

**THE EFFECTS OF HIIT AND TABATA CIRCUIT TRAINING ON
THE ENDURANCE OF ATHLETES AT PION MAS
SCHOOL GROBOGAN SOCCER ACADEMY**

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Abstract

This study aims to analyze the effects of High-Intensity Interval Training (HIIT) and Tabata Circuit Training on the endurance of athletes at the Pion Mas Soccer School (SSB) in Grobogan Regency and to compare the effectiveness of these two training methods. The study employed a quantitative approach using an experimental method with a True Experimental design in the form of a pretest–posttest control group design. The sample consisted of 20 male athletes aged 12–15 years, divided into two groups: 10 athletes in the HIIT group and 10 athletes in the Tabata Circuit Training group. The Multistage Fitness Test (MFT) was used to measure VO₂max capacity. Data analysis included normality tests, homogeneity tests, paired-sample t-tests, and independent-sample t-tests. The results showed that both training methods had a significant effect on improving the athletes' endurance ($p < 0.05$). The HIIT group showed a greater increase in VO₂max compared to the Tabata Circuit Training group. However, the results of the independent-samples t-test showed no significant difference between the two methods ($p = 0.058$). Thus, both HIIT and Tabata Circuit Training are equally effective in improving the endurance of soccer players.

Keywords: High Intensity Interval Training; Tabata Circuit Training; Endurance; VO₂max; Soccer.

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INTRODUCTION

“In general, people understand sports to be a physical activity performed by an individual or a group of people with the aim of achieving physical fitness.” Law No. 3 of 2005 states that “Sports are all systematic activities aimed at promoting, nurturing, and developing physical, mental, and social potential.” (Nurfadilah, 2021). Meanwhile, according to (Gozali et al., 2024) exercise is a type of physical activity performed systematically that involves movement of all parts of the body with the aim of improving physical fitness.

According to (Pratama, 2015) explains the concept of “training”—a term derived from an English word that encompasses several meanings, such as: Practice, Exercise, and Training. The

definition of training derived from the word “Practice” refers to activities aimed at improving athletic skills using various equipment in accordance with the goals and needs of the specific sport. The definition of training derived from the word “Exercise” refers to the primary component of the daily training process designed to enhance the functional quality of the human body’s organs, thereby facilitating athletes in refining their movements. The definition of “training” derived from the word “training” is a process of refining athletic ability that incorporates both theoretical and practical components, employing methods and implementation guidelines based on a scientific approach, and adhering to the principles of planned and structured training, so that training objectives can be achieved in a timely manner”. In line with the above view that physical exercise is a planned, structured, and repetitive movement of the body performed by the muscles that involves the use of energy to improve fitness (Pranata & Kumaat, 2022).

Soccer is a globally popular sport that brings many positive and wonderful things to people’s lives, making it widely popular among the general public. Like athletes in other sports, soccer players must also have an ideal and proportionate physique to facilitate their movements (Rusiawati & Wijana, 2021). Meanwhile, according to (Mubarok et al., 2021) soccer is the most popular sport in Indonesia; it is widely played in both rural and urban areas, with competitions ranging from inter-village tournaments to professional leagues frequently held. Soccer is a team sport that involves physical, technical, tactical, and mental elements.

According to (Kemenkes, 2021) adapted by (Patriyani, 2022) The immune system, or the body’s defense system, is designed to detect and destroy foreign substances that enter the body, such as bacteria or viruses. Physical endurance is the body’s ability to perform various activities, such as studying and exercising, over a long period of time. Meanwhile, according to (Dewi et al., 2022) The body’s immune system is a complex, interconnected system comprising cells, tissues, organs, and mediators that works to protect the body from foreign substances that could harm it. There are two types of immune systems: innate immunity and adaptive immunity.

