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ANALYSIS OF AEROBIC AND ANAEROBIC ENDURANCE IN FUTSAL EXTRACURRICULAR

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ABSTRACT

Participants in the futsal extracurricular programme at SMPN 1 Babirik often experience fatigue during competitions, which indicates a weak physical condition, particularly with regard to endurance. This study aims to analyse participants' aerobic and anaerobic endurance in order to prepare a more effective and targeted exercise programme. The research method uses a quantitative approach with descriptive methods. The study population consisted of 20 futsal extracurricular participants, sampled using the total sampling technique. The Multistage Fitness Test (MFT) was used to measure aerobic endurance and the Running-based Anaerobic Sprint Test (RAST) was used to measure anaerobic endurance. The results showed that the students' aerobic endurance was mostly in the very bad (75%), bad (20%) and sufficient (5%) categories, with an average score of 32.35. Anaerobic endurance, meanwhile, showed better results: 80% in the very good category and 20% in the good category, with an average maximum power of 223 watts, a minimum power of 124 watts and an average fatigue index of 2.55. This study indicates an imbalance between aerobic and anaerobic endurance. Therefore, a programme of exercises focused on improving aerobic endurance is needed. Further research using a wider sample size is recommended to make the results more representative.
Keywords: analysis; endurance; anaerobic aerobics; sports; futsal

ANALISIS DAYA TAHAN AEROBIK DAN ANAEROBIK DALAM EKSTRAKURIKULER FUTSAL

Abstrak

Peserta ekstrakurikuler futsal di SMPN 1 Babirik sering mengalami kelelahan saat bertanding, yang menunjukkan lemahnya kondisi fisik, khususnya dalam aspek daya tahan tubuh. Penelitian ini bertujuan untuk menganalisis kemampuan daya tahan aerobik dan anaerobik peserta sebagai dasar dalam penyusunan program latihan yang lebih efektif dan tepat sasaran. Metode penelitian menggunakan pendekatan kuantitatif dengan metode deskriptif. Populasi dalam penelitian ini terdiri dari 20 siswa yang mengikuti kegiatan ekstrakurikuler futsal, dengan teknik total sampling sebagai metode pengambilan sampel. Instrumen yang digunakan adalah Multistage Fitness Test (MFT) untuk mengukur daya tahan aerobik dan Running-based Anaerobic Sprint Test (RAST) untuk mengukur daya tahan anaerobik. Hasil penelitian menunjukkan bahwa daya tahan aerobik siswa sebagian besar berada pada kategori sangat buruk (75%), buruk (20%), dan cukup (5%), dengan skor rata-rata 32,35. Sementara itu, daya tahan anaerobik menunjukkan hasil yang lebih baik, yaitu kategori sangat baik (80%) dan baik (20%), dengan daya maksimal rata-rata 223 watt, daya minimal 124 watt, dan indeks kelelahan rata-rata 2,55. Kesimpulan dari penelitian ini menunjukkan adanya ketidakseimbangan antara daya tahan aerobik dan anaerobik. Oleh karena itu, diperlukan program latihan yang fokus pada peningkatan daya tahan aerobik. Penelitian lanjutan disarankan menggunakan sampel lebih luas agar hasilnya lebih representatif.
***kata kunci**: analisis; daya tahan; aerobik anaerobic; ekstrakurikuler; futsal*

INTRODUCTION

Futsal is the Spanish term for indoor soccer, which comes from the combination of the words 'futbol' and 'sala' (Asikin, Arifin, and Amirudin 2024). Futsal, which is a branch of big ball, began to be known in Indonesia since the beginning of the 21st century and was officially recognized by PSSI in 2004 (Widiyono, Setiandi, and Susanto 2022). Futsal began to enter Indonesia in 1998 and

became a popular sport among teenagers because it does not require a large field, is played by two teams of five players each, and provides various benefits such as improving physical fitness, fostering sportsmanship between teams, providing psychological refreshment, and strengthening individual mentality when competing (Luhardi et al. 2022). Futsal matches last for two halves, and each half lasts 20 minutes. Futsal is a sport that aims to attack the opponent's defense by scoring goals, while teaching fast ball circulation, attacking and defensive strategies, movement without the ball, and proper timing (Yerianto Manuk, Sulistiya, and Wibowo 2023). In order to play futsal well, players need to master individual techniques and have good strategic skills (Yusuf Habibi, Ardiyanto, and Hudah 2021). In addition, physical condition also plays an important role in optimizing the performance of futsal players on the field.

