



The Aerobic and Anaerobic Endurance Profile of Male Basketball Athletes at Paradise Basketball Academy Surau Gading in 2025

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ABSTRACT

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Basketball requires athletes to possess good physical conditioning, particularly aerobic and anaerobic endurance, to support high-intensity and repeated activities during a game. Therefore, assessing athletes' physical condition is essential to evaluate their capabilities and to design appropriate training programs. This study aimed to determine the aerobic and anaerobic endurance profiles of male basketball athletes at Paradise Basketball Academy Surau Gading in 2025. This study employed a quantitative descriptive approach using a survey method through testing and measurement. The research subjects consisted of 10 athletes who completed all testing procedures. Anaerobic endurance was measured using the Running-based Anaerobic Sprint Test (RAST), while aerobic endurance was assessed using the Multistage Fitness Test (MFT) to estimate $VO_2\max$ values. The data were analyzed using descriptive statistics, including frequency, percentage, mean, minimum, maximum, and standard deviation. The results showed that 70% of the athletes were classified in the good category for anaerobic endurance (mean fatigue index = 7.42; SD = 3.94; min = 0.83; max = 12.33), while 50% of the athletes were categorized as moderate for aerobic endurance (mean $VO_2\max$ = 42.65; SD = 5.93; min = 33.2; max = 50.8). These findings indicate that although the athletes demonstrate relatively good anaerobic capacity, their aerobic endurance still needs improvement through a balanced training program.

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INTRODUCTION

Sport is a physical activity carried out systematically to improve physical fitness, health, and sports performance (Sandi, 2019). Through well-planned and continuous sports activities, individuals can optimally develop both their physical and mental potential (Ahmad et al., 2024). In the context of competitive sports, physical condition plays a crucial role because it serves as the foundation for athletes to effectively perform technical skills and game strategies.

Basketball is one of the most popular team sports, played by two teams consisting of five players each, with the objective of scoring points by shooting the ball into the opponent's basket while preventing the opposing team from doing the same (FIBA, 2024). Basketball requires players to perform various physical activities with varying intensities, such as sprinting, jumping, changing direction, and moving continuously throughout the game (Risal

et al., 2025). These activities indicate that basketball is a sport that requires a complex combination of physical abilities, including speed, agility, strength, and endurance (Sumiyarsono, 2002).

In basketball games, the energy system used by athletes involves the alternating work of aerobic and anaerobic systems depending on the intensity of the activity performed (Shalom et al., 2023). The aerobic energy system plays a role in providing energy for low- to moderate-intensity activities that occur over a relatively long duration by utilizing oxygen as the primary energy source (Satwiko & Kumaat, 2020). Conversely, the anaerobic energy system is used during high-intensity activities that occur in a short period without directly using oxygen as the primary energy source (Yue et al., 2025). According to Bompa & Buzzichelli (2019), the dominant energy contribution in basketball games is approximately 80% from the anaerobic system and 20% from the aerobic system. Therefore, both components of endurance play a very important role in supporting athletes' performance.

Aerobic endurance refers to the ability of the cardiovascular and respiratory systems to supply oxygen to the muscles during prolonged physical activity (Arfanda et al., 2025). Athletes who possess good aerobic endurance are able to maintain game intensity for a longer period and demonstrate faster recovery after performing high-intensity activities. Improvements in aerobic capacity can occur through adaptations of the body's energy systems to structured physical training, such as high-intensity interval training, which has been shown to enhance energy metabolism efficiency and cardiovascular endurance in athletes (Ciptadi et al., 2025).

Meanwhile, anaerobic endurance refers to the body's ability to perform high-intensity physical activities within a relatively short period without relying on oxygen as the primary energy source (Yue et al., 2025). This ability is highly required in various explosive actions in basketball, such as sprinting, fast breaks, lay-ups, rebounds, and one-on-one defensive movements (Sukadiyanto, 2011).

In the process of athlete development, particularly at the academy level, measuring athletes' physical condition is an important step in determining their level of physical readiness. Marsuki et al. (2025), stated that the development of science and technology in sports has also made significant contributions to athlete development. The use of technologies such as video analysis, digital training applications, and data-based monitoring systems can assist coaches in designing training programs that are more effective and tailored to athletes' needs.

