



The Effect of HIIT on Increasing VO² Max in White Water Rafting Athletes

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Article Info

Article History :

Received : March 2024

Revised : March 2024

Accepted : March 2024

Keywords:

HIIT,
VO² Max,
Rafting,

Abstract

This research was carried out to find out the effect of training using the High Intensity Interval Training (HIIT) model on increasing VO² Max in white water rafting athletes. This research design is an experimental pre-post design. This research used 28 white water rafting athletes, consisting of 16 male athletes and 12 female athletes. The athlete's age range is 16-22 years. All research subjects were in healthy condition. All subjects were given the same treatment, namely training using the HIIT model. Intervention with HIIT cardio training. The HIIT training model uses an intensity of 90-100% of Maximal Heart Rate (MHR). HIIT is done with a ratio of 30 seconds of exercise then 3 minutes of rest. Exercise uses an intensity of 90% MHR in the first week and will be increased every week until it reaches 100% MHR. Exercises were carried out for 6 weeks with a frequency of 4x per week. VO² Max measurements are carried out using a multistage test instrument. In this research, it can be seen that HIIT exercise carried out for 6 weeks with a frequency of 4 times per week can increase athletes' VO² Max. There is a significant difference in VO² Max between male and female athletes with a difference test result of P < 0.05. Exercise using the HIIT model which is carried out for 6 weeks with a frequency of 4x a week can increase the VO² Max of white water rafting athletes. HIIT training can be used as a recommendation to increase VO² Max for white water rafting athletes.



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INTRODUCTION

Physical fitness is a key aspect in measuring an athlete's physical performance. Regular physical activity is a key aspect that can be done to improve physical fitness so that you can achieve optimal physical fitness. Lack of physical activity is also a cause of cardiovascular disease, diabetes mellitus, stroke and obesity (Kour et al., 2019). VO^2 Max is considered the most important variable that describes a person's fitness level and is routinely used to describe a person's cardiorespiratory capacity (Hutajulu et al., 2017). VO^2 Max is the most important component in athlete fitness, so the development of sports science and increasing athlete performance requires an in-depth understanding of various effective methods for increasing maximum oxygen capacity (VO^2 Max). The VO^2 Max value achieved during maximal activity is the best indicator of the level of cardiorespiratory fitness (Kour et al., 2019). VO^2 Max is the maximum amount of oxygen that can be used by a person to carry out physical activity (Huldani et al., 2019). The way to increase VO^2 Max is to do anaerobic training and aerobic training (Patel et al., 2017). Anaerobic exercise is intensive and involves high-intensity activity over a shorter period of time, can increase anaerobic endurance and improve the body's capacity to cope with exercise situations that require rapid energy release (Park et al., 2021). Anaerobic activity can assist the cardiovascular framework with working better, expanding the proportion of oxygen utilization in contracting muscles (Saghiv., 2020).

This expansion in anaerobic capacity is brought about by the preparation program that has been given so the body can adjust so the body can acknowledge heavier burdens and the

body functions can work all the more effectively (Sözen H & Akyıldız C., 2018). Stated that HIIT training can also significantly increase VO^2 Max and improve athlete performance, HIIT is a model of exercise with high intensity with interspersed recovery during each exercise (Coates et al., 2023). This exercise is very effective for improving physical components and will have a good impact on increasing the body's metabolism (Fajrin et al., 2018).

Another exercise that can increase VO^2 Max is aerobic exercise. Aerobic exercise, which typically involves low to moderate intensity exercise performed over longer periods of time, has long been recognized as an effective way to increase aerobic endurance and increase VO^2 Max. Aerobic ability will support the cardiovascular ability to work more effectively so that muscle capacity can be maximized (Watulingas., 2014). Other studies have found that aerobic exercise can increase cardiorespiratory endurance (Budijanto & Kurniawan., 2020). Exercise can also increase blood flow, and help eliminate metabolic waste more quickly, so that recovery ability is faster and fatigue will decrease (Palar et al., 2015).

In this case, American Whitewater, which focuses on fast-flow sports, states that VO^2 Max is an important component in supporting performance for fast-flow sports (American Whitewater., 2011). Rowing sports require a higher VO_2 Max because it can affect muscle mass and endurance which is really needed in this sport (Kim et al., 2016). Even though HIIT provides optimal results in increasing VO_2 Max, in-depth study is still needed in its application to rafting. Therefore, this study aims to fill the knowledge gap by carrying out a more detailed study of the effects of HIIT training on increasing VO^2 max. By studying in more depth, it is hoped that this research can provide more precise

guidance in developing training programs for athletes by considering the context and specific goals of training.

METHODS

Participants

This research used 28 white water rafting athletes, consisting of 16 male athletes and 12 female athletes. The athlete's age range is 16-22 years. All research subjects were in good health. All subjects were given the same treatment, namely training using the HIIT model.

