

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/351401748>

# HIGH-INTENSITY INTERVAL TRAINING, FARTLEK TRAINING & OREGON CIRCUIT TRAINING: WHAT ARE THE BEST EXERCISES TO INCREASE VO<sub>2</sub> MAX?

Article in *Annals of Tropical Medicine and Public Health* · January 2021

DOI: 10.36295/ASRO.2021.24363

CITATIONS

3

READS

1,242

9 authors, including:



Rifqi Festiawan

Universitas Jenderal Soedirman

65 PUBLICATIONS 260 CITATIONS

SEE PROFILE



Lim Boon Hoi

2 PUBLICATIONS 6 CITATIONS

SEE PROFILE



Fuad Noor Heza

Universitas Jenderal Soedirman

7 PUBLICATIONS 6 CITATIONS

SEE PROFILE



Adi Wijayanto

IAIN Tulungagung

32 PUBLICATIONS 39 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



DEVELOPMENT OF TRADITIONAL SPORTS-BASED GAMES IN LEARNING TO IMPROVE THE FUNDAMENTAL MOVEMENT SKILLS OF CHILDREN [View project](#)



Asthma and physical activity [View project](#)

## HIGH-INTENSITY INTERVAL TRAINING, FARTLEK TRAINING & OREGON CIRCUIT TRAINING: WHAT ARE THE BEST EXERCISES TO INCREASE VO<sub>2</sub> MAX?

Rifqi Festiawan<sup>1</sup>, Lim Boon Hoi<sup>2</sup>, Siswantoyo<sup>3</sup>, Ngadiman<sup>1</sup>, Indra Jati Kusuma<sup>1</sup>, Fuad Noor Heza<sup>1</sup>, Bayu Suko Wahono<sup>1</sup>, Adi Wijayanto<sup>4</sup>, Sri Sumartiningih<sup>5</sup>

<sup>1</sup>Department of Physical Education, Faculty of Health Sciences, Jenderal Soedirman University.

<sup>2</sup>University of Malaya. Malaysia.

<sup>3</sup>Sport Science Faculty, Yogyakarta State University. Indonesia.

<sup>4</sup>Graduate Study Program of Madrasah Ibtidaiyah Teacher Education, State Islamic Institute of Tulungagung

<sup>5</sup>Department of Sport Science, Faculty of Sport Science, Semarang State University

**Corresponding author:** Rifqi Festiawan, E-mail: [rifqi.festiawan@unsoed.ac.id](mailto:rifqi.festiawan@unsoed.ac.id)

### Abstract

**Objective:** This study aims to determine the effect of High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training on the level of VO<sub>2</sub> Max Athlete Soedirman Expedition VII and find out which exercises have the best influence.

**Method:** This study uses a pre-experimental method with two group pretest posttest design. The study population numbered 40 people and used a total sampling technique to obtain a sample of 30 people. The research instrument used is the Multistage Fitness Test (MFT). Data analysis techniques used are Paired T-Test and Independent T-Test.

**Results:** The results showed that there was an effect of High Intensity Interval Training (HIIT) ( $p = 0,000$ ), Fartlek Training ( $p = 0,000$ ) and Oregon Circuit Training ( $p = 0,001$ ) on increasing the level of VO<sub>2</sub> Max Soedirman VII Athlete Expedition. But there is no significant difference in effect between High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training on increasing the level of VO<sub>2</sub> Max athletes of Soedirman VII Expedition. With these results there is no difference in the effect of the three types of exercise on increasing VO<sub>2</sub> Max capacity, however, when viewed from the percentage increase, the High Intensity Interval Training method shows better results with a percentage increase of 40.68% and it is recommended to increase VO<sub>2</sub> Max capacity.

**Keywords:** High Intensity Interval Training- Fartlek Training- Oregon Circuit Training- VO<sub>2</sub> Max

**How to cite this article:** Festiawan R, Hoi LB, et al (2021): High-intensity interval, farlek training & Oregon circuit training: What are the best excercises to increase VO<sub>2</sub> max? *Ann Trop Med & Public Health*; 24(S03):

SP24363. DOI: <http://doi.org/10.36295/ASRO.2021.24363>

### INTRODUCTION

Today, climbing mountains has become one of the most popular sports in many circles. This is evidenced by the number of tourists visiting the mountain and people participating in high-altitude sports including climbing, trekking and various snow sports (skiing, snow-boarding, etc.) have increased in recent years.(1).

Every year, more than 100 million tourists travel to highland areas around the world. More specifically, some forty million mountaineers and skiers climb as high as 5,000 m in the Alps(2). In Africa every year, around 40,000 tourists climb the 5,800m-high summit of Kilimanjaro, and more than 4,000 climbers have tried to climb Mt. The Aconcagua is 6,962 m high(3). There was a high increase in the number of climbers in Nepal between 1994 and 2000, of 450%, along with a sevenfold increase in climbers seeking to ascend some of the Himalayan's most difficult and challenging peaks above 8000 m. From 1995 to 2006, more than 30,000 climbers attempted to reach the highest peak in the world, Mount Everest(4).

