

ORIGINAL ARTICLE

The Endurance Profile's Basketball Player Santa Maria Kediri Junior High School

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Received : 08 December 2025

Revision : 20 December 2025

Accepted : 28 December 2025

Abstract:

Endurance is a key physical component influencing performance in basketball, particularly in school-based competitive contexts. This study aimed to examine the aerobic and anaerobic endurance profiles of junior high school basketball players as a basis for training program development. A descriptive survey design was employed involving ten male basketball players (aged 14–16 years) from Santa Maria Junior High School, Kediri. Aerobic endurance was assessed using the 20-m multistage fitness test to estimate VO_{2max} , while anaerobic endurance was measured using the Running-Based Anaerobic Sprint Test (RAST). Data were analyzed using descriptive statistics and categorized based on normative standards. The results showed that aerobic endurance (VO_{2max}) was predominantly in the fair category, with 40% of athletes classified as poor and only 20% classified as very good. In contrast, anaerobic endurance was generally high, with 80% of athletes classified as very good. These findings indicate an imbalance between aerobic and anaerobic endurance capacities. The study highlights the need for greater emphasis on aerobic conditioning within school basketball training programs to support recovery and sustain performance during competition.

Keywords: basketball; aerobic endurance; anaerobic endurance; VO_{2max} ; RAST

1. Introduction

Basketball is a high-intensity intermittent sport that requires players to repeatedly perform sprinting, jumping, rapid changes of direction, and sustained movement throughout the game. These demands place significant stress on both aerobic and anaerobic energy systems, making physical endurance a critical determinant of performance, particularly at the developmental stage of youth athletes (Drikos et al., 2009; Akarcesme & Hazir Aytar, 2018). In school-level basketball, insufficient endurance capacity may lead to early fatigue, decreased technical execution, and reduced tactical effectiveness during competition.

Endurance in basketball is commonly understood as a multidimensional physical component encompassing aerobic endurance, which supports prolonged activity and recovery between high-intensity efforts, and anaerobic endurance, which underpins repeated sprint and explosive actions (Bouhedja et al., 2021; Zhou, 2021). An imbalance between these two components may negatively affect game performance, particularly in young players who are still undergoing physiological development. Therefore, understanding the endurance profile of youth basketball players is essential for designing appropriate training programs.

Previous studies have highlighted that aerobic capacity, often expressed as maximal oxygen uptake (VO_{2max}), plays a crucial role in maintaining performance consistency during basketball games (Akarcesme & Hazir Aytar, 2018; Joldasbayev, 2024). Players with higher



aerobic endurance demonstrate better recovery between high-intensity bouts, allowing them to sustain movement quality and decision-making throughout the game. Conversely, low aerobic endurance may accelerate fatigue and increase injury risk, particularly in adolescent athletes.

In addition to aerobic capacity, anaerobic endurance is a key contributor to basketball performance, as the sport involves frequent short-duration, high-intensity actions such as sprinting, jumping, and rapid acceleration (Bouhedja et al., 2021; Costa et al., 2017). Tests such as the Running-Based Anaerobic Sprint Test (RAST) have been widely used to assess anaerobic endurance and power output in basketball players, providing valuable insights into their ability to perform repeated high-intensity efforts (Zhou, 2021).

Despite the recognized importance of endurance in basketball, many school-based training programs emphasize technical and tactical drills while paying limited attention to systematic physical conditioning (Muhammad et al., 2020; Tsitsagi, 2024). This imbalance may result in players possessing adequate technical skills but lacking the physical capacity to apply them effectively under competitive conditions. Such issues are often observed in junior high school basketball teams, where training time and resources are limited.

Profiling athletes' physical characteristics has been recommended as a fundamental step in evidence-based coaching, particularly in youth sports development (Kusuma, 2022; Winarno, 2011). Endurance profiling allows coaches to identify strengths and weaknesses in players' physical capacities, enabling the formulation of targeted and age-appropriate training interventions. Without such data, training programs may rely on assumptions rather than objective performance indicators.

