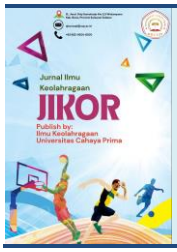

JIKOR: Jurnal Ilmu Keolahragaan

E-ISSN 3123-1853
Volume 1, Number 2 (2026), Page. 28–36
Available online at:
https://ojs.ucp.ac.id/index.php/JIKOR

Analysis of The Level of Maximal Oxygen Uptake (Vo2Max) Ability in Football Extracurricular Students of MTs Bahrul Ulum, Rokan Hulu Regency

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ARTICLE INFO
Article History
Received: 12-03-2026
Accepted: 14-03-2026

Keywords:
VO_2Max, football extracurricular, multi stage fitness test

ABSTRACT

VO_2Max is an important indicator of cardiorespiratory fitness that plays a significant role in supporting performance in football. This study employed a descriptive quantitative method with a survey design. The population of this study consisted of all grade VIII students who participated in the football extracurricular activity at MTs Bahrul Ulum, totaling 20 students. The sampling technique used was total sampling, meaning that all members of the population were included as research participants. The instrument used to measure VO_2Max was the Multi-Stage Fitness Test (MFT), also known as the Beep Test. The test results were analyzed using descriptive statistics and frequency distribution. The results showed that the VO_2Max ability of students participating in the football extracurricular activity at MTs Bahrul Ulum was generally at a low level. The lowest recorded VO_2Max value was 24.00 and the highest was 42.90. The average (mean) value was 31.87 with a standard deviation of 5.74. Based on the frequency distribution, the majority of students were categorized as Poor and Fair. Specifically, 50% of students (10 individuals) were in the Poor category and 30% of students (6 individuals) were in the Fair category. The study concluded that the VO_2Max capacity of MTs Bahrul Ulum football extracurricular students is at a low level, indicating that their cardiorespiratory fitness still needs improvement to achieve optimal performance and long-term health benefits. Therefore, it is recommended that more structured and specific training programs be implemented to improve VO_2Max.

https://doi.org/10.65943/jikor.2026.v1.i2.70

INTRODUCTION

Health and physical fitness are essential aspects that support the quality of human life (Supriadi et al., 2026). Good physical fitness enables individuals to perform daily activities optimally without experiencing excessive fatigue (Ujung et al., 2026). In the educational context, students' physical fitness plays an important role in supporting the learning process

as well as their physical and mental development (Putranto & Efendi, 2024). Students with good physical fitness tend to be more active, demonstrate better learning concentration, and are able to participate optimally in various school activities (Budiman et al., 2023).

One of the indicators commonly used to measure physical fitness, particularly cardiorespiratory endurance, is maximal oxygen uptake (VO_2Max) (Langland et al., 2021). VO_2Max refers to the maximum capacity of the body to take in, transport, and utilize oxygen during high-intensity physical activity (Kenney et al., 2022). It reflects the ability of the cardiovascular and respiratory systems to supply oxygen to the working muscles (Langland et al., 2021). Aerobic endurance is closely related to the function of the cardiovascular and respiratory systems in delivering oxygen to the muscles during physical activities that are performed over relatively long durations (Sitompul et al., 2026). The higher an individual's VO_2Max value, the better their aerobic endurance capacity, allowing them to perform physical activities for longer periods without experiencing significant fatigue (Boihaqi et al., 2021).

Within the school environment, sports extracurricular activities serve as an effective means of improving students' physical fitness (Hibatulloh & Wibowo, 2022). One of the most popular extracurricular activities among students is soccer (Valentino & Iskandar, 2020). Soccer is a sport that requires a high level of physical fitness because it involves high-intensity activities such as running, sprinting, rapid changes of direction, and other physical movements over a relatively long duration of play (Carling et al., 2012; Rodríguez-Fernández et al., 2025). Athletic performance is not only determined by technical skills but also by a well-developed physical condition (Ahmad et al., 2026). According to Bompa & Buzzichelli (2019), cardiorespiratory endurance is a fundamental component of physical fitness that is crucial for soccer players, as it determines their ability to maintain performance throughout a match.

Although students actively participate in soccer extracurricular activities, their level of physical fitness, particularly VO_2Max, is not always clearly known. At MTs Bahrul Ulum in Rokan Hulu Regency, data regarding the VO_2Max levels of students participating in soccer extracurricular activities are still very limited. This condition makes it difficult for both the school and the coaches to obtain a clear understanding of the students' cardiorespiratory fitness levels as well as the effectiveness of the training programs that have been implemented.

