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Analysis of Anaerobic Capacity of Basketball Athletes in the Provincial Championship of Balangan Regency

Muhammad Risfi[1A-E*], Lazuardy Akbar Fauzan[2B-D], Edwin Wahyu Dirgantoro[3B-D]

[1,2] Universitas Lambung Mangkurat, South Kalimantan, Indonesia

risfimuhammad@gmail.com[1], lazuardy.fauzan@ulm.ac.id[2], edwin.dirgantoro@ulm.ac.id[3]

ABSTRACT

This research aims to analyze the anaerobic capacity of basketball athletes from the Regional Championship of Balangan Regency to provide an overview of the athletes' physical condition and recommendations for training program development. The method used is a quantitative descriptive study with purposive sampling techniques, involving 16 athletes who meet the criteria as samples. The measurement instrument used is the Running-based Anaerobic Sprint Test (RAST) based on a validated Android application. The collected data includes maximum power, minimum power, average power, and fatigue index, which are then categorized based on physical fitness norms. The results show that out of 16 athletes tested, 12 athletes (75%) have anaerobic endurance in the 'very good' category, and 4 athletes (25%) are in the 'good' category. No athletes were found in the moderate, insufficient, or very insufficient categories. The maximum average power obtained is 222.89, the minimum power is 122.71, and the average power is 165.22. This study concludes that the anaerobic capacity of basketball athletes in the Balangan District provincial championship is generally very good. However, there is still room for improvement, particularly in recovery efficiency after intense activities. The results of this study are expected to serve as a reference for coaches in designing more directed training programs to improve athletes' performance, especially in the aspect of anaerobic endurance.

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INTRODUCTION

Basketball is a game that uses a large ball, played by two teams, each consisting of five players, whose aim is to score by putting the ball into the opponent's basket and to defend their basket from being scored on. (Gumantan, Mahfud, et al, 2021) . According to (Yosi et al, 2025:326). Basketball is a high-intensity sport that requires speed, endurance, and strength.

According to Fatahilah (Candra, 2020:107), Basketball is a sport that involves movement activities that require various abilities, techniques, and tactics to achieve the

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risfimuhammad@gmail.com[1*]

goals of the game. Basketball is played by two teams, each consisting of five players. Each team consists of twelve players, including the captain. Each team aims to score points. The objective of each team is to shoot the ball into the opponent's basket and to prevent the opposing team from scoring (FIBA, 2024). Based on this theory, basketball is a team sport of team cooperation to put the ball into the opponent's basket while defending against the ball entering our basket.

According to (Hidayah et al, 2019:2), Physical condition is one of the most fundamental aspects needed in any effort to improve an athlete's performance and serves as the foundational starting point for any sport. According to Eni (Aunilah et al, 2024:270), participating in sports regularly helps individuals develop physically and mentally. Physical fitness becomes one of the important elements in terms of performance improvement (Fauzan, L. A., & Dirgantoro, 2020). A person can excel if they have good physical quality and quality of life. Good quality of life allows a person to have a refreshed physical quality to enjoy life and their existence, both physically, mentally, emotionally, and socially (total fitness) (Dirgantoro, E. W., & Fauzan, 2021) . According to Adi et al (2023:280). The component of physical condition in basketball is very important because of the long duration of the match, as well as the intensity of the game that often forces basketball players to engage in physical contact with their opponents.

According to Sajoto Affirdausy et al (2020:2), there are 10 components of physical condition, namely: strength, endurance, power, speed, flexibility, balance, agility, accuracy, coordination, and reaction. Each sport has its physical condition requirements according to the characteristics of the sport.

Basketball is a form of sport that requires a combination of physical components and technique. According to Endrisman et al (2023:601). The physical components in basketball include coordination, speed, flexibility, accuracy, agility, power, endurance, stamina, and high physical fitness. Meanwhile, the technical components are: the ability to dribble, pass, shoot, and rebound.

