

Research Article

Impact of VO₂ Max Capacity And Application of Training Methods on the Effectiveness of Endurance Ability

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Abstract.

This research aims to see the effectiveness of training methods and aerobic capacity (VO₂ Max) to increase endurance capacity (aerobic capacity). The method used in this research is an experimental method, with the research sample being Karawang district football players. The independent variables of this research are interval training and vo₂ max, while the dependent variable is general endurance (aerobic capacity). In carrying out research, the interval method will be given taking into account the high and low aerobic capacity. The results of the research show that the interval method has a significant influence on increasing endurance (aerobic capacity), and the interval method has an interdependence with the level of aerobic capacity in increasing endurance. Extensive intervals are suitable for athletes who have low aerobic capacity and have not been in the process for long. Intensive interval training is suitable for athletes who have moderate aerobic capacity and have been in the training process for quite a long time. And short intervals are suitable for athletes who have a high aerobic capacity and have been training for a long time. Providing the interval method needs to take into account the high and low levels of aerobic capacity, because the interval method is a fairly heavy training method which needs to take into account the aerobic capacity capital of the athlete who will be trained and whether or not they have been involved in the training process for a long time.

Keywords: extensive intervals, intensive and short intervals, VO₂ Max, Speed Endurance

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1. Introduction

The study of knowledge and research that is currently developing in performance sports is related to physical training, the effort of which is how to create a positive impact from training on performance. The ever-increasing emphasis that is placed on athleticism and sporting success has led scientists to investigate numerous training methods that can have a positive effect on performance [1]. One such method that has received significant attention is complex training (CT). One aspect that the author observes is the



role of physical condition, especially speed endurance/stamina and aerobic endurance of our athletes [2]. The physical condition demands of world elite athletes for each sport are actually known and there is statistical data, and it is no longer a secret for public consumption [3], one of the physical conditions is endurance and stamina, which is expressed in the VO₂ max value. So if we want to compete with the world's top athletes, we just need to make our athletes' physical conditions similar, even if we want to increase our chances of being able to beat them, their VO₂ max value must be able to exceed that of the world's elite athletes. And that's what we should do if we want to compete, so that our expectations match reality.

The VO₂ max value of world elite athletes is 70 ml/kg, while the data obtained by our athletes is generally below 60 ml/kg. So based on data from just one physical condition, it will be difficult for our hopes to become a reality that will come true. If we follow the development of sports in Indonesia, either through electronic or print media, it is revealed that there are many problems that have not been solved, the current condition of national sports achievements is still very worrying when compared with past achievements, as is the case with the development of international multi-event achievements to date. have not succeeded in returning to become the overall champion in various events. In realizing sports achievements, especially when athletes enter the elite level, physical training is a very important component. Therefore, every trainer is obliged to understand physical training comprehensively [4]. The competency required by every trainer in physical training is the application of appropriate training methods and forms for the sport.

Some of the weaknesses that trainers still experience in the field are the variations in training methods and forms for each physical component. A physical trainer is a very important factor if you want to achieve maximum performance in every sport [5]. The key to successful achievement is the presence of factors that determine achievement, both internally and externally [6]. Physical trainers are a very important part when this training takes place at the elite level, because it is time to improve excellent physical quality [7]. According to trainers, there are many physical components that are needed for athletes' performance, especially physical trainers, to try hard to understand physical training well, such as: how to improve physical abilities, flexibility, physical abilities, speed of movement (in the form of speed, agility, or quickness), physical abilities. strength, both maximum strength, fast strength, strength endurance, how to increase physical abilities, anaerobic endurance, and also how to increase physical abilities, aerobic endurance.

2. Method

The research was carried out using experimental methods. The experimental method is a research method used to find the effect of certain treatments on others under controlled conditions. Meanwhile, Nana said that experimental research is the most complete quantitative research approach, in the sense that it fulfills all the requirements for testing cause and effect relationships. This research consists of the dependent variable, namely endurance (Vo2 Max) and the independent variable of treatment is the training method and the moderator independent variable, namely VO2 max. The research design used is a 2 x 3 treatment by level design, where the independent variables are classified into 3 (three). The treatment independent variables are classified into three forms of training methods (A), namely the extensive interval training method (A1), the intensive interval training method (A2) and short interval training method (A3). Meanwhile, the moderator independent variable is classified into two levels of VO2 max (B), namely high VO2 max (B1) and low VO2 max (B2). Treatment plan by level 2 x 3.

