

## Intensive and Extensive Interval Training; Which is Better Against $VO_2$ max Football Athletes?



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**ABSTRACT:** This study aimed to determine the difference between intensive and extensive interval training on the  $VO_2$ Max of football athletes. This type of research is an experiment. The sample used was football athletes at LPSB Mutiara Purwokerto, totalling 14 athletes with an age range of 13-15 years. Samples were divided into two groups based on pretest scores using ordinal pairing. The instrument for measuring  $VO_2$ Max uses the intermittent Yo-Yo test. Data analysis techniques include descriptive analysis, prerequisite tests (normality and homogeneity tests), and hypothesis testing using paired sample tests and independent sample tests. The analysis used SPSS 23 software. The results showed (1) a significant effect of intensive interval training on the  $VO_2$ Max of football athletes. The magnitude of the increase in  $VO_2$ Max in soccer athletes after being given intensive interval training was 5.07%. (2) There is a significant effect of intensive interval training on the  $VO_2$ Max of soccer athletes. The magnitude of the increase in  $VO_2$ Max in soccer athletes after being given extensive interval training was 12.54%. (3) There is a significant difference between intensive and extensive interval training on the  $VO_2$ Max of football athletes. The mean difference in the increase in  $VO_2$ Max of the intensive and extensive interval group soccer athletes was 2.02, so the extensive interval training group was better than the intensive interval training group on the  $VO_2$ Max of soccer athletes.

**KEYWORDS:** intensive intervals, extensive intervals,  $VO_2$ Max

### INTRODUCTION

Football is a sport that needs to improve its achievements, especially in Indonesia. For football players to achieve good performance, supporting factors are needed, one of which is the ability to be in good physical condition. Physical condition greatly affects the performance of an athlete when playing/competing because, with a less-than-perfect physique, an athlete's game can harm himself and can also harm his team. Football is a game that has dynamic movements (Zouhal et al., 2019) and has good physical conditions such as strength, speed, agility, endurance, flexibility, accuracy, power, reaction, and coordination (Abd Karim et al., 2019); (Boraczynski et al., 2019). A player is required to be able to make fast movements such as jumping, running, stepping forward and backward, running with fast dribbles, and dribbling past opponents (Doewes et al., 2020); (Abdullaeva, 2021), and there are many more basic movements in the game of football that are required to be able to use excellent physical conditions.

Recent literature has also provided physical performance information that describes the most intense periods of soccer play (Rennie et al., 2020); (Dolci et al., 2020). The premise for obtaining this data is to gather evidence about the most demanding parts of the game, which coaches can use to condition their players appropriately (Delaney et al., 2017). Another study identified periods of intense competition using a rolling average of 3 minutes and reported average peak speeds ranging between 160 and 180 m per minute (Black et al., 2016). The physical components that soccer players must possess are cardiorespiratory fitness or what is often referred to as the Maximum Oxygen Volume ( $VO_2$ Max) level (Jemni et al., 2018); (Kuswoyo & Lahinda, 2020).  $VO_2$ Max endurance is a physical condition component that must be developed first before developing other physical condition components (Taufik et al., 2021).

Based on a research journal on the  $VO_2$ Max of football players in Belgium, according to (Boone et al., 2012), the  $VO_2$ Max reported in the literature varies between 55 and 65 ml/kg/min for elite soccer players. A soccer player with a higher  $VO_2$ Max value, the better stamina. Vice versa, the lower the value, the lower the stamina. The standard  $VO_2$ Max value for Indonesian players is usually only 56, while foreign players average 60. The standard  $VO_2$ Max for a goalkeeper is 52, centre-backs 55, full-backs 61, midfielders 60, and attackers 56. Differences in standard  $VO_2$ Max based on position are normal because there are

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different positions. Demands harder performance than other positions. The sample consisted of 289 adult players from 6 first division teams in the Belgian league (Boone et al., 2012).

Globalization in the field of sports leads to innovation in training methods, thus giving birth to a type of exercise to increase VO<sub>2</sub>Max, which is often termed interval training. The exercise interval training method aims to develop and increase aerobic endurance (Menz et al., 2019); (Hurst et al., 2019). Interval training is highly recommended because, indeed, the results are very positive for the development of an athlete's endurance. Interval training itself is a training system interspersed with intervals in the form of rest periods (Trisaptono & Sumintarsih, 2020); (Christiansen et al., 2021). The interval training method has characteristics, namely consistency in the effort made and the rest period between repetitions taking place consistently (Haugen et al., 2019). The implementation of the interval training method is divided into extensive interval training and intensive interval training.

