities including training activities or competitions, so that the achievement of the expected training or competition goals is less than optimal. Having VO2Max means having a good fitness level, with good fitness a person can carry out daily life without causing excessive fatigue and still have the ability to fill other light jobs.

There is a difference in the effect of low and high Body Mass Index (BMI) on Time Exhaustion of badminton extracurricular participants MA Skills Al Irsyad, Gajah District, Demak Regency. The results showed that F table = 4.35, because F arithmetic > F table or 10.27 > 4.35 and a significance value of 0.000 < 0.05. It can be interpreted that there is a difference in the effect of Body Mass Index (BMI) on Time Exhaustion. Time exhaustion is closely related to a person's performance in maintaining his intensity (Lausen, 2007). The biggest fatigue factor occurs because the body is not able to maintain its anaerobic ability properly. Aerobic ability is basically the process of meeting energy needs in the body to utilize glycogen to become a source of energy without the help of oxygen from outside. To support this ability, proper training is needed.

Proper anaerobic exercise will help a person in creating the ideal body mass. Anaerobic exercise requires a source of energy obtained from the formation of ATP through energy sources derived from creatine phosphate and glycogen stored in the body (Hita, 2020). Anaerobic exercise is an exercise that is carried out intensively and strenuously, and is very draining on stamina. The main benefit of anaerobic exercise is that it can build stronger muscle strength.

There is a difference in the effect of low and high Body Mass Index (BMI) on the Vital Lung Capacity of the badminton extracurricular members of MA Al Irsyad Skills, Gajah District, Demak Regency. The results showed that F arithmetic > F table or 12.684 > 4.35 and a significance value of 0.000 <0.05. It can be interpreted that there is a difference in the effect of Body Mass Index (BMI) on vital lung capacity. Body Mass Index (BMI) under normal circumstances, inspiration is an active process of muscle contraction which will increase the intrathoracic volume. During quiet breathing, the intrapleural pressure at the base of the lungs will drop from a normal value of about -2.5 mmHg at the start of inspiration to -6 mmHg. The pressure in the airways becomes slightly more negative, and air flows into the lungs. At the end of inspiration, the recoil forces of the lungs begin to pull the chest wall back into the expiratory position, until a balance is reached between the recoil forces between the lung tissue and the chest wall. The pressure in the airways becomes more positive, and air flows out of the lungs (Ganong, 2002). Likewise, during quiet breathing, expiration is a passive process that requires muscle contraction to decrease intrathoracic volume. However, at the beginning of expiration, there is still mild contraction of the inspiratory muscles. This contraction serves to hold the power of lung recoil in slowing expiration (Guyton, 2011: 504). The diaphragm muscle, which is located on the inside and outside of the intercostals, contracts deeper. The thoracic cavity closes when air enters the lungs, outside the intercostal muscles compress the ribs and controls the area of the chest cavity that supports expiration so that the outer intercostal parts of expiration press the abdomen. The upward force of the diaphragm helps restore the volume of the pleural space. So that when you take a deep breath, the muscles contract, but exhalation is a passive process. When the diaphragm closes deeply, inhaling through the contents of the chest cavity again enlarges the lungs and the body wall moves until the diaphragm and sternum close to their original position. Breathing activity is the basis which includes the movement of the ribs when breathing in from increased air volume (Sherwood, 2013). However, in conditions of above normal BMI or obesity associated with fat accumulation, the more fat accumulation causes changes in the structure of the thoracic-abdominal region, so that the movement of the diaphragm and ribs is limited (Pinzon, 1999). Limited movement of the diaphragm and ribs due to the accumulation of fat is what affects the reduced vital capacity of the lungs.

There is a difference in the effect of low and high Body Mass Index (BMI) on the VO2Max of the badminton extracurricular members of MA Skills Al Irsyad, Gajah District, Demak Regency. The results showed that F arithmetic > F table or 6.758 > 4.35 and a significance value of 0.000 <0.05. It can be interpreted that there is a difference in the effect of Body Mass Index (BMI) on VO2Max. VO2Max is the volume of oxygen consumed in unit time, usually expressed in liters of water or milliliters (Junusul Hairy, 1989: 186). VO2Max is measured based on the heart's ability to pump oxygen-rich blood to all parts of the body, and the ability to adjust to the recovery process from physical activity. The strength of the heart in pumping blood is related to a person's physical condition. A person's physical condition is closely related to the physical activity undertaken, lack of physical activity causes more body fat to be stored in tissues, while low physical fitness can affect physical health. Based on several studies on subjects who have less physical activity, the VO2Max value is in the less category and after the

exercise and diet intervention has increased even though it is still in the less category, this proves that physical activity can improve a person's VO2Max value. Fat tissue adds weight, but does not support the ability to directly use oxygen during strenuous exercise. Thus, if Vo2max is expressed relative to body weight, fat weight tends to increase the denominator without affecting the numerator. So, obesity tends to reduce VO2Max (Uliyandari, 2009). Pate (1984) in Budiarto (2012) explains that the most important cardiovascular response to physical activity is an increase in cardiac output. This increase is caused by an increase in stroke volume and heart rate, which can reach about 95% of the maximum level. Because the use of oxygen by the body cannot be more than the speed of the cardiovascular system delivering oxygen to the tissues, it can be said that the cardiovascular system delivers oxygen to the tissues, so it can be said that the cardiovascular system can limit the value of VO2Max. b) There is an interaction between Exercise Methods and Body Mass Index (BMI) on Time Exhaustion, Vital Lung Capacity and VO2Max badminton extracurricular participants MA Skills Al Irsyad, Gajah District, Demak Regency. The results showed that each group had a calculated Q value > Q table, with a Q table value of 2,971. The results showed that each variable can have a different effect on Time Exhaustion, Lung Vital Capacity and VO2Max, or in other words that the proposed research hypothesis is proven true. This shows that to improve the results of time exhaustion, vital lung capacity and VO2Max not only by using the exercise method, but also by the condition of the Body Mass Index (BMI). Even though the trainer has used the training method well, without being supported by the ability to have a good BMI, this will result in not achieving the goal, so the process cannot be absorbed perfectly. This shows that to improve physical condition, the trainer must be able to choose the appropriate training method and also consider the ability of the physical condition, in this case the condition of body mass. The interaction between training methods and BMI on time exhaustion, vital lung capacity and VO2Max as described above can be described by comparing the average scores between groups of athletes/participants with high and low categories with the same treatment with different training methods.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there are interactions and differences in the effect of the exercise method on Time Exhaustion, Vital Lung Capacity and VO_2Max with the calculated F value greater than the F table value and the significance value less than 0.05, and the Q value results count is greater than the table Q value. The interval training method has more influence on Time Exhaustion, Vital Lung Capacity and VO_2Max than the cicuit training method for badminton extracurricular participants MA Skills Al Irsyad, Gajah District, Demak Regency.

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