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The Effectiveness of Active Intermittent Anaerobic Exercise and Passive Intermittent Anaerobic

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Abstract--- *The purpose of this study was to determine the type of exercise that has a more effective effect in increasing the maximum work capacity between active anaerobic exercises with passive anaerobic exercises after conducting research on 24 male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima) in aged 17-19 years as samples. The sample was divided into 2 groups, each of 12 people, namely anaerobic exercise group with active and passive intermittent anaerobic training groups. Both types of exercise are carried out on an ergometer bicycle (Monark). Design of the study "Randomized control group pre-test and post-test design". Collecting instrument "Ergometer bicycle which is stated by the number of Watts". Analysis with paired observation pair t-test statistics and two independent sample t-tests. The results obtained in this study are as follows; (1) The first hypothesis, there is the effect of anaerobic training that is active later on to increase the maximum work capacity in the male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima). (2) The second hypothesis is that there is an effect of passive anaerobic training on increasing the maximum work capacity of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima). (3) The third hypothesis, there are differences in the effect of active intermittent anaerobic training and passive intermittent anaerobic exercises on increasing maximum work capacity. However, from the results of different tests prove that active intermittent anaerobic training is more effective when compared to passive anaerobic training to increase maximum work capacity in male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).*

Keywords--- *Anaerobic Exercises Intermittent Active; Intermittent Passive; Maximum Work Capacity*.

I. INTRODUCTION

Achievement abilities that an athlete can achieve are determined by many factors. Broadly speaking there are two main factors, namely, hereditary factors and environmental factors. These two factors are equally important and mutually supportive. However the magnitude of the biological potential (heredity / talent) of an athlete, without the support of environmental factors (for example: proper training), the maximum achievement is difficult to achieve (Fardy, n.d.).

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In an effort to improve the performance of an athlete, the quality of the training given is a very decisive thing. Therefore, the training program needs to be carefully prepared. This is where the contributions of scientists to the development of training theory and methodology, and the insight of a trainer on this matter also influence the performance of an athlete. Each training program must always include physical factors, techniques, tactics and mental factors of athletes, because it is a basic factor of an athlete's performance. These four factors are interconnected with each other to achieve peak performance (Patellongo, 1993).

In various sports, one of the components of the physical condition that determines to achieve maximum performance is endurance. This endurance or endurance does not only include muscle endurance, but also the endurance of the lung heart which in exercise is expressed with the ability to carry oxygen to the maximum or what is more called maximum working capacity. Maximum work capacity determines the amount of oxygen that can be transported to networks and transport of CO2 and substances that are not useful to expenditure devices (Gleser & Vogel, 1973). The ability of the maximum work capacity can also be interpreted to be the same as the maximum oxygen transport capability or also known as VO2max. in this study researchers used the term maximum work capacity.

The main maximum work capacity is the ability of the heart to pump blood, the ability of the lungs to absorb oxygen and the ability of cells to use oxygen (Fox, 1998). Maximum work capacity is one of the main factors in supporting the appearance or achievements of athletes in long activities. This is very much needed in almost all sports, more specifically on anaerobic sports activities that prioritize not only muscle endurance but the heart's lung resistance. Besides that, maximum work capacity is the best physiological parameter to determine a person's resilience capacity (Kenney, Wilmore, & Costill, 2015).

Before elaborating and discussing intermittent training in relation to maximum work capacity, it should be understood in advance what is meant by training, so that there is a unified language and interpretation in following the next description.

What is meant by training? There are various understandings given by sports experts about the meaning of training. Physiologists like Brooks, (1996)(Gleser & Vogel, 1973) "are more likely to provide a definition of this training as an attempt to improve the system of organs or body organs and their function with the aim of optimizing the appearance or performance of athletes". Furthermore, from various opinions of reference (Bompa, 1994), perfecting that "training is a systematic process of repetition, a progressive performance which also involves the learning process and has the aim to improve the system and function of the organs so that the athlete's appearance reaches optimal. Physiologically physical training is a process of forming conditional reflection, the process of learning to move and the process of memorizing movements. Other similarities have been raised by reference (Harsono, 1982), that training or "training is a systematic process rather than practicing or working repeatedly, with more and more days increasing the amount of training or work." In connection with the training, reference (Nala, 1998) explaining that "by doing systemic training the organs of the body function will increase more than before training. This function enhancement is needed to fulfill the performance of the body's activities or performance, both during sports activities and while working ".

Thus, training is a physical movement and / or mental activity that is carried out systematically and repeatedly (repetitive) over a long period of time, with progressive and individual loading which aims to improve the system and physiological and psychological functions of the body so that when doing sports activities can achieve optimal performance.

Intermittent training is a physical exercise method that takes place alternately between work intervals and resting phases, where the resting phase can change to work relief or rest relief (Bowers & Fox, 1992).