3. Results and Discussion

3.1. Extensive and intensive interval methods for increasing Vo2 max

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	1.44	1.64
Variance	0.060421	0.113053
Observations	20	20
Pooled Variance	0.086737	
Hypothesized Mean	0	
df	38	
t Stat	-2.14748	
P(T<=t) one-tail	0.019098	
t Critical one-tail	1.685954	
P(T<=t) two-tail	0.038197	
t Critical two-tail	2.024394	

Figure 1:

From the above it can be concluded that the t test value from the calculation results of the comparison of extensive and intensive interval methods shows a value of $T = 0.019 < 0.05$. So it can be concluded that the two methods are equally effective in increasing Vo2max, meaning that there is no difference between the two methods in increasing

Vo2max. From the graph below you can see the difference in the increase between the two methods in terms of increasing VO2Max.

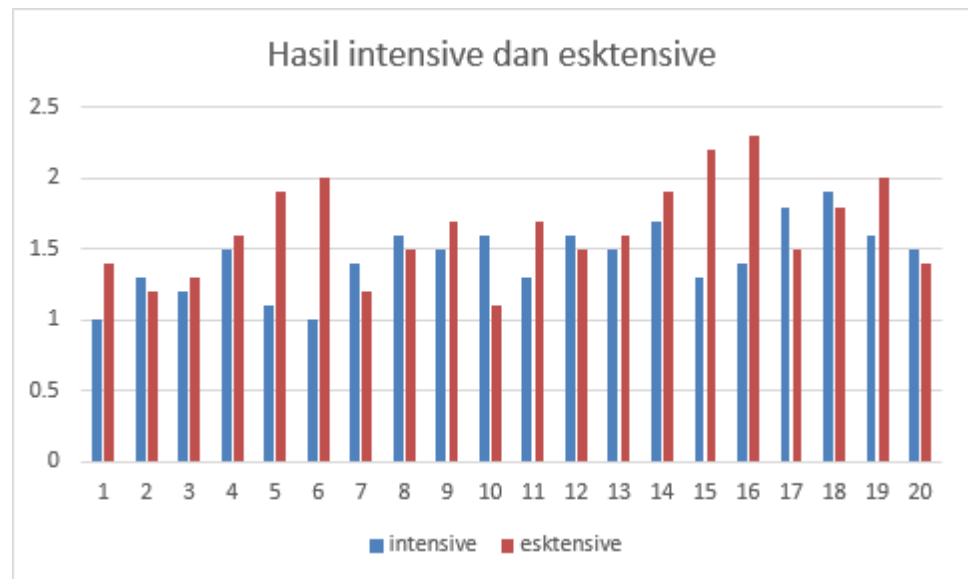


Figure 2:

3.2. Extensive interval and short interval methods for increasing Vo2 max

	Variable 1	Variable 2
Mean	0.825	1.64
Variance	0.067237	0.113053
Observations	20	20
Pooled Variance	0.090145	
Hypothesized Mean	0	
df	38	
t Stat	-8.58395	
P(T<=t) one-tail	9.93E-11	
t Critical one-tail	1.685954	
P(T<=t) two-tail	1.99E-10	
t Critical two-tail	2.024394	

Figure 3:

From the above it can be concluded that the t test value from the calculation results comparing the extensive and short interval methods shows a value of $T = 9.9 > 0.05$. So this means that there are differences between the two methods in increasing Vo2 Max. namely the extensive method is better than the short method. From the graph

below you can see the difference in the increase between the two methods in terms of increasing VO2Max.

