Effect of high-intensity interval training and fartlek on increasing VO$_2$max in futsal players

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Abstract
This study’s goal was to find out how fartlek and high intensity interval training affected VO$_2$max growth. This study was conducted at the golden futsal field in Jambi from April to May. Three times a week the treatment is given 18 times. In this study, the pretest-posttest design was applied to one group. Jambi futsal players from the Pratama family made up the demographic that the researcher chose to study. For a sample of 14 persons, inclusion and exclusion criteria were applied. The research tool employed in the study, specifically equipment from the Multi Stage Fitness Test, was used to measure VO$_2$max pretest and posttest. The data analysis processes of normality, homogeneity, and hypothesis testing are carried out using SPSS. The distribution is normal and homogenous, according to this study’s normality and homogeneity data (sig. > 0.05). The hypothesis test findings indicate a significance value of 0.00; 0.05. VO$_2$max of the Pratama family’s futsal players in Jambi was raised via fartlek and high-intensity interval training. Additionally, this study demonstrates that fartlek training and high-intensity interval training both work to raise VO$_2$max by 61.9%. These results suggest that fartlek and high-intensity interval training are useful training methods for boosting VO$_2$max.

Keywords: VO$_2$max, high intensity interval training, fartlek

1. Introduction
One of the games that has received great attention lately is the game of futsal and is one of the most popular games in the world. Futsal is a game full of movement activities because futsal is a combination of sports components and physical activity (Korobeinikov et al., 2020) [11]. Futsal is played by over 30 million players from 100 countries and is a sport in which two teams of five players compete against each other (Dogramaci S et al., 2015) [10]. Futsal is a game played on a 40 x 20-meter court and unlimited substitutions can be made without stopping time which supports a high level of intensity throughout the match (Ayarra et al., 2018) [1]. Futsal is a game that involves players who are always moving in terms of attack and defense so that futsal can be tiring. So futsal is a high intensity game (Naser et al., 2017) [14]. High intensity futsal matches require physical effort, technique, and good tactic (Borges et al., 2022) [13]. It also has a dynamic and complex environment that requires players to make quick and precise movements for successful performance (Iedynak, Galamandjuk, et al., 2019; Iedynak, Marzec, et al., 2019) [9, 10], according to (Dal Pupo et al., 2017) [4]. According to him, physical exercise is crucial for futsal players as futsal matches are interrupted by high-intensity work and short-term recovery.

Endurance is a very important physical factor in determining the performance of an athlete. Good endurance allows athletes to maximize the use of skills and tactics, allows athletes with good endurance to excel easily. Endurance is an important part of your physical condition for playing futsal, because it is involved in transporting oxygen throughout the body through the heart and lungs to produce energy. This is due to futsal periodic nature, which includes an aerobic metabolism that accounts for 75% of the energy consumed throughout a game (de Oliveira et al., 2019) [8]. One of the most significant factors affecting endurance performance is maximum oxygen volume (Lundby et al., 2017) [12]. In this situation, VO$_2$max is regarded as the gold standard for evaluating an individual's level of aerobic fitness. The higher the VO$_2$max value of futsal players, the more oxygen the body can use for metabolism and ensure sufficient stamina and stamina when competing.
A good endurance is characterized by the highest volume of oxygen and is the maximum reaction to oxygen consumption. (Pratama & Bafirman, 2020) [16]. Has a good VO2max capacity, must be owned by futsal players to support a desired achievement. A good VO2max helps support athlete performance (Teatro C et al., 2017) [19]. Futsal players must exhibit optimal aerobic conditions to be able to tolerate the high intensity physiological demands presented both in training and in competition. To be able to handle the high intensity demands on one's body presented during both training and competition, futsal players must have ideal aerobic conditions, maximum oxygen consumption rate (VO2max) has been linked to more sprints, longer distances traveled, more involvement with the ball, less weariness, and less cardiovascular stress while playing. (Matzenbacher et al., 2014) [13]

From the results of observations made by the researchers, it was confirmed by tests and measurements to determine the player’s VO2max ability using a multistage fitness test. The measurement test that was followed by 14 players from the Pratama family jambi futsal team, the results of the VO2max test were 2 players in the middle category, 12 players in less category. The gold standard for determining fitness level is considered to be direct measurement of VO2max. (Peric & Nikolovski, 2017) [18]. Before establishing a training program for athletes, trainers must first understand the athlete's endurance profile. (Nilsson & Cardinale, 2018) [15]. The researcher came to the conclusion that an exercise program was required to raise the player's VO2max based on the findings of the tests and measurements that were done. Researchers also interviewed the head coach. So far, the only exercises that are often done are techniques and games. Exercise that leads to physical exercise, especially endurance training is still lacking, to increase VO2max, players need to be given an appropriate and appropriate training program so that the preparations are carried out well. One of the training programs that the researchers implemented was high intensity interval training and Fartlek to get the players in good physical condition.