But on the other hand, there are many problems that often occur when climbing, one of which is physical problems, expedition participants must have good physicality from every component of the physical condition. Preparation for physical exercise that is done well will result in satisfactory achievement(5). Physical exercise also trains participants to adapt to mountains. In principle, physical training preparation is important in expeditions because good training determines the quality and ability to achieve optimal performance demands. The importance of the training preparation model as a basis for maximum achievement, especially in the mountains in accordance with the training standards of the physical condition itself, where in an open state disturbance is very likely to occur, becomes the sole purpose of outdoor adventure. Climbing that realm is for the purpose of attainment so physical exercise is very important.

Physical condition is the initial requirement and as a basis for following training in achieving an achievement. Physical condition is the foundation and barometer of performance achievement and the body's ability or fitness component required by an athlete(6).Cardiovascular endurance is often referred to as VO2 Max. VO2 Max is the maximum capacity of the lung, heart and muscle systems to absorb oxygen(7). There are several factors that can affect your VO2 Max level including age, gender, fitness and exercise(8)In line with this opinion, to get a good VO2 Max quality, many training methods can be applied such as High Intensity Interval Training (HIIT) and Fartlek Training.

*High Intensity Interval Training* (HIIT) is one of the most efficient exercises in improving physical abilities that includes strength, aerobic and anaerobic endurance, flexibility and coordination in one training session (9). The origins of High Intensity Interval Training (HIIT) can be traced back to the early 1900s, when Olympic runner Paavo Nurmi and his coach Lauri Pihkala began using the interval training system for their training sessions.(10). High Intensity Interval Training (HIIT) is known to be effective in increasing musculoskeletal, metabolic, and cardiorespiratory(11). This exercise model has received a lot of attention worldwide because of the tissue adaptations it produces, similar to the adaptations produced by other aerobic exercises. However, what really makes High Intensity Interval Training (HIIT) so attractive to sportsmen around the world, is the time it takes to complete a training session.(12). That's where High Intensity Interval Training (HIIT) comes in. High intensity interval training sessions can be completed in 20-30 minute timeframes, depending on the duration of each exercise. High Intensity Interval Training (HIIT) is a form of exercise that is done with high intensity and an active and passive recovery process(13).

To increase VO2Max The training program should be done carefully, systematically, orderly and constantly increasing, following the principles and methods of accurate exercise in order to achieve the expected objectives. Thus, an alternative training that can be used and applied to increase VO2 Max is circuit training. Circuit Training is a training system that can improve the overall fitness of the body, namely the power elements, durability, strength, agility, speed, and components of other physical conditions. Circuit training is an exercise model combining strength, power, speed and endurance exercises anaerobic or endurance Aerobic. Circuit exercises can be said to influence the athlete's stamina quality in the short term. This is because the circuit exercises include almost all components of the physical condition performed with high tempo simultaneously in a relatively short period of time (12). The selection of the training loads in the training circuit should be adjusted to the general purpose of Circuit training that is to be achieved. Circuit training carried out in a designated area has several posts, for example 8 posts. Each post, implementation should be done in the form of certain exercises. Activities in each post are development for all physical fitness components (18). The term "circuit training" describes the way a workout is structured rather than the type of exercise performed. It typically consists of a series of exercises or stations completed in succession with minimal rest in between. Circuit routines allow the athlete or coach to create an endless number of workouts and add variety to routine training programs (20).

*Fartlek Training* to increase VO2 Max to improve physical conditions by walking, jogging, and sprinting. Based on observations made by researchers, people who do fartlek exercises feel a challenge because those who usually only do jogging with a slow and continuous rhythm, try other alternatives with fartlek exercises that combine walking-jogging-sprints. This further confirms that the requirements for carrying out training with heart and lung fitness are a frequency of 3-5 times each week, the intensity of the exercise is at 75% -85% of the maximum heart rate, for those who are just starting to exercise or are elderly, start- is training at a lower intensity, for example 60%, continue to gradually increase until reaching the proper training intensity and a duration of up to 20-60 minutes will be achieved. The *Fartlek* training method is a lot of fun and aims to increase the athlete's strength and aerobic capacity(14). The principle of *fartlek* training is to run with variations, this means that we can set the desired walking speed during training according to the preferences and conditions / abilities of the athlete.(15)

Some of the results of previous research related to High Intensity Interval Training (HIIT), *Fartlek* Training and Oregon Circuit Training include: (1) HIIT can significantly increase VO2 Max levels for both young and adult ages. Furthermore, when comparing the two training modes, the advantage in VO2 Max is greater with HIIT. In addition, the determination of intensity, volume and type affects the results obtained(16); (2) *Fartlek* exercise has a significant effect in increasing maximum oxygen consumption and resting pulse rate (Muthu Eleckuvan, 2014).

