

Survey of Differences In Endurance Levels of Soccer Players with Various Positions

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Abstract

This study aims to determine the level of endurance of players in different positions in soccer games. The research method used in this study is a survey method with testing and measurement techniques. The population in this study is the SSB Macan Tutul players in 2021, as many as 22 players aged 17 years, using total sampling by making the population a sample. The results of the study are calculated based on the player's position and criteria in the SSB Macan Tutul group in 2021. The results of the study based on the position of the players showed that the goalkeeper position got an average score of 41, the defender 42.7, the midfielder 44, and the attacker 42.3, and none of them met the VO₂max standard. Based on the criteria for the 2021 SSB Macan Tutul group, it shows that in the very good category (4.5%) or as many as 1 person, good (27.3%) or as many as 6 people, moderate (40.9%) or as many as 9 people, bad (27.3%) or as many as 6 people, and very bad (0%) or not at all. The player who has the highest VO₂max is the midfield player, with a value of 48.8 ml/kg/min. The player with the lowest VO₂max is the goalkeeper, with a value of 40.8 ml/kg/min, compared to an average player's VO₂max of 43 ml/kg/min.

Keywords: Endurance Level, Player Position, VO₂max

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1. INTRODUCTION

Football is a sport that is very popular and favored by almost everyone in the world, including Indonesia. Starting from children to adults, both men and women, Football is a team sport that is played using the feet with 11 vs 11 players fighting for the ball to put it in the opponent's goal. Football is a team sport played by each team consisting of eleven players, and one of them is a goalkeeper (Agustina, 2020). In the game, it is allowed to do it with all

members of the body other than the hands, except the goalkeeper, who is allowed to use his hands. In addition to aiming to score as many goals as possible against the opponent's goal, football games are also required to be able to maintain and defend their goal so as not to concede the ball (Nosa & Faruk, 2013).

Soccer is a sport that uses predominantly anaerobic energy systems. According to Suhadak (2017), the anaerobic energy system is the predominant energy system used in football games. Football games require players to move with speed, because at the time of attack and when defending, the players move more with speed or sprints. Anaerobic energy systems produce energy without the need for oxygen. The final product resulting from anaerobic glycolysis is lactic acid. Football is a sport that has a relatively complex motion that includes walking, running, and jumping activities. According to Gadev & Gutev (2015), football players do walking (walking), then jogging (light running), followed by high speed (high speed), and finally sprint (full speed running). In soccer, players must jog (normal running), run at high speed (high speed running), and sprint (full speed running), performing three different movements at different speeds. The characteristics of the athlete's movement during football games are not carried out continuously, but are cut into pieces for 2x45 minutes. This condition is also in line with soccer because the activities are carried out with high intensity. According to Hutajulu (2017), in a high-intensity football game, it is the most constant thing that occurs during the match. With high intensity, a person can experience fatigue triggered by lactate.

Football is a sport that demands high physical performance. Activities of high intensity in football games often occur and can cause fatigue (Riffai et al., 2018), where fatigue is associated with the level of player performance (Parwata, 2015; Sutopo & Misno, 2021; Widiyono & Mudiono, 2021). Therefore, fatigue can interfere with performance in the field. Fatigue during sports activities is a problem that can lead to the decline of an achievement. Lack of energy reserves and high levels of lactic acid in the blood can trigger fatigue. According to Wiarto (2015), lactic acid will lower the pH in muscles and blood, and this decrease in pH will inhibit the work of glycolytic enzymes and interfere with chemical reactions in the muscles. This situation will result in muscle contractions getting weaker and eventually experiencing fatigue.

Fatigue is an indicator of a person's lack of fitness. According to Suhartoyo et al., (2019), physical fitness is one of the main factors in being able to perform various physical activities and sports. During the football game, a level of physical fitness is needed that can support the performance of the players on the field. According to (Bryantara, 2016; Sibarani & Manurung, 2021; Widodo & Najibuzzamzam, 2021), the game of football is a type of sport that is very fast and lasts a long time. This situation will certainly drain a lot of energy and stamina, so it requires very high physical fitness. A person's level of physical fitness is supported by several components, and one of these components is cardiopulmonary endurance. According to Wiarto (2015), cardiopulmonary endurance is an important component of physical fitness.