Now futsal has started to be popular among students, so many schools hold extracurricular futsal activities to develop students' interests and talents. Extracurricular is an additional activity held inside or outside the school environment outside of main lesson hours, which aims to broaden students' horizons and support the development of their talents and interests (Harahap and Rizal 2020). One way to improve students' physical fitness in schools is through participation in extracurricular activities (Ashari, Arifin, and Amirudin 2024).Physical fitness refers to a person's ability to complete daily work with a high level of effectiveness and efficiency, and maintain energy without experiencing significant fatigue (Department of Education and Culture, 1996) in (Fauzan and Dirgantoro 2020). Activities such as playing, exercising, and studying are closely related to a person's level of physical fitness (Hayati, Fauzan, and Dirgantoro 2023). As part of extracurricular activities, futsal helps improve students' physical fitness, which is important to support daily activities. A person's body is said to be fit if it is able to adapt to physical activities without causing excessive fatigue (Wahyu Dirgantoro and Akbar Fauzan 2021).

Statement put forward by (Nur, Mulhim, and Indah 2023) that physical condition is a very important aspect in futsal because every player must always move to open up space that supports the implementation of tactics and the creation of goal opportunities. Physical condition training must receive special attention and be designed carefully and systematically so that the level of physical fitness and the function of body organs can increase well (Arifin et al. 2022). Good endurance is needed in carrying out various activities that require energy, speed, strength, and other physical skills (Mustofa and Sukamti 2024). Although the size of the futsal field is relatively small, the demand for optimal physical condition remains important (Muhammad Imran, Fathoni, and Subekti 2022). In fact, players must be smart and agile in creating space when attacking, and quickly closing space when defending so as not to give gaps to opponents. Thus, physical condition is the main factor in achieving achievements in futsal and other sports. In research (Suhendra, Amirudin, and Mulhim 2023) It is also emphasized that although futsal has gained an important place in the educational environment and as a competitive arena, tournaments such as Gerindra Futsal Cup season 2 show that the physical condition of the players is the main key. Without optimal fitness, the implementation of techniques and tactical strategies will be hampered, which will ultimately have a negative impact on the results of the match.

Futsal sports have characteristics that require endurance, strength and agility which must be maintained over a fairly long period of time (Kharisma and Mubarok 2020). Endurance is a person's ability to perform physical activity for a long time without feeling excessively tired (Suprayitno 2022). In futsal, physical endurance is classified into two main categories, namely aerobic and anaerobic endurance (Muchlis Jubairi and Widyah Kusnanik 2020). Aerobic endurance refers to the body's ability to perform moderate-intensity physical activity for a long period of time with the help of oxygen as the main energy source. In contrast, anaerobic endurance is the body's capacity to perform physical activity without the involvement of oxygen, but using energy stored in the muscles (Sekar and Widodo 2021). Ideal endurance is in the range of 55.9 cc/kgBW/minute and can be measured like the bleep test, where in the futsal game players are required to move quickly forward and backward as well as right and left, so that all players must always be involved in both attacking and defensive situations.(Hidayatullah and Saputra 2025). In research (Faisal and Indrayogi 2021)also revealed that a futsal player should have optimal aerobic endurance in order to play

effectively throughout the match without experiencing excessive fatigue. In addition, this sport also uses anaerobic endurance, because it relies on glycogen as an energy source without involving oxygen from outside (Wibisana 2020).