Intense interval training is a training method that can be used to increase an athlete's VO<sub>2</sub>Max. Intensive interval training is a training method in which distance, travel time, the number of repetitions and recovery time have been determined (Yamin & Gusril, 2020). The intensive interval training method is carried out with a relatively small amount of load, with exercise intensity ranging from 80-90% and loading time ranging from 30-60 seconds with not full rest. The next interval training method is extensive intervals. In principle, extensive intervals are a training method that is the same as regular interval training in which the intensity, reps, number of sets, and rest are determined. The extensive interval method is known through medium load intensity, which ranges from 60 percent to 80 percent, large amounts of load through many repetitions and incomplete rest. Extensive interval training is a form of exercise used to increase endurance.

Several previous studies, including those conducted by (Yamin & Gusril, 2020), showed that extensive interval training was more effective than intensive interval training in increasing VO<sub>2</sub>Max in school football players. Furthermore, the study conducted (Suhdy, 2018) proved that there was a significant difference in the VO<sub>2</sub>Max of the two groups of intensive-extensive training method tests. Where the extensive interval training method is better than the intensive training method. In contrast to the results of previous research, the study conducted (Mubarak & Kharisma, 2021) shows that the intensive interval training method has a better effect than the extensive interval training method on increasing aerobic endurance.

## METHODS

This type of research is an experiment. Experimental research is research conducted to find out the consequences of a treatment given intentionally by researchers (Rogers & Revesz, 2019). The sample used was football athletes at LPSB Mutiara Purwokerto, totaling 14 athletes with an age range of 13-15 years. Samples were divided into two groups based on pretest scores using ordinal pairing. Instruments for measuring VO<sub>2</sub>Max use the Yo-Yo intermittent test (Michailidis et al., 2020); (Taskin & Taskin, 2021). The score is obtained from the distance travelled during the test treatment, after which it is calculated using the Yo-yo Intermittent Recovery Test formula. Yo-yo Intermittent Recovery Test level 1 takes around 6-20 minutes per session (Smith et al., 2022); (Ramirez-Campillo et al., 2018). Data analysis techniques include descriptive analysis, prerequisite tests (normality and homogeneity tests), and hypothesis testing using paired sample tests and independent sample tests. Analysis using SPSS 23 software. The intensive-extensive interval training program is shown in Table 1.

**Table 1. Intensive-extensive interval training program**

| Description | Intense Interval Training | Extensive Interval Training |
|-------------|---------------------------|-----------------------------|
| Intensity   | 80–90%                    | 60-80%                      |
| Repetition  | 6-10 times                | 20-30 times                 |
| intervals   | 90-180 seconds            | 45-90 seconds               |

## FINDING

The research process was carried out for 16 meetings for 5 weeks. The results of the descriptive analysis of the VO<sub>2</sub>Max pretest and posttest statistics are presented in Table 2.

**Table 2. Results of Descriptive Analysis of VO<sub>2</sub>Max Pretest and Posttest Statistics**

| VO <sub>2</sub> Max      |          | N | Minimum | Maximum | Mean  | Std. Deviation |
|--------------------------|----------|---|---------|---------|-------|----------------|
| Intensive Interval Group | Pretest  | 7 | 28.40   | 37.45   | 32.55 | 3.03           |
|                          | Posttest | 7 | 30.20   | 38.50   | 33.99 | 3.13           |
| Extensive Interval Group | Pretest  | 7 | 27.60   | 35.70   | 32.29 | 2.85           |
|                          | Posttest | 7 | 30.20   | 40.50   | 35.75 | 3.66           |

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Based on Table 1, it shows that the VO<sub>2</sub>Max of the intensive interval group soccer athletes at the pretest averaged 32.55 ± 3.03 while the posttest increased by an average of 33.99 ± 3.13. The VO<sub>2</sub>Max of soccer athletes in the extensive interval group at the pretest averaged 32.29 ± 2.85 while the posttest increased by an average of 35.75 ± 3.66.

The data normality test uses the Shapiro-Wilk method with a significance level of 0.05, the results are in Table 3:

**Table 3. Results of Normality Test Analysis**

| VO <sub>2</sub> Max      |          | Shapiro-Wilk |    |       |
|--------------------------|----------|--------------|----|-------|
|                          |          | Statistic    | df | Sig.  |
| Intensive Interval Group | Pretest  | 0.981        | 7  | 0.966 |
|                          | Posttest | 0.936        | 7  | 0.603 |
| Extensive Interval Group | Pretest  | 0.949        | 7  | 0.723 |
|                          | Posttest | 0.965        | 7  | 0.864 |

Based on the statistical analysis of the normality test that was carried out using the Shapiro-Wilk test, the VO<sub>2</sub>Max data during the pretest and posttest obtained normality test results with a significance value of  $p > 0.05$ , which means that the data is normally distributed.

