

Analysis of Aerobic and Anaerobic Endurances of Defenders, Midfielders, and Forwards in Football



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ABSTRACT: This study aimed to analyze the aerobic and anaerobic endurance of defenders, midfielders, and forwards in football game. The researchers applied quantitative descriptive methods and selected 30 football players as the research participants using purposive sampling. Tests and measurements were utilized to collect the data from the participants. The research instrument for measuring aerobic endurance was the Multistage Fitness Test (MFT) and the Running Based Anaerobic Sprint Test (RAST) for measuring anaerobic endurance. After the data had been collected, they were analyzed using the One-way Anova test. The results showed no significant difference between aerobic and anaerobic endurance for amateur football defenders, midfielders, and forwards. Midfielders had the highest average of aerobic endurance with an average score of 47.68 compared to defenders with an average score of 43.8 and forwards with an average of 47.1. As for anaerobic endurance ability, midfielders also obtained the highest average score of 5.07 compared to defenders, with a result of 8.24 and forwards, with a result of 8.73.

KEYWORDS: Football, Aerobic Endurance, Anaerobic Endurance, Player Position

I. INTRODUCTION

Aerobic and anaerobic physical abilities are essential physical components in a football game to achieve successful performance and eventually win the game (Yi, Qing et al., 2019). The performance of a successful team depends on the cooperative interaction between players playing in the front and back positions (Aquino, Rodrigo et al., 2020). Therefore, imaging requires anaerobic and aerobic energy for the team's performance. Aerobics and anaerobic are necessary because football games require running at high speed over short distances (sprints, accelerations, and decelerations). Their particular movements are associated with football-specific actions such as tackling opponents, defending, or creating space when mastering the game, with sprints being the most common actions before scoring (Cochrane, D.J. & Monaghan D., 2021). Football is a sport played by two teams in teams with eleven players who have their respective positions with different tasks. Each player's position requires different physical abilities, namely aerobic and anaerobic.

Generally, goalkeepers have a high posture and defenders have big bodies, especially central defenders. Central defenders have less running distance than players in other positions, which may be closely related to defenders' tactical role and lower aerobic physical capacity (Mohr, M., Krustup, P., & Bangsbo, J., 2003). Unlike the central defender, the full-back has a fast speed. Midfielders have accurate passes and the task of flowing the ball. The midfielders have the greatest distance because it acts as a link between defence and offence (Rienzi, E., Drust, B., Reilly, T., Carter, J.E., & Martin A., 2000). One midfield player can cover a total distance of 12.3 km, with 3.5 km of high intensity. Another midfielder can cover a distance of 10.8 km, of which 2 km is at high intensity (Evaggelos, M., Christos, P., Konstantinos, M., Ioannis, G., Evaggelos, B., Aristomenis S., 2012). The centre or midfielder runs about 10-12 km with an average intensity of 80-90% of the maximum heart rate and 70-80% of the level of VO₂max. In this state, it is close to the anaerobic threshold (Casajús, J.A., 2001). Furthermore, the wing midfielder and central midfielder cover the largest distances of 11.990 meters and 12.027 meters. Moreover, it is stated that the wing midfielder covers the greatest distance in high intensity (19.1-23 km/h: 738 m; >23.0 km/h: 446 m), as well as the central midfielder has the highest volume with medium intensity (11.1-14 km/h: 1965 m; 14.1-19 km/h: 2116 m) (Aloui, G., Hermassi, S., Khemiri, A., Bartels, T., Hayes, L.D., Bouhafs, E.G., Souhail, Chelly, M., & Schwesig, R., 2021).