Cardiovascular endurance is very dependent on oxygen because the body's use of movement requires oxygen intake in the process of carrying out sports activities so as not to experience fatigue. Cardiac and pulmonary endurance is the ability of the heart, lungs, and blood vessels to function optimally when carrying out an activity for a long period of time without experiencing significant fatigue (Widiastuti, 2015). The quality of cardiopulmonary endurance is quantitatively expressed by VO_{2max} , which is measured in units of ml/kg

bw/minute (Almy & Sukadiyanto, 2014; Azizah & Sudarto, 2021; Demirci & Phytanza, 2021).

A person with a good $VO_2\max$ capacity has a heart, lungs, and blood circulation that work efficiently and effectively and can supply oxygen to the muscles so that a person is able to work continuously without experiencing excessive fatigue. A person's ability to be able to carry out endurance activities well and perform recovery (recovery) quickly even though the activity lasts a long time shows that the person has a high $VO_2\max$ ((Pramantik, 2021; Widodo & Zainul, 2021)Kusumawati, 2014), while according to Nirwandi (2017), someone who has a $VO_2\max$ will be able to maintain their physical condition during the match. So, the high endurance of the heart and lungs of players is determined by the body's ability to consume oxygen, or the capacity of $VO_2\max$.

In every activity, football players have different activities in terms of moving and mileage. The role of $VO_2\max$ as an energy source is needed because the total distance traveled by football players in one match can reach 10 kilometers (Sinurat, 2019;Dellal et al., 2010). So, it is important that every football athlete has a higher capacity level that can support physiological loads during the game, and that is seen from the maximum oxygen consumption.

From the description of the background above, it can be concluded that fatigue in football games is due to the high intensity, which means fatigue is easily occurring. The accumulation of lactic acid that occurs due to the use of an anaerobic energy system can be neutralized by the amount of oxygen that enters the body and a high $VO_2\max$ capacity. Each athlete has a different position and distance traveled, and a midfielder has a better $VO_2\max$ capacity than other positions. A high $VO_2\max$ capacity is determined by the body's ability to consume maximum oxygen. $VO_2\max$ is an indicator of a person's physical ability.

2. METHODS

2.1 Participants

The population in this study were SSB Macan Tutul players aged 17 in 2021, as many as 22 people, consisting of goalkeepers, defenders, midfielders, and attackers. The sampling technique used was total sampling.

2.2 Research Design

This research is a type of quantitative descriptive research (Fraenkel et al., 2012). The research method used in this research is a survey using tests and measurements. The purpose and objective of using quantitative methods in this research is to collect data in the form of numbers and analyze and describe them in accordance with the results obtained to find information in the form of the level of physical fitness of all SSB Macan Tutul players in 2021.

2.3 Instruments

In this study, the instruments used by researchers in taking data were tests and measurements. The test used in this research is the Yo-Yo Intermittent Recovery Test Level 1.

2.4 Procedures

The intermittent yo-yo test level 1 (YIRTL1) proved valid in measuring endurance. This is evidenced by research conducted by Castagna et al., (2009). As for the procedure for carrying out the test according to Castagna et al., (2006), the Yo-Yo IRL1 test consists of a 20-m running

track performed at an increasing speed with 10 seconds of active recovery between tracks spaced 5 m apart. The test is deemed to have ended when the participant twice failed to reach the front line in time (objective evaluation) or when the participant felt unable to complete another shuttle at the specified speed (subjective evaluation).