Intermittent training is one of the training methods of a small number of training systems that have been systematically and scientifically investigated. This method provides a variety of variations that can be arranged in such a way as to develop both anaerobic systems as the main energy system, as well as the reverse aerobics system as the main energy system, or to develop the three energy systems equally, depending on the intensity and duration of the exercise used (Fox, 1998); (Bowers & Fox, 1992). According to references (Annarino, 1986) and (Fox, 1998), intermittent training is the basis of conditioning for all sports branches and is considered the best training method,

because this exercise uses the principle of progressive overload; with an increasing training load nearing maximum, a person's physical ability will gradually increase.

Anaerobic exercise is active and passive intermittent, is one of the intermittent training variations, where the load given during the work phase is anaerobic load (maximum or near maximum load done for less than 3 minutes). If the resting phase is given a light or medium workload, for example jogging, then anaerobic exercise is called active intermittently, and if it is not given a load or very light work, for example the road, called passive intermittent anaerobic training.

If we want to improve the energy system ATP-CP-LA more dominant than the others, then the burden that must be given during the work phase is anaerobic load that lasts for 30-80 seconds with a resting phase in the form of light work (work relief), and a comparison between the working phase with the resting phase is 1: 2 - 1: 3. With this exercise it will certainly increase the anaerobic power through increasing ATP-CP-LA, as well as its aerobic power, although the development of anaerobic power is more dominant than its aerobic power. Therefore, this exercise, hereinafter referred to as active intermittent anaerobic exercise, will increase the maximum work capacity which is the maximum anaerobic power plus maximum aerobic power. If this exercise is made a new variation, by changing the resting phase into passive rest (rest-relief), so that it becomes passive intermittent anaerobic exercise without changing the duration of work, the comparison of the working phase with the resting phase, and the number of repeaters, this will make some questions. Does this passive intermittent anaerobic exercise have a different effect on increasing maximum work capacity? if different, which one is better?

To determine the type of training that can increase maximum work capacity, there are still many different opinions. Under maximum training conditions can increase maximum work capacity (Fox, 1998). To increase maximum work capacity you should do anaerobic exercises with intermittent breaks (Soekarman, 1987). However, the reality in various trainings is that coaches use methodical approaches, some prioritize anaerobic training later with active breaks, while on the other hand they prefer anaerobic training after passive terms.

Because there is still an inequality of opinion in an effort to increase this maximum work capacity, it is felt necessary to look for answers that might help sports coaches, coaches and athletes to carry out their duties, so that good waste in the form of time, effort and cost can be eliminated or can be avoided.

From the problems and theoretical studies, the objectives to be achieved in this research are; (1) To find out whether active anaerobic exercises affect the maximum work capacity. (2) To find out whether passive anaerobic exercises affect maximum work capacity. (3) To produce a training model that is more effective in increasing the maximum work capacity between active anaerobic exercises and passive intermittent anaerobic exercises for PKL FIK Unima.

With the problems encountered in this study, it is hoped that it will provide meaningful benefits to; (1) Having meaning for the development of the substance of science, especially in increasing maximum work capacity (theoretical benefits). (2) Having meaning for the development of methodology, which will support efforts to improve sports performance (methodological benefits). (3) Having meaning for practical use in the field of sports coaching to choose methods, types or forms of exercise that are more effective or appropriate (applicative benefits).

II. METHODOLOGY/MATERIALS

The type or method of research used is "true experiment". The research design was "Randomized control group pre-test and post-test design" (Zainuddin, 1988). For data collection the maximum work capacity is carried out using a bicycle ergometer which is stated by the number of Watts both measurements in the initial conditions (pre-test) and measurements in the final condition (post-test) conducted in the three groups (Wahjoedi, 2001). The research site at FIK Unima Laboratory for data collection of maximum work capacity and anaerobic training is active and passive intermittent. The time needed in this study is for 5 (five) months.

The population were all male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima) semester two (II) and semester four (IV), with 72 male students. The sample

was obtained as many as 24 respondents who were drawn using the "Semple random sampling" technique. Furthermore, the sample was divided into two groups with a "Matched ordinal pairing" technique, each group of 12 respondents for active intermittent anaerobic exercise and 12 respondents for passive intermittent anaerobic exercise. The test statistic used is the paired observation t-test and is based on two independent samples.

III. RESULTS AND FINDINGS

The first hypothesis testing result. From the results of calculations using the paired t-test statistical observations obtained t observation value of tob = 7.853. Whereas from the table of critical values t with a significant level $\alpha = 0.05$; n - 1 obtained t table value of ttab = 2.201 (table value attached). This fact shows that the value of tob = 7.853> ttab = 2.201, thus the null hypothesis (Ho) is rejected and accepts an alternative hypothesis (Ha).

Based on the testing criteria in the first hypothesis, it states that refuse Ho if tob> ttab, this shows that Ha is accepted which states that there is an effect of anaerobic training actively on the maximum work capacity of the male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

The second hypothesis testing result. From the results of calculations using the paired t-test statistical observations obtained t observation value of tob = 6.196. Whereas from the table of critical values t with a significant level $\alpha = 0.05$; n - 1 obtained t table value of ttab = 2.201 (table value attached). This fact shows that the value of tob = 6.196> ttab = 2.201, thus the null hypothesis (Ho) is rejected and accepts an alternative hypothesis (Ha).

