Analysis of the physical condition of soccer athletes through the yo-yo test: a survey study on preparation for the provincial sports week

Análisis de la condición física de los deportistas de fútbol mediante el test del yo-yo: un estudio de encuesta sobre la preparación para la semana deportiva provincial

*Ryan Hardinata, **Putra Sastaman B, ***Ardo Okilanda, ****Trisnar Adi Prabowo, *****Teddy Tjahyanto, 
****Muhammad Fakhur Rozi, ******Mikkey Anggara Suganda, ******Dedi Suryadi:

Abstract. Background and Study Aim. Activities carried out for a long time must have a good foundation of VO2max (maximum oxygen volume). Exercise with the right prescription and in no time will increase your VO2max ability. Characteristics of the sport of football which has a long duration of time and a wide field. Based on this, the VO2max ability of football players should be high. The purpose of this study was to see the ability of the maximum oxygen volume of football sports which are conducting training camps in preparation for the provincial sports week. Materials and Methods. This study uses a quantitative approach through survey methods. Where in the research there were tests and measurements to find out the level of VO2max ability. The subjects in this study were the Gabsis football club which was preparing for the provincial sports week (PORPOV). The sampling technique in this study used saturated sampling so that all athletes were sampled, namely 25 soccer athletes. The test instrument used was the yo-yo intermittent recovery test level 1. Furthermore, the data obtained in the field was analyzed using descriptive statistics assisted by the Microsoft Excel 2019 application. Results. Based on the research results, the VO2max level is 32% in the below average category. Furthermore, there are 48% in the average category, and 20% in the good category. Based on these findings, the average VO2max ability of soccer athletes is in the sufficient category. Conclusions. The average categorization of Club Gabsis players is still relatively low based on the results of the VO2max ability test. However, it is important to note that the limitations of this study are the players’ uncontrolled dietary consumption and their age, both of which must be taken into account by researchers. It can also find information on the impact of athlete nutrition on endurance abilities.

Keywords: Physical Condition, VO2max, Football

Introduction

VO2max is an indicator of aerobic power metabolism that is widely used in various sports and is consistently used to determine performance. VO2max is also considered the gold standard and the most significant measure of aerobic ability (Jemni, Prince, & Baker, 2019). As happens in long-distance runners who have efficient use of VO2max energy during running (I. Aziz et al., 2023; Larsen & Sheel, 2015). In addition, the ability to generate great strength is supported by aerobic capacity (Ahsan & Ali, 2021). Research conducted by (Bento-Torres et al., 2019) confirms that high maximal oxygen volume levels are able to carry out activities with higher intensity, longer and reduce excessive fatigue after carrying out activities.

Many studies have been carried out on efforts to increase VO2max such as low, medium and high interval training, the results of these exercises can increase aerobic endurance ability (Wen et al., 2019). Subsequent research conducted by (Taufik, Widiastuti, Setiakarnawijaya, Firmansyah, & Dilis, 2021) confirmed that circuit and interval training could increase maximal oxygen volume. Subsequent research that proves various exercises that can increase maximum oxygen volume include small side games (Alben, Tirtawiyara, & Niyonsaba, 2022), linear acceleration (Taskin & Taskin, 2021), fartlek (Gumantan & Fahrizoqi, 2020; Syahroni et al., 2020; Syaroni & Kusuma, 2020), tabata (A., P., Munar & Pasaribu, 2020; Herlan & Komarudin, 2020) and aerobic circuits (Ashfahani, 2020).

The results of previous research illustrate that fartlek exercise is one of the exercises that is often done as an effort to increase VO2max and has been proven to have a positive effect. Subsequent research that has an effect on increasing the maximum oxygen volume includes: doing exercises in the form of games in a simple field (Kusuma & Purnomo, 2019; Puriana, 2019; Zainudin & Kahri, 2019), triangle run...
In soccer, a good aerobic system is needed (Nugroho & Kusuma, 2022). An example of a soccer player using an aerobic energy system is when a soccer player is jogging (Purba & Setiowati, 2022). In addition, a positive relationship (between VO2max and running performance during matches) can influence the way soccer players train (Papadopoulos et al., 2022). That way, it will help the coach estimate the running performance of the player's match through measurement. The VO2max ability of football players is low, so it will be difficult for them to carry out activities for a long time. Performance during the match is not optimal until concentration becomes disturbed as the body's energy runs out which will reduce performance.