As for how to fill in the yo-yo intermittent recovery test level 1, as follows:

- Fill in the name of the participant who will take the test.
- Put a tick (✓) for each successful turn.
- After the participant is no longer able to continue the test, record the level and at the end of the last number of times they can do it, write it down at the bottom of the table.
- See the results of the yo-yo intermittent recovery test level 1 obtained on the assessment norm.
- Then calculate $VO_2\text{max}$ using the following formula:

$$VO_2\text{max (mL/min/kg)} = \text{IR1 distance (m)} \times 0.0084 + 36.4.$$

*IR 1 distance = The most recent distance traveled.

2.5 Data Analysis

After the data is obtained, the next step is to analyze the data to draw conclusions from the research to be carried out. The data analysis technique used in this research is in the form of descriptive statistics with percentages.

3. RESULTS

The results of the study were calculated based on two criteria, namely those based on the player's position and those based on the norms in the SSB Macan Tutul group in 2021.

Based on the results of the study using descriptive statistics, the results showed that the goalkeeper position obtained an average score of 41, the highest score was 41.4, and the lowest score was 40.8. Of the three goalkeepers tested, none of the goalkeeper positions met the standard $VO_2\text{max}$ criteria for goalkeepers (Table 1).

Table 1.

Goalkeeper Position $VO_2\text{max}$ Results

Standardization of $VO_2\text{max}$	Total	$VO_2\text{Max}$
	Goalkeeper 1	40.8
51	Goalkeeper 2	40.8
	Goalkeeper 3	41.1

The results showed that the position of the defender obtained an average score of 42.7, the highest score was 47.5, and the lowest score was 41.1. Of the 8 players who took the test, none of them met the standard $VO_2\text{max}$ criteria for defenders (Table 2).

Table 2.*Defender Position VO₂max Results*

Standardization of VO ₂ Max	Total	VO ₂ Max
61	Defender 1	41.1
	Defender 2	44.1
	Defender 3	42.4
	Defender 4	41.4
	Defender 5	44.5
	Defender 6	41.1
	Defender 7	41.8
	Defender 8	47.5

The results showed that the position of the midfielder obtained an average score of 44, the highest score was 48.8, and the lowest score was 42.1. Of the 6 players who took the test, it showed that none of the players in the midfielder position met the standard VO₂max criteria for the midfielder position (Table 3).

Table 3.*Midfielder Position VO₂max Results*

Standardization of VO ₂ max	Total	VO ₂ Max
62	Midfielder 1	42.1
	Midfielder 2	42.1
	Midfielder 3	43.1
	Midfielder 4	42.4
	Midfielder 5	48.8
	Midfielder 6	44.5

Based on the results of research using descriptive statistics, the results show that the front position has an average value of 42.3, the highest score is 44.5, and the lowest value is 41.1 (Table 4).

Table 4.*Forward Position VO₂max Results*

Standardization of VO ₂ max	Total	VO ₂ Max
60	Forward 1	41.1
	Forward 2	41.4
	Forward 3	41.1
	Forward 4	42.4
	Forward 5	44.5

After the results of the research based on the position of the players showed that there were no players who met the VO₂max standard for each specified position, then data processing was carried out using descriptive statistics based on the norms in the SSB Macan Tutul group of players in 2021.

The distribution of standardization criteria is based on the reference norm as seen from the average value in the group of SSB Macan Tutul players in 2021. Based on the results of research using descriptive statistics, the results show that the average value is 43, the highest value is 48.8, and the lowest value is 40.8. In terms of $VO_2\text{max}$ ability in the SSB Macan Tutul group in 2021, it was found that 1 player (4.5%) had $VO_2\text{max}$ ability in the "very good" category, 6 players (27.3%) had $VO_2\text{max}$ ability in the "good" category, 9 players (40.9%) had a $VO_2\text{max}$ ability in the "medium" category, 6 players (27.3%) had a $VO_2\text{max}$ ability in the "bad" category, and no player (0%) had a $VO_2\text{max}$ ability in the "very bad" category. The results of the research based on the criteria in the SSB Macan Tutul group in 2021 can be seen in table 5 and figure 1.

Table 5.