Based on the testing criteria in the second hypothesis states that reject Ho if tob> ttab, this shows that Ha is accepted which states that there is an effect of passive anaerobic training on maximum work capacity in male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

The third hypothesis testing result. From the results of calculations using the t-test statistics of two independent samples (different tests) obtained t observation value of tob = 2.407. Whereas from the table of critical values t with a significant level $\alpha = 0.05$; n1 + n2-2 obtained t table value of ttab = 2.074. This fact shows that the value of tob = 2.407> ttab = 2.074, thus the null hypothesis (Ho) is rejected and accepts an alternative hypothesis (Ha).

Based on the testing criteria in the third hypothesis which states that reject Ho if tob> ttab, this shows that in the Ho Ho rejected, Ha was accepted which states that the average maximum working capacity with active anaerobic training is better than the average value Maximum work capacity with anaerobic training is passive intermittent for male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

The first hypothesis testing result, show that with active intermittent anaerobic exercises can increase maximum work capacity. It can be seen that the initial conditions or pre-test and final conditions or post-tests indicate a change in the acquisition numbers for each child in terms of their maximum work capacity. The results are evidenced by the calculation of statistical analysis of pair observation t-test, where the result of tob = 7.853> ttab = 2.201 so that Ho is rejected and accepts Ha which states that there is an effect of active intermittent anaerobic training on maximum work capacity in male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

Thus in this study, specifically on testing the first hypothesis shows that active intermittent anaerobic training carried out based on the principles of proper training and carried out for eight weeks of training with the frequency of exercise three times a week can increase the maximum work capacity of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima)..

The second hypothesis testing result, show that with passive intermittent anaerobic exercises can increase maximum work capacity. It can be seen that the initial conditions or pre-test and final conditions or post-tests indicate a change in the acquisition numbers for each child in terms of their maximum work capacity. The results are proven by

the calculation of the statistical analysis of the t-pair observation test, where the result of tob = 6.196> ttab = 2.201 so that Ho is rejected and accepts Ha which states that there is a passive anaerobic training effect on the maximum work capacity of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

Thus, in this study, specifically on testing the second hypothesis shows that passive intermittent anaerobic training carried out based on the principles of proper training and carried out for eight weeks of training with the frequency of exercise three times a week can increase the maximum work capacity of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

From the third hypothesis testing result, it shows that there is a difference in the increase in the maximum work capacity between active anaerobic exercises and passive intermittent anaerobic exercises. This can be seen from the data of the initial conditions or the pre-test and the final condition or post-test of the two training groups, it can be seen that there are differences in the acquisition figures at maximum work capacity. These results show that the initial conditions or pre-test of the two groups did not show significant differences, but in the final condition or post-test the two groups showed significant differences, where for the post-test scores the anaerobic exercise group was later active the acquisition of more numbers the increase is higher than the acquisition of the numbers in the passive anaerobic training group. These results have been proven by the calculation of the statistical analysis of the two independent samples t-test, where the result of tob = 2.407> table = 2.074, so Ho is rejected and accepts Ha which states that the average value of maximum working capacity with anaerobic active training is better than the value the average maximum work capacity with anaerobic training is passive in the male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

Thus in this study, specifically on testing the third hypothesis shows that intermittent anaerobic training and passive intermittent anaerobic exercises are carried out based on the principles of proper training and carried out for eight weeks of exercise with the frequency of exercise three times a week, both groups can increase work capacity maximal in the students of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima). However, the results of different tests prove that active anaerobic training is more effective when compared to passive anaerobic training for maximum work capacity in male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

IV. CONCLUSION

From the research findings that has been proven by conducting training and testing data analysis based on the measured variables, a conclusion can be drawn as follows; The first hypothesis, there is the effect of active intermittent anaerobic training which is carried out based on the principles of proper training and carried out for eight weeks of training with the frequency of exercise three times a week can increase the maximum work capacity of the students of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima). The second hypothesis, there is the effect of passive intermittent anaerobic training which is carried out based on the principles of proper training and carried out for eight weeks of training with the frequency of exercise three times a week can increase the maximum work capacity of the students of male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima). The third hypothesis, there are differences in the effect of active intermittent anaerobic training and passive intermittent anaerobic exercises that are carried out based on the principles of proper training and carried out for eight weeks of training with the frequency of exercise three times a week, both groups can increase maximum work capacity. However, from the results of different tests prove that active intermittent anaerobic training is more effective when compared to passive anaerobic training for maximum work capacity in male students of the Department of Coaching Education (PKL) Faculty of Sport Sciences (FIK) Manado State University (Unima).

The research findings are expected to provide meaningful suggestions on the following matters: Can be input for trainers, trainers, and athletes as well as sports lovers as an effort in the development and coaching of sports, especially the development of sports coaching knowledge. In an effort to increase maximum work capacity, intermittent and active passive anaerobic exercises can be used. However, to get faster and better results in increasing maximum work capacity, you should use anaerobic exercises later on. Further research is recommended with the same exercises at various age levels and with specific measurements of physiological parameters to determine with certainty the increase in the energy system which is a component of maximum work capacity. If deemed necessary the research findings may be additional information for further research.

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