This study aims to determine the effect of HIIT and *Fartlek* Training on the VO2Max level of Soedriman VII Expeditionary Athletes. One of the cardiorespiratory qualities can be seen from the VO2 Max level, which is the maximum amount of oxygen the body can consume in milliliters per kilogram (body weight), per minute (ml / kg -1 / minute).(17). The greater the VO2 Max a person has, the better physical fitness will be, where the quality of the biometric components will also be better(18). The higher the VO2 Max value, the higher the body's ability to consume oxygen for metabolism. VO2 Max is the maximum aerobic capacity representing the maximum amount of oxygen consumed per unit of time by a person(19). Thus, the more oxygen the body consumes, the better, VO2 Max is needed, including for sports activities such as mountain climbing (Festiawan et al., 2020).

From these studies, all of them have only one independent variable, HIIT or *Fartlek* Training alone, besides that there is no study that has tested these two training models on mountaineering athletes, so this research can be an alternative source for climbing mountain.

## METHODS

The design of the research used in this research is "two group pretests and posttest Design", in this design there are two groups that are divided with ordinal pairing techniques, then given a pretests to know the initial state is there a difference from Experimental group to be researched. A good pretests result if the value of the experiment group does not differ significantly (20). The population used was all of Sudirman VII's expedition athletes numbering 30 people, With an average age of 19-21 years, with male gender, the average weight of the sample is 56.2 Kg and the average body height is 165.3 cm. The sampling technique used is a total sampling. The data obtained were then entered into the norms for the level of physical fitness in Table 1.

**Table 1.** Fitness Level Norms by Age

No.	Status	18-25 years
1.	Very Fit	> 60
2.	Fit	52-60
3.	Above average	47-51
4.	Average	42-46
5.	Below average	37-41
6.	Not Fit	30-36
7.	Very Unfit	<30

The instrument used by researchers in this study was the Multi stage Fitness Test (MFT) method, to determine the Vo2Max level of the Sudirman VII expedition. The calculation of VO2 Max using the MFT (Multistage Fitness test) test can be seen in the following table 1. The data in this study include: A prerequi site test that includes data effectiveness test and data homogenization test, followed by a hypothesis test using paired t-test and independent t-test.

## RESULTS

This research was conducted four times a week at Jenderal Soedirman University, Purwokerto. The research sample was 30 athletes of Sudirman VII expedition. The implementation of the pre-test was carried out in January 2019 and the final test (posttest) in July 2019.

### Analysis of Research Results

The dependent variable of this research is Passing ability. Compilation of ability data using the Multistage Fitness Test (MFT). The data obtained from the test can be seen in Table 2.

Table 2. Research Data

DATA	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Pretest HIIT group	38	48.5	43.5	1,946
HIIT group posttest	52.5	64	60.3	2,802
Pretest Fartlek group	40.2	49	42.2	2,236
Posttest of the Fartlek Group	52	63.5	58.6	2,871
Pretest Circuit Training	40	49	42	2,126
Posttest Circuit Training	52	63	58,5	2,248

Table 3. Pretest Results VO2 Max Level

No.	Category	Score	Frequency	Percentage
1.	Very Fit	> 60	0	0%
2.	Fit	52-60	0	0%
3.	Above average	47-51	6	20%
4.	Average	42-46	14	46,7%
5.	Below average	37-41	10	33,3%
6.	Not Fit	30-36	0	0%
7.	Very Unfit	<30	0	0%
	total		30	100%

From Table 2, for the variable VO2 Max level of Sudirman VII Expedition Athletes (Goes to Aconcagua: Argentina) which has a total sample size of twenty samples, the mini-mum value is obtained = 38, the maximum value = 64, the mean (mean) of the tactics group is pretest = 43.5 and post-test = 60.3, while the mean (mean) of the strategy group is pre-test = 42.2 and post-test = 58.6, then the standard deviation of the tactics group is pre-test = 2.066 and post-test = 2.348, while the standard deviation of the strategy group is pre-test = 1.838 and post-test = 2.726.