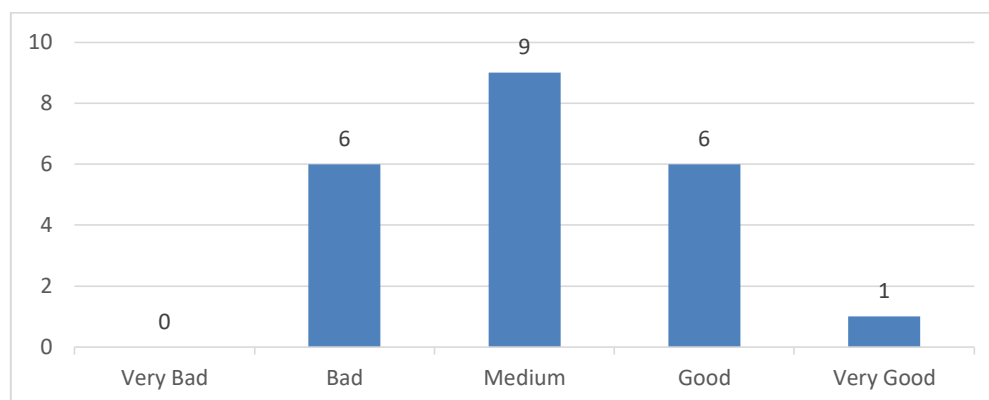
The Frequency Distribution of Criteria in the SSB Macan Tutul Group in 2021

Category	Interval	Frequency	Percentage
Very Bad	$X < 40$	0	0%
Bad	$40 < X \leq 42$	6	27.3%
Medium	$42 < X \leq 44$	9	40.9%
Good	$44 < X \leq 46$	6	27.3%
Very Good	$X > 46$	1	2.5%
Total		22	100%

$VO_2\text{max}$ ability in the SSB Macan Tutul group in 2021 had the highest number in the moderate category at 9 players, while the same number was obtained in the bad and good categories with 6 players each, followed by the very good category with 1 player, and there are no players who fall into the very bad category (Figure 1).

Figure 1.

Criteria for the SSB Macan Tutul Group in 2021



Based on the results above (Figure 1), it shows that there is a difference in $VO_2\text{max}$ capacity within the SSB Macan Tutul group in 2021. Midfielders have the highest $VO_2\text{max}$ capacity, while goalkeepers have the lowest capacity compared to other positions.

4. DISCUSSION

This study aims to determine the level of endurance of players in different positions in soccer games. Based on the results of the study, it showed that there were differences in the

VO₂max capacities of players who played as goalkeeper, defender, midfielder, and forward. The results of the study showed that the goalkeeper, defender, midfielder, and forward players did not meet the VO₂max standard. The results of the study were based on the criteria in the SSB Macan Tutul group in 2021, with the results showing that the player who had the highest VO₂max was the midfielder, with a value of 48.8 ml/kg/min. The player with the lowest VO₂max is the goalkeeper, with a value of 40.8 ml/kg/min, compared to an average player VO₂max of 43 ml/kg/min.

VO₂max is a measure of the body's ability to take in oxygen and absorb it maximally. VO₂max is an indicator of a player's physical ability. Players with good VO₂max capacity have a heart, lungs, and blood circulation that work efficiently and effectively and can supply oxygen to the muscles so that they are able to work continuously without experiencing excessive fatigue (Hutama & Yuliasrid, 2017; Irawan & Limanto, 2021; Irawan & Prayoto, 2021).

Based on the results of the research on the positions of players using the VO₂max standard for each position, it shows that there are no goalkeepers, defenders, midfielders, and attackers who meet the VO₂max standard in the norm reference. Furthermore, data processing was carried out using descriptive statistics based on the norms in the group of SSB Macan Tutul players in 2021, and the results showed that there was 1 player in the very good category, while the same number was obtained in the bad and good categories, with as many as 6 players each. The highest number in this study was 9 players in the medium category, and no players included in the very bad category. The player who has the highest VO₂max is the midfielder with a value of 48.8 ml/kg/min. The player with the lowest VO₂max is occupied by the goalkeeper position, with a value of 40.8 ml/kg/min.