Research on VO_2Max levels in soccer players has been widely conducted among professional athletes and players affiliated with clubs that follow structured training programs. However, studies that specifically examine cardiorespiratory fitness levels among students participating in school-based soccer extracurricular activities remain relatively limited. Furthermore, studies describing the VO_2Max profile of junior high school students, particularly in the Rokan Hulu Regency area, are still scarce. The limited availability of such data has resulted in the absence of a clear picture of the cardiorespiratory fitness levels of students who are actively involved in school sports activities. Therefore, this study contributes empirical data regarding the VO_2Max profile of soccer extracurricular students at MTs Bahrul Ulum in Rokan Hulu Regency, which can serve as a basis for evaluating and developing more effective training programs.

Based on these issues, it is necessary to conduct research to analyze the VO_2Max levels of students participating in soccer extracurricular activities at MTs Bahrul Ulum in Rokan Hulu Regency. This study is expected to provide an overview of the students' cardiorespiratory fitness levels and serve as a reference for coaches and school administrators

in evaluating and developing more effective training programs to improve students' physical fitness.

METHOD

Research Design

This study employed a quantitative approach using a descriptive research design. Descriptive research aims to systematically describe conditions or phenomena that occur within the research object based on data obtained from the field (Rahmadi, 2011). In this study, the descriptive method was used to analyze and describe the level of maximal oxygen uptake (VO_2Max) among students participating in soccer extracurricular activities.

Time and Research Location

This research was conducted at MTs Bahrul Ulum in Rokan Hulu Regency after obtaining permission from the school authorities. Data collection was carried out in September 2025.

Population and Sample

The population of this study consisted of all eighth-grade students who participated in soccer extracurricular activities at MTs Bahrul Ulum in Rokan Hulu Regency, totaling 20 students. The sampling technique used was total sampling, which involves selecting all members of the population as research samples (Sugiyono, 2019). Therefore, the total sample in this study consisted of 20 students aged 14–15 years who were actively involved in soccer extracurricular activities.

Research Instrument

The instrument used in this study was the Multistage Fitness Test (MFT), also known as the Beep Test (Sepdanius et al., 2019). This test is commonly used to measure aerobic capacity or cardiorespiratory endurance, which is expressed as a VO_2Max value.

During the test, participants ran back and forth over a distance of 20 meters while following the rhythm of a beep sound that gradually increased in speed at each level. Participants were required to reach the designated line before the next beep sounded. The test was terminated when participants failed to keep up with the beep rhythm for two consecutive attempts. The VO_2Max value was then estimated based on the level and number of shuttles successfully completed by the participants during the test (American College of Sports Medicine, 2025).

Data Analysis Technique

The data analysis technique used in this study was quantitative descriptive analysis. The collected data were analyzed by calculating descriptive statistical values, including the mean, standard deviation, maximum value, and minimum value. Subsequently, the data were classified into fitness level categories using standardized scores (T-scores) with five categories: very good, good, moderate, poor, and very poor (Arikunto, 2010). In addition, frequency distribution and percentage analysis were used to describe the overall VO_2Max levels of the students. Data processing was carried out using the SPSS software application.

RESULT AND DISCUSSION

Results

Data Description

The data in this study represent the results of the analysis of maximal oxygen uptake (VO_2Max) levels among students participating in soccer extracurricular activities at MTs Bahrul Ulum in Rokan Hulu Regency, totaling 20 participants. The data were obtained using the Multistage Fitness Test (MFT), which is commonly used to measure aerobic endurance. After the data were collected, they were processed to determine the classification of the students' physical fitness levels. The descriptive statistical results of the students' VO_2Max values are presented as follows.

Table 1. Descriptive Statistics of VO_2Max Levels among Soccer Extracurricular Students at MTs Bahrul Ulum, Rokan Hulu Regency

Variable	N	Mean	Min	Max	Std. Deviation
Vo2 Max MTs Bahrul Ulum Regency Rokan Hulu	20	31,87	24,00	42,90	5,74

Based on the descriptive statistical data presented, the VO_2Max levels of the 20 soccer extracurricular students at MTs Bahrul Ulum in Rokan Hulu Regency show considerable variation. The lowest recorded VO_2Max value was 24.00, while the highest reached 42.90. The mean VO_2Max value of the students was 31.87, with a standard deviation of 5.74. This standard deviation indicates that the data distribution is relatively close to the mean value, suggesting that most students' VO_2Max values are clustered around the average.