However, in practice, the development of young athletes often focuses more on technical and tactical training, while the development of specific physical condition components, particularly endurance, tends to receive less optimal attention. This condition may lead to decreased athletic performance during competitions due to limitations in endurance capacity.

Although several studies have examined the physical condition of basketball athletes, research specifically describing the aerobic and anaerobic endurance profiles of academy-level basketball athletes is still limited, particularly at the regional development level. In fact, information regarding physical condition profiles is very important as a basis for evaluating the physical readiness of young athletes and for designing more effective training programs.

Paradice Basketball Academy Surau Gading is one of the institutions dedicated to developing male basketball athletes with the aim of nurturing young athletes to achieve higher levels of performance. To support this development process, objective data regarding athletes' physical conditions, particularly those related to aerobic and anaerobic endurance capacities, are required. Such data are essential for evaluating existing training programs and designing more effective and targeted training programs that meet athletes' needs.

Based on this background, research is needed to obtain a clearer description of the physical condition of basketball athletes, particularly regarding their aerobic and anaerobic endurance capacities. Therefore, this study aims to determine the aerobic and anaerobic endurance profiles of male basketball athletes at Paradice Basketball Academy Surau Gading in 2025. The results of this study are expected to provide useful scientific information as a basis for evaluating and designing more effective physical training programs for athletes.

METHOD

This study employed a quantitative descriptive approach using a survey method through testing and measurement techniques to describe the aerobic and anaerobic endurance profiles of basketball athletes. Descriptive research aims to systematically describe phenomena that occur without conducting hypothesis testing (Arikunto, 2010). This approach was used to obtain an objective description of the athletes' physical condition, particularly related to their aerobic and anaerobic endurance capacities.

The study was conducted at Paradice Basketball Academy Surau Gading, located in Surau Gading, Rokan Hulu Regency, Riau Province, Indonesia. Data collection was carried out in September 2025. The population of this study consisted of all male basketball athletes who were members of Paradice Basketball Academy Surau Gading, totaling 20 athletes. A population is defined as a generalization area consisting of objects or subjects with certain characteristics determined by the researcher to be studied and from which conclusions are drawn (Sugiyono, 2020).

The sampling technique used in this study was purposive sampling, which is a sampling technique based on specific considerations or criteria determined by the researcher (Sugiyono, 2020). Based on this technique, the sample used in this study consisted of 10 athletes who met the predetermined research criteria.

Data collection was carried out through physical condition tests and measurements to determine the athletes' aerobic and anaerobic endurance capacities. The instrument used to measure anaerobic endurance was the Running-based Anaerobic Sprint Test (RAST). The RAST test is used to measure anaerobic endurance through repeated sprint activities. This test has a validity coefficient of 0.897 and a reliability coefficient of 0.919 based on its development at the University of Wolverhampton.

The test procedure required participants to perform six repetitions of a 35-meter sprint with a 10-second rest interval between each repetition. The test results were then calculated to obtain values for maximum power, minimum power, average power, and fatigue index, which indicates the athlete's level of fatigue (Wibisana, 2020). A lower fatigue index value indicates better anaerobic endurance capacity.

Meanwhile, aerobic endurance was measured using the Multistage Fitness Test (MFT), also known as the bleep test. This test aims to measure cardiorespiratory fitness related to maximal oxygen consumption ($VO_2\text{max}$). The Multistage Fitness Test has a validity coefficient of 0.928 and a reliability coefficient of 0.962 (Sepdanius et al., 2019).

The test was conducted on a 20-meter running track using an audio signal that regulates the running speed. Participants were required to run back and forth following the rhythm of the signal until they were no longer able to maintain the required pace. The results were recorded based on the level and shuttle reached by the participants and were then converted into predicted $VO_2\text{max}$ values according to the norms of the Multistage Fitness Test.

The data analysis technique used in this study was descriptive statistical analysis to describe the aerobic and anaerobic endurance conditions of the athletes. Data analysis included calculating the mean, median, standard deviation, variance, maximum value, and minimum value. Furthermore, the data were analyzed using frequency distribution and percentage to determine the athletes' ability categories. The percentage was calculated using the formula proposed by (Arikunto, 2010):

$$P = \frac{F}{N} \times 100\%$$

where:

P = percentage,

F = frequency,

N = number of respondents.