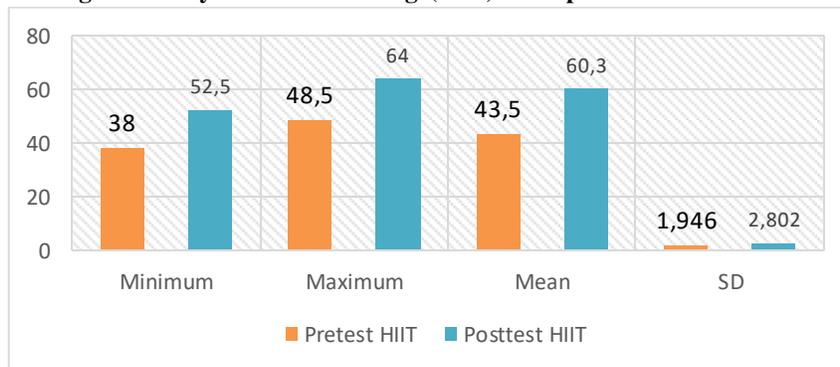
The results of the analysis from Table 3 show that there is no sample who gets the very fit category, then no sample gets the fit category, then the sample that gets the category above the average is six samples with a percentage of 20%, then the sample who gets the category In the average category, there are fourteen samples with a percentage of 46,7%, and the sample that gets the category below the average is ten samples with a percentage of 33,3%, then no sample gets the unfit category and no sample gets the very unfit category.

**Table 4.** Posttest Results VO2 Max Level

No.	Category	Score	Frequency	Percentage
1.	Very Fit	> 60	11	36,7%
2.	Fit	52-60	19	63,3%
3.	Above average	47-51	0	0%
4.	Average	42-46	0	0%
5.	Below average	37-41	0	0%
6.	Not Fit	30-36	0	0%
7.	Very Not fit	<30	0	0%
total			30	100%

Analysis results From Table 4, it shows that there are eleven samples who get the very fit category with a percentage of 36,7%, then there are nineteen samples who get the fit category with a percentage of 63,3%, then no sample gets the category above average, then no sample gets obtained the average category, and none of the sample was categorized as below average, unfit and very unfit.

**Research Data of the High Intensity Interval Training (HIIT) Group**

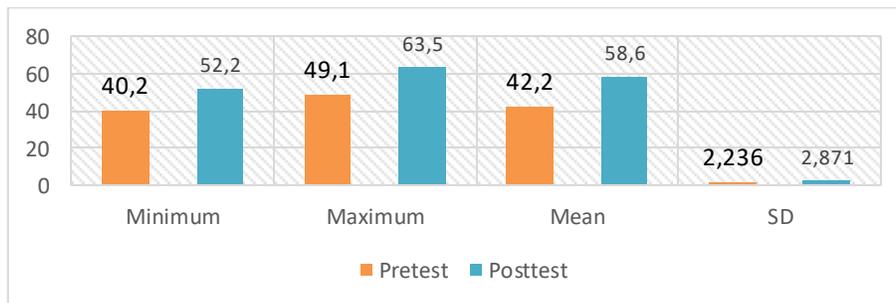


**Figure 3.** Group Research Results Diagram *High Intensity Interval Training (HIIT)*

The results of the study for the High Intensity Interval Training (HIIT) group had a total of ten samples obtaining a minimum value of pretest = 38 and posttest = 52.5, the maximum value of pretest = 48.5 and posttest = 64. The mean (mean) of pretest = 43.5 and posttest = 60.3. Then the standard deviation of the High Intensity Interval Training (HIIT) group pretest = 1.946 and posttest = 2.802.

**Research Data of the Fartlek Training Group**

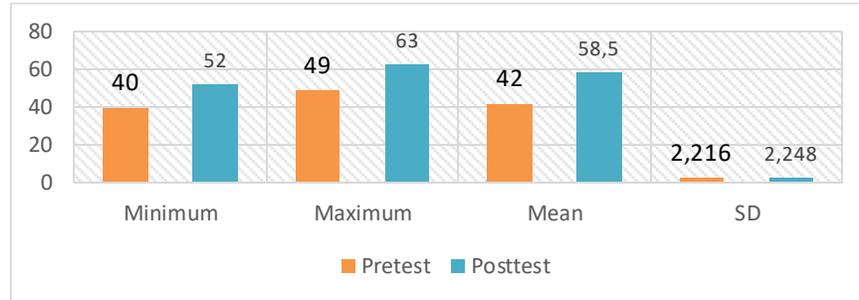
The results of the research for the Fartlek Training group had a total of ten samples obtaining a minimum value of pretest = 40.2 and after practice = 52.2, the maximum value of pretest = 49.1 and posttest = 63.5. The mean (mean) pretest = 42.2 and posttest = 58.6. Then the standard deviation of the Fartlek Training group pretest = 2.236 and posttest = 2.871.



**Figure 4.** Fartlek Training Group Research Result Diagram

**Research Data of the Oregon Circuit Training Group**

The results of the research for the Oregon Circuit Training group had a total of ten samples obtaining a minimum value of pretest = 40 and after practice = 52, the maximum value of pretest = 49 and posttest = 63. The mean (mean) pretest = 42 and posttest = 58.5. Then the standard deviation of the Fartlek Training group pretest = 2.126 and posttest = 2.248.



**Figure 5.** Oregon Circuit Training Group Research Result Diagram

**Prerequisite Test**

The prerequisite test in this study consisted of a data normality test and a data homogeneity test.