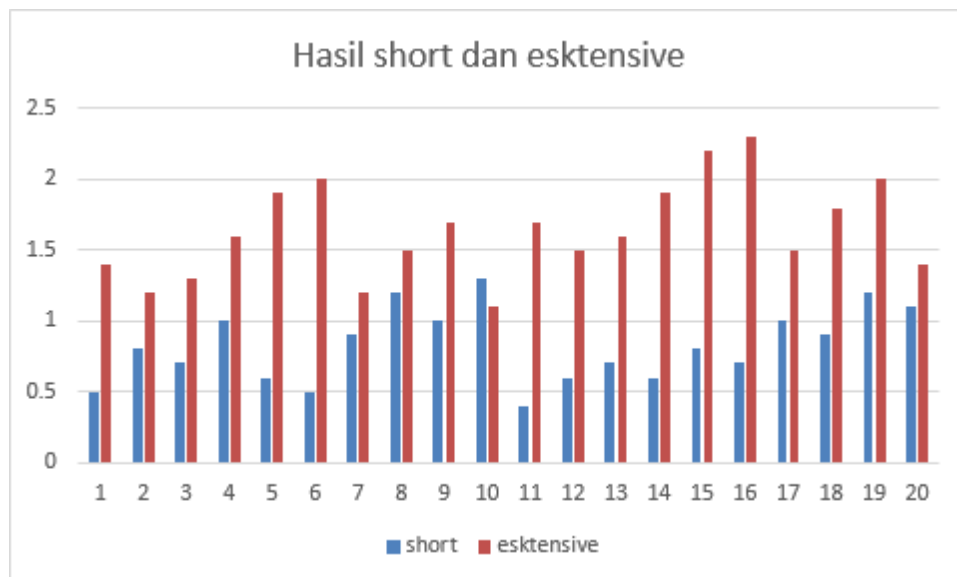


Figure 4:

3.3. Intensive interval method and short interval method for increasing Vo2 max

	Variable 1	Variable 2
Mean	0.825	1.44
Variance	0.067237	0.060421053
Observations	20	20
Pooled Variance	0.063829	
Hypothesized Mean	0	
df	38	
t Stat	-7.69779	
P(T<=t) one-tail	1.43E-09	
t Critical one-tail	1.685954	
P(T<=t) two-tail	2.85E-09	
t Critical two-tail	2.024394	

Figure 5:

From the above it can be concluded that the t test value from the calculation results of a comparison of the extensive and short interval methods shows a value of $T=1.43 > 0.05$. So this means that there are differences between the two methods in increasing VO2 Max. namely the intensive method is better than the short method. From the graph below you can see the difference in the increase between the two methods in terms of increasing VO2Max.

4. Discussion

Based on the results of testing processing and data analysis for each training group, interesting findings were obtained to pay attention to. Overall, the training group that used the extensive interval method showed a greater average score compared to the group that used the intensive interval method and the short interval method. Testing the significance of the average gains considered as a result of the training process shows that this research has significant implications for our understanding of the effectiveness of the extensive interval method in increasing aerobic capacity or maximum VO₂. In this study, a comparison between the work or exercise performed and the rest time in the extensive interval method provided results indicating that sufficient or moderate doses in this method had a very large influence on increasing maximum VO₂. These results provide a strong indication that the extensive interval method has significant advantages in improving aerobic capacity or general endurance ability [8].

First of all, this study highlights the importance of adjusting training dosage in the extensive interval method to achieve optimal maximum VO₂ increases. By calculating adequate or moderate dosages, coaches and athletes can design exercise programs that suit individual fitness levels and maximize results [9]. In addition, these findings confirm that providing appropriate rest periods between sets of exercises also plays an important role in the effectiveness of this method. Furthermore, this research provides a strong scientific basis for coaches and athletes in choosing the most appropriate training method to increase aerobic capacity or maximum VO₂. By knowing that the extensive interval method can have a huge impact on increasing maximum VO₂ [10], they can prioritize the use of this method in their training program. In addition, the results of this study also highlight the importance of continuing to carry out research and development in the field of exercise physiology [11]. With a better understanding of training methods that are effective in increasing aerobic capacity, we can continue to refine and develop training strategies that can help athletes and other individuals reach their full physical potential. Thus, this research not only makes a significant contribution to the scientific literature on exercise physiology, but also has practical implications that can be directly applied by coaches and athletes in efforts to improve aerobic performance and overall physical endurance.

