



Effect of High Volume Intensity Training and Polarized Training on Aerobic Endurance and Anaerobic Capacity in Intermittent Sports

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Abstract. Performance in intermittent sports requires a very fast recovery ability in each activity because the character of the sport demands maximum performance in each movement. The purpose of this study is to analyze the impact of both training models on sports performance including aerobic endurance and anaerobic capacity. The research method used is a type of quantitative research with a pseudo-experimental design. The sample used is students who have intermittent sports with an age range of 19-22 years including soccer, futsal, volleyball, basketball, and badminton. Aerobic and anaerobic endurance measurements using a treadmill with a protocol RUN 10 km / h and polar H 10. The speed increase with the protocol used will increase 0.5 km / h every minute after the initial 2 minutes of running. The data treatment obtained was analyzed using paired sample T-Test, then the results showed that there was a varied increase in each group of exercise models including the HVIT Exercise group only significantly increased in the VO₂ Max variable. In addition, the POT Exercise Group showed that there was a significant increase in the VO₂ Max and Anaerobic Capacity variables. So it can be concluded that the provision of treatment with the two methods above has a similar impact, namely on the indicator of increasing VO₂ Max, and the advantages of the POT method can increase anaerobic capacity.

Keywords: Training, Method, HVIT, POL.

1 Introduction

Athletes in intermittent sports such as badminton, basketball and football require different performance values. The needs of the above sports have their own uniqueness in each performance, but there are the same needs that are needed by the above sports even though they have different characteristics on the field, namely endurance ability, recovery heart rate, and anaerobic capacity. These three variables can be improved with several training models including high volume interval training (HVIT) and polarized training (POL). The application of HVIT begins with a low intensity of around 65-75% of the maximum oxygen volume VO₂max (VO₂max) or <80% of the maximum heart rate or <2mmol.L⁻¹ blood lactate [1]. This type of training increases vo₂max by increasing stroke and plasma volume. This model of training is often known as training in the aerobic endurance formation phase, usually occurring at the beginning of the

periodization phase. Often coaches in making periodization make the initial goal of building muscle endurance and cardiorespiratory endurance.

POL is a combined training model of high volume and high intensity with the hope of maximizing improvements in athlete performance such as endurance and anaerobic capacity. This training model is a unique concept because it combines the two concepts of the above models. The obstacles in the field in improving athlete performance are maximizing aerobic, anaerobic as demands of intermittent sports more effectively. Because of the uniqueness of the three models above, the researchers took the initiative to test the three models to determine which model is more effective in improving athlete performance and finding the right phase in implementing the model as a variation in the training program. The output of the application of the three models by measuring the time of exhaustion and VO₂max, recovery heart rate and anaerobic capacity. This training model is a combination of the two training models above between high volume and high intensity with the aim of answering the debate about which training model is more effective in improving adaptability and athlete performance. Polarized training is a concept of mixed training between low and high intensity (polarization) or a gradual decrease in training volume from low to high intensity [2].

The polarized training (POL) model consists of a high percentage of low intensity exercise (75-80%) accompanied by a small amount of time at moderate intensity (5 - 10%) with the remainder spent at high intensity (15 - 20%) [3]. This polarized model provides better ability than HIIT in increasing VO₂max. Some opinions state that polarized training, which combines two interval training modalities—HIIT and SIT—is advantageous for building aerobic capacity because it significantly raises maximal aerobic power (APmax) and oxygen consumption in experienced cyclists [4], [5].

The recovery pulse rate is important in a sport as an asset to maintain the quality of the athlete's performance in the next match. This study showed that faster HRR associated with functional overreaching in endurance-trained athletes can be observed at training intensities (60-100% maximal oxygen speed or MAS). More specifically, Vo₂Maxi observed that the magnitude of HRR acceleration with functional overreaching was greatest at the lowest intensity (60-65% of MAS) [6]. Although previous research has shown that faster HRRs may indicate an improved training status, the results of the above research confirm that this may not always be the case.

2 Method

This study uses a quantitative type with a comparative design. This study has three types of variables including independent and dependent variables. high volume training and polarized training as independent variables. The dependent variables include endurance and anaerobic capacity. The sample of this study used sports students aged 19-22 years with sampling techniques using purposive sampling. The required criteria include students who are active in sports with a minimum of 3 times a week, have sports that fall into the intermittent category.