**Data Normality Test**

The data normality test is one of the tests that aims to determine whether the data in the study is normally distributed or not. Data is normally distributed if the significant value is greater than 0.05 or (Sig. > 0.05), on the other hand, if the data is smaller than 0.05 or (Sig. < 0.05), the data is said to be abnormal. In this study, the normality test was carried out using SPSS assistance with the Shapiro Wilk test. The results of the normality test can be seen in Table 5.

**Table 5.** Normality Test Results Data

DATA	Statistics	Df	Sig	Conclusion
Pretest High Intensity Interval Training (HIIT) group	,951	10	,569	Normal
Posttest High Intensity Interval Training (HIIT) Group	,959	10	,774	Normal
Posttest Fartlek Training Group	,971	10	,851	Normal
Posttest Fartlek Training Group	,941	10	,669	Normal
Posttest Oregon Circuit Training Group	,971	10	,751	Normal
Posttest Oregon Circuit Training Group	,941	10	,769	Normal

From the data in Table 5, it can be concluded that the Sig value of the group pretest and posttest *High Intensity Interval Training (HIIT)*, *Fartlek Training* Group and *Oregon Circuit Training* Group all of them are greater than 0.05 or the value of Sig > 0.05, it can be concluded that the data for the two groups are normally distributed.

**Data Homogeneity Tests**

Data homogeneity test is one of the tests used to determine the similarity of the variants of the study population. Homogeneity test of this data was carried out with SPSS assistance. The decision making criteria is if the value of Sig > 0.05 or t count < t table, it means that the sample is homogeneous.

**Table 6.** Homogeneity Test Result Data

DATA	Levene Statistics	df1	df2	Sig.	Conclusion
Pretest High Intensity Interval Training (HIIT) group	,398	1	10	,689	Homogeneous
Postest High Intensity Interval Training (HIIT) Group	,468	1	10	,752	Homogeneous
Postest Fartlek Training Group	,472	1	10	,760	Homogeneous
Postest Fartlek Training Group	,497	1	10	,772	Homogeneous
Postest Oregon Circuit Training Group	,472	1	10	,740	Homogeneous
Postest Oregon Circuit Training Group	,497	1	10	,732	Homogeneous

From Data in Table 6, it can be concluded that the Sig values of the pretest and posttest of the High Intensity Interval Training (HIIT) group, the Fartlek Training group, and Oregon Circuit Training Group are all greater than 0.05 or the Sig value > 0.05, it can be concluded that the variants of the two groups are homogeneous.

**Hypothesis testing**

The data analysis technique used is the t-test with a significance of 5%. There are two types of t-test, namely Paired t-test and independent sample t-test.

**Table 7.** Result of Paired T-Test

Paired Sample T-Test		Sig. (2-tailed)
Pair 1	Pretest HIIT Group Posttest HIIT Group	,000
Pair 2	Pretest Fartlek Group Posttest Fartlek Group	,000
Pair 3	Pretest Oregon Circuit Training Group Posttest Oregon Circuit Training Group	,001

Based on paired t-test analysis (Table 7), the Sig. (2-tailed) the High Intensity Interval Training (HIIT) group was 0.000, the Sig. (2-tailed) the Fartlek Training group was 0.000 and the Sig. (2-tailed) the Oregon Circuit Training group was 0.001. With these results, both groups have a Sig value. <0.05 and it can be concluded that there is a significant effect between High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training on the VO2 Max level of Soedirman VII Expedition Athletes (Goes to Aconcagua: Argentina).

From the table 8, the results of Sig. (2-tailed) the three groups is 0.676. With these results the three groups have a value of 0.676 > 0.05 and it can be interpreted that there is no significant difference in effect between High Intensity Interval Training, Fartlek Training and Oregon Circuit Training on the level of Vo2Max Athlete Soedirman Expedition VII.

**Table 8.** Independent T-Test Test Results

Independent Samples Test		F	Sig.	T	Df	Sig. (2-tailed)
Posttest results VO2 Max level	Equal variances assumed	,282	,789	-,574	44.5	,676
	Equal variances not assumed			-,574	43.6	,676

**Table 9.** Table of Difference Increase in VO2 Max

Research variables	Mean Pretest	Mean Post-test	Difference	Percentage
High Intensity Interval Training (HIIT)	43.5	60.3	16.8	40.69%
Fartlek Training	42.2	58.6	16.4	39.69%
Oregon Circuit Training	42	58,5	16,5	39,98%

Table 9 shows the difference in the increase in VO2 Max levels which can be seen from the difference between the pretest and posttest means in the two groups. The difference in the High Intensity Interval Training (HIIT) group was obtained from the pretest average of 43.5 and the posttest average of 60.3 having a difference of

16.8 and the percentage being 40,69%. Whereas in the Fartlek Training group, the difference was obtained from an average pretest of 42.2 and posttest of 58.6 having a difference of 16.4 and a percentage of 39.28%. and the Oregon Circuit Training group, the difference was obtained from an average pretest of 42 and posttest of 58.5 having a difference of 16.4 and a percentage of 39.98%. So it can be concluded that the group that was given High Intensity Interval Training (HIIT) training had a greater increase in their VO2 Max level than the Fartlek Training group and Oregon Circuit Training Group.