This research is important to do as an effort to prove the importance of VO2max for athletes, especially soccer players. Football is a sport that uses complex energy processing using two energy systems, namely aerobic (maximum oxygen volume) and anaerobic (Jarkasih & Fardi, 2020). In addition, information related to VO2max can be used as input for consideration in planning athlete development programs. This is also because a high level of aerobic capacity helps soccer players cope with physical demands and challenges (Impellizzeri, Rampinini, & Marcora, 2005), and have a faster recovery during matches (Brown, Hughes, & Tong, 2007).

Several studies that have been conducted provide information about the importance of VO2max for athletes with good standards above ordinary people. The type of test used to measure the maximum oxygen volume is using the yo-yo intermittent recovery test level 1. By knowing the endurance of athletes, this will make it easier for coaches to design the right training program (Suryadi, Yanti, et al., 2023). Based on these problems, this study aims to see the ability of the maximum oxygen volume of the football sport which is conducting training camps in preparation for the provincial sports week.

**Materials and Methods**

**Participants**

The population of this study were all players who had registered after registering to join the Gabis soccer team squad. Then the sampling technique uses saturated sampling, which means that all players on the team will take the VO2max test and measurement.

**Research Design**

This study uses a quantitative approach through survey methods, namely the existence of tests and measurements of the sample. The instrument used in this study was the yo-yo intermittent recovery test level 1 as a valid tool for measuring the VO2max level of football athletes (Hardinata et al., 2021)(Yanti, Gustian, Gani, & Setiawan, 2022). The implementation of the Yo-Yo Intermittent Recovery Test level 1 has a 20 meter running track. Running speed will increase according to level, with active recovery/10 second rest between 5 meter runs. To avoid injury during the
exam, the athlete first warmed up and stretched. Furthermore, the test is deemed complete if the player fails to cross the finish line twice or if the player no longer feels like completing the moderate test at the predetermined speed (Schmitz et al., 2018).

![INTERMITTENT RECOVERY TEST](image)

**Figure 1. Yo-Yo Intermittent Recovery Test Instrument**

**Statistical Analysis**

Data analysis in this research uses descriptive percentages, to determine the VO2max level of soccer athletes. Then data calculations are assisted using the Microsoft Excel 2019 software application. Furthermore, the fitness norm category is used to find out an explanation of the VO2max value achieved by athletes based on (Hardinata et al., 2021).

| Table 1. VO2max Assessment Norms through the Yo-Yo Test for Men |
|-----------------|-----------------|-----------------|
| Levels          | Value Range     | Category        |
| Elite           | >20.1           | >56.6           |
| Excellent       | 18.7-20.1       | 53.2-56.6       |
| Good            | 17.3-18.6       | 49.2-52.9       |
| Average         | 15.7-17.2       | 45.1-48.8       |
| Below average   | 14.2-15.6       | 40.8-44.8       |
| Poor            | <14.2           | <40.8           |

**Results**

This research took place on the Gabsis football field, Sambas Regency, West Kalimantan Province, Indonesia. The measurement test used is the yo-yo intermittent recovery test level 1. Based on the players who took the measurement test, the results of the VO2max value distribution are described in the following table.

