SMALL-SIDE GAMES 5V5: IMPROVING AEROBIC ENDURANCE OF YOUTH FOOTBALL PLAYERS

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract
The purpose of this study was to determine the effect of small-sided games 5v5 on increasing aerobic endurance in football players.

Materials and methods. This type of study is a quasi-experiment with a one-group pretest-posttest design. The population of this study was Gama Muda Football School (SSB) players in Pasaman Regency (Indonesia), totaling 60 persons. Sampling was performed using a targeted sampling technique, so the sample was determined to be a maximum of 20 individuals. The players' endurance capacity was determined by measuring their VO\textsubscript{2max} capacity. The study used the Yo-Yo Intermittent Recovery Test (Yo-Yo IR Test) as an instrument to obtain research data. Data analysis in this study used the mean difference test (t-test) statistical method. Before testing our hypothesis, we first performed a normality test using the Lilliefors test.

Results. After hypothesis testing, the results obtained show the value of t-count (10.15) > t-table (1.729), indicating that small-sided games 5v5 training effectively improves the aerobic endurance ability of young football players.

Conclusions. The results of this study demonstrate that small-sided games 5v5 training can improve the aerobic endurance of young football players.

Keywords: small-sided games, aerobic endurance, football.

Introduction
Football today is developing very rapidly in terms of technique, physical, and tactics. In recent years the rhythm of football games is faster. Players are able to execute techniques and make good tactical decisions even when running fast (Rago et al., 2017). In order to avoid pressure from opponents, players must have high technical, physical, and skill abilities.

In modern football, achieving the best results is determined by three main factors: technique, tactics, and the overall condition of each player (physical, moral, psychological, etc.) (Bolotin & Bakayev, 2017). Physiological, technical, and tactical skills are all important to soccer performance (Hoff et al., 2002; Dio Juliandi & Sukarmin, 2019). Football is a sport that requires intermittent aerobic and anaerobic abilities according to the fundamental characteristics of the game (Evangelos et al., 2012; Reinhardt et al., 2020; Sulaiman et al., 2022). To be a great football player, players must have good performance components (physical, technical, tactical, and psychological). (Menegassi et al., 2018; Ade et al., 2014; Forsman et al., 2016; Anam et al., 2022). Soccer requires its players to train in various physical conditioning components, including strength, speed, jumping, and aerobic capacity (Altavilla et al., 2017; Oone et al., 2012; Joo, 2018).

The game of football has the idea of scoring as many goals as possible and guarding your own goal so you don’t concede. Based on this idea, the game of football becomes even more interesting. In the modern football era, football games are played at a fast and high tempo (Jozef et al., 2018; Dost et al., 2016). The movements made by players during the match cover a considerable distance. A player runs 8-12 km during a match. The distance traveled by players in one match ranges from 10-12 km (Taylor, 2016; Emmonds et al., 2016; Najafi et al., 2015). The distance covered by a football player during the game is 10-14 km (Theocharis et al., 2022). In high-level football games, the total distance traveled is between 10-13 km (Michailidis, 2022).

In the distance of 10-14 km, many actions are performed by football players. The activities performed by players while...
on the field are 1) walking at 3.1 km, 2) low-speed running at 1.5 km, 3) moderate-run speed at 1.2 km, 4) high-speed running at 0.2 km, 5) sprinting (100% speed) 250 m, 6) running backward 800 m (Taylor, 2016). During the 90 minutes, the players covered a distance of over 11 km, with 3% running and 5% running at high intensity (Rodriguez-Fernández et al., 2019). In a high level of effort, football players perform 150-200 short, powerful actions during a match; for example, sprinting, changing speed and direction, tackling, acceleration, deceleration, and jumping (Ferraz et al., 2017).

According to (Afyon et al., 2015) at a higher level, football players are very fast runners for 90 minutes of matches. They frequently run 2500 to 3500 m and average anaerobic thresholds of 1500 to 2500 m and 600 to 1200 m.

The range and activity are quite a lot and to support high performance during the above-mentioned actions requires good physical condition. According to (Bahra et al., 2022) one of the factors that determine the improvement of sports performance is physical condition. One of the key physical requirements for soccer players to have endurance. The body's ability to carry out activities as long as possible without experiencing fatigue is called endurance (Scheunemann, 2012; Wiguna, 2017). Endurance is the body's capacity to carry out activities for a long time without experiencing fatigue and accompanied by rapid recovery (Sidik et al., 2019; Emral, 2017). Aerobic endurance is the body's ability to take, transport and use oxygen (Hardiansyah et al., 2020; Zarwan et al., 2020).

Football matches that have high mobility and so long, namely 2×45 minutes require good endurance. The problem that we often see in training to improve endurance is boredom of players during the training process. This is because endurance training has a long duration of time. In addition, the activities carried out are very monotonous. Lack of variety in training methods is only in the form of long-distance running to train the physically applied so that training becomes boring and less effective for improving the ability of students (Prakoso & Sugiyanto, 2017). Fatigue contained in physical exercise and training programs that are not yet appropriate is thought to be a trigger for not achieving training goals so the right training method is needed to increase VO2max capacity (aerobic endurance) (Hostrup & Bangsbo, 2017; Rago et al., 2017). This is sometimes what makes the increase in player endurance slow and even tends to stagnate. If the player's aerobic endurance is not at a good level, it will interfere with the player's performance in the match.