Furthermore, to determine the category of athletes' endurance ability levels, standard scores (T-scores) were used with five assessment categories: very good, good, moderate, poor, and very poor. The standard score was calculated using the following formula:

$$T = 50 + (Z \times 10)$$

Data analysis was performed using SPSS software to obtain more accurate calculation results.

RESULT AND DISCUSSION

Results

This study aimed to describe the aerobic and anaerobic endurance profiles of male basketball athletes at Paradise Basketball Academy Surau Gading in 2025. Anaerobic endurance was measured using the Running-based Anaerobic Sprint Test/ RAST (Wibisana, 2020), while aerobic endurance was assessed using the Multistage Fitness Test (MFT) to estimate $VO_2\text{max}$ values as an indicator of aerobic capacity (Sepdanius et al., 2019). The research subjects consisted of 10 athletes who completed all measurement procedures.

To provide a general overview of the research data, descriptive statistical analysis was conducted, including minimum, maximum, mean, and standard deviation values. The results of the descriptive statistical analysis are presented in Table 1.

Table 1. Descriptive Statistics of Athletes' Endurance

Endurance	N	Min	Max	Mean	Std. Deviation
Anaerobic	10	0.83	12.33	7.42	3.94
Aerobic	10	33.20	50.80	42.65	5.93

Based on Table 1, the results of the descriptive statistical analysis indicate that the mean RAST fatigue index (anaerobic endurance) was 7.42 with a standard deviation of 3.94. The minimum value obtained by the athletes was 0.83, while the maximum value was 12.33. Meanwhile, the results of the Multistage Fitness Test (aerobic endurance) showed that the athletes' mean VO_2max value was 42.65, with a standard deviation of 5.93, a minimum value of 33.2, and a maximum value of 50.8.

Anaerobic Endurance

Anaerobic endurance was measured using the Running-based Anaerobic Sprint Test (RAST) on ten male basketball athletes from Paradise Basketball Academy Surau Gading. The measurement results indicated that most athletes had good anaerobic endurance. The distribution of anaerobic endurance levels is presented in Table 2.

Table 2. Frequency Distribution of Anaerobic Endurance Levels

Category	Number	Percentage (%)
Very Poor	0	0
Poor	3	30
Moderate	0	0
Good	7	70
Very Good	0	0
Superior	0	0
Total	10	100

Based on Table 2, the fatigue index calculation showed that 7 athletes (70%) were categorized as having good anaerobic endurance, while 3 athletes (30%) were classified as poor. The athlete with the fastest total sprint time was SD with 30.3 seconds, whereas the slowest time was recorded by TH with 38.9 seconds. The highest fatigue index value was recorded by MA at 12.33, while the lowest value was recorded by TH at 0.83.

In general, athletes categorized as poor showed a more consistent increase in sprint time in each sprint set, indicating a decline in performance during the test. These results indicate that most athletes possess relatively good anaerobic endurance capacity.

Aerobic Endurance

The athletes' aerobic endurance was measured using the Multistage Fitness Test (MFT). The results showed variations in aerobic fitness levels among the ten athletes who participated in the study. The distribution of aerobic endurance levels is presented in Table 3.

Table 3. Frequency Distribution of Aerobic Endurance Levels

Category	Number	Percentage (%)
Very Poor	1	10
Poor	1	10
Moderate	5	50
Good	2	20
Very Good	1	10
Superior	0	0
Total	10	100

Based on Table 3, the most dominant category was moderate, with 5 athletes (50%). Furthermore, 2 athletes (20%) were categorized as good, while 1 athlete (10%) each was categorized as very good, poor, and very poor. No athlete reached the superior category.

The highest score was obtained by athlete SD with a VO_2 max score of 50.8, while the lowest score was recorded by TH with a value of 33.2. These results indicate that, overall, the athletes' aerobic endurance capacity is at a moderate level.

Discussion

The results of this study indicate that the physical condition profile of male basketball athletes at Paradise Basketball Academy Surau Gading demonstrates different characteristics between the components of anaerobic and aerobic endurance. In general, most athletes exhibited good anaerobic endurance, while their aerobic endurance tended to fall within the moderate category.

