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Anaerobic Capacity Overview of Trained and Untrained Players to the Members of the Futsal Student Activity Unit at Hasanuddin University Makassar

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ABSTRACT

Backgrounds. The main asset that every futsal player must have is good aerobic and anaerobic endurance. The dominant endurance used in this sport is anaerobic endurance because it makes extensive use of glycogen as an energy source without external oxygen support. **Objective.** The purpose of this study was to determine the anaerobic endurance of trained and untrained players in the futsal student activity unit (UKM) at Hasanuddin University. **Methods.** This study was a descriptive analytical study using purposive sampling and determining the sample size using a statistical calculation with the Slovin formula, resulting in a sample of 68 people. The anaerobic endurance measurement used was the Running-based Anaerobic Sprint Test (RAST). **Results.** Players with good anaerobic capacity (low fatigue index) were predominantly 21 years old with the most common playing position being pivot. The majority of futsal players have a normal body mass index (BMI), with the most common training frequency being twice a week. In addition, the majority of futsal players have a high level of activity. **Conclusion.** The results of the study showed that the anaerobic capacity of futsal club members was still lacking, with 37 out of a total of 68 respondents having good anaerobic capacity.

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1. INTRODUCTION

Exercise has many benefits and functions for those who practice it correctly. Sports activities themselves tend to be fun and entertaining, thus promoting physical and mental health, thus developing quality individuals (Willanda et al., 2019). Currently, futsal is growing rapidly around the world. Every sport requires excellent physical condition and has a maximum performance limit. Futsal players must be physically fit or in good physical condition. Futsal is characterized by the need for endurance, strength, and agility over a relatively long period of time. Excellent physical condition significantly supports a player's performance (Faisal and Sepdanius, 2020). Futsal and soccer have different systems and energy requirements. Regulations regarding the size and system of the game are very different. This affects the amount of energy required. Examples include field size and game duration. This relates to the aerobic and anaerobic requirements that

differentiate the two sports (Wibisana, 2020). Futsal is a fast-paced game where players move the ball. Players must constantly move, find space, pass the ball, and move again (Faisal and Sepdanius, 2020). Futsal requires all players to be in prime physical condition to support their performance and achieve success. No matter how good a player's technique and tactics are, if they are not accompanied by prime physical condition, they will not be optimally utilized on the field (Litardiansyah and Hariyanto, 2020).

An athlete's endurance also influences their mobility in match situations, in addition to basic techniques such as passing, control, and dribbling (Maulana and Priyambada, 2023). Given the characteristics of futsal, the dominant physical components are endurance, explosive power, speed, agility, and strength (Saputra and Kusuma, 2019). Every player must have a good level of endurance because they must be able to maximize their full potential over a long period of time (Wahyu and Susanto, 2022). This is in line with research findings that suggest that poor stamina can lead to uncontrolled basic techniques, resulting in inaccurate, weak, and incorrect kicks (Kharisma and Mubarak, 2020). The endurance component consists of muscular and cardiovascular endurance. Muscular endurance is the ability of muscles to withstand continuous load, while cardiovascular endurance encompasses both aerobic and anaerobic endurance. Aerobic endurance relates to the ability to perform prolonged activity without fatigue, while anaerobic endurance relates to the body's ability to perform rapid, repetitive movements with rest intervals (Firmansah and Jatmiko, 2021). Factors that can influence anaerobic endurance or capacity can be internal or external. Internal factors originate from within a person and are fixed in nature, including genetics, age, gender, and so on. External factors, on the other hand, include physical activity, training duration, environment, rest patterns, and so on. To improve anaerobic endurance, athletes must train regularly and avoid external factors that can affect endurance levels (Willanda et al., 2019). Characteristics of a good futsal player include maximum anaerobic endurance, powerful techniques that can be used to adapt to any condition, and a high level of game intelligence (Sulaeman and Jayadilaga, 2023). Therefore, the main capital that every futsal player must have is good aerobic and anaerobic endurance.