Responding to this problem requires a breakthrough in choosing or finding the right training method. According to (A. U. K. Putra et al., 2016) Many training methods can be used to increase aerobic endurance such as interval training, fartlek, continuous running and SSG. To increase aerobic endurance, several training programs have been carried out, including aerobic exercise and small sided games (SSG) (Los Arcos et al., 2015). Meanwhile, according to (Strudwick, 2016) the football team uses a variety of training methods to improve players' physical conditioning, general training (e.g. continuous, circuits, intervals, repeated sprints) and specific training (e.g. small side games, soccer technique drills, special drill positions with the ball). Many methods can be used to improve the aerobic endurance of football players. Both the general (without the ball) and the specific (with the ball). The choice of method depends on the situation and the needs of the coach.

From the description described above, the small side games method was chosen to improve the aerobic endurance of players. SSG is a drill designed with fewer players and a smaller field size compared to 11v11 games (Bergkamp et al., 2020). SSG are a form of exercise carried out in the form of playing that adopts the actual game so that players can master technical, tactical, and physical skills simultaneously (A. N. Putra et al., 2022; Setyadi, 2016; Praniata et al., 2019). This type of training is often played with modified games on a reduced field area, using adapted rules and involving fewer players than traditional games (Hammami et al., 2018). Small Side Games are one of the exercises that can be used by coaches to improve endurance and develop technical skills (Moran et al., 2019). Intense training with SSG for 4 weeks can increase endurance performance by 8.2% in soccer players (Paul et al., 2019). Small side games training is effective and efficient to increase the endurance of beginner female futsal players (Wenly et al., 2021).

Although there have been many studies on this model but more on small-side games in general. In this study, researchers modified and improvised with a focus on 5v5 small-sided games. The research results (Gaudino et al., 2014) explain in SSG 5v5 the player's mileage is higher, acceleration and deceleration are large, and the speed distance is very high and maximum. High mileage will indirectly be able to increase aerobic endurance. In addition, modifications were also made to the training variables, namely training intensity, duration, and set. The intensity of the exercise is between 75-85%, and the duration of the exercise is long. Taylor (2016) explains training for aerobic capacity (VO2max) is most often referred to as basic endurance training. In terms of exercise intensity level, it is recommended to train in intensity zones 1 and 2 (60-80 to 85% of HRmax) and duration between 30-60 minutes. The modification of this form of training is different from previous studies.

Research related to this method is expected to increase the awareness of coaches that the small-side game's method can improve various aspects of football such as physical condition (especially aerobic endurance), technical skills, and tactical abilities. The urgency of this research has an impact on training methods in football so that later coaches use the small-side game's method to improve endurance in football games. The aim of this study was to determine the effect of small side-game 5v5 training on improving aerobic endurance in young football players.

Material and Methods

Study Participants

The study is classified as a type of quasi-experiment with a one-group pre-test post-test design. The subject in this study were SSB Gama Muda Pasaman players with a total of 60 people. Samples were taken by means of purposive sampling in order to obtain a sample of 20 U-15 players. The distribution of selected players is goalkeeper 2 people, defender 8 people, midfielder 6 people, and strikers 4 people.

Study organization

This study modifies small side games to increase aerobic endurance. Modifications made to player count focused
on SSG 5v5. Exercises are carried out for 16 sessions with a frequency of 3 times a week. The training program is structured in such a way as to achieve an increase in the aerobic endurance of players. The size of the field is designed 45×35 m by adjusting the number of players. The training load in this study was adjusted to the training load to increase aerobic endurance. Training intensity 75-85%, set 3 times per session, rest 2 minutes between sets and duration of 20-50 minutes. The duration of the training is increased every week (training program in table 1).

### Measurement & Statistical Analysis

The test used in this study is the Yo-Yo Test (Bangsbo & Mohr, 2015). After the data is collected then the data is compiled, then data processing is carried out with the t-test analysis technique with the following calculation steps: 1) Normality test using Lilefors. The normality test aims to determine whether the data obtained are normally distributed or not, 2) To see the difference between the two forms of exercise, the t-test is used.

### Results

The study process was conducted for 18 meetings, with details of one session for pre-test, 16 sessions for treatment, and one session for post-test. The results of the study will be described by the objectives of the previously proposed hypothesis. Starting with aerobic endurance data, normality test, and t-test. Table 3 is the frequency distribution of aerobic endurance tests.