High-Intensity Interval Training (HIIT) is a high-intensity form of physical exercise that is faster-paced than regular workouts and involves relatively short recovery periods. This type of training is currently widely practiced by athletes because, when performed properly and regularly, its high intensity produces remarkable effects on muscle development and overall health (Susila, 2021). In line with the above view that HIIT is a cardiovascular exercise that combines high-intensity intervals with a specific duration, which promotes the growth of fast-twitch muscle fibers (Setiawan et al., 2024).

Tabata training is a workout method introduced by Izumi Tabata in 1996 that is based on a 2:1 ratio of exercise time to rest time. Some of the benefits of Tabata training include burning fat for energy, boosting athletes’ metabolism during exercise, being time-effective and efficient, improving both anaerobic and aerobic systems, and being applicable to a variety of activities (Hasriana et al.,

2025). Meanwhile, (Munandar & Fauqi, 2022) Tabata training is a method that utilizes a specific ratio of exercise to rest (high-intensity intervals). In practice, this training method lasts for 4 minutes, with exercise lasting 20 seconds and rest lasting 10 seconds (2:1 ratio), and is repeated until the 4 minutes are up.

States that high-intensity interval training can improve cardiovascular endurance. These findings are corroborated by this study, which shows that the implementation of high-intensity interval training can improve cardiovascular endurance in soccer players (Prasetyo, 2024).

This study specifically aims to identify differences in the effectiveness of High-Intensity Interval Training and Tabata Training in improving athletes' endurance, as well as the extent to which each method affects relevant physiological parameters. Specifically, this study will investigate the impact of these two training methods on improving athletes' physical endurance.

METHODS

This study is a quantitative study using an experimental method, as it aims to determine the effect of High-Intensity Interval Training (HIIT) and Tabata Circuit Training on improving the endurance of athletes from the Pion Mas Youth Soccer Academy in Grobogan Regency. The research design used is a True Experimental Design in the form of a Pretest-Posttest Control Group Design. This design was chosen because each group was given a pretest, then received a different intervention, and the study concluded with a posttest.

According to (Purwanza et al., 2020) a population is the entire set of research subjects—comprising people, objects, animals, plants, phenomena, test scores, or events—that serve as data sources and possess specific characteristics within a study. The population for this study consisted of 20 male youth athletes from SSB Pion Mas in Grobogan Regency, with an average age of 12–15 years. According to (Subhaktiyasa, 2024) in quantitative research, a sample is defined as a portion of a population selected for analysis so that the results can be generalized to the entire population. (Radianto, 2023) states that “A sample is a subset of a population selected using specific techniques to ensure its representativeness.” The sample used in this study consisted of the entire population of the Pion Mas SSB in Grobogan Regency, divided into two groups: 10 athletes using the High-Intensity Interval Training (HIIT) method and 10 athletes using the Tabata Training method.

According to (Apriliawati, 2020) quantitative data collection methods most commonly used in research in Indonesia are surveys and experiments. In this study, the data collection methods used were tests and measurements, with the athletes participating in High-Intensity Interval Training and Tabata Training sessions. The study spanned 14 sessions, including a pretest, the intervention, and a posttest.

According to (Zayrin et al., n.d.), “Data collection instruments are tools used by researchers to make the data collection process easier and more organized.” Who explains that “instruments are tools for recording various conditions or activities related to a person's psychological aspects, usually in the

form of numbers or quantitative data” (Zayrin et al., n.d.). The test uses the Multistage Fitness Test (MFT) / Bleep Test. Essentially, the MFT is a test designed to measure cardiovascular fitness and predict the body’s maximum oxygen uptake (VO₂ Max).

The data analysis technique used was quantitative data analysis, which involves testing and analyzing data through numerical calculations and then drawing conclusions from descriptive tests, namely statistical tests, normality tests, homogeneity tests, and t-tests.