The dominant endurance used in this sport is anaerobic endurance, as it utilizes glycogen as an energy source without external oxygen support. Futsal uses 60% anaerobic alactic, 20% lactic anaerobic, and 20% oxygen. Sliding, dribbling, and tight dribbling are also used. requires anaerobic lactic energy, while anaerobic lactic energy is needed for kicking, and aerobic energy is expended when futsal players run or jog to anticipate the ball (Ramadhan et al., 2021). Anaerobic capacity is essential for futsal athletes because they often engage in sudden activities that do not use oxygen. If an athlete lacks good anaerobic endurance, they cannot perform activities with maximum intensity and short duration or explosive activities (Mighra and Djaali, 2021). The predominant high-intensity anaerobic characteristics of futsal are demonstrated by very rapid movement changes and require power at the start of the movement, jumping, kicking, and stopping, thus requiring high energy and causing physiological changes in the body (Yustika et al., 2019).

Although the importance of anaerobic endurance in futsal has been widely discussed theoretically, many student futsal coaches still lack objective data on their athletes' anaerobic capacity to base their training programs on. This results in training programs that tend to be general and not fully tailored to the players' physiological needs. As a result, it is not uncommon for players to experience decreased playing intensity, fatigue quickly, and a decline in technical quality in the final phase of a match. If this condition is allowed to persist, the process of developing student futsal performance has the potential to be suboptimal and difficult to achieve maximum performance. Therefore, research into the anaerobic capacity of futsal players is crucial and urgent as a basis for more precise, targeted, and scientifically based training plans.

2. METHODS

This is a descriptive analytical study. The aim of this study was to determine the anaerobic capacity of trained and untrained players among members of the futsal student activity unit at Hasanuddin University. The population in this study was 80 members of the futsal student activity unit at Hasanuddin University. Sampling criteria were adhered to. During the data collection process, a sample of 68 participants was obtained. Anaerobic capacity was measured using the Running-based Anaerobic Sprint Test (RAST). This test is one of the more valid anaerobic fatigue tests for measuring anaerobic muscle fatigue in running-based sports. It was developed by the

University of Wolverhampton (UK) to assess an athlete's anaerobic performance (Agustiana and Lisdiantoro, 2022). This test is quite easy to perform, requiring only a stopwatch and a calculator to calculate the results.

The data obtained is primary data from measurements of the anaerobic endurance of futsal players. After the data was collected, it was analyzed and processed using Statistical Product and Service Solutions (SPSS) to determine the mean, median, minimum, maximum, frequency distribution, and percentage values. The data will be presented in tables and histograms, and descriptive analysis will be used to describe the characteristics of the research data and answer the descriptive questions.

3. RESULT AND DISCUSSION

Results

4. Table 1. Distribution of General Characteristics of Futsal Players

Characteristics	Frequency	Percentage (%)
Playing Position		
<i>Anchor</i>	12	18
<i>Flank</i>	30	44
<i>Pivot</i>	20	29
<i>Keeper</i>	6	9
Total	68	100
Exercise Frequency in a Week		
1 time	5	7
2 times	43	63
3 times	17	25
4 times	0	0
5 times	1	1
7 times	2	3
Total	68	100
Length of Time Joining the Team		
< 1 year	11	16
1 year	27	39
2 years	11	16
3 years	13	19
4 years	1	1
5 years	3	4
6 years	2	3
7 years	0	0
Total	68	100
Body Mass Index (BMI)		
Severely Underweight	1	1
Underweight	3	4
Normal Body Weight	50	74
Mild Obesity	3	4
Severe Obesity	11	16
Total	68	100
Physical Activity		
Light Physical Activity	1	1

Moderate Physical Activity	11	16
Heavy Physical Activity	56	82
Total	68	100
Trained/Untrained Players		
Trained	20	30
Untrained	48	70
Total	68	100

Source: Primary Data, 2024

Table 1 shows the characteristics of respondents based on playing position, weekly training frequency, length of membership, body mass index (BMI), physical activity level, and trained and untrained player categories. The general characteristics of respondents (N=68) indicate that the majority of players play the flank position (30 players, 44%) and most have been with the team for 1 year (27 players, 39%).

In terms of physical condition and habits, most respondents had a Normal Body Mass Index (BMI) (50 people, 74%) and reported a level of Heavy Physical Activity (56 people, 82%). The majority of respondents fell into the Untrained Players category with a training frequency of 1–2 times a week (48 people, 70%), while Trained Players (training frequency of 3–7 times a week) numbered 20 people (30%). The highest training frequency was 2 times a week (43 people, 63%).