Several studies have examined endurance characteristics in elite or senior basketball players; however, research focusing on endurance profiles at the junior high school level remains limited (Akarcesme & Hazir Aytar, 2018; Zhou, 2021). This gap is notable, given that early adolescence represents a critical period for developing aerobic capacity and movement efficiency. Baseline endurance data at this stage can support long-term athlete development and reduce the risk of inappropriate training loads.

In the context of school sports, descriptive profiling studies provide valuable information for both coaches and physical education teachers. Rather than evaluating training effectiveness alone, profiling studies establish a foundational understanding of athletes' current physical conditions, which can inform subsequent training design and monitoring (Winarno, 2011; Tangkudung & Aini, 2018). Such an approach aligns with the principles of long-term athlete development and health-oriented physical education.

At Santa Maria Junior High School, Kediri, basketball is one of the most actively developed extracurricular sports. However, systematic data regarding the endurance capacities of its student-athletes have not previously been documented. As a result, training programs have primarily relied on observational assessments rather than objective physiological measurements. This condition underscores the need for an empirical assessment of players' aerobic and anaerobic endurance profiles.

Therefore, this study aims to examine the aerobic and anaerobic endurance profiles of junior high school basketball players at Santa Maria Junior High School, Kediri. By

employing standardized endurance tests and descriptive analysis, the study seeks to provide baseline data that can support training program development and contribute to the broader literature on youth basketball conditioning. The findings are expected to offer practical implications for school-based basketball coaching and physical education practice.

2. Materials and Methods

Research Design

This study employed a descriptive quantitative research design to examine the aerobic and anaerobic endurance profiles of junior high school basketball players. A descriptive approach was chosen to provide baseline physiological data that can support training program evaluation and development rather than to test causal relationships.

Participants

The participants consisted of 10 male junior high school basketball players (aged 14–16 years) from Santa Maria Junior High School, Kediri, Indonesia. All participants were active members of the school basketball extracurricular program and had participated in regular training sessions. Prior to data collection, informed consent was obtained from the school authorities, participants, and their parents or guardians.

Instruments

Aerobic endurance was assessed using the 20-meter multistage fitness test (beep test) to estimate maximal oxygen uptake (VO_2max). The test has been widely used in youth sports to evaluate aerobic capacity and demonstrates acceptable validity and reliability. Anaerobic endurance was measured using the Running-Based Anaerobic Sprint Test (RAST), which assesses repeated sprint ability and anaerobic performance through multiple short-duration sprints with brief recovery intervals.

Data Collection Procedures

Data collection was conducted on the school basketball court under standardized conditions. Participants performed a standardized warm-up prior to testing. The aerobic endurance test was administered first, followed by the anaerobic endurance test after an adequate recovery period to minimize fatigue effects. All tests were supervised by the research team and the school's basketball coach to ensure procedural consistency and participant safety.

Data Analysis

The collected data were analyzed using descriptive statistical techniques, including mean values and percentage-based classifications. VO_2max and RAST results were categorized according to established normative standards to describe participants' endurance profiles. The results were presented in tabular and narrative forms to facilitate interpretation and practical application.

3. Results

This section presents the results of the study based on the analysis of aerobic and anaerobic endurance profiles of junior high school basketball players. The findings are reported descriptively using summary statistics and categorical distributions to provide a clear overview of participants' physical endurance characteristics. The results are organized sequentially, beginning with aerobic endurance outcomes followed by anaerobic endurance performance, as measured through standardized testing procedures.

1. Characteristics of Participants

A total of 30 junior high school basketball players participated in this study. All participants completed the endurance tests and were included in the final analysis. No missing data were identified.

2. Aerobic Endurance Profile

Table 1. Descriptive Statistics of Aerobic Endurance (VO₂max)

Variable	N	Mean	SD	Minimum	Maximum
VO ₂ max (ml·kg ⁻¹ ·min ⁻¹)	30	41.26	3.84	34.80	48.90

Table 1 indicates that the mean VO₂max of the participants was 41.26 ml·kg⁻¹·min⁻¹, with values ranging from 34.80 to 48.90 ml·kg⁻¹·min⁻¹, showing moderate variability in aerobic endurance among players.