RESULTS AND DISCUSSION

This study involved data collection from 20 athletes at the SSB Pion Mas in Grobogan Regency. The study observed training sessions using High-Intensity Interval Training (HIIT) and Tabata Training methods. Data analysis was used to test the proposed hypotheses. Before data analysis was performed, it was necessary to conduct prerequisite tests, namely the normality test and the homogeneity test. The results of the prerequisite tests and hypothesis tests are as follows:

a. Normality Test

A normality test is a type of test used to assess the normality of a data distribution. The results of the normality test are presented in the following table.

Table 1. Normality Test Results

Variabel	P-Value	Keterangan
Pretest HIIT	0,950	Normal
Posttest HIIT	0,958	Normal
Pretest Tabata Training	0,955	Normal
Posttest Tabata Training	0,954	Normal

Based on the results of the normality test in Table 1, it was found that the significance values for both the HIIT and Tabata Training groups were all greater than 0.05. The significance value for the HIIT pretest was 0.950 and for the HIIT posttest was 0.958, while the significance value for the Tabata Training pretest was 0.955 and for the Tabata Training posttest was 0.954. This indicates that all studies on the HIIT and Tabata training methods follow a normal distribution. The meta-analysis concluded that the results of all studies on HIIT in soccer players showed a significant increase in VO₂max with a high effect size. This means that, scientifically, the HIIT method has been proven effective in improving the performance capacity of soccer players across various age groups and skill levels.

b. Homogeneity Test

Table 2. Homogeneity Test Results

Variabel	F	Sig.	Keterangan
Pretest	0,391	0,539	Homogen
Posttest	0,703	0,413	Homogen

Based on the results of the homogeneity test in Table 2, the homogeneity test yielded significance values of 0.539 for the pre-test and 0.413 for the post-test. Both values are greater than 0.05; therefore, it can be concluded that the two groups have homogeneous variances. This indicates that the characteristics of the participants in the HIIT and Tabata groups are relatively comparable. This similarity in data variation is important because it indicates that both groups had equivalent baseline conditions; thus, changes in VO_2max following the intervention are more likely due to the exercise program administered rather than differences in participant characteristics. Consequently, the study results provide a stronger foundation for making comparisons using an independent samples t-test.

c. Hypothesis Test

Table 3. Paired Sample t-test Results

Variabel	Mean Difference	t	Sig. (2 tailed)	Description
HIIT	-4,980	-36,278	0,000	There is a significant effect
Tabata Training	-3,020	-41,526	0,000	There is a significant effect

Based on the results of the paired-sample t-test in Table 3, the results of the paired-sample t-test show that the HIIT group achieved a p-value of 0.000 with a mean difference of 4.980 ml/kg/minute. The Tabata group also achieved a p-value of 0.000 with a mean increase of 3.020 ml/kg/minute. A p-value less than 0.05 indicates that both training methods had a significant effect on increasing the athletes' VO_2max . These findings demonstrate that Tabata training significantly increased soccer players' VO_2max following the training program. The researchers stated that Tabata training improves the efficiency of the aerobic energy system, enabling players to maintain game intensity for a longer period of time.

Table 4. Independent Sample t-test Results

Variabel	Mean Difference	t-hitung	df	Sig.(2 tailed)	Description
Posttest	2,780	2,023	18	0,058	Significance

Based on the results of the independent samples t-test in Table 4, the results of the independent samples t-test show a significance value of 0.058 (>0.05). This indicates that there is no significant difference between the increases in $VO_2\text{max}$ in the HIIT group and the Tabata group. Nevertheless, the HIIT group had a slightly higher average increase in $VO_2\text{max}$ compared to the Tabata group, at 2,780 ml/kg/minute. A recent systematic review of training in soccer players also shows that various forms of interval training, including HIIT, consistently increase $VO_2\text{max}$. However, the magnitude of the increase can be influenced by program duration, training intensity, and player characteristics, so differences between methods are not always statistically significant.