Table 2. Distribution of Anaerobic Capacity Values of Futsal Players

Category	Frequency	Percentage (%)
Low Fatigue Index	37	54
High Fatigue Index	31	46
Total	68	100

Source: Primary Data, 2024

In general, the majority of respondents (N=68) showed Good Anaerobic Capacity (Low Fatigue Index) namely 37 people (54%), while the rest had Poor Anaerobic Capacity (High Fatigue Index) namely 31 people (46%).

Table 3. Distribution of Anaerobic Capacity Based on Respondent Characteristics

Variable Characteristics	Category	Anaerobic Capacity of Trained Players (N=20)	Anaerobic Capacity of Untrained Players (N=48)
		Good (n, %)	Less (n, %)
Capacity Status	Total	13 (65%)	7 (35%)
Playing Position	<i>Pivot</i>	2 (10%)	1 (5%)
	<i>Anchor</i>	3 (15%)	3 (15%)
	<i>Flank</i>	7 (35%)	3 (15%)
	Goalkeeper	1 (5%)	0 (0%)
Exercise Frequency	1 time/week	0 (0%)	0 (0%)

Variable Characteristics	Category	Anaerobic Capacity of Trained Players (N=20)	Anaerobic Capacity of Untrained Players (N=48)
	2 times/week	0 (0%)	0 (0%)
	3 times/week	11 (55%)	6 (30%)
	4-7 times/week	2 (10%)	1 (5%)
BMI	Thin	1 (5%)	0 (0%)
	Normal	12 (60%)	4 (20%)
	Overweight	0 (0%)	2 (10%)
	Obesity	0 (0%)	1 (5%)
Physical Activity	Currently	3 (15%)	3 (15%)
	Heavy	10 (50%)	4 (20%)

Source: Primary Data, 2024

DISCUSSION

The study results showed that 54% of the total respondents from the Hasanuddin University Futsal Student Activity Unit (UKM Futsal) had good anaerobic capacity (low fatigue index). This finding aligns with the characteristics of futsal, which is a High-Intensity Intermittent Exercise (HIIE) activity, requiring players to perform rapid and repeated sprints, accelerations, and changes of direction over short durations. Futsal performance is highly dependent on energy supply from the anaerobic-glycolytic system. Therefore, the ability to delay fatigue (good anaerobic capacity) is a key asset for players (Wahyu and Susanto, 2022).

This capacity reflects the physiological adaptation of the respondents to the demands of the exercise, which allows the muscles to effectively overcome the buildup of lactic acid which is the main cause of fatigue. One factor from the research results obtained is that the respondents are someone who is active in sports and has a regular training schedule. Futsal players themselves must have excellent endurance because futsal is a tiring activity. Loading is done in the form of running, which is done continuously by the players until the game time is over. Players are required to survive in a long game, namely for 2 x 20 minutes. (Khalissyarif and Himawan, 2021).

In-depth analysis validated the hypothesis that training status influences anaerobic capacity. The trained group of players demonstrated a higher proportion of good capacity (65%) compared to the untrained group (50%). This difference was further reinforced by training frequency. The trained players predominantly trained three times per week or more, which created a consistent and adequate training stimulus. This high-frequency training program promoted specific adaptations, such as increased muscle glycogen stores, increased activity of key glycolytic enzymes, and improved hydrogen ion buffering, all of which increased the anaerobic fatigue threshold (Teixeira et al., 2018). In contrast, the predominance of twice-per-week training in the untrained group resulted in balanced anaerobic capacity results (50% Good and 50% Poor), indicating that the intensity or volume of training at this frequency was not optimal for producing superior and consistent improvements in anaerobic fitness.

In the trained group, the highest good capacity was found in the flank position (35%). This is consistent with the fact that the flank position has the highest demands for sprinting and changes of direction, so anaerobically fit players tend to perform well in this position. Conversely, in the untrained group, the highest poor capacity was also found in the flank position (29.1%), indicating that without adequate training, players in this physically demanding position are most susceptible to fatigue. This finding implies that training status is more important than position in determining anaerobic capacity. The high or low results of these anaerobic capacity measurements are likely influenced by the level of

playing maneuvers or the positional tasks performed by the player, as each position has its own characteristics and instincts, especially physical condition characteristics (Mashud et al., 2019). Furthermore, each playing position has specific physical, technical, and tactical demands that must be taken into account in planning better training. Different positions in futsal require different anaerobic capabilities due to varying physical and tactical demands. Attackers and wingers typically engage in higher-intensity activities, such as sprinting and rapid changes of direction, which rely heavily on the anaerobic energy system. (Buhmann et al., 2022). These findings suggest that structured training serves to optimize physical potential according to position, ensuring that players in vital positions (such as flank) have the anaerobic capacity necessary to maintain power output throughout the match.