The table above explains that in the pre-test the aerobic endurance ability of the dominant players is in the good category (15 people) and there is no very good category. whereas during the post-test there was an increase in aerobic endurance ability, where the category became 16 people and the very good category was 1 person. For more clarity, it can be seen in the histogram below:

![Histogram of Pre-test and Post-test](image)

After the data description, hypothesis testing was carried out to answer the hypothesis that had been proposed. Before hypothesis testing, a normality test was conducted. A summary of the results of the data normality test can be seen in the following table:

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>L0</th>
<th>Lt</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>46.24</td>
<td>2.02</td>
<td>0.074</td>
<td>0.190</td>
<td>Normal</td>
</tr>
<tr>
<td>Post-Test</td>
<td>47.52</td>
<td>2.46</td>
<td>0.052</td>
<td>0.190</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Based on the table above, it can be seen that all data are normally distributed, where Lt > L0. So, the next step is to test the data hypothesis. The results of the hypothesis test can be seen in the table below:

### Discussion

Results of this study reveal that training in small side-games can improve endurance in football players. This is consistent with multiple studies and literature stating that small side game training can improve endurance. SSG train-
ing method can improve the aerobic endurance of U-17 football players (Arianto & Setyawan, 2019). SSG can improve the aerobic and anaerobic capacity of football players and train football players more specifically (Evangelos et al., 2012). Small-side games allow the HR response to increase, similar to some short-duration intermittent runs that are effective in increasing player endurance (Dellal et al., 2011; Sannicandro et al., 2016; Sannicandro & Cofano, 2023). In addition, the results of research (Wahyudianto et al., 2020) explained that small sided games type Intermittent training has a significant effect on the aerobic capacity of Satria Muda football players.

Football is a sport that is carried out for a long duration, so good endurance is needed. Player movement is greatly helped if you have good endurance. Excellent endurance will support players to always be consistent and fight in matches, otherwise, without excellent endurance, it will be difficult for players to fight until the end of the match. This situation will be a must for players to improve endurance. One of the efforts that can be made to increase endurance is to carry out continuous and systematic training. The exercises performed must be by the principles of endurance training to build endurance.

The training process that is carried out structured, intensive, and systematic will be able to increase the endurance of football players. One way to see whether or not a person’s endurance has improved is by measuring their VO\textsubscript{2\text{max}}. VO\textsubscript{2\text{max}} is a level of the body’s ability expressed in liters per minute or milliliters/minute/kg body weight (Herlan & Komarudin, 2020). The body’s capacity to consume oxygen optimally in activities or exercise is called VO\textsubscript{2\text{max}} (Emral, 2017; FIFA, n.d.; Poon et al., 2021; Yanti et al., 2022; Candra, 2020). From several theories, it is explained that the VO\textsubscript{2\text{max}} needs of football players are various. VO\textsubscript{2\text{max}} of international football players is 55-68 ml/kg/minute (Slimani et al., 2019), and 48-62 ml/kg/minute (Wells et al., 2011). Professional 56.5 ml/kg/min; Amateur 55.7 ml/kg/min (Helgerud et al., 2001). The high requirements for VO\textsubscript{2\text{max}} in a football game mean that the coach must be able to provide the right training methods that can increase endurance.

In football, the exercises that are designed should be more specific to the actual game of football. In training to increase endurance ideally done with ball exercises (Scheunemann, 2012; Hoff et al., 2002). Training to improve the physical abilities of football players should use specific training such as SSG, technique drills, and playing position drills (Strudwick, 2016; Seeger, 2015). Training performed with high intensity in the form of specific exercises. Football players will have a specific way of improvement. SSG is one of the exercises that can improve aerobic and anaerobic endurance. SSG exercise can also improve the player’s tactical understanding and also train the player’s mentality.

Conclusions

The results of this study can improve the aerobic endurance of football players, this is evidenced by the value of t\textsubscript{0.025} . Thus, H0 in this study is accepted.

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ігри неповними складами 5 на 5: підвищення аеробної витривалості юних футболістів

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; Д – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 8 с., 4 табл., 1 рис., 67 джерел.

Метою цього дослідження було визначення впливу ігор неповними складами 5 на 5 на підвищення аеробної витривалості у футболістів.

Матеріали та методи. Цей тип дослідження є квазіекспериментом за схемою попереднього та підсумкового тестування на одній групі. Генеральною сукупністю в цьому дослідженні були гравці футболної школи Гама Муда в регентстві Пасаман (Індонезія), загальною численністю 60 осіб. Відбір вибірки проводили методом цільового відбору, тому розмір вибірки був заданий кількістю максимум 20 осіб. Показник витривалості гравців визначали шляхом вимірювання їхньої показника максимального споживання кисню (VO_{2max}). Як інструмент для отримання даних дослідження в дослідженні використовували тест Йо-йо з переміжним відпочинком (тест Йо-йо). Для аналізу даних у цьому дослідженні використовували статистичний метод критерію середньої різниці (t-кriterion). Перш ніж перевірити нашу гіпотезу, маємо провести тест на нормальність за допомогою критерію Ліллієфорса.

Результати. Після перевірки гіпотези одержані результати показують обчислене значення t-кriterion (10,15) > та- бличне значення t-кriterion (1,729), що вказує на те, що тренування з ігор неповними складами 5 на 5 ефективно підвищує аеробну витривалість юних футболістів.

Висновки. Результати цього дослідження демонструють, що тренування з ігор неповними складами 5 на 5 можуть покращувати аеробну витривалість юних футболістів.

Ключові слова: ігри неповним складом, аеробна витривалість, футбол.
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