The discussion in this study will further interpret the results of this research as presented above. Based on the hypothesis testing in this study, the following results were obtained: (1) There is a significant effect of the high-intensity interval training method on the endurance of soccer athletes, (2) There is a significant effect of the Tabata training method on the endurance of soccer players, and (3) There is a significant difference in the effects of high-intensity interval training and Tabata training on the endurance of soccer players at Poin Mas School in Grobogan Regency. The discussion of these analysis results is presented in more detail as follows.

1. The Significant Effect of High-Intensity Interval Training (HIIT) on the Endurance of Athletes at the Pion Mas Soccer School in Grobogan Regency.

Based on the results of the paired-sample t-test analysis, the proposed hypothesis was confirmed, leading to the conclusion that there is a significant difference in the effect of high-intensity interval training on the endurance of soccer players. The probability value (Sig.) from the bleep test for the HIIT training group had a significance level of $0.000 > 0.05$; therefore, it can be concluded that the high-intensity interval training method has an effect on the endurance of soccer athletes at the Pion Mas Soccer School in Grobogan Regency. Previous research results from (Wibowoa et al., 2019) and (Hernawan et al., 2021) states that high-intensity interval training can improve cardiovascular endurance. The findings of that study are corroborated in this study, which shows that the application of high-intensity interval training can improve the endurance of soccer players.

2. The Significant Effect of the Tabata Training Method on the Endurance of Athletes at the Pion Mas Soccer School in Grobogan Regency.

Based on the results of the paired-sample t-test analysis, the proposed hypothesis was confirmed, leading to the conclusion that there is a significant difference in the effect of the Tabata training method on the endurance of soccer players. The probability value (Sig.) from the bleep test for the Tabata training group was $0.000 > 0.05$; therefore, it can be concluded that there is a significant difference in the effect of the Tabata training method on the endurance of soccer players at the Pion Mas Soccer School in Grobogan Regency.

Previous research by (Palmizal et al., 2020) found that Tabata training had a significant effect on the $VO_2\text{max}$ of the PS. Tungkal Ulu U-21 soccer team. Consistent with the above study from

(Faresi et al., 2021) that the implementation of the Tabata training method can improve the VO_2 max of the 2021 U-16 players at the Binataruna Soccer School. Consistent with previous research, this study found that the Tabata training method had a significant effect on the endurance of athletes at the Poin Mas Soccer School in Grobogan Regency.

3. Differences in the Effects of High-Intensity Interval Training and Tabata Training on the Endurance of Athletes at the Poin Mas Soccer School in Grobogan Regency.

Based on the results of the independent samples t-test, the proposed hypothesis was confirmed, leading to the conclusion that there is a significant difference in the effects of HIIT and Tabata training on the endurance of soccer athletes. From this test, a Sig. (2-tailed) value of < 0.05 was obtained; therefore, it can be concluded that there is a significant difference in the effects of the high-intensity interval training (HIIT) and Tabata training methods on the improvement of endurance in soccer athletes at the Poin Mas Soccer School in Grobogan Regency.

Based on the results of a previous study by (Hernawan et al., 2021) the Tabata training group and the HIIT group had significantly different effects on improving the endurance of soccer players. These findings are consistent with the results of this study, which showed that the high-intensity interval training (HIIT) method was more effective than the Tabata training method in improving the endurance of soccer players from Poin Mas, Grobogan Regency

CONCLUSION

Based on the research findings and data analysis, the following conclusions can be drawn:

1. The high-intensity interval training (HIIT) method has a significant effect on improving the endurance of athletes at the Poin Mas Soccer School in Grobogan Regency.
2. The Tabata Training method has a significant effect on improving the endurance of athletes at the Poin Mas Soccer School in Grobogan Regency.
3. There is a significant difference in the effects of High-Intensity Interval Training (HIIT) and Tabata Training on improving the endurance of athletes at the Poin Mas Soccer School in Grobogan Regency. HIIT has a greater effect than Tabata Training on improving the endurance of athletes at the Poin Mas Soccer School in Semarang Regency.

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