Homogeneity test using the Levene Test, the results are in Table 4:

**Table 4. Results of Homogeneity Test Analysis**

| Test of Homogeneity of Variances |                  |     |     |       |
|----------------------------------|------------------|-----|-----|-------|
| VO <sub>2</sub> Max              | Levene Statistic | df1 | df2 | Sig.  |
| Pretest                          | 0.015            | 1   | 12  | 0.904 |
| Posttest                         | 0.229            | 1   | 12  | 0.641 |

Based on the results of the analysis in Table 4, it can be seen that the VO<sub>2</sub>Max pretest-posttest obtained sig.  $p > 0.05$ , so the data is homogeneous.

Hypothesis analysis using the t-test, the t-test used is the paired sample test and the independent sample test. The first and second hypotheses were analyzed using the paired sample t test ( $df = n-1$ ) using SPSS 23 at a significance level  $< 0.05$ . The results of hypothesis testing are presented in Table 5:

**Table 5. Results of Paired Sample T Test Analysis**

| Paired Samples Test                          |                    |                |                 |   |       |        |    |                 |
|--|--------------------|----------------|-----------------|---|-------|--------|----|-----------------|
| Pair   | Paired Differences |                |                 |   |       | t      | df | Sig. (2-tailed) |
|  | Mean               | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference |       |        |    |                 |
|  |                    |                |                 | Lower                                     | Upper |        |    |                 |
| Pretest-Posttest Intensive Interval Training | -1.44              | 0.94           | 0.35            | -2.31                                     | -0.58 | 4.069  | 6  | 0.007           |
| Extensive Interval Training Pretest-Posttest | -3.46              | 0.88           | 0.33            | -4.28                                     | -2.65 | 10.369 | 6  | 0.000           |

Based on the analysis results in Table 5, the pretest-posttest for the intensive interval group obtained a t-count of 4.069 with a p-significance value of  $0.007 < 0.05$ . These results indicate that there is a significant difference. Thus the first hypothesis, which reads, "There is a significant effect of intensive interval training on the VO<sub>2</sub>Max of football athletes", is **accepted**. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after being given intensive interval training was 5.07%.

Based on the analysis results in Table 5, the pretest-posttest for the extensive interval group obtained a t-count of 10,369 with a p-significance value of  $0.000 < 0.05$ . These results indicate that there is a significant difference. Thus the second hypothesis, which reads, "There is a significant effect of intensive interval training on the VO<sub>2</sub>Max of football athletes", is **accepted**. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after being given extensive interval training was 12.54%.

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**Table 6. Results of the Independent Samples Test Analysis**

| Independent Samples Test     |                             |       |        |                 |                 |                       |   |          |
|------------------------------|-----------------------------|-------|--------|-----------------|-----------------|-----------------------|---|----------|
| t-test for Equality of Means |                             |       |        |                 |                 |                       |   |          |
|                              |                             | t     | df     | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |          |
|                              |                             |       |        |                 |                 |                       | Lower                                     | Upper    |
| VO <sub>2</sub> Max          | Equal variances assumed     | 4.149 | 12     | 0.001           | -2.02143        | 0.48724               | -3.08302                                  | -0.95983 |
|                              | Equal variances not assumed | 4.149 | 11.958 | 0.001           | -2.02143        | 0.48724               | -3.08344                                  | -0.95942 |

Based on the results of the analysis in Table 6, the VO<sub>2</sub>Max of the intensive and extensive interval groups obtained a  $t_{count}$  of 4,149 with a p-significance value of  $0.001 < 0.05$ , these results indicate that there is a significant difference. Thus the third hypothesis which reads "There is a significant difference between intensive and extensive interval training on the VO<sub>2</sub>Max of football athletes", is **accepted**. The mean difference in the increase in VO<sub>2</sub>Max of the intensive and extensive interval group soccer athletes was 2.02, so that the extensive interval training group was better than the intensive interval training group on the VO<sub>2</sub>Max of soccer athletes.