Based on observations when the author conducted observations during teaching assistance activities and coaching for extracurricular futsal coaches, it showed that many participants experienced relatively rapid fatigue during the match, especially when entering the second half of the match, which caused a lack of speed when running, and concentration which resulted in a lack of ball control. This indicates a potential problem in the level of endurance of students, which can limit their performance on the field and reduce the effectiveness of training. Therefore, an in-depth analysis is needed regarding the aerobic and anaerobic endurance of extracurricular futsal participants at SMPN 1 Babirik to be the basis for appropriate intervention. With less than optimal physical conditions, extracurricular futsal participants at SMPN 1 Babirik have not been able to achieve maximum performance. Mistakes and defeats often occur, especially because of the slowness in anticipating the opponent's movements when defending. The transition from attacking to defending often weakens the defense, making it easier for the opponent to score goals. This affects the results of matches or trials that are less than satisfactory, most likely due to less than optimal endurance.

The problem of low levels of physical fitness of futsal extracurricular students at SMPN 1 Babirik has not received comprehensive attention until now. One of the suspected causes is the minimal frequency of training, which is only done once a week. Study by (Rangga, Sabarini, and Manshuralhudlori 2021) highlights the importance of training frequency in improving aerobic endurance in young futsal players. This is certainly an obstacle for coaches to provide an optimal physical training program. In fact, increasing endurance requires routine and consistent training. On the other hand, students have not shown a commitment to doing additional training independently outside the extracurricular schedule. As a result, the physical condition of students is still not ideal and is a challenge that must be addressed together, both by coaches and participants themselves. This study is important because the level of aerobic and anaerobic endurance of participants is not yet known, which makes it difficult to compile a training program. Seeing this, researchers feel the need to examine the level of physical endurance of extracurricular futsal participants at SMPN 1 Babirik, especially aerobic and anaerobic endurance. The results of the study are expected to provide accurate data as a basis for compiling a more efficient training program to improve participant performance in futsal.

METHOD

The approach used in this research is descriptive with a quantitative type (Sugiyono 2019). The population studied consisted of 20 students involved in futsal extracurricular activities at SMP Negeri 1 Babirik. In this study, the total sampling technique was used for sampling. Total sampling is a method that involves all members of the population as samples (Amin, Garancang, and Abunawas 2023). If the population is not more than 100 people, then all individuals included in the population can be directly used as research samples. Therefore, in this study, the entire population of 20 students was used as a sample. In this study, the author will use the Bleep Test, also known as the Multi-Stage Fitness Test, to determine the level of aerobic endurance and the Running-based anaerobic sprint test (RAST) to determine anaerobic endurance through the fatigue index of futsal extracurricular participants at SMPN 1 Babirik. The norms of the two tests are then used as a reference for managing the data. After the processing process, the data is categorized according to its level, then the results are calculated in the form of a percentage. This study describes the endurance of futsal extracurricular participants at SMPN 1 Babirik, using two types of tests: aerobic and anaerobic endurance tests. Data analysis was carried out using the percentage formula $P = F / N \times 100\%$, where P is the percentage, F is the frequency, and N is the number of respondents. The research steps began with the preparation stage, including the preparation of a proposal and obtaining an implementation permit. Furthermore, data collection was carried out through the implementation of the two tests directly in the field. After

the data was collected, the results were analyzed and interpreted, then conclusions were drawn based on the findings obtained.

RESULTS AND DISCUSSION

Based on the results of data analysis, as many as 20 students who are members of the futsal extracurricular at SMPN 1 Babirik have taken aerobic and anaerobic endurance measurements. To measure aerobic endurance, the Multi-Stage Fitness Test (MFT) is used, while anaerobic endurance is measured using the Running-based Anaerobic Sprint Test (RAST). The results of both tests are then processed based on applicable standards or norms, categorized according to their levels, and then the percentage is calculated. The percentage of the results of each test is presented in the next section.

Table 1. Aerobic Endurance Results

Interval	Category	Frequency	Percentage %
51.0-55.9	Very well	0	0%
45.2-50.9	Good	0	0%
38.4-45.1	Enough	1	5%
35.0-38.3	Bad	4	20%
<35.0	Very bad	15	75%
Amount		20	100%

Referring to the data presented in Table 1, the majority of participants showed a very poor level of aerobic endurance, with a percentage reaching 75%. Meanwhile, 20% of participants were in the poor category, 5% were classified as sufficient, and there were no participants in the good or very good categories. More complete details regarding the results of this aerobic endurance test can be seen in Figure 1.