A striker is a player in charge of scoring goals into the opponent's goal, so a striker usually has a hard or accurate calm kick. The strikers have the fastest sprint times, reaching >90% of the maximum running speed and the best agility (Al Haddad et al.,

Analysis of Aerobic and Anaerobic Endurances of Defenders, Midfielders, and Forwards in Football

2019). The forwards use most of the total amount of distance with a short sprint which is part of the anaerobic endurance ability and requires high explosive power and speed to pass the opposing defender (Boone, J., Vaeyens, R., Steyaert, A., Vanden, Bossche, L., & Bourgois, J., 2012). The strikers need anaerobic power skills such as solid jumping to control long passes from defenders or head the ball to feedback one of his teammates. An attacker must always be vigilant and be able to take an ideal position to make a goal-scoring attempt. The position of a football player in a game is a significant thing. Each position a player executes certainly has differences in tactical patterns, player mileage, and the type and intensity of actions achieved (Najafi, A., Shakerian, S., Habibi, A., Shabani, M., Fatemi, R., 2015). So, a coach must be careful to form or plan the best strategy with the composition of his players, for example, by basing the plan on aerobic and anaerobic abilities. Therefore, coaches and athletes must work together to have a strong team.

II. METHODOLOGY

The method used was quantitative research in the form of numbers and statistical analysis to analyze the differences in aerobic and anaerobic endurance in defenders, midfielders, and forwards in football games. The participants for this study included 30 Subur Jaya Blora male football players in the U-17 age group. This sample determination technique utilized a purposive sampling technique. The purposive sampling technique, also called judgement sampling, is the deliberate selection of samples based on the researcher's understanding or judgment. Simply put, the researcher decides what needs to be known and establishes through prescribed conditions in order to find samples that can and are willing to provide information based on knowledge or experience. In this study, the researchers gave the condition: male players of PS Subur Jaya Blora in the U-17 age group. The data collection techniques used were in the form of tests and measurements. In measuring the anaerobic ability, the instrument used was the Running-based Anaerobic Sprint Test (RAST) test which had a validity of 0.897 and reliability of 0.919. RAST results provided neuromuscular and energy estimates of maximum anaerobic performance (Zacharogiannis, E., Paradisis, G., Tziortzis, S., 2004). This test can be a good option for evaluation in sports that require a lot of energy, such as football, athletics, and basketball (Balčiūnas, M., Stonkus, S., Abrantes, C., Sampaio, J., 2006).

Meanwhile, the instrument for measuring the efficacy of aerobic endurance was the Multistage Fitness Test (MFT) test, which was a back-and-forth running test carried out above a distance of 15-20 meters (m) with a progressive increase in speed every minute (Lockie et al, 2021) which had a validity of 0.915 and a reliability level of 0.868. The MFT had the advantage of forcing individuals to increase their running cadence during the test before the number of successful alternating runs was recorded as a score (Orr, R.M., Caust, E.L., Hinton, B., & Pope R., 2018). The researchers used the One-way Anova test as the data analysis test, which is a test to compare more than two average results of a study. Before the analysis test, a pre-assessment was first carried out, namely a homogeneity test and a normality test.

III. RESULTS AND DISCUSSION

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A. Descriptive Results of Football Players

This research is a descriptive study, so the state of the object was described based on the data obtained. This study intended to describe and compare the state of aerobic and anaerobic endurance of amateur defenders, midfielders, and forwards in Blora. The research data obtained include age, weight, aerobic endurance ability (VO₂ max), and anaerobic endurance ability (fatigue index). The descriptive results of football players can be seen in table 1 as follows.

Table 1. Result Descriptive Player Football at Club Amateur

| Variable | Defenders (n=10) | Midfielder (n=10) | Forwards (n=10) |
|---|------------------|-------------------|-----------------|
| Age | 17.1±1.2 | 16.6±1.71 | 17.3±1.06 |
| Weight (kg) | 58.4±5,74 | 54.2±2.62 | 56.5±4.86 |
| Aerobic Endurance (VO ₂ max) | 43.38±6.06 | 47.68±6.22 | 47.09±5.59 |
| Anaerobic Endurance (FI) | 8.24±5.6 | 5.07±3.97 | 8.73±4.25 |

*(mean±SD) FI: Fatigue Index, SD: Standard DeviationBased on table 1 above, it can be seen:

The average age of amateur club football defenders in Blora was 17.1; the midfielder was 16.6, and the forward was 17.3. The defender's average body weight was 58.4 kg; the midfielder was 54.2 kg; and the forward wa 56.5 kg. Defenders had a greater weight than midfielders and forwards, with a difference of 4.2 kg for the midfielder and 1.9 kg for the forward.