Table 2. Frequency Distribution of Students VO_2Max Levels at MTs Bahrul Ulum, Rokan Hulu Regency

No	Level	VO_2Max	Category	Frequency	Percentage (%)
1	<4/7	<27,2	Very Poor	0	0
2	4/7-6/1	28,7-33,2	Poor	10	50
3	6/2-7/4	33,6-37,8	Fair	6	30
4	7/5-8/9	38,2-42,6	Average	3	15
5	8/10-9/8	42,9-45.8	Good	1	5
6	9/9-12/2	46,2-54,3	Very Good	0	10
7	>12/2	>54,3	Exellent	0	0
Total				**20**	**100**

Based on the frequency distribution shown in Table 2, most students at MTs Bahrul Ulum in Rokan Hulu Regency fall within the Poor and Fair categories of VO_2Max levels. A total of 50% of the students (10 individuals) were classified in the Poor category with VO_2Max values ranging from 28.7 to 33.2. The Fair category accounted for 30% of the students (6 individuals) with VO_2Max values between 33.6 and 37.8. The Average category included 15% of the students (3 individuals) with VO_2Max values ranging from 38.2 to 42.6. Meanwhile, the Good category consisted of only 1 student (5%) with a VO_2Max value between 42.9 and 45.8.

No students were categorized as Very Poor, Very Good, or Excellent. Overall, these findings indicate that the VO_2Max levels of students participating in soccer extracurricular activities at MTs Bahrul Ulum are distributed across several categories; however, the majority fall within the lower fitness levels. The following histogram illustrates the frequency distribution of the students' VO_2Max values (Figure 1).

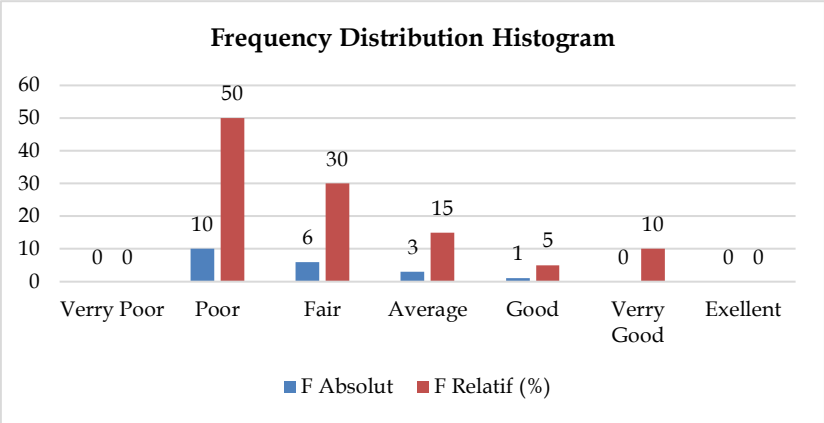

Figure 1. Histogram of VO_2Max Frequency Distribution of MTs Bahrul Ulum Students, Rokan Hulu Regency

Discussion

The data in this study represent the results of an analysis of maximal oxygen uptake (VO_2Max) levels among students participating in soccer extracurricular activities at MTs Bahrul Ulum in Rokan Hulu Regency. The total sample consisted of 20 students. The data were obtained using the Multistage Fitness Test (MFT), also known as the Beep Test, which is a standardized instrument used to measure aerobic capacity and cardiovascular endurance. After the data were collected, they were processed to determine the classification of the students' physical fitness levels.

Descriptive statistical analysis indicated a considerable variation in the students' VO_2Max levels. The results showed that the lowest recorded VO_2Max value was 24.00, while the highest reached 42.90. The mean VO_2Max value of the students was 31.87, with a standard deviation of 5.74. This standard deviation suggests that the distribution of the data is relatively close to the mean value, indicating that most students' VO_2Max values are clustered around the average.

Based on the analysis results, the VO_2Max levels of the soccer extracurricular students at MTs Bahrul Ulum in Rokan Hulu Regency were generally classified as low. This can be seen in Table 2, which presents the frequency distribution, where most students fall into the Poor and Fair categories. A total of 50% of the students (10 individuals) were categorized as Poor, with VO_2Max values ranging from 28.7 to 33.2. Meanwhile, the Fair category included 6 students (30%), with VO_2Max values between 33.6 and 37.8. These findings indicate that although the students actively participate in a sport that requires high physical intensity, their cardiorespiratory fitness levels are still not optimal.

These findings are consistent with the study conducted by (Juniardi et al., 2016) on soccer extracurricular students at SMP N 4 Sei Nyirih, which also reported that the majority of students had VO_2Max levels categorized as "poor" and "below average." This suggests a gap between the training programs implemented and the expected improvements in physical fitness.