### DISCUSSION

Based on the results of the analysis, it is known that there is a significant effect of intensive interval training on the VO<sub>2</sub>Max of football athletes. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after being given intensive interval training was 5.07%. The results of this study were reinforced in the research (Alkayis, 2019), which showed that there was an effect of intensive interval training on VO<sub>2</sub>Max abilities in extracurricular participants at SMA Negeri 1 Slawi in 2019. Research (Mubarak & Kharisma, 2021) showed that intensive interval training methods had an effect on increasing power aerobic resistance. Research (Yamin & Gusril, 2020) shows that intensive interval training has an effect on increasing VO<sub>2</sub>Max.

Intensive interval training is a training method in which distance, travel time, the number of repetitions and recovery time have been determined. The intensive interval training method is carried out with a relatively small amount of load, with exercise intensity ranging from 80-90% and loading time ranging from 30-60 seconds with no full rest (Yamin & Gusril, 2020). Intense interval training is characterized by fewer repetitions and long breaks. In this training method, longer rest periods are given, thus providing better rest opportunities. According to (Alkayis, 2019), the characteristics of the intensive interval method are load intensity of 80-90% of maximum ability, moderate amount/volume of load, namely 6-10 times per series, intervals/rest of 90-180 seconds per series, and the effect of this exercise increases endurance speed.

Application through an intensive interval method with a moderate-high intensity training program with a pulse rate of more than 180-190x/minute, few repetitions, not many intervals, a maximum of 3 sets with rest time settings between repetitions and between sets, shows a greater effect Good for increasing aerobic endurance. The intensive interval method will be able to improve complex motor nerves. This incomplete rest can be done with passive rest, namely resting without doing activities (sleeping, standing, sitting) and in the form of active rest, namely resting by doing light activities (jogging, walking) (Suhdy, 2018).

The intensive interval training method provides development of aerobic endurance abilities. Physical condition training has a very important role in improving and maintaining physical ability, the higher the physical ability, the more aerobic capacity it determines. Through high-intensity training methods, few repetitions and short rest periods can increase maximum aerobic capacity which is often called VO<sub>2</sub>Max which is classified as one of the physical factors in determining achievement (Yudi et al., 2022); (Hardiansyah, 2020).

Based on the results of the analysis, it is known that there is a significant effect of intensive interval training on the VO<sub>2</sub>Max of football athletes. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after being given extensive interval training was 12.54%. The results of this study were reinforced in the research (Alkayis, 2019), which showed that there was an effect of extensive interval training on VO<sub>2</sub>Max abilities in extracurricular participants at SMA Negeri 1 Slawi in 2019. Research (Mubarak & Kharisma, 2021) showed that the extensive interval training method increased power aerobic resistance.

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Research (Yamin & Gusril, 2020) shows that extensive interval training has an effect on increasing VO<sub>2</sub>Max. Research (Badaruddin, n.d.) shows that there is an effect of extensive interval training on aerobic ability for students of SMP Negeri 1 Tomia, Wakatobi district. Research (Khaidir & Komaini, 2019) shows that extensive interval training has an effect on cardiovascular endurance. Research (Pianda & Tohidin, 2019) shows that there is a significant effect of the extensive interval training method on VO<sub>2</sub>Max ability.

The extensive interval method is known through medium load intensity, which ranges from 60 to 80%, large amounts of load through many repetitions and not full rest. The number/volume of high loads and the number of repetitions is 20-30 times per series, and the intervals/rests are not full, namely 45-90 seconds per series. Extensive interval training means that the training load given to athletes has the following characteristics: (a) large training volume; (b) low or medium training load intensity; (c) long recovery time and; (d) the frequency and rhythm of slow and slow motion.

In principle, extensive intervals are a training method that is the same as regular interval training in which the intensity, reps, number of sets and rest are determined. The extensive interval method is known through medium load intensity, which ranges from 60-80%, large amounts of load through many repetitions and incomplete rest (Yamin & Gusril, 2020). The application of training through the extensive interval training method, which is carried out at low-moderate intensity, pulse rate below 170x/minute, lots of repetitions, short intervals and lots of sets/series, has shown a good effect on increasing aerobic endurance ability. Providing training using the extensive interval training method shows an advantage in increasing aerobic endurance ability. The training method with activities in the form of repeated repetition so that the stimulus and response associations become very strong and not easy to forget.

Extensive interval training is a form of exercise which has the characteristics of moderate training intensity, lots of repetitions and longer rest than intensive interval training. This exercise is required for the athlete trying to fight or overcome fatigue. The application of extensive interval training with many repetitions and little rest will stimulate the work of the heart so that the process of taking oxygen will be maximised. The characteristics of the extensive interval method are moderate load intensity, namely 60% -80%, high load volume/volume and many repetitions, namely 20-30 per series, and incomplete intervals/rest, namely 45-90 seconds per series. Thus it is hoped that the effect of the exercise will be an increase in fighting fatigue (Pianda & Tohidin, 2019).