## DISCUSSION

This study aims to determine the effect of High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training on the VO2 Max level of Soedirman VII Expedition athletes (Goes to Aconcagua: Argentina).

After that, this study also compared the difference in influence between the two. The study began with a pretest, after which treatment was given for sixteen meetings using the High Intensity Interval Training (HIIT) training method and Fartlek Training which had a balanced portion between the two exercises, then in the final stage continued with posttest. This study uses the research design "Two Group Pretest-Posttest Design" which is a research design that functions to determine the effect of each group before and after treatment and then compares the differences in influence through the results of the paired t-test and independent t-test, so that the differences can be known more accurately. The following is a discussion of each research hypothesis:

The results of the statistical analysis of the study for the variable VO2 Max level of athletes in the High Intensity Interval Training (HIIT) exercise method group had a total sample of ten people, the minimum score of pretest = 6 and posttest = 9, the maximum value of pretest = 13 and posttest = 16. (mean) pretest = 9.60 and posttest = 11.80. Then the standard deviation of the High Intensity Interval Training (HIIT) group pretest = 2.066 and posttest = 2.348. From these data then tested with Paired t-test and obtained t-test results with the value of Sig. The pretest and posttest (2-tailed) High Intensity Interval Training (HIIT) groups were 0.001. So that from these results it can be seen that the Sig. smaller than 0.05 or 0.001 <0.05, this means that High Intensity Interval Training (HIIT) training has a significant effect on increasing the VO2 Max level of Sudirman VII Expedition Athletes (Goes to Aconcagua: Argentina).

This is in line with several previous studies including research from (21) who said that High Intensity Interval Training (HIIT) could increase VO2 max (SMD 0.83, 95% CI 0.56 to 1.10;  $p < 0.00001$ ) with a large effect on the normal weight trial sample. Meanwhile, (22) concluded that in a young sample, 20 periodic HIIT sessions led to a significant increase in VO2 Max accompanied by an increase in SV and maximal CO. The data suggest that the increase in VO2 Max as a result of HIIT is due to an increase in central O2 delivery as is often reported.

Another study from (23) mentioned that HIIT is effective for increasing VO2 Max in healthy adults, overweight / obese and athletes. With several variations of HIIT, short work interval HIIT ( $\leq 30$  seconds of work / session), low-volume HIIT ( $\leq 5$  minutes of work / session) and short-term HIIT ( $\leq 4$  weeks) are effective and efficient ways to increase VO2 Max levels. For better results in increasing VO2 Max, several HIIT training programs are recommended including long-interval ( $\geq 2$  minutes / submaximal intensity), high-volume ( $\geq 15$  minutes / session) and moderate to long-term ( $\geq 4 - 12$  weeks). Based on this description, it can be concluded that High Intensity Interval Training (HIIT) is defined as an exercise consisting of several cycles of short or medium duration and high intensity and each cycle is interspersed with rest periods in the form of light intensity exercise.

According to (24) various types of exercises that can be done using HIIT include walking, running, cycling, climbing stairs, and swimming. HIIT consists of three stages, namely warm-up, maximum intensity training and cooling down. Warming up is carried out for three minutes, followed by six cycles. Each cycle consisted of two

minutes of maximum intensity exercise with an intensity of 80-90% reserve heart rate and one minute of moderate intensity exercise with an intensity of 50-60% reserve heart rate. The workout ends with a three minute cooling down exercise. Therefore, by doing HIIT, a person's VO2 Max level can be better and it is possible to carry out physical activities of a longer duration.

The results of the statistical analysis of the research for the variable VO2 Max level of athletes in the Fartlek Training training method group had a total sample size of ten people, obtained a minimum value of pretest = 6 and posttest = 9, the maximum value of pretest = 13 and posttest = 16. 9.60 and posttest = 11.80. Then the standard deviation of the High Intensity Interval Training (HIIT) group pretest = 2.066 and posttest = 2.348. From these data then tested by Paired t-test and obtained t-test results with the value of Sig. The pretest and posttest (2-tailed) High Intensity Interval Training (HIIT) groups were 0.001. So that from these results it can be seen that the Sig. smaller than 0.05 or 0.001 <0.05, this means that High Intensity Interval Training (HIIT) training has a significant effect on increasing the VO2 Max level of Soedirman VII Expedition Athletes (Goes to Aconcagua: Argentina).