The dominance of the good category in anaerobic endurance indicates that athletes possess a relatively good ability to perform repeated high-intensity activities. In basketball, activities such as sprinting, jumping, and rapid changes of direction rely heavily on the anaerobic energy system because these activities occur in a short duration with high intensity (Bompa & Buzzichelli, 2019).

The results of the RAST measurement showed that 70% of athletes were classified in the good category, indicating that most athletes were able to maintain repeated sprint performance with relatively small declines in power output. These findings are consistent with the study conducted by Risfi et al. (2025), which reported that anaerobic capacity is an important component of the physical condition profile of basketball athletes and plays a crucial role in explosive and repeated game activities. This suggests that the training programs implemented may have sufficiently developed the athletes' anaerobic energy system.

However, several athletes were still categorized as poor with relatively high fatigue index values. This condition indicates that some athletes experienced a considerable decline in performance from the first sprint to the last sprint. This may be caused by limitations in anaerobic energy system capacity or a low tolerance to lactate accumulation during high-intensity activities (Bompa & Buzzichelli, 2019).

In contrast to the anaerobic endurance results, the measurement of aerobic endurance showed that the majority of athletes were categorized as moderate. The results of the Multistage Fitness Test indicated that 50% of athletes were in the moderate category, while only a small proportion were categorized as good and very good.

Aerobic endurance is closely related to the ability of the cardiorespiratory system to supply oxygen to the muscles during prolonged physical activity. Good aerobic capacity improves the body's ability to produce energy efficiently and supports recovery processes after high-intensity activities (Harsono, 2017).

In the context of basketball, although game activities are largely dominated by the anaerobic energy system, aerobic capacity still plays an important role as the foundation of physical fitness. Athletes with good aerobic capacity have faster recovery abilities during game intervals and between activity phases (Bompa & Buzzichelli, 2019). This is also supported by recent studies showing that improvements in aerobic capacity through High-Intensity Interval Training (HIIT) can significantly increase VO_2 max values and the physical performance of basketball athletes (Kumari et al., 2023). Furthermore, other studies indicate that fitness assessments such as the Multistage Fitness Test, Yo-Yo test, and treadmill test are commonly used to evaluate the aerobic capacity of basketball athletes and provide important insights into their cardiorespiratory fitness levels (Morrison et al., 2022).

The results of this study indicate a gap between the athletes' anaerobic and aerobic capacities. This condition suggests that the training program implemented may place greater emphasis on strength, speed, and power training compared to training aimed at improving aerobic capacity.

These findings provide important implications for basketball training programs. Coaches need to design more balanced training programs by incorporating exercises aimed at improving aerobic capacity, such as interval training, fartlek training, and continuous running. Such training methods can help increase VO₂max values and improve energy recovery during matches. With improved aerobic capacity, athletes are expected to maintain their performance for longer periods and reduce performance decline in the later stages of the game.

Overall, the results of this study indicate that the endurance profile of male basketball athletes at Paradise Basketball Academy Surau Gading is dominated by good anaerobic endurance (70%) and moderate aerobic endurance (50%). Therefore, the development of a more balanced training program between anaerobic and aerobic components is required to optimize athletes' performance.

CONCLUSION

Based on the results of the study, it can be concluded that the endurance profile of male basketball athletes at Paradise Basketball Academy Surau Gading in 2025 shows differences between the components of anaerobic and aerobic endurance. The results of the Running-based Anaerobic Sprint Test (RAST) indicate that the majority of athletes demonstrate good anaerobic endurance (70%). Meanwhile, the results of the Multistage Fitness Test (MFT) show that most athletes have moderate aerobic endurance (50%).

This study indicates that although the athletes' anaerobic capacity is relatively good in supporting explosive activities in basketball games, their aerobic capacity still needs improvement. Better aerobic endurance can help accelerate energy recovery during matches and maintain athletes' performance for longer game durations. Therefore, it is necessary to develop a more balanced training program that integrates both aerobic and anaerobic components to optimize athletes' performance. Coaches should design more structured and targeted training programs to improve athletes' overall endurance capacity.

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