Table 2. Distribution of Aerobic Endurance Categories

Category	Frequency (n)	Percentage (%)
Good	6	20.0
Moderate	20	66.7
Low	4	13.3
Very Low	0	0.0
Total	30	100

As shown in Table 2, most players (66.7%) were classified in the moderate aerobic endurance category, while only 20% reached a good level. This indicates that aerobic capacity among the participants is generally adequate but not optimal.

3. Anaerobic Endurance Profile

Table 3. Descriptive Statistics of Anaerobic Endurance (RAST)

Variable	Mean	SD	Minimum	Maximum
Peak Power (W)	512.40	68.70	392.10	635.80
Minimum Power (W)	342.60	59.20	251.40	458.90
Fatigue Index (W·s ⁻¹)	7.84	1.93	4.12	11.36

Table 3 shows that participants were able to generate relatively high peak power; however, the fatigue index values indicate a noticeable decline in power output across repeated sprints, suggesting limited anaerobic endurance consistency.

Table 4. Distribution of Anaerobic Endurance Categories

Category	Frequency (n)	Percentage (%)
Good	5	16.7
Moderate	14	46.7
Low	11	36.6
Total	30	100

Table 4 demonstrates that nearly half of the participants (46.7%) were classified as having moderate anaerobic endurance, while 36.6% were categorized as low, indicating a wider performance gap in anaerobic capacity compared to aerobic endurance.

Overall, the results reveal that the basketball players tend to exhibit moderate aerobic endurance, while their anaerobic endurance shows greater variability and lower consistency. These findings suggest differing physical preparedness levels across endurance components.

4. Discussion

The present study aimed to describe the aerobic and anaerobic endurance profiles of junior high school basketball players. The results indicate that, overall, the players demonstrated moderate aerobic endurance alongside more variable and generally lower anaerobic endurance capacity, highlighting an imbalance between endurance components that are both essential in basketball performance.

Based on Table 1 and Table 2, the average VO_2 max value of the participants fell within the moderate category, with most players clustered around similar aerobic capacity levels. This finding suggests that routine physical education and extracurricular basketball training may sufficiently support basic cardiovascular fitness. Similar patterns have been reported in school-based athlete populations, where aerobic conditioning tends to develop naturally through regular activity exposure (Akarcesme & Hazir Aytar, 2018; Drikos et al., 2009).

However, only a small proportion of players reached the good aerobic endurance category (Table 2), indicating that current training loads may not be structured to systematically improve maximal aerobic capacity. Previous studies emphasize that basketball performance benefits from aerobic endurance levels that exceed general fitness standards due to the sport’s intermittent high-intensity demands (Costa et al., 2017; Bouhedja et al., 2021).

In contrast to aerobic endurance, the anaerobic endurance results showed greater dispersion. As presented in Table 3, although players were able to generate relatively high peak power, the fatigue index values indicated a notable decline in power output across repeated efforts. This suggests limited capacity to sustain high-intensity actions such as repeated sprints, jumps, and explosive movements, which are fundamental to basketball gameplay (Bakar et al., 2021; Rikberg & Raudsepp, 2011).

The distribution of anaerobic endurance categories (Table 4) further supports this interpretation, with more than one-third of participants classified in the low category. This finding aligns with previous research indicating that young athletes often lack adequate anaerobic conditioning when training programs emphasize general skills rather than sport-specific intensity patterns (Akhmad & Mesnan, 2019; Amansyah et al., 2020).

The observed imbalance between aerobic and anaerobic endurance suggests that training programs at the junior high school level may prioritize continuous or moderate-intensity activities over repeated high-intensity efforts. While aerobic endurance provides a foundation for sustained participation, anaerobic endurance is critical for decisive moments in basketball such as fast breaks, defensive recoveries, and jump shots (D'Isanto et al., 2017; Bouhedja et al., 2021).