Physical ability is an important asset for athletes to optimize their potential. According to (Satwiko et al, 2020), The Analysis of Aerobic and Anaerobic Endurance Ability of Male Basketball Extracurricular Students of SMA Negeri 1 Kotabumi 327 reveals that about 80% of the energy used in basketball comes from the ATP/PC system (anaerobic alactic or phosphagen).

Anaerobic is an activity that does not require the assistance of oxygen. Therefore, anaerobic endurance is not like aerobic endurance, which is a process of meeting energy demands that does not require external oxygen from the human body, while anaerobic capacity itself can be interpreted as the maximum speed of work done using anaerobic energy sources (Wilson, 2007).

Anaerobic endurance involves the process of energy production without oxygen, divided into two systems: alactic anaerobic and lactic anaerobic. The alactic anaerobic system uses energy sources from the breakdown of ATP and PC without producing lactic acid, while the lactic anaerobic system uses muscle glycogen through anaerobic glycolysis, producing energy along with lactic acid (Maulana, 2018).

According to Satria (2018) states that the anaerobic lactic energy system is a system that operates without requiring oxygen, but produces lactic acid. According to (Sukadiyanto, 2011), "Anaerobic lactic endurance is an individual's ability to handle training loads with peak intensity in the time range of 10 to 120 seconds", which shows the importance of this system in supporting high-intensity physical activity.

According to (Satria, 2018), in the anaerobic glycolysis process, one molecule of glucose produces 3 ATP. The accumulation of lactic acid in muscle cells causes a decrease in muscle pH, which can affect enzyme activity and chemical reactions within muscle cells. During the recovery phase, lactic acid produced from anaerobic glycolysis is transported to less active muscles and to the liver, where it is converted into pyruvic acid. This pyruvic acid is then converted to glucose, which is released into the bloodstream and sent to active muscles to be reused as an energy source during activity.

In Balangan Regency, basketball is one of the sports that is highly popular among the community. However, there has not been any research specifically evaluating the anaerobic endurance levels of athletes participating in this sport. Therefore, this study aims to analyse the physical condition of athletes in the provincial championship basketball in Balangan Regency by measuring anaerobic endurance using the Running-based Anaerobic Sprint Test (RAST).

In the observations conducted by the researcher on the basketball athletes during the provincial championship matches and training, problems were found in the athletes' physical condition, specifically in anaerobic endurance during games. Athletes often feel tired when engaging in happy games or during matches. Anaerobic endurance while playing basketball involves all participants performing short sprints during warm-ups and games. Therefore, the researcher intends to analyse how the fatigue index and anaerobic endurance are for the provincial basketball athletes. The purpose of this research is to evaluate the anaerobic endurance of the basketball athletes in Balangan Regency. The results of this study are expected to provide benefits in improving athlete performance and developing more focused training strategies.

METHODS

This research uses a quantitative descriptive research method. Quantitative descriptive research is used to describe, examine, and explain something being studied as it is, and draw conclusions from observable phenomena using numbers. Quantitative descriptive research is research that only describes the content of a variable in the study, not intended to test a specific hypothesis. Thus, it can be understood that quantitative descriptive research is research that describes, analyzes, and explains a phenomenon with data (numbers) as they are, without intending to test a specific hypothesis (Sulistyawati et al, 2022).

The population in this sample consists of basketball athletes from the provincial championship, totalling 26 athletes. The sample used in this study is 16 athletes. The sampling technique used is purposive sampling, which is a sampling technique based on

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risfimuhammad@gmail.com[1*]

specific criteria. The criteria in this study are basketball athletes from the provincial championship of Balangan Regency.

RAST (Running-Based Anaerobic Sprint Test) is a physical test developed in the UK in 1997 by Draper and Whyte at the University of Wolverhampton (DRAPER, 1997) in (Millah et al, 2024). The RAST test is performed by sprinting 35 meters 6 times with a 10-second rest between sprints. This test is used to measure anaerobic endurance by calculating maximum power, minimum power, and fatigue index.