This study aims to compare the effect of the same dose on increasing maximum VO₂ (VO₂ max) through extensive and intensive interval methods, by varying the ratio between work/exercise and rest time. The results showed that the two interval methods, even though they used the same dose in terms of total training volume, had different

effects on increasing VO₂ max. First of all, in the extensive interval method, where work/exercise is performed at a lower intensity and rest periods are shorter, a significant increase in aerobic capacity is seen [12]. This shows that even though the intensity of work/exercise is relatively lower, the amount of work done in a shorter period of time still provides sufficient stimulus to increase VO₂ max. Additionally, this increase may also be accompanied by increased efficiency of oxygen use and other physiological adjustments. On the other hand, the intensive interval method, where work/exercise is performed at a higher intensity with longer rest periods, also produces a significant increase in VO₂ max [13]. However, this increase may be more related to an increase in anaerobic capacity or muscle strength than an increase in pure aerobic capacity. Despite the higher work intensity, longer rest periods allow for better recovery between sets, thereby increasing the ability to maintain the quality of work/exercise during the training session. Overall, the results of the study show that even if the same training dose is used, extensive and intensive interval methods have different impacts on increasing VO₂ max. Selection of an appropriate method should take into account individual goals, initial fitness level [14], and training preferences, taking into account the balance between increased aerobic and anaerobic capacity and other benefits such as muscle recovery and strength.

Research on the intensive interval method has provided in-depth insight into how work/exercise and rest time compare to increases in VO₂ max, an important indicator in evaluating a person's aerobic capacity or general endurance ability [15]. Consistently, these findings show that the intensive interval method plays an important role in increasing VO₂ max with sufficient doses to provide a significant effect. In this context, the ratio between the duration of work/exercise and rest time stands out as a key factor in achieving optimal increases in aerobic capacity. Research has shown that intensive intervals, which involve periods of intense work followed by relatively short periods of rest, can provide superior results in increasing VO₂ max compared to continuous training at the same intensity. For example, one study observed that intensive intervals with 4 minutes of high-intensity work followed by a short 3-minute rest provided greater increases in VO₂ max compared to continuous exercise at the same intensity over a longer period of time. Furthermore, the study also highlighted that interval dosage settings, including work/exercise duration and rest periods, directly influence the body's physiological response to the exercise. For example, research shows that intervals with longer work and shorter rest tend to produce greater increases in VO₂ max, while intervals with shorter work and longer rest may be more effective in increasing exercise tolerance. Thus, research on the intensive interval method consistently confirms the

superiority of this approach in improving aerobic capacity or general endurance ability [16]. This emphasizes the importance of careful management of work/exercise variables and rest periods in designing an effective exercise program to improve VO₂ max and overall cardiorespiratory health

5. Conclusions

Research on comparing interval training methods shows that there are differences in the ability of each method to increase VO₂ max capacity. In particular, the research results show that extensive interval training methods tend to provide greater benefits in increasing VO₂ max capacity compared to intensive and short interval methods. This highlights the importance of training duration and intensity in influencing the body's physiological response to interval training. Research has shown that extensive interval training methods, which involve longer periods of work at moderate intensity followed by relatively short periods of rest, can produce significant increases in VO₂ max capacity. This may be because this method provides the body with the opportunity to gradually adapt to the training load provided, thereby allowing for greater improvements in aerobic capacity. On the other hand, although intensive and short interval training methods are also effective in increasing VO₂ max capacity, the increase may not be as great as that achieved with extensive methods. Intensive methods usually involve shorter periods of work at a higher intensity, while short methods involve periods of short, high-intensity work followed by a short rest. Although both are effective in triggering an increase in VO₂ max, the body's adaptation possibilities in this method may be more limited compared to the extensive method. Thus, although each interval training method has its own benefits, research shows that extensive methods tend to provide better results in increasing VO₂ max capacity. However, choosing the right interval training method must take into account the goals, individual physical condition, and other factors to achieve optimal results in increasing aerobic capacity.

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