Analysis of Aerobic and Anaerobic Endurances of Defenders, Midfielders, and Forwards in Football

The average aerobic endurance of amateur club football defenders in Blora was 43.38 ml/kg/min; the midfielder was 47.68 ml/kg/min; and the forward was 47.09 ml/kg/min. Midfielders had a higher average than defenders with a difference of 4.3 ml/kg/min, and forwards with a difference of 0.59 ml/kg/min. Table 1 above shows that the average anaerobic endurance (fatigue index) of amateur club football defenders in Blora was 8.24; midfielders by 5.07; and forwards by 8.73. The midfielder has a better average than the defender, with a margin of 3.17, and the forward, with a difference of 3.66.

B. Data Analysis Test Results

Before the One-way Anova test, normality and homogeneity tests were carried out as prerequisite tests. The results of the prerequisite test, namely the homogeneity test and the normality test of aerobic endurance ability for defenders, centre players and forwards, and the results of the One-way ANOVA test can be seen in table 2 as follows.

Table 2. Test Data Analysis

| Variable | Sig value. | | |
|--------------------|------------|------------|----------|
| | Defenders | Midfielder | Forwards |
| Homogeneity Test | Aerobics | 0,919 | |
| | Anaerobic | 0,487 | |
| Normality Test | Aerobics | 0,475 | 0,195 |
| | Anaerobic | 0,498 | 0,998 |
| One-Way Test Anova | Aerobics | 0,235 | |
| | Anaerobic | 0,183 | |

Based on table 2, it is stated that the normality test of aerobic endurance ability for defenders has a Sig. Value of 0.475; the midfielder has a Sig. Value of 0.311; and the forward has a Sig. Value of 0.195, due to sig value. Defenders, midfielders, and forwards >0.05 mean that the data was normally distributed. At the same time, the anaerobic endurance ability for defenders has a Sig. Value of 0.498; the midfielder has 0.068; and the forward has 0.998. Due to the Sig. Value of the defenders, midfielders, and forwards >0.05 means that the data is normally distributed. Further to the homogeneity test obtained, each sig value of 0.919 for aerobic endurance and 0.487 for anaerobic endurance. Because the sig value is >0.05 , the data can be stated as homogeneous.

After fulfilling the prerequisite tests, namely, the normality and homogeneity tests, the One-Way ANOVA test was carried out. In the variable aerobic endurance ability, a sig value was obtained at 0.235. Because it was >0.05 , there is no significant difference between the defender, the midfielder, and the forward. Meanwhile, in the variable anaerobic endurance ability, a sig value was obtained at 0.183. Because it was >0.05 , it can be stated that there was no significant difference between the defender, the midfielder, and the forward.

C. Discussion

This study aimed to analyze the conditions of aerobic and anaerobic endurance of amateur football players in Blora and the differences among the three positions. The study results showed no significant difference between aerobic and anaerobic endurance among the three player positions (Alpay., 2016). These results were also in line with several other studies showing that vo_{2max} does not differ significantly among players in each different position. Meanwhile, for anaerobic ability, some studies reported that there was no difference between the anaerobic capacities of the players according to their playing position (Nilsson, J., & Cardinale, D., 2015)