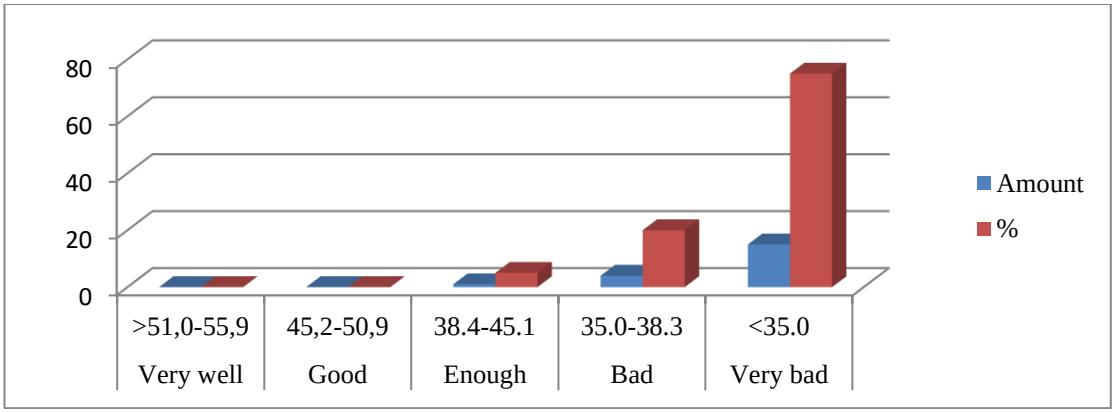

Figure 1. Aerobic Endurance Results Diagram

The results of data analysis regarding participants' anaerobic endurance are presented in Table 2.

Table 2. Anaerobic Endurance Results

Interval	Category	Frequency	Percentage %
0-4	Very well	16	80%
4.1-10	Good	4	20%
10.1-15	Enough	0	0%
15.1-20	Bad	0	0%
>21	Very bad	0	0%
Amount		20	100%

Based on Table 2, it can be seen that most of the futsal extracurricular participants at SMPN 1 Babirik have a very good level of anaerobic endurance, with a percentage reaching 80%. Meanwhile, the other 20% of participants are in the good category. There are no participants included in the sufficient, bad, or very bad categories. For a more detailed explanation of the results of the anaerobic endurance test, please refer to Figure 2.

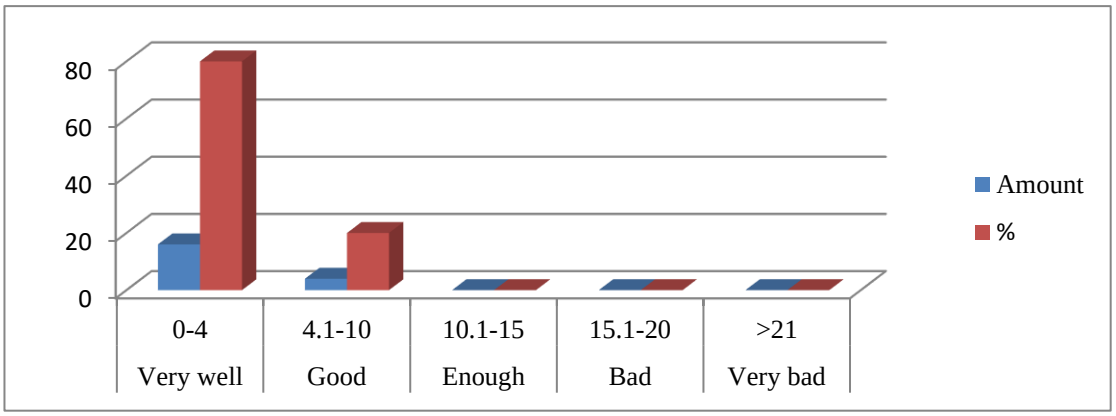

Figure 2. Anaerobic Endurance Results Diagram

This study used two items to determine endurance, namely the Multistage Fitness Test (MFT) to determine aerobic endurance, and the Running-Based Anaerobic Sprint Test (RAST) to determine anaerobic endurance. The following is a description of the data results from each test that has been carried out:

The results of the MFT test revealed that the aerobic endurance of participants with the sufficient category was 1 participant, the poor category was 4 participants, and the very poor category was 15 participants, with an average value of 32.35. These results indicate that most participants do not yet have an optimal level of aerobic endurance to support futsal activities that are intense and last for a relatively long duration. The majority of participants were seen unable to regulate their running tempo with the bleep sound. After the participants did the bleep test, the majority of them looked very tired even though the test level itself was still low. This finding is reinforced by research conducted by (Michael et al. 2023) which found that students aged 13-15 years in soccer schools generally have low cardiovascular endurance. Previous research by (Yustika, Iswati, and Subagyo 2019). also confirms that endurance is an important factor in futsal because players must be able to survive throughout the game to maintain performance. The weak aerobic endurance of futsal extracurricular participants at SMPN 1 Babirik may be due to lack of training, which is only done once a week. (Amirudin and Abdillah 2020) stated that low cardiorespiratory endurance in students is caused by inadequate training frequency. Based on these results, efforts are needed to improve aerobic endurance in participants. Training methods such as high intensity interval training (HIIT) and small sided games have been shown to be able to increase the aerobic endurance capacity of futsal players gradually, as long as they are carried out consistently and continuously, with the implementation of this training routinely, the aerobic ability of futsal players has the potential to experience a significant increase (Nugroho and Kusuma 2022).

In contrast, the RAST test results revealed that the anaerobic endurance of participants in the good category was 4 participants and the excellent category was 16 with an average score of 2.55. These results are thought to be related to training patterns that involve more fast activities such as sprints. According to (Arifin, Hamid, and Hasani 2024) If players only focus on anaerobic training, they are at risk of experiencing fatigue more quickly during long-duration matches, because their aerobic abilities have not developed optimally. Research by (Muchlis Jubairi and Widyah Kusnanik 2020) and (Agustiana and Lisdiantoro 2022) also found that in futsal teams, anaerobic capacity tends to be higher than aerobic capacity. Research by (Effect et al. 2025) revealed that the application of small-sided games training with an interval approach was able to significantly increase anaerobic

lactacyd capacity in U-17 soccer players. This approach has proven effective in developing anaerobic performance through a combination of high intensity and planned rest patterns. Similarly, a study conducted by (Ramadhan, Nurdin Wibisana, and Kresnapati 2021) discussed the comparison of interval training and circuit training in improving the anaerobic endurance of U-16 soccer players. The results showed that although both methods had a positive impact, interval training provided a more prominent increase in anaerobic capacity. Therefore, even though the anaerobic endurance of the participants was already good, coaches are still advised to maintain this type of exercise, while strengthening the aerobic component. Overall, the results of this study showed an imbalance between the aerobic and anaerobic capacities of the participants. Anaerobic endurance was at a good to excellent level, but aerobic endurance was very low. The implications of these findings point to the need for planning an exercise program that is balanced between aerobic and anaerobic exercise. According to Syafruddin (2011) in (Fauzan et al. 2022) achievement development is highly dependent on physical condition and technical skills, where a weak physique will hinder the application of techniques effectively and efficiently.

CONCLUSION

This study shows that futsal extracurricular participants at SMPN 1 Babirik have a relatively low level of aerobic endurance, while anaerobic capacity is in the good to very good category. This imbalance had an impact on students' performance during matches, especially in the second half, where a decrease in speed and concentration became factors that influenced the outcome of the match. This finding illustrates that training activities that are predominantly anaerobic in nature have not been balanced with exercises that develop the aerobic system optimally. One of the causes is the limited frequency of training, and the absence of a systematically designed coaching program to develop both aspects of endurance proportionally. Therefore, a more structured and consistent training program planning is needed, with attention to the balance between aerobic and anaerobic components. Exercises such as high intensity interval training (HIIT) and small sided games can be an effective alternative to increase aerobic capacity without neglecting the anaerobic aspect. Strengthening overall endurance is expected to support the achievement of more optimal performance in school futsal activities.

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