The implementation of the study for 9 weeks plus 2 days for data collection for the initial test and final test. The tests used included Treadmill, Fitmate Pro, and wireless heart rate. Treadmill is used as a means to run with the help of fitmate pro to measure time exhaustion, vo2max and anaerobic capacity. Wireless heart rate is used to measure pulse rate which will be used in analyzing aerobic, anaerobic capacity.

Implementation of high volume training (HVIT)

The HVIT program consists of 3 blocks with each training for three weeks including 2 weeks of high volume training followed by 1 week of recovery. Two weeks of high volume with 6 training sessions each consisting of 3 exercises of 45 minutes of low intensity, 2 exercises of 60-90 minutes of low intensity.

Implementation of polarized training (POL)

The POL program consists of 3 blocks with each training for three weeks including 2 weeks of high intensity and high volume training followed by 1 week of recovery. High intensity and high volume each 6 training sessions with two HIIT exercises for 45 minutes, two high volume exercises for 60-90 minutes.

The data collection technique of this study uses several ways including measurement of aerobic capacity measured from the amount of VO₂max and time of exhaustion, pulse rate every minute during activity. Measurement of anaerobic capacity using the percentage of the appearance of anaerobic threshold during the running test to the maximum. Data analysis was carried out using descriptive analysis, assumption testing and hypothesis testing using paired sample t-test in each group based on data from the initial and final tests.

3 Results

The mean of the test results for each group is covered in the study's summary of the findings. The test results will be entered and computed using SPSS version 25 depending on the group and kind of exercise used.

Table 1. Descriptive analysis results

Variable	Indicator	Mean
VO ₂ max	Pre HVIT	42.42
	Post HVIT	48.49
	Pre POL	42.15
	Post POL	53.15
Anaerobic capacity	Pre HVIT	58.60
	Post HVIT	58.00
	Pre POL	45.60
	Post POL	49.50

Based on the results of the analysis, it shows that the results of Vo2 Max in both exercise groups have increased in detail as follows in the Pre-test and Post-test measurements of the HVIT group have an achievement of 42.42 + 48.49 ml / kg / min, while in the Polarized Training (POL) group shows an achievement of 42.15 + 53.15 ml / kg / min. so that based on the data above it can be concluded that the highest increase is in the POL group. This is different from anaerobic capacity which shows that the HVIT group experienced a decrease of 0.6 although this is quite small, in contrast to the POL group which experienced a considerable increase of 3.9.

Table 2. The result of paired sample t-test

Variable	Indicator	Normality Test	Sig.
VO ₂ max	Pre HVIT	0.311	0.000
	Post HVIT	0.263	
	Pre POL	0.285	0.000
	Post POL	0.061	
Anaerobic capacity	Pre HVIT	0.576	0.217
	Post HVIT	0.290	
	Pre POL	0.701	0.000
	Post POL	0.133	

Based on the results of the analysis, it shows that overall, the data is normally distributed, but we can see that in the POL group post data section, the results are quite close to the significant test limit, which means that there are some data that have similarities. Based on these results, it becomes the basis for continuing the hypothesis analysis. In addition, the results of paired test analysis in the HVIT and POL groups showed a significant increase in both exercise groups on the VO2 Max variable. so that it can be used as a finding that the two groups have a good impact on increasing the aerobic endurance of the samples, especially in intermittent sports. In contrast to the anaerobic capacity variable which shows that the two groups produce quite striking differences in results, because the HVIT group did not experience an increase, while in the POL group the increase was significant. This is a finding in this study that the application of the POL method is better in increasing anaerobic capacity than the HVIT group.

4 Discussion

The research showed that the ability of student peer tutors to provide constructive feedback and be good role models had a positive influence on student motivation and performance in volleyball training sessions. The feedback they receive as an important means to improve their technical and strategic skills in playing volleyball, 33.3% stated that almost every training session was given feedback, 27% stated that every training session was given feedback, 33.3% stated that sometimes feedback was given, and few reports for rarely given feedback.

