

Effect of Interval Training to Increase Physical Fitness

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Abstract— The aim of this study was to know the effect of interval training to increase physical fitness. Subject was Student Extracurricular at Senior High School 1 South Indralaya, Palembang, and collected using total sampling (N =30). Through a quasi-experimental research, treatment given to the subject during 8 weeks and the frequency of training 3 times a week with 60% -70% of the maximum heart rate and duration of 30 minutes. Sample do to a 400-meter jogging with 3 replicates, the ratio of 1:3 and active recovery. The results showed that there was difference between pretest and posttest data physical fitness (p-value < 0,05). It can be concluded that the interval training can be used to improve physical fitness.

Keywords— *Interval Training, Physical Fitness, Maximal Heart Rate*

I. INTRODUCTION

Many kinds of sport activities such as athletic, football, and basketball need anaerobic energy system. Throughout the game, sport activities need aerobic energy system to provide ATP. The endurance of the body condition is needed on each set in the athlete, most of which occurs on the matches, the physical condition of the athlete declined due to fatigue in match. Athlete that has the best readiness that will have better opportunity to win the game, if the athlete has the prime technical, mental and physical condition of VO_2Max . Given the importance of the physical condition of a professional athlete's, VO_2Max is the major percentage in reaching prime physical condition before the other training. For example, strength, endurance, speed, agility, and so forth. Exercise is known to increase muscle energy status of the work, then resulting in the ability to maintain muscle strength for a long time. Intensity training is an important component of an athlete's training program, it remains unclear how to best manipulate these components in order to achieve optimal performance of intense exercise in well-trained athletes.

Exercise is part of a planned physical activity, structured, and repetitive and has as its final destination or the repair or maintenance of physical fitness. One of the many types of training and exercise is interval training. One of the most effective training regimens is called interval training which was first described by Reindell and Roskamm [1] and was popularized in the 1950s by the Olympic Champion, Emil Zatopek. Interval training interleaves high intensity exercises with recovery or rest periods [2]. The idea behind this approach is breaking up a set amount of work into smaller segments rather than performing a greater volume of work at a

higher intensity. In addition, it is well known that exercise at varying intensities helps improve exerciser's aerobic capacity to exercise longer. Definition of interval training programs consists of short to moderate intensity training in which exceed anaerobic threshold, interspersed with short periods with low intensity or passive rest breaks [3].

Interval training can be defined that repetition exercise with recovery periods to develop aerobic endurance capacity. Repetition interval allows the athlete to perform a greater volume of training at the right intensity in a single training session. Interval training generally refers to repeated sessions are relatively brief, intermittent exercise, in which short intervals of intense exercise separated by longer periods of recovery. Depending on the power level, a single effort may last from a few seconds to several minutes, with separate training intervals up to a few minutes of rest or low intensity exercise [4]. Interval training program, involving: sets, repetitions, training time, training distance, frequency, interval exercise, and passive recovery or active recovery interval [5].

Researchers chose the method of interval training for the sport of basketball, indoor soccer, football, volleyball, athletics, swimming, and other movements contained in the interval, in addition to the two methods is an appropriate method to enhance the athlete's VO_2Max so that the match will not be shortage of VO_2Max . With intense exercise is considered as the one that took place between 1 and 8 minutes, where there is a mixture of adenosine triphosphate (ATP) energy from both aerobic and anaerobic energy systems [6]. According to [7], recommends aerobic training for ages 18-65 years. For moderate-intensity aerobic exercise, at least 30 minutes with a frequency of 5 times in 1 week, while the intensity of aerobic exercise with heavy intensity minimum duration of time ranging from 20 minutes with a frequency of 3 times a week. Interval training program conducted for 8 weeks. With intensities ranging from 60% - 79% of the maximum capacity (maximum heart rate) and duration of 45-60 minutes [8, 9]. In this study, intensity used 60% -70% of the maximum capacity (maximum heart rate) and duration of 30 minutes. According to [10] reducing SIT work-interval duration from 30 to 15 s had no impact on training-induced increases in aerobic or anaerobic power, or on increases in lactate threshold (absolute) and critical power. To achieve better interval training effect, this study first investigates the dynamic responses of VO_2Max by building a model. Although existing literatures [11] have studied the HR and/or VO_2

responses to the onset and offset exercises, we need to re-explore the onset and offset dynamics with a certain maximum intensity (70 percent of VO₂Max) for the purpose of improving cardiovascular fitness.

Interval training with repetition of running program form is a quick method to increase VO₂Max. With interval training methods athletes can obtain a fit physical condition and excellent endurance. Thus, in the game, athletes do not run out of Oxygen Maximum Volume (VO₂Max) that support their performance during the playing. Maximal oxygen capacity is defined as the maximum amount of oxygen that the organism consumes per unit of time while doing the exercise intensity grows, and that can't be improved with further increase in exercise intensity [12]. Maximal oxygen uptake (VO₂Max) is a the body's capacity to transport and use oxygen during a maximal exertion involving dynamic contraction of large muscle groups, such as during running or cycling. Also known as maximal aerobic power and cardiorespiratory endurance capacity [13].