These results are in line with several previous studies including research from (25) who concluded that the fartlek training method had an effect on increasing the maximum oxygen volume with a significance value of 0.000 at the sig ( $\alpha$ ) 0.05 level. In addition, research from (26) which states that the Fartlek Training method is effective for increasing the VO2 Max of athletes, but Fartlek Training is more effective in increasing VO2 Max for football players who have a high BMI. Research results from (27) shows that respondents in the Fartlek group increased body resistance (VO2 Max) by an average pretest of 36.84, and posttest of 37.01 with a value of  $p = 0.012$ .

Based on the description above, it can be concluded that Fartlek Training is a form of training that is very good for developing endurance in almost all sports, especially sports that require endurance, one of which is mountain climbing. Combining aerobic demands with continuous motion at interval speed, the Fartlek Training method is a very fun exercise aimed at increasing the strength and aerobic capacity of the athlete. Fartlek Training can affect cardiovascular endurance, because Fartlek Training strengthens the respiratory muscles so that it provides benefits for the maintenance of cardiovascular fitness, with increasing lung volume will accelerate the process of gas exchange (diffusion).

Then for the independent t test results are Sig. (2-tailed) *High Intensity Interval Training (HIIT) and Fartlek Training* is equal to 0.676. With result then both groups have a Sig value. > 0.05, and it can be interpreted that there is no significant difference between High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training on the VO2 Max level of Soedirman VII Expedition athletes (Goes to Aconcagua: Argentina). This is because the three exercises (treatment) both have an influence on the VO2 Max level of Soedirman VII Expedition athletes (Goes to Aconcagua: Argentina). The difference is in the difference between the mean (mean) of the all groups, namely the High Intensity Interval Training (HIIT) group got the pre-test = 43.5 and the post-test = 60.3, while the Fartlek group's Training, namely pre-test = 42.2 and post-test = 58.6. Based on these results, the difference in influence can be compared in another way, namely looking at Table 9 regarding the difference in the increase in the two groups, the difference in the High Intensity Interval Training (HIIT) group is obtained from the pretest average of 43.5 and the average posttest of 60, 3 has a difference of 16.8 and the percentage is 40.69%.

The results of this study prove that it turns out that High Intensity Interval Training (HIIT), Fartlek Training and Oregon Circuit Training are able to contribute to increasing the VO2 Max level of Soedirman VII Expedition athletes (Goes to Aconcagua: Argentina).

## CONCLUSIONS

Based on the research results it can be concluded that there is a significant effect of the High Intensity Interval Training (HIIT) training method on the VO2 Max level of Sudirman VII Expeditionary Athletes (Goes to Aconcagua: Argentina). There is a significant effect of the Fartlek Training training method on the VO2 Max level of Soedirman VII Expeditionary Athletes (Goes to Aconcagua: Argentina). There is no significant difference in the effect of the High Intensity Interval Training (HIIT) training method and Fartlek Training on the VO2 Max level of Sudirman VII Expeditionary Athletes (Goes to Aconcagua: Argentina), but when viewed from the average increase, the High Intensity Interval Training Shows better results compared to Fartlek Training and Oregon Circuit Training.