Data collection was conducted using the Android application RAST, which has been validated with a 98% feasibility score. This android-based anaerobic capacity test product, RAST, has been validated by informatics experts who conducted validation tests in terms of User Interface (UI) usability and User Experience (UX) with a validation questionnaire score of 42 out of a total score of 45, meaning it is deemed feasible for use with a score of 93% from both assessment aspects. The results of the feasibility validation of the reference material for sports measurement tests conducted by sports measurement experts yielded a score of 49 out of a total score of 50, indicating that it is 98% feasible for use (Millah et al, 2024:969).

The results of the RAST test are recorded and categorized based on fitness norms.

Table 1.
RAST Norms (Mackenzie, 2005)

Norms	Category
0 - 4	Very good
4.1 - 10	Good
10.1 - 15	Enough
15.1 - 20	Less
>21	Very less

The results of maximum power, minimum power, and average power per athlete are calculated, and their average is sought.

Data is analyzed using quantitative descriptive analysis, which involves calculating the average of measurement results and categorizing them into levels of physical fitness based on existing norms. The analysis techniques used include:

1. Anaerobic Endurance Analysis
   (maximum power, minimum power, and fatigue index from RAST)
2. Percentage Category Distribution
   To understand the distribution pattern of athlete test results.

RESULTS AND DISCUSSION

Result

This section presents the results of the anaerobic endurance measurements of basketball athletes from the Provincial Championship in Balangan Regency. The data analyzed according to the applicable physical fitness norms.

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risfimuhammad@gmail.com[1*]

Table 2.
Test Results of RAST from the RAST Application Export

No.	Name	Weight	Run1	Run2	Run3	Run4	Run5	Run6	Max Power	Min Power	Average Power	Fatigue Index
1	MHA	54 kg	06.81 sec	06.56 sec	06.40 sec	06.28 sec	06.35 sec	06.93 sec	267.69 watts	199.07 watts	236.41 watts	1.74 watts/sec
2	ASH	75 kg	05.91 sec	06.23 sec	06.15 sec	06.89 sec	07.14 sec	07.13 sec	444.0 watts	253.58 watts	334.97 watts	4.83 watts/sec
3	MAF	60 kg	05.75 sec	06.12 sec	05.85 sec	07.03 sec	07.18 sec	06.80 sec	387.32 watts	198.7 watts	286.36 watts	4.87 watts/sec
4	KA	55 kg	04.95 sec	05.99 sec	05.61 sec	05.88 sec	05.43 sec	06.69 sec	556.06 watts	224.37 watts	370.93 watts	9.6 watts/sec
5	DHGS	101 kg	06.54 sec	07.69 sec	07.49 sec	07.57 sec	07.74 sec	07.91 sec	443.09 watts	250.0 watts	301.01 watts	4.3 watts/sec
6	PA	34 kg	07.26 sec	08.24 sec	08.65 sec	08.69 sec	08.78 sec	09.31 sec	108.16 watts	51.14 watts	70.54 watts	1.12 watts/sec
7	PA	33 kg	08.34 sec	07.88 sec	07.75 sec	08.17 sec	08.10 sec	08.20 sec	86.51 watts	69.3 watts	76.69 watts	0.36 watts/sec
8	RH	54 kg	07.29 sec	08.09 sec	08.04 sec	08.38 sec	08.34 sec	08.49 sec	171.07 watts	109.02 watts	126.58 watts	1.28 watts/sec
9	PD	54 kg	07.11 sec	07.25 sec	07.97 sec	08.50 sec	09.09 sec	08.69 sec	183.32 watts	87.32 watts	130.45 watts	1.97 watts/sec
10	TS	53 kg	08.01 sec	07.86 sec	08.21 sec	08.98 sec	09.18 sec	08.66 sec	134.43 watts	84.81 watts	108.93 watts	0.97 watts/sec
11	YE	38 kg	06.74 sec	07.72 sec	07.11 sec	08.45 sec	08.01 sec	08.91 sec	151.86 watts	65.71 watts	102.76 watts	1.84 watts/sec
12	DR	48 kg	07.12 sec	07.99 sec	07.11 sec	08.19 sec	07.93 sec	08.61 sec	162.95 watts	91.82 watts	126.41 watts	1.52 watts/sec
13	K	44 kg	07.72 sec	08.25 sec	07.87 sec	08.25 sec	08.24 sec	08.43 sec	117.6 watts	89.47 watts	101.04 watts	0.58 watts/sec
14	M	40 kg	08.20 sec	08.14 sec	08.31 sec	08.90 sec	08.54 sec	09.37 sec	91.16 watts	59.84 watts	78.93 watts	0.61 watts/sec
15	HOP	52 kg	07.86 sec	08.22 sec	09.15 sec	09.68 sec	10.21 sec	10.84 sec	131.9 watts	50.39 watts	85.24 watts	1.46 watts/sec
16	S	55 kg	08.04 sec	08.04 sec	08.74 sec	08.80 sec	08.73 sec	09.51 sec	129.2 watts	78.94 watts	106.42 watts	0.97 watts/sec