<p>| Table 2. Data on the results of the physical condition test for VO2max ability through the level 1 yo-yo test |
|-------------------------------------------------|-------------------------------------------------|</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>VO2max Results</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>48.2</td>
<td>Average</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>45.8</td>
<td>Average</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>40.8</td>
<td>Below average</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>46.6</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>45.8</td>
<td>Average</td>
</tr>
<tr>
<td>6</td>
<td>21</td>
<td>45.8</td>
<td>Average</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>46.5</td>
<td>Average</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>49.2</td>
<td>Average</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>46.1</td>
<td>Average</td>
</tr>
<tr>
<td>10</td>
<td>21</td>
<td>49.2</td>
<td>Good</td>
</tr>
<tr>
<td>11</td>
<td>19</td>
<td>40.8</td>
<td>Below average</td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>45.1</td>
<td>Average</td>
</tr>
<tr>
<td>13</td>
<td>21</td>
<td>44.5</td>
<td>Below average</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>45.1</td>
<td>Average</td>
</tr>
<tr>
<td>15</td>
<td>21</td>
<td>44.5</td>
<td>Below average</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>56.6</td>
<td>Good</td>
</tr>
<tr>
<td>17</td>
<td>20</td>
<td>49.2</td>
<td>Good</td>
</tr>
<tr>
<td>18</td>
<td>20</td>
<td>45.8</td>
<td>Average</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
<td>44.1</td>
<td>Below average</td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>46.1</td>
<td>Average</td>
</tr>
<tr>
<td>21</td>
<td>19</td>
<td>41.5</td>
<td>Below average</td>
</tr>
<tr>
<td>22</td>
<td>21</td>
<td>45.8</td>
<td>Average</td>
</tr>
<tr>
<td>23</td>
<td>18</td>
<td>42.1</td>
<td>Below average</td>
</tr>
<tr>
<td>24</td>
<td>20</td>
<td>43.5</td>
<td>Below average</td>
</tr>
<tr>
<td>25</td>
<td>20</td>
<td>45.1</td>
<td>Average</td>
</tr>
</tbody>
</table>

The value of the VO2max level in soccer athletes is shown based on the findings data presented in Tables 2 and 3. Based on these results, the athlete’s VO2max ability is 32% in the below average category. Furthermore, there are 48% in average, and 20% in the Good category. Based on these findings, the average VO2max ability of soccer athletes is in the sufficient category. Where this result is still relatively low for a soccer athlete who should have a good VO2max level.

**Discussion**

study aims to see the ability of the maximum oxygen volume of football sports which are conducting training camps in preparation for the provincial sports week. The results in this study describe the VO2max condition of Club Gabsis soccer players. Where football athletes who take this test are athletes who are selected from the best regions. The results of the study show that the VO2max value in the Gabsis men’s soccer athletes has a sufficient average of 48% with a value range of 45.1-48.8. The results can be seen from the percentage of VO2max levels in athletes. A study revealed that the VO2max value that a male soccer player must have is 50-75 ml/kg/min(Modric, Versic, & Sekulic, 2020). However, when viewed from the competitive level, the VO2max value in men’s football ranges from 48-62 ml/kg/min (Slimani, Znazen, Miarka, & Bragazzi, 2019). Based on the results of relevant research reviews, the average VO2max ability of the Gabsis football players is still relatively low. This can be seen from the results achieved with the most being in the moderate category. The VO2max value for each player is different, such as position and physiology.

The results of a scientific literature review regarding VO2max values vary between 48.4 - 57.5 ml/kg/min for goalkeepers, 53.2 - 62.8 ml/kg/min for defenders, 54.7 - 63 ml/kg/ min for midfielder and 54 – 62.9 for attacker (Slimani et al., 2019). The difference in the VO2max value...
is influenced by the performance and cruising range of each football player, between the goalkeeper and the defenders, midfielders and forwards (attackers). The results of this study provide information about differences in the VO2max ability of soccer players with existing standards. The cause of this occurrence may be due to the short duration of physical exercise or the repetition and intensity that is not quite right. Therefore for the development of endurance it should be done with well-organized training ranging from duration, repetition and intensity to have a positive effect (Bompa & Buzzichelli, 2015).

Relevant research findings explain that various studies to increase VO2max have been carried out including the 50 meter sprint exercise (Arifin, 2019), cross-country training (Heru & Apri, 2019), interval training (Bo, 2023; Bravo et al., 2008; Faude, Steffen, Kellmann, & Meyer, 2014), training with running and plyometrics (Gómez-Molina, Oguesta-Alday, Camara, Stickley, & García-lopez, 2018), circuit weight training (R Bahtra, Fahrozi, & Putra, 2020), aerobic training (Lestari, Liana, & Setiono, 2019), fartlek training on sand (Ramdhon, Usra, & Destriani, 2020), training circuit (Iswahyudi, Fajar, Sugeng, & Derana, 2020)(Suryadi et al., 2021). The results of a research study on VO2max have provided clear information that the exercise plan is carried out correctly. The prescription given is controlled, related to age, level of competition to the variety of exercises given will have an effect on increasing the maximum oxygen volume.