## REFERENCES

1. Davies SEH, Marnewick JL, West S. Rooibos *Aspalathus linearis*—Can it reduce the incidence and severity of acute mountain sickness? A case study of Aconcagua (6962 m) climbing expedition, Argentina. *African J Phys Act Heal Sci* 25 (2 .... 2019;25(June):232–51.
2. Burtscher M, Bachmann O, Hatzl T, Hotter B, Likar R, Philadelphia M, et al. Cardiopulmonary and metabolic responses in healthy elderly humans during a 1-week hiking programme at high altitude. *Eur J Appl Physiol*. 2001;84(5):379–86.
3. Bacon AP, Carter RE, Ogle EA, Joyner MJ. VO2max Trainability and High Intensity Interval Training in Humans: A Meta-Analysis. *PLoS One*. 2013;8(9).
4. Windsor JS, Firth PG, Grocott MP, Rodway GW, Montgomery HE. Mountain mortality: A review of deaths that occur during recreational activities in the mountains. *Postgrad Med J*. 2009;85(1004):316–21.
5. Rahman FA, Kristiyanto A. Mountaineering Physical Activities as Community Recreational Sports. *J Pendidik*. 2018;3(3):398–405.
6. Subarjah H. LATIHAN KONDISI FISIK. *Educacion*. 2013;
7. Smirmaul BPC, Bertucci DR, Teixeira IP. Is the VO2max that we measure really maximal? *Front Physiol*. 2013;
8. P.O I, U.G E. Maximum oxygen uptake and cardiovascular response of Professional male football and Basketball players to Chester step test. *IOSR J Sport Phys Educ*. 2016;
9. Monaco M. The Effect of High Intensity Interval Training vs Resistance-Based Circuit Training Recommended Citation [Internet]. Western Michigan University; 2018. Available from: [https://scholarworks.wmich.edu/honors\\_theses/2999](https://scholarworks.wmich.edu/honors_theses/2999)
10. Kumarassan E, Saravanan J. EFFECT OF INTERVAL AND CIRCUIT TRAINING ON VO 2 MAX OF HOCKEY PLAYERS. *Int J Phys Educ Yoga Heal Sci*. 2016;3(February):37–8.
11. Williams BM, Kraemer RR. Comparison of Cardiorespiratory and Metabolic Responses in Kettlebell High-Intensity Interval Training Versus Sprint Interval Cycling. *J Strength Cond Res*. 2015;29(12):3317–25.
12. Ramos JS, Dalleck LC, Tjonna AE, Beetham KS, Coombes JS. The Impact of High-Intensity Interval Training Versus Moderate-Intensity Continuous Training on Vascular Function: a Systematic Review and Meta-Analysis. *Sport Med* [Internet]. 2015;45(5):679–92. Available from: <http://dx.doi.org/10.1007/s40279-015-0321-z>
13. Paoli A, Pacelli QF, Moro T, Marcolin G, Neri M, Battaglia G, et al. Effects of high-intensity circuit training, low-intensity circuit training and endurance training on blood pressure and lipoproteins in middle-aged overweight men. *Lipids Health Dis*. 2013;12(1):1–8.
14. Jones AM. *Sport and Exercise Physiology Testing Guidelines*. Sport and Exercise Physiology Testing Guidelines. New York: Routledge; 2016.
15. Pratama L, Kushartanti W. The Effects of Circuit and Fartlek Exercise Method and Peak Expiratory Flow on Vo2max. *Adv Soc Sci Educ Humanit Res*. 2019;278(YISHPESS):310–5.
16. Milanović Z, Pantelić S, Sporiš G, Mohr M, Krstrup P. Health-related physical fitness in healthy untrained men: Effects on VO2max, jump performance and flexibility of soccer and moderate-intensity continuous running. *PLoS One*. 2015;10(8):1–14.
17. Marcinko K, Sikkema SR, Samaan MC, Kemp BE, Fullerton MD, Steinberg GR. High intensity interval

- training improves liver and adipose tissue insulin sensitivity. *Mol Metab* [Internet]. 2015;4(12):903–15. Available from: <http://dx.doi.org/10.1016/j.molmet.2015.09.006>
18. Sylta Ø, Tønnessen E, Hammarström D, Danielsen J, Skovereng K, Ravn T, et al. The effect of different high-intensity periodization models on endurance adaptations. *Med Sci Sports Exerc*. 2016;48(11):2165–74.
  19. Sawyer BJ, Tucker WJ, Bhammar DM, Ryder JR, Sweazea KL, Gaesser GA. Effects of high-intensity interval training and moderate-intensity continuous training on endothelial function and cardiometabolic risk markers in obese adults. *J Appl Physiol*. 2016;121(1):279–88.
  20. Sugiyono. *Metodologi Penelitian Kuantitatif, Kualitatif, dan R&D*. CV Alfabeta. 2016.
  21. Batacan RB, Duncan MJ, Dalbo VJ, Tucker PS, Fenning AS. Effects of high-intensity interval training on cardiometabolic health: A systematic review and meta-analysis of intervention studies. *Br J Sports Med*. 2017;51(6):494–503.
  22. Astorino TA, Edmunds RM, Clark A, King L, Gallant RA, Namm S, et al. High-Intensity Interval Training Increases Cardiac Output and V-O<sub>2</sub>max. *Med Sci Sports Exerc*. 2017;49(2):265–73.
  23. Wen D, Utesch T, Wu J, Robertson S, Liu J, Hu G. Effects of different protocols of high intensity interval training for VO<sub>2</sub>max improvements in adults: A meta-analysis of randomised controlled trials. *J Sci Med Sport* [Internet]. 2019;1–7. Available from: <https://doi.org/10.1016/j.jsams.2019.01.013>
  24. Nugraha AR, Berawi KN. Pengaruh High Intensity Interval Training (HIIT) terhadap Kebugaran Kardiorespirasi. *J Major* [Internet]. 2017;6(1):1–5. Available from: <http://juke.kedokteran.unila.ac.id/index.php/majority/article/view/1521>
  25. Reza Agus Hariyanto I Ketut Yoda Gdtm. Pengaruh Pelatihan Fartlek Terhadap Volume Oksigen Maksimal Dan Kecepatan. *E-Journal Ikor Univ Pendidik Ganesha*. 2018;I(1):1–11.
  26. Sukadiyanto Maa. Perbedaan Pengaruh Circuit Training Dan Fartlek Training ... Muh. Akmal Almy, Sukadiyanto 59. *J Keolahragaan*. 2014;2(3):59–68.
  27. Triansyah A, Haetami M. *Pengaruh Fartlek Dan Interval Training Komunitas Parkour And Freerun*. Universitas Tanjungpura Pontianak; 2015.