However, these results differ from the findings reported by Al Ma'ruf et al. (2024), who examined soccer players from Persikab Bandung and reported significantly higher levels of cardiorespiratory fitness. Their study found that 46.9% of players were categorized as superior, 40.6% as very good, and 12.5% as good, with an average VO_2Max value of 51.675 ml/kg/min, which falls within the very good category. These differences may be influenced by factors such as training level, playing experience, and the intensity of structured training programs typically

implemented in club-level soccer compared to school-based extracurricular activities. This explanation is supported by Niknam et al. (2025), who stated that systematic training programs with higher intensity can significantly improve aerobic capacity and VO_2Max values through physiological adaptations in the cardiovascular system and skeletal muscles. Consequently, athletes with more advanced training experience tend to demonstrate higher levels of physical fitness.

In the context of soccer extracurricular activities, having a high VO_2Max is crucial because soccer requires continuous and high-intensity physical activity throughout a 2 × 45-minute match (Düking et al., 2024). Players with low VO_2Max levels tend to experience fatigue more quickly, which can disrupt concentration and lead to decreased performance during a match (Oukheda et al., 2024). Therefore, optimal VO_2Max levels are considered one of the key determinants of successful performance in soccer.

The factors influencing VO_2Max are complex and include genetics, age, sex, fitness level, and training (Firdausi & Sulistyarto, 2021). Although genetic factors may provide a predisposition, Fortunati et al. (2025) found that regular and structured aerobic training can significantly improve VO_2Max values through physiological adaptations in the cardiovascular and respiratory systems, such as increased cardiac output, improved oxygen transport efficiency, and enhanced muscle capacity to utilize oxygen during physical activity. Therefore, the findings of this study may serve as a basis for developing more structured and effective training programs aimed at improving students' VO_2Max levels.

In addition, the development of training programs requires appropriate training methods, as these play an important role in improving aerobic capacity. One training method that has been shown to be effective is High-Intensity Interval Training (HIIT), which involves repeated bouts of high-intensity exercise interspersed with short recovery periods. This method has been proven to improve VO_2Max, aerobic capacity, and energy metabolism efficiency through physiological adaptations in the cardiovascular system (Ciptadi et al., 2025).

The importance of improving VO_2Max is not limited to sports performance alone. According to McArdle et al. (2023), having a high VO_2Max also provides significant health benefits, including reducing the risk of chronic diseases such as heart disease, type 2 diabetes, and certain types of cancer. Furthermore, Powers and Howley (2018) stated that higher VO_2Max levels can improve overall quality of life by reducing fatigue and increasing energy levels for daily activities.

Thus, the results of this study have significant relevance because data regarding the VO_2Max levels of soccer extracurricular students at this school are still very limited. This study provides important preliminary data for understanding the physical fitness levels of students at MTs Bahrul Ulum and serves as a basis for effective interventions, particularly given that the findings indicate relatively low VO_2Max levels.

These results also provide valuable insights for coaches and physical education teachers at MTs Bahrul Ulum. They may use this data to evaluate the effectiveness of current training programs and design more specific training strategies to improve students' cardiorespiratory endurance. For the school, these findings may serve as a reference for developing policies related to extracurricular sports programs in order to improve students' overall health and physical fitness.

Overall, this study demonstrates that the VO_2Max levels of soccer extracurricular students at MTs Bahrul Ulum in Rokan Hulu Regency are relatively low, with the majority of students falling into the Poor and Fair categories. These findings highlight the need for intervention through more structured and effective training programs to improve their cardiorespiratory fitness.

CONCLUSION

Based on the results of this study, it can be concluded that the maximal oxygen uptake (VO_2Max) levels of students participating in soccer extracurricular activities at MTs Bahrul Ulum in Rokan Hulu Regency are generally low. Most students were classified within the Poor and Fair categories of VO_2Max. These findings indicate that although the students actively participate in sports activities, their cardiorespiratory fitness levels still need improvement in order to achieve more optimal physical fitness.

The findings of this study imply that coaches and physical education teachers should develop more structured and specific training programs to improve students' aerobic capacity, such as High-Intensity Interval Training (HIIT) or continuous aerobic training. In addition, the results of this study may serve as an evaluation reference for schools in developing more effective sports development programs aimed at improving students' overall physical fitness.

Future studies are recommended to examine the relationship between VO_2Max and other physical fitness components in soccer, such as speed, agility, and strength, or to investigate the effectiveness of various training methods in improving students' VO_2Max capacity.

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