Based on the research data analysis on the aerobic and anaerobic endurance of amateur football in Blora, the average aerobic endurance (VO_{2max}) of defenders was 43.38. This result was the lowest compared to the centre and forward players because the main task of a defensive player was to keep the defensive area from being damaged by the opposing players. So, the movement intensity of defenders, especially central defenders, tends to be lower than other positions. In addition to goalkeepers, they have the lowest aerobic ability and anaerobic threshold, and their anaerobic sprint performance and agility are also relatively low. These results align with the findings of other studies on elite football players (Portes, L.A., Canhadas, I.L., Silva, R.P.L., de Oliveira, N.C., 2015). The lower sprint performance and agility might be due to the large body size, which hinders the sudden change of direction during the game on the court. Moreover, the average weight of defenders was the highest compared to middle players and forwards, which was 58.4 kg, indicating high body fat, thus affecting the player's aerobic and anaerobic endurance. At the same time, the average anaerobic endurance (fatigue index) ability was 8.24. Their anaerobic jump power is higher than other positions, and their body size benefits their head play, which is an essential part of defensive skills. A defensive player guarding the defence often heads up in anticipation of attacks from hull passes and crossings. In this case, power and a combination of aerobic and anaerobic abilities are demanded by football defenders. In modern football, a defender

Analysis of Aerobic and Anaerobic Endurances of Defenders, Midfielders, and Forwards in Football

must be able to assist in an attack, especially wing-back. A wing-back generally has a better anaerobic endurance ability than a central defender because it often helps the attack or overlaps and must quickly return to position when attacked. The central defender travels a smaller total distance when running at a high intensity (anaerobic) during the game than players in other positions. Compared to the central defender, the full-back performs more runs in high intensity (Bujnovsky, D., Maly, T., Zahalka, F., & Mala, L., 2015)

The average aerobic endurance (VO₂max) of a midfielder was 47.68. The centre player had the best VO₂max compared to the defenders and the forwards because the centre player had the main task of flowing the ball. Center players need the highest level of aerobic fitness, as they run the farthest distance during the game due to their connecting role between the back and centre of the field with the front. Midfielders must have good VO₂max because it is needed when attacking and helping the defence. Midfielders must also have good stamina because their mileage in the game is quite far as a link between defender and forward. In a football match, a midfielder must be constantly active because the centre player is the heart of the game. In comparison, the average ability of anaerobic endurance (fatigue index) of the middle player was 5.07. The midfielder must have good anaerobic endurance ability, specifically for wingers. A winger is a player positioned on the court's side. In football matches, a wing midfielder often sprints or runs with high intensity to receive the ball from the middle and back players to be passed to the forward by crossing or penetration to pass the opponent.

The average aerobic endurance (VO₂max) of the forwards was 47.09, better than the defenders, and was still below the midfield. The forward is a player whose position is closest to the opponent's goal, and his main task is to create goals. Even so, in modern football games, players positioned as forwards do not have to do the task of scoring goals. A modern attacking player must have the ability to score goals and the skills to open up/create possible spaces for his other colleagues to score. That is why an attacker needs aerobic endurance ability. The average anaerobic endurance (fatigue index) of forward players was 8.73. The attacker will use most of the total amount of distance with a short sprint, which is part of the anaerobic endurance ability and requires high explosive power and speed to pass the opposing defender because a defender generally has a lower running ability compared to other positions.

In this study, because the players were amateur, their aerobic ability was relatively low compared to several other studies (Aslan, C.S., & Koç, H., 2015). In order to improve the aerobic endurance ability of defenders, centre players, and forwards who still fall into the category of lacking, one way to improve it is to do interval training. During interval training, a person or athlete will perform physical activity at a relatively high level of intensity repeatedly and, between repetitions, will be given a period of recovery (rest) corresponding to the repetition of the given exercise (García-Hermoso, A., Cerrillo-Urbina, A.J., Herrera-Valenzuela, T., Cristi-Montero, C., Saavedra, J.M., & Martínez-Vizcaíno, V., 2016). This method combines various conditions ranging from sprinting, jogging, and walking to rest.

V. CONCLUSIONS

Based on data analysis, description, testing of research results, and discussion, it can be concluded that amateur club players' aerobic and anaerobic endurance abilities in Blora have an average difference between player positions, although not significant. Therefore, both defenders, midfielders, and forwards have equally essential needs for aerobic and anaerobic abilities.

Therefore, it is recommended that further research needs to use a more significant number of samples and also use professional football players

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Analysis of Aerobic and Anaerobic Endurances of Defenders, Midfielders, and Forwards in Football

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