In the aspect of football achievement, a high VO₂max is an element for an athlete to have (Burhaein et al., 2020; Phytanza et al., 2018; Prasetya, 2021). Because football is a sport that is played on a very wide field, with a high VO₂max ability, players will be able to maintain physical condition during the match, so that technical and mental the player's playing ability can be maintained. On the other hand, if the player has a low VO₂max ability, it will be easy to experience fatigue, which can lead to mental and technical declines for the player (Catur & Mujiriah, 2021; Nirwandi, 2017; Sulistianoro & Setyawan, 2021).

There is similar research in support of this research conducted by Sanjaya (2015) this research shows that there are differences in maximum VO₂ capacity between front, center, and back players, members of the communication forum between football schools aged 17, Cilacap district in 2015. Midfielders have the highest average maximum VO₂ capacity with an average of 49.34, while defenders have an average of 42.54, and forwards with a 45.69 average.

Research conducted by Zakiyuddin (2017) where this study shows that of the 20 players who were sampled, the average value was 47.76 ml/kg/minute, and it is known that there are 3 players (15%) in the bad category, 10 players (50%) in the medium category, and 7 players (35%) in the good category, which is still below the VO₂max standard of Indonesian football players.

Based on data from the National Team from PSSI (Nugraha, 2013:8), shows that VO₂max Bambang Pamungkas (attacker) has a value of 57 ml/min/kg, Ponaryo Astaman (midfielder) reaches a value of 60 ml/min/kg, Charis Yulianto (defender) reaches a value of 55 ml/kg/min, and the highest U-19 captain, Evan Dimas, with a value of 63 ml/min/kg, a picture

which shows that the average football athlete in Indonesia has a $VO_2\text{max}$ of 55-65 ml/min/kg (Tumiwa et al., 2016).

From the research above, it can be said that football players need to have a high $VO_2\text{max}$ in order to maintain physical condition during a match. In fact, there are still a lot of football players who fall into the moderate category or even less, and each player's position is different.

It is important for every football player to have a good $VO_2\text{max}$ with a normal time of 2 x 45 minutes and an energy system that is predominantly anaerobic. The research conducted by Hutama & Yuliasrid (2017) with the title Relation of $VO_2\text{max}$ to Pulse Recovery after Submaximal Exercise in 18-Year-Old Men's Soccer Players El Faza Surabaya showed that there was a significant relationship between the $VO_2\text{max}$ level of 18-year-old male soccer players and the pulse rate recovery after submaximal exercise. From these results, the researcher explained that the higher the $VO_2\text{max}$ level, the faster the pulse recovery time to return to normal after submaximal exercise.

Research conducted by Triansyah & Kushartanti (2015) with the title Effectiveness of Recovery Techniques and $VO_2\text{max}$ in Recovery of Blood Lactic Acid and Heart Rate After Running shows that there are differences in the effectiveness of high and low $VO_2\text{max}$ abilities in recovering blood lactic acid and heart rate after running 6x35 meters. The researchers also explained that the high $VO_2\text{max}$ ability was more effective in restoring blood lactic acid and heart rate.

The $VO_2\text{max}$ of every football player must be high, even though they are in different positions, but at least football players have good criteria. An athlete must have a good $VO_2\text{max}$. With a good $VO_2\text{max}$, the recovery is fast, and with a normal time of 2x45 minutes, the player will recover faster. If the player's $VO_2\text{max}$ is high, then the player's anaerobic threshold capacity is also high, so lactic acid will be easily decomposed.

5. CONCLUSIONS

Based on the results of the research carried out, it can be concluded that none of the SSB Macan Tutul players in 2021 met the standard reference norms. Athletes should be given more endurance-related exercises. This study has limitations because it is only in that group. It is necessary to conduct further research related to $VO_2\text{max}$ with various positions and a larger number of samples.

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