The study that was presented demonstrated that the application of volume training and polarized training had an impact on the group of trained cyclists. The peak anaerobic

power value remained constant during the sprint interval testing methodology, however the average anaerobic power, which was derived from the four repeats, increased concurrently. These findings could supplement other studies [6] that detailed the advantages of polarized training on aerobic capacity levels in endurance athletes. Similar to the study that was just described, there was a gain in both maximal aerobic power and maximal oxygen uptake among the POL group of students. Numerous writers came to the conclusion that engaging in physical activity with endurance [7]. These findings could support earlier research that showed how polarization training improved endurance athletes' levels of aerobic capacity [5]. Similar to the study that is being presented, there was also an increase in the maximal oxygen absorption and maximal aerobic power among the cyclists in the experimental group. When compared to the findings of research published in other scientific articles, the study's findings about the decrease in quadriceps femoris muscle thickness are different. Many writers come to the conclusion that using consistent strength [8] endurance [7], and interval [9]. Muscle thickness rises with exercise. Training regimens that combine endurance and strength training have also been shown to enhance muscle thickness [7], as well as regimens including interval training and strength training [10]. The persons who took part in the studies mentioned earlier were not trained. On the other hand, cyclists in the study reported in this publication had trained methodically before the experiment. Given this, it is reasonable to assume that the starting degree of physical activity played a role in explaining the variations between the results of this study and the authors' previously mentioned research.

Strength training may act as a catalyst to cause an increase in muscle thickness in endurance athletes [11]. A similar outcome was shown when SIT-style instruction was given to experienced hockey players [12]. However, a number of authors have contended that athletes' muscle thickness does not develop as a result of adopting training regimens designed with strength and endurance training. Trial experiment included SIT in addition to HIIT and endurance training, just like the study [12], however no strength training was done. We hypothesized that intense SIT training among mountain bike riders would lead to the development of muscle thickness, but our investigation suggests that endurance training may have prevented this growth. Surprisingly, we also saw in the E group a reduction in the thickness of the left and right quadriceps femoris muscles during our experiment. A different SIT training protocol could possibly account for discrepancies in the effects of the experiment reported in this publication and the experiment by Naimo et al. [12]. The maximal repetitions in our investigation took place over 30 seconds each. Furthermore, maximal repetitions lasting 10–30 s were used by Naimo et al [12]. The rest intervals between the repeats were the primary distinction. While Naimo [12] used a 4-minute rest interval between maximal sprints, we employed an active rest of 90 seconds in our study. According to Campos et al. [13], increasing the number of repetitions performed during strength training and utilizing a short rest interval between repetitions, which does not allow for appropriate rest, have no effect on changes in muscle thickness. Strength training with extended rest intervals and few repetitions produced the reverse result, i.e., an increase in muscle thickness [13]. According to other research (on animals), using intervals for resistance training [14] or interval training [15] that do not allow for the ideal rest in between repetitions causes a decrease in muscle thickness (muscle atrophy). This is due to the fact that implementing a brief rest interval caused the

expression of proteins with a catabolic function to rise and the expression of proteins with an anabolic function to fall [15].

The intensity of training required to reach the peak provides a clear mechanism explaining why the periodization pattern leads to improved physiology and greater performance [16]. On the one hand, research has demonstrated that during the decline phase, maximizing relative intensity and decreasing training volume lead to peak performance [17]. According to tradition, training intensity has a major influence in consolidating the physiological adaptations and performance of well-trained athletes in the 14 days leading up to the race that they are primarily targeting [18]. As a result, no single value can fully account for the peak; rather, it stems from a confluence of hormonal, psychological, muscular, and cardiovascular variables resulting from high-intensity exercise [19] that work in concert to optimize exercise adaptation. According to this logic, gradual increases in intensity throughout an exercise program can facilitate the achievement of goal-appropriate peak performance. We have shown how an initial increase in intensity in the first 8 weeks, as was the case in the POL group, resulted in a relevant performance improvement only on its test, while there was no improvement for capacity.

5 Conclusion

Polarized training significantly increases aerobic endurance and anaerobic capacity in intermittent athletes, in contrast to High Volume Intensity Training significantly increases aerobic endurance only.

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