VO2max has become an issue in the world of performance sports. Various studies have been carried out to increase the maximum oxygen volume capacity. this is because the maximal oxygen volume capacity is obtained through exercise adaptation (Joyner & Lundby, 2018). Through a high volume of oxygen, it can increase stamina so that it has good endurance during matches (Septiany, Basyar, & Hardian, 2019). Recovery time is faster and shows maximum performance when under high pressure (Ridho Bahtra, Asmawi, Widiastuti, & Dlis, 2020; Pratama & Bafirman, 2020). VO2max capacity is especially important for football players because it affects running performance during matches, the number of sprints, and the amount of action with the ball (Helgerud, Engen, Wisloff, & Hoff, 2001). Up to the running distance in a match (Gamonales, León, Rojas-Valverde, Sánchez-Ureña, & Muñoz-Jiménez, 2021).

VO2max has a relationship with running performance in a match which is usually influenced by the opponent, match level, tactical role, playing position and level of motivational stimulus boost (Slimani et al., 2019). In addition, differences in oxygen volume between players must be considered to optimize physiological responses during high-intensity running activities (Riboli, Coratella, Rampichini, Limonta, & Esposito, 2022). This is because VO2max is a differentiator in football appearance at the age of 14, 15 and 16 years (Le, Carling, Williams, & Reilly, 2010).

Evaluation regarding the maximum oxygen volume should also be of particular concern, because this will determine the outcome-related data to be obtained as information for planning an exercise program. Experts about 60% recommend field tests using continuous and intermittent shuttle runs (A. Aziz, Mukherjee, Chia, & Teh, 2008; Boraczyński, Boraczyński, Podstawski, & Wójcik, 2015; Canhadás, Silva, Chaves, & Portes, 2010; Gil, Ruiz, Irazusta, Gil, & Irazusta, 2007; Le et al., 2010; Reilly, Williams, Nevill, & Franks, 2000; Silvestre, West, Maresh, & Kraemer, 2006). Then validated regarding ecology, criteria and synchronization with direct assessment methods for senior athletes (Bangso, Iaia, & Krustrup, 2008; Castagna, Impellizzeri, Cecchini, Rampinini, & Alvarez, 2009; Rampinini et al., 2007).

Conclusions

Based on the results of research on VO2max in soccer athletes in preparation for the provincial sports week. The research results have a strong foundation regarding VO2max, which has been included in the results discussion. The results showed that the VO2max ability level of Gabsis club soccer athletes on average was in the Average category. However, these results are still relatively low and football athletes should at least have good VO2max abilities. This is also due to the need for high intensity in the game. These results have provided additional new references related to VO2max in soccer games. With the results of this study, it can be a reference for coaches in developing appropriate training programs for athletes, especially in the sport of football. However, it should be noted that the limitations of this study lie in the condition of the players’ nutritional intake which has not been controlled and their age which must also be taken into consideration by researchers. Furthermore, it can find out information on the influence of athlete nutrition on endurance.

Acknowledgments

The author would like to thank the managers, coaches and athletes at the Gabsis men’s soccer club who are willing to follow the flow of the research. Acknowledgments also go to colleagues who have helped in completing the manuscript.

Conflict of interests

There is no conflict of interest.

References

Ahsan, M., & Ali, M. F. (2021). Relationship between maximal oxygen uptake and dynamic stability in university rugby and

- 1094 -

Retos, número 50, 2023 (4° trimestre)


Olahraga, 6(1), 115–124. https://doi.org/10.3322/juara.v6i1.1180


Naranjo Orellana, J., & Muela Galán, S. (2021). Retrògrade extrapolation of VO2max from recovery values recorded breath by breath (Extrapolación retrógrada del VO2max a partir de valores de recuperación recogidos respiración a respiración). Retos, 41, 695–700. https://doi.org/10.47197/retos.v41i0.84525


Riboldi, A., Coratella, G., Rampichini, S., Limonta, E., & Esposito, F. (2022). Testing protocol affects the velocity at VO2max in semi-professional soccer players. Research in...