Consistent with various sports studies, the results of this study indicate that anaerobic capacity in both groups was dominated by respondents with a normal BMI (trained: 60%; untrained: 37.5%) and a high level of physical activity. A normal BMI is an ideal condition for physical performance because it reduces excessive physical workload on muscles and joints, thereby increasing mechanical and metabolic efficiency, which are prerequisites for superior anaerobic endurance (Sulaeman and Jayadilaga, 2023). Players with an overweight or obese BMI tend to have a higher fatigue index. Vigorous physical activity in general, whether structured or unstructured, contributes to the maintenance of cardiorespiratory and neuromuscular fitness, which are essential foundations for anaerobic capacity. Furthermore, vigorous physical activity requires adequate recovery for the body to recover and adapt properly. If someone does not devote sufficient time and attention to recovery, this can hinder the improvement of anaerobic capacity. Insufficient recovery can lead to fatigue buildup and overtraining, which can impact the body's ability to adapt and increase anaerobic capacity. (Asmara et al., 2023).

The results of this study also found that respondents with light and moderate levels of physical activity had good anaerobic capacity. A high level of physical activity does not guarantee that someone is performing the appropriate training to develop anaerobic capacity. Strength training and interval training involving fast, high-intensity movements are necessary to stimulate the body's adaptations that improve anaerobic capacity. (Asmara et al., 2023) Although individuals with moderate or light activity levels may have lower anaerobic capacity, it's important to remember that physical activity levels can change and improve through increased intensity and frequency of exercise. Similarly, the respondent with light physical activity levels trained three times a week. With appropriate and regular exercise, anaerobic capacity can improve over time. (Stankovic et al., 2023).

Although training and BMI show a positive correlation, the observation of three trained flank players with lower anaerobic capacity warrants further discussion. These individuals had favorable factors (young age, sufficient membership), yet their test results were poor. This can be explained by a methodological confounding variable, namely pre-test conditions. Two of the three players underwent anaerobic capacity measurements immediately after a routine training session. Acute fatigue due to the accumulation of metabolic products (e.g., hydrogen ions) after intense training leads to a decrease in power output and a drastic increase in the fatigue index during the test (Wibisana, 2020). This is in line with other findings suggesting that After an activity, the body will experience increased anaerobic energy use to provide the power and endurance needed during the activity. This can impact changes in anaerobic endurance measurements after the activity. (Mighra and Djaali, 2021). Furthermore, lack of rest is another factor that impacts physical fitness tests. Adequate rest before the test significantly influences a person's fitness level (Ayunda et al., 2022). This case highlights that to ensure the validity of findings, strict control of test protocols, including ensuring respondents are in adequate resting conditions, is crucial.

4. CONCLUSION

Overall, this descriptive study concluded that members of the Hasanuddin University Futsal Student Activity Unit (UKM) have adequate anaerobic capacity, with the majority of respondents being in the good category. The main results showed that training status was a significant determinant: the trained Players group had a higher proportion of good anaerobic capacity than the untrained group, confirming that a higher training frequency (dominantly 3 times a week) is crucial for achieving superior anaerobic endurance adaptation. Furthermore, good anaerobic capacity was strongly correlated with ideal physical characteristics, with most respondents with good capacity, whether trained or not, having a normal BMI and a vigorous level of physical activity. These findings suggest that to optimize anaerobic performance, a structured training program should be supported by maintaining an ideal nutritional status (BMI). However, this study also identified methodological limitations, namely anomalous cases of low anaerobic capacity in trained players believed to be caused by acute fatigue conditions due to the collection of physical test data immediately after routine training, which requires strict control of the respondents' conditions in future studies.

AUTHOR'S STATEMENT

This article is the author's original work and has never been published in any scientific journal, and is not currently in the process of being reviewed or published in another journal. The author hereby declares that the research article entitled "Description of Anaerobic Capacity of Trained and Untrained Players in the Futsal Student Activity Unit Members at Hasanuddin University" is the author's original work and has never been published in any journal or proceedings, and is not currently under consideration for publication by other publishers.

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