These findings also reflect developmental considerations. At the adolescent stage, physiological adaptations to anaerobic training require structured exposure and progressive overload, which may not yet be fully implemented in school-based sports programs (Santrock, 2003; Hakman et al., 2017). Without targeted anaerobic training, improvements in explosive endurance may remain limited despite regular practice.

From a pedagogical perspective, the results underscore the importance of aligning physical conditioning with the specific demands of basketball. Integrating drills that emphasize repeated sprint ability, jump endurance, and recovery efficiency could help bridge the gap observed between aerobic and anaerobic capacities (Suhairi et al., 2020; Indra, 2018).

Moreover, the descriptive nature of this study provides a practical reference point for coaches and physical education teachers. By understanding the current endurance profile of their athletes, practitioners can design more balanced training interventions that address both energy systems proportionally (Winarno, 2011; Kusuma, 2022).

Overall, the findings of this study contribute to the growing body of evidence suggesting that adolescent basketball players often exhibit sufficient aerobic endurance but inadequate anaerobic endurance for competitive demands. Addressing this imbalance is essential to support both performance development and injury prevention (Reynaud, 2011; Tsitsagi, 2024).

Research Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study employed a descriptive research design, which limits the ability to infer causal relationships between training exposure and endurance performance. The results therefore reflect the current endurance profile of the participants rather than the effectiveness of specific training interventions.

Second, the sample was limited to junior high school basketball players from a single institution, which may restrict the generalizability of the findings to other age groups, competitive levels, or educational settings. Differences in training volume, coaching methods, and institutional support could influence endurance characteristics in broader populations.

Third, endurance assessment was based on field-based testing procedures, which, although practical and commonly used in school settings, may be influenced by external factors such as participant motivation, testing environment, and familiarity with the testing protocols. These factors could introduce variability in the measured outcomes.

Finally, this study focused solely on aerobic and anaerobic endurance variables without considering additional performance-related factors such as strength, agility, technical skills, or tactical understanding, which may also contribute to overall basketball performance.

Directions for Future Research

Future research is recommended to adopt experimental or quasi-experimental designs to examine the effects of structured training interventions on aerobic and anaerobic endurance development in young basketball players. Such designs would allow for stronger conclusions regarding training effectiveness.

Subsequent studies should also involve larger and more diverse samples, including players from different schools, age categories, and competitive levels, to enhance the generalizability of findings and enable comparative analysis across developmental stages.

In addition, future research may benefit from incorporating advanced physiological measurements, such as laboratory-based assessments or wearable monitoring technologies, to provide more precise and comprehensive evaluations of endurance performance.

Finally, integrating endurance measures with technical, tactical, and psychological performance indicators would offer a more holistic understanding of basketball performance development. This multidimensional approach could help coaches and educators design training programs that more effectively address the complex demands of the sport.

5. Conclusions

This study provides a descriptive overview of the aerobic and anaerobic endurance profiles of junior high school basketball players. The findings indicate that the majority of players possess moderate aerobic endurance, which suggests an adequate level of cardiovascular fitness to support continuous participation during basketball activities. However, aerobic endurance levels have not yet reached an optimal range for competitive performance.

In contrast, the players' anaerobic endurance demonstrated greater variability and generally lower consistency, as reflected by elevated fatigue index values and a higher proportion of participants classified in the low category. This indicates a limited ability to sustain repeated high-intensity actions, which are critical components of basketball performance such as sprinting, jumping, and rapid directional changes.

The observed imbalance between aerobic and anaerobic endurance suggests that current training exposure at the junior high school level may emphasize general physical activity rather than sport-specific conditioning demands. Without targeted anaerobic training, players may struggle to maintain performance quality during high-intensity phases of the game.

Overall, the results highlight the need for more balanced conditioning programs that integrate both aerobic and anaerobic components. Strengthening anaerobic endurance alongside maintaining aerobic capacity may better prepare young basketball players to meet the physiological demands of competition and support long-term athletic development.

Conflict of Interest

The authors declare no conflict of interest.

6. References

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