According to [14] compared the ways of continuous training and intervals with the same total duration and volume of exercise and reported that the increase in maximal aerobic capacity after continuous training was mainly a result of peripheral adaptation (increased capillary density and increased arteriovenous differences), while improvement after exercise interval produced from the periphery (increased difference in arteriovenous) and central adaptation (increased cardiac output).

II. METHOD

This research is a quasi-experimental research with one group pretest and posttest design. 30 sample, age ±17, do interval training during 8 weeks and the frequency of training 3 times a week with 60% -79% of the maximum heart rate and duration of 30 minutes. The subject represents was Student Extracurricular at Senior High School 1 South Indralaya, Palembang. Sample do to a 400-meter jogging with 3 replicates, the ratio of 1:3 and active recovery. Measurement of physical fitness using Multistage Fitness Test (MFT). To analyze differences physical fitness data before and after the treatment, we used paired sample t-test when the differences was significant (p < 0,05) according to the result of paired sample t-test.

III. RESULT AND DISCUSSION

Based on table 1 the mean value of the study sample was 27,933 (pretest) and 30,756 (posttest), the standard deviation was 3,357 (pretest) and 3,266 (posttest) and the increase was 9.178%.

Table 1. Data Description

	Pretest	Posttest	Increase
N	30	30	
Minimum	23.6	24.8	
Maximum	35	36	9,178%
Mean	27.933	30.756	
Std. Deviation	3.357	3.266	

Then the hypothesis will be tested to answer the research question. But previously the normality and homogeneity test of the data was carried out as a prerequisite for testing the hypothesis. Tests for normality and homogeneity of data are shown in table 2 and table 3 below:

Table 2. One-Sample Kolmogorov-Smirnov Test

Data	Pretest	Posttest
N	30	30
Asymp. Sig. (2-tailed)	0.079	0.134

In table 2 it appears that the p-value is 0.079 for the pretest and 0.134 data for the posttest data. Because the p-value > 0.005, it can be concluded that the pretest and posttest data are normally distributed.

Table 3. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
0.000	1	58	0.990

In table 3 it appears that the p-value is 0.990, because the p-value > 0.005, it can be concluded that the pretest and posttest data are homogeneous.

Table 4. Paired Samples Test

T	14.313
Df	29
Sig. (2-tailed)	0.000

In Table 3, statistical differences for the data pretest and posttest were analyzed using paired samples t-test for the total score of the maximum oxygen capacity (VO₂Max), the results showed significant difference in maximal oxygen capacity (VO₂Max) before and after treatment using the method of interval training [t = 14,313; p = 0.000 (<0.05)].

Nowadays, interval training method becomes a well know exercise protocol which helps strengthen and improve cardiovascular fitness. Several studies have shown an increase in VO₂Max following various HIT and SIT protocols (15, 16; 17, 18) and SIT protocols with work-interval durations as low as 10–15 s can increase aerobic capacity and exercise performance [17, 19]. However, to our knowledge, only one previous study has simultaneously evaluated multiple SIT protocols to elucidate the effect of decreasing SIT work-interval duration on aerobic performance [17]. This study suggests there is a significant increase in VO₂Max in student. The results of this study are a result of the manifestation of the principles of training which are applied in a specialized training program in order to increase VO₂Max. A well design interval training protocol can guide the exerciserto timely shift from low to high training intensities and vice versa within the exercise zone to achieve desired exercise targets with safe.

VO₂peak has increased by interval training. It also increases buffering capacity, whole body fat oxidation, mitochondrial density, blood flow, and increased regulation of glycolytic enzymes [20, 21]. Increasing the oxidative capacity of muscles and consequently the output of the power at which muscles begin to rely on the ability of anaerobic metabolism,

potentially increasing muscle buffer capacity by increasing circulation of lactic acid. Motor unit activation which as been increased leads to accumulation of glycolytic metabolites, such as lactate, hydrogen ions, inorganic phosphates, and ammonia [22]; Therefore, a greater increase in oxidative capacity and utilization of lactate can result in delayed fatigue. It also increases muscle regenerative capacity. This condition make the overall ability of athletes still survive in one full match by having a good condition. However, additional research is needed to explain potential mechanisms which increase the effect of interval training programs. The findings of this study that are relevant to the current investigation is that IT significantly increases the time for fatigue and is become an effective tool that stimulates significant aerobic improvement with a relatively short training period.

IV. CONCLUSION

Based on the result can be concluded that the sprint interval training can be used to improve physical fitness. So, to improve athletes' $VO_2\text{Max}$, not only done by continuous training & fartlek, but can be done with the interval training method. There is a clear need for further study examining the relationships between interval intensity, training volume and cardiac-specific adaptations to HIT and SIT and must be added variable, such as body composition, body mass index (BMI), and/or method of training.

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