Anaerobic endurance measurement is done using the Running-based Anaerobic Sprint Test (RAST). The distribution of the anaerobic endurance categories of the athletes is shown in the table below:

Table 3.
Results of the RAST Test Observation

NO.	Criteria	Category	Frequency	Percentage
1.	0-4	Very good	12	75%
2.	4.1-10	Good	4	25%
3.	10.1-15	Enough	0	0
4.	15.1-20	Less	0	0
5.	>20	Very less	0	0
Number			**16**	**100%**
Average				**2,37**
Maximum Score				**0,36**
Minimum Score				**9,6**

Based on the table above, from the test results conducted on 16 basketball athletes in the Balangan district championship, it is known that 12 athletes have anaerobic endurance in the very good category (75%), while 4 athletes (25%) fall into the good

category. There are no athletes in the moderate, poor, or very poor categories, indicating that the athletes' anaerobic endurance is already very good.

Table 4.
Results of RAST Power Test Observations

NO.	Research Sample	Body Weight	During Running	Maks. Power	Min. Power	Average Power
1.	MHA	54	39.1	267.69	199.07	236.41
2.	ASH	75	39.2	444.0	253.58	334.97
3.	MAF	60	38.5	387.32	198.7	286.36
4.	KA	55	34.2	556.06	224.37	370.93
5.	DHGS	101	44.6	443.09	250.0	301.01
6.	PA	34	50.6	108.16	51.14	70.54
7.	PA	33	48.2	86.51	69.3	76.69
8.	RH	54	48.2	171.07	109.02	126.58
9.	PD	54	48	183.32	87.32	130.45
10.	TS	53	50.6	134.43	84.81	108.93
11.	YE	38	46.8	151.86	65.71	102.76
12.	DR	48	46.7	162.95	91.82	126.41
13.	K	44	48.5	117.6	89.47	101.04
14.	M	40	50.3	91.16	59.84	78.93
15.	HOP	52	55.7	131.9	50.39	85.24
16	S	55	51.7	129.2	78.94	106.42
Average				222.89	122.71	165,22
Maximum Score				556.06	253.58	370.93
Minimum Score				86.51	50.39	70.54

The purpose of the data description above is to illustrate the maximum power mean, minimum power, and individual average power, which are accumulated from the sample of basketball athletes from the Balangan Regency provincial championship. Based on the table above, the results show that the overall maximum power mean of all athletes is 222.89, the minimum power of all athletes is 122.71, and the average power accumulated from all athletes is 165.22.

Discussion

Basketball is a heavy sport that requires strong physical endurance. According to (Irdyahningtyas et al, 2020:183), Basketball requires good skills as well as support from good physical condition, such as aerobic and anaerobic endurance, because the movements in basketball are very complex and demand heavy physical exertion. According to Dinata et al (2022). Basketball requires individuals to have good skill mastery and support from good physical endurance, such as aerobic and anaerobic endurance, as the movements in basketball are very complex and demand a consistently fit physique.

Basketball is a game that requires quick movements, sudden stops, rapid direction changes, all of which must be balanced by the player's ability to control their body balance (Fajar Aditya et al, 2019:51), in (Satwiko et al, 2020:73).