Based on the results of the analysis, it is known that there is a significant difference between intensive and extensive interval training on the VO<sub>2</sub>Max of football athletes. The mean difference in the increase in VO<sub>2</sub>Max of the intensive and extensive interval groups of soccer athletes was 2.02%, so the extensive interval training group was better than the intensive interval training group on the VO<sub>2</sub>Max of soccer athletes. This form of interval training is useful for increasing VO<sub>2</sub>Max capacity because training with an intensive interval method demands maximum performance, while training with an extensive interval method requires moderate endurance for a relatively long time so that athletes can improve their VO<sub>2</sub>Max ability for the better.

The results of this study were reinforced in the research (Suhdy, 2018), which proved that there was a real difference in the VO<sub>2</sub>Max of the two groups of intensive-extensive training method tests. Where the extensive interval training method is better than the intensive training method. Alkayis (2019) showed that there were differences in the effect of extensive interval training and intensive interval training on increasing VO<sub>2</sub>Max. Research conducted (Sulastio, 2016) proves that extensive interval training is better than intensive interval training. Research (Yamin & Gusril, 2020) shows that extensive interval training is more effective than intensive internal training in increasing VO<sub>2</sub>Max.

Interval training is a system of exercises interspersed with intervals in the form of rest periods. In implementing the interval training method, there are rest periods between training activities, so there is a sequence of activities, namely: exercise–rest–exercise–rest–exercise and so on (Oliveira et al., 2022). Apart from being used in strength training and speed training, interval training can also be used to develop aerobic and anaerobic endurance and to develop other types of endurance (Kelly et al., 2021).

The interval training method in execution aims to develop and improve aerobic endurance. Interval training is highly recommended because the results are very positive for the development of endurance athletes. Interval training is a system of exercises interspersed with intervals in the form of rest periods. If a person does aerobic endurance exercise for a certain period of time, the pulse reflex point will increase. This increase is caused by changes in the cardiovascular system, such as changes in heart size, changes in muscle mitochondria, changes in blood vessels and increases in blood haemoglobin levels (Bossi et al., 2020).

Interval training takes place alternately between work intervals and rest intervals, and the rest phase is developed in the form of work relief and rest relief. This exercise is a form of training method that can be used for all sports to improve physical conditioning abilities. By using the principles of training in such a way, you can increase the anaerobic system as the primary energy system and the aerobic system as the main system or develop it in a balanced way so that physical abilities will increase

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gradually. The interval training method has characteristics, namely consistency in the effort made and the rest period between repetitions taking place consistently. The implementation of the interval training method that must be considered is the need to know the athlete's pulse for recovery after the first work/activity (repetitions). The results of the pulse that are known at the beginning will be a benchmark for use as rest time for the next repeat, and again see the recovery time after the end of the repetitions in the first set, which is then used as a benchmark for resting between sets (Feito et al., 2018).

The forms of intensive interval training and extensive interval training certainly have different characteristics but lead to the same goal, namely improving the quality of a player to achieve a goal, namely achievement. This means that with the intensive interval method and the extensive method, there is a difference that is more efficient and effective in increasing the VO<sub>2</sub>Max of soccer players. Extensive interval training is a training method that is almost the same as the intensive interval training method in which the intensity, reps, number of sets and rest are determined. In principle, extensive interval training is one method of interval training that is carried out continuously and systematically with moderate intensity loads, lots of repetitions, and few rest periods. With lots of repetitions and a little rest, this will stimulate the work of the heart so that the process of taking oxygen will be maximised (Yamin & Gusril, 2020).

### CONCLUSION

The conclusions of the study show (1) there is a significant effect of intensive interval training on the VO<sub>2</sub>Max of soccer athletes. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after being given intensive interval training was 5.07%. (2) There is a significant effect of intensive interval training on the VO<sub>2</sub>Max of soccer athletes. The magnitude of the increase in VO<sub>2</sub>Max in soccer athletes after extensive interval training was 12.54%. (3) There is a significant difference between intensive and extensive interval training on the VO<sub>2</sub>Max of football athletes. The mean difference in the increase in VO<sub>2</sub>Max of the intensive and extensive interval groups of soccer athletes was 2.02%, so the extensive interval training group was better than the intensive interval training group on the VO<sub>2</sub>Max of soccer athletes.

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