Exercise Protocol

Athletes were given intervention with HIIT cardio training. The HIIT training model uses an intensity of 90-100% of Maximal Heart Rate (MHR). HIIT is done with a ratio of 30 seconds of exercise then 3 minutes of rest. Training uses an intensity of 90% MHR in the first week and will be increased every week until it reaches 100% MHR. Exercises were carried out for 6 weeks with a frequency of 4x a week.

Measurement

VO² Max measurements are carried out using a multistage test instrument. Measurements were carried out before (Pre) and after (Post) treatment on men and women.

Data Analysis

Data analysis used the SPSS 20 statistical program. Data testing used the Paired sample T test to test differences in pretest and posttest measurements of VO² max and body composition. Before carrying out the difference test, A normality test will be carried out first to find out that the data is normally distributed.

RESULT

The first data analysis used is to describe the initial data of the research subject. Initial description data is used to see the initial description or condition of each subject. From table 1 it can be seen that Male and female athletes experienced an increase in VO₂ max values after intervention with HIIT training for 6 weeks.

Table 1. Pre-post Difference Test Results In VO² Max

Variabel	Male		Female	
	Pre	Post	Pre	Post
VO ² Max	41.53±3.3	43.92±3.7*	24.11±5.2	30.26±1.9*

The results in table 1 of different tests on the weight variable for male and female turned out to be no significant difference between before being given HIIT exercise treatment and after ($P > 0.05$). In the VO² Max variable, there is a huge distinction between before exercise and after for male and female ($P < 0.05$). The male and female groups experienced an increase in VO² Max values after doing HIIT training. In male, the average VO²

Max before treatment was 41.53 and after treatment it increased to 43.92. while for females the average before treatment was 24.11 and after training it increased to 30.26.

DISCUSSION

In this research, it can be seen that HIIT exercise carried out for 6 weeks with a frequency of 4 times per week can

increase athletes' VO^2 Max. These results support research which states that HIIT training can increase VO^2 Max by 6.1% to 7.7% (Atakan et al., 2021). Other findings also show that training with the HIIT protocol has a higher effect of increasing VO^2 Max compared to Moderate Intensity Continuous Training (MICT) (Chandu & Johnson., 2021). There were no significant differences in BMI and body weight, this happened because the entire sample was in a condition where the criteria for body weight and BMI were normal. High Intensity Interval Training exercises that are done regularly can increase cardiopulmonary endurance capacity (Atakan et al., 2021). HIIT training causes an increase in blood flow capacity, the heart increases in size, and the arteries become wider (Hellsten & Nyberg., 2016). These adaptive changes that occur improve the performance of the cardiovascular system so that it can transport oxygen to be distributed throughout the body, resulting in an increase in human aerobic capacity (Ma X et al., 2023).

HIIT is a training concept that uses high intensity and is alternated with short recovery periods (Herlan & Komarudin., 2020). HIIT training is considered as a method to effectively improve metabolic and cardiovascular function (Stankovic et al., 2023). HIIT can increase VO^2 max, HIIT can increase Akt (Ser473), IRS (Tyr612) phosphorylation in skeletal muscle, and increase the protein content of β -HAD and COX-IV which can have an effect on increasing oxidative metabolism (Matos et al., 2018). HIIT training can increase basal metabolism (BMR) which can occur when the body is at rest after exercising (Pavlidou et al., 2023). This can happen because HIIT causes an increase in the EPOC (excess post exercise oxygen consumption) process, namely the process of increasing oxygen consumption which

remains high even though the exercise has been completed (Valstad et al., 2017)

When the body's metabolism increases, oxygen demand will also increase. This increase in oxygen occurs because HIIT is able to increase maximum cardiac output and maximum stroke volume so that it can increase oxygen delivery throughout the body (Astorino et al., 2017). With a person's high VO^2 Max, it will allow the body to carry out intense activities for longer and speed up recovery time when fatigue occurs (Vaccari et al., 2023). Other findings show that HIIT exercise can increase Tumor Necrosis Factor-alpha (TNF- α) (Hadiono et al., 2023). An increase in TNF- α can induce satellite cells so that it can increase regeneration and calcineurin expression which can increase the body's metabolism even higher (Otis et al., 2014). This can be used as a factor in the adaptation factor of HIIT training in its role in increasing the VO_2 Max of a white water rafting athlete.

CONCLUSION

Training using the HIIT model which is carried out for 6 weeks with a frequency of 4x a week can increase the VO^2 Max of white water rafting athletes. HIIT training can be used as a recommendation to increase VO^2 Max for white water rafting athletes.

Because white water rafting athletes need a good VO^2 Max to support performance in competitions, considering that white water rafting is an activity related to cardiovascular endurance and power.

ACKNOWLEDGEMENT

Thanks are given to the academic community of PGRI Yogyakarta University who have supported the success of this research.

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