Basketball requires athletes to have good anaerobic endurance to support their performance in playing. According to Bompa (2018), Basketball is a sport that relies on the anaerobic energy system for about 80% during the match. Good anaerobic capacity

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risfimuhammad@gmail.com[1*]

allows players to sprint, jump, and change direction explosively. This is in line with Brittenham's opinion (Satwiko et al, 2020:74) "Basketball consists of about 20% aerobic and 80% anaerobic, with many factors affecting the energy ratio usage for each athlete".

According to (Wibisana, 2020:141), Anaerobic is an activity that does not require the assistance of oxygen. Therefore, anaerobic endurance is not like aerobic endurance, which is a process of meeting energy needs that does not require external oxygen from the human body. Anaerobic endurance is the body's ability to repeat anaerobic work activities multiple times (Ulum, 2013:6) in (Wijaya et al, 2018).

Anaerobic capacity is the short-term ability to produce energy through creatine phosphate metabolism and glycolysis, without using oxygen, where lactate accumulates (Krops et al, 2017:289). According to (Wijaya et al, 2018), when energy exchange occurs in the body's network without the use of oxygen, this is an anaerobic process.

According to McArdle (Millah et al, 2024:955), in the anaerobic energy system, energy formation occurs without the intake of oxygen, only by releasing energy from creatine phosphate or rapidly broken down glucose. This energy system allows the body to produce energy quickly, but it can only last for a few seconds to a few minutes due to the buildup of lactic acid, which causes fatigue. According to (Wibisana, 2020:143), the fatigue index is the level of physical condition of an athlete. By knowing their level of fatigue, the athlete's physical condition can be implicitly predicted.

This research was conducted to analyze the anaerobic capacity of basketball athletes in the Balangan Regency provincial championship. Based on the RAST results, 12 athletes exhibited very good anaerobic endurance (75%), and the other 4 were categorized as good (25%). The results of this study indicate that although the anaerobic endurance of the athletes is already very good, there is still room for improvement, especially in recovery efficiency after intensive activities. Therefore, coaches can add training methods that support anaerobic development to enhance the athletes' anaerobic endurance efficiency. According to Hikmad (Sidik et al, 2023:164), Exercise is a systematic activity that enhances functional capacity.

Similar research has also been conducted by (Yosi et al, 2025). In the male basketball extracurricular students of SMA Negeri 1 Kotabumi, it was found that 8 students have anaerobic endurance in the good category (72.7%), while 3 students (27.3%) are in the adequate category. There are no students in the poor or very poor categories, indicating that the anaerobic endurance of the students is quite good.

The RAST Test is conducted by sprinting over a distance of 35 meters, and during the sprint, power or explosive strength is certainly required. According to Sajoto (Amrullah, 2017:16), Power or explosive power refers to a person's ability to utilize maximum strength exerted in the shortest possible time. According to Sukadiyanto (Susila et al, 2021:232), Muscle power is the quality that allows a muscle or group of muscles to produce physical work explosively.

According to Harsono (Prayoga et al, 2021:11), Power is the ability of muscles to exert maximum strength in a very short time. In basketball, this power is needed to perform strong movements such as sprinting, fast breaks, and jumping.

This research was also conducted to calculate the average RAST test results from the maximum power, minimum power, and the average power that has been accumulated from all athletes. From the calculation results of the power table above, the average maximum power possessed by athletes is 222.89, the average minimum power is 122.71, and the average power that has been accumulated from all athletes is 165.22.

CONCLUSION

Based on the research results regarding the anaerobic endurance of basketball athlete competitors in Balangan Regency, it can be concluded that:

The anaerobic endurance of the athletes is very good, with a percentage (75%) of athletes having anaerobic endurance in the very good category. And the results of the power observations above show that the average maximum power of the athletes is 222.89, the average minimum power is 122.71, and the average accumulated power of all athletes is 165.22.

The results above indicate that the athletes already have very good anaerobic endurance to support their performance in basketball. From the results, it is hoped that coaches can provide training programs to improve anaerobic endurance.

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