Fartlek is a type of endurance training intended to improve, maintain, and help one stay in top physical shape for a variety of sports, especially ones that need endurance. (Pratama & Kushartanti, 2018) [17]. The goal of fartlek training is to run more than usual so that we can determine the best running pace for each athlete's preferences and skills. (Pratama & Kushartanti, 2018) [17]. High intensity interval training is regarded as the best kind of exercise for athletes to improve their cardiovascular and metabolic health. (Buchheit & Laursen, 2013) [2].

2. Materials and Methods
2.1 Participants
One group pretest-posttest is the research design chosen because it is an experimental study. In this model a pre-test was carried out before treatment, so that the results of the treatment can be more clearly seen and compared with the results before treatment. The sample of this research is 14 pratama family team players. The study was conducted one month and a half and consisted of 18 lessons. Three meetings per week are held. The multistage fitness test was the tool employed in this investigation. Statistical analysis of variance (ANNOVA) methods were used to analyze the data (SPSS25).

2.2 Procedure
Before starting measurement, athletes warm up. The Multi Stage Fitness Test was the research tool employed in the study, and it was used to track the growth of the athlete's maximal oxygen volume (VO2max). The test consists of continuous running between two lines at a distance of 20 meters, where is heard “bleep” previously recorded, candidates are asked to try to run to the other end to match "bleep", every time a "bleep" is heard the candidate must reach one end of the runway. If the competitor fails to reach the 20-meter distance before the beep sounds, he will be warned and must keep running until he reaches the limit, while increasing its speed so as not to be late for the next beep. If a candidate fails twice in a row, he is considered eliminated from the test, the final score it achieves becomes the score for the test. Treatment lasts for one and a half months and entails 18 sessions, three of which are held each week. This test is used to evaluate how well fartlek exercises and high-intensity interval training (HIIT) raise VO2max. Participants warmed up as an opening activity and finished each of the 18 treatment sessions with a cool-down exercise.

3. Results & Discussion
The results of the VO2max score of 14 players are as follows:

<table>
<thead>
<tr>
<th>Table 1: Data description</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest VO2max</td>
<td>14</td>
<td>41.1</td>
<td>50.2</td>
<td>45.64</td>
<td>2.23</td>
</tr>
<tr>
<td>Posttest VO2max</td>
<td>14</td>
<td>44.5</td>
<td>52.8</td>
<td>49.77</td>
<td>2.14</td>
</tr>
</tbody>
</table>

The author employs a sample of 14 participants to produce descriptive statistics that describe the study's findings, gives a VO2max ability initial test result with a mean of 45.64 and a standard deviation of 2.23, a minimum score of 41.1 and a highest score of 50.2. The average VO2max score for the final examination is 49.77 with a standard deviation of 2.14. With a minimum score of 44.5 and a maximum score of 52.8.

Before testing the research hypothesis, premise test that is, normality and homogeneity tests were carried out. Table 2 displays the normality test findings, while Table 3 displays the homogeneity test results. In this study normality was tested by looking at the sig value using the Shapiro-Wilk test, with decision making > 0.05 is considered normal. The normalcy test's findings are as follows:

<table>
<thead>
<tr>
<th>Tabel 2: Normality test</th>
<th>Shapiro-Wilk</th>
<th>Statistic</th>
<th>Df</th>
<th>Sig</th>
<th>Kesimpulan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest VO2max</td>
<td>0.967</td>
<td>14</td>
<td>0.841</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Posttest VO2max</td>
<td>0.940</td>
<td>14</td>
<td>0.422</td>
<td>Normal</td>
<td></td>
</tr>
</tbody>
</table>

Levene's test was used in this study to determine whether decision-making was homogeneous. Decision-making with a sig value > 0.05 is regarded as homogeneous. The homogeneity test's findings are as follows:

<table>
<thead>
<tr>
<th>Tabel 3: Homogeneity test</th>
<th>Levene statistics</th>
<th>df1</th>
<th>df2</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2max</td>
<td>0.054</td>
<td>1</td>
<td>26</td>
<td>0.818</td>
</tr>
</tbody>
</table>

The paired t-test was employed by researchers to assess their hypotheses. The findings of the study are shown in the fourth table below:

<table>
<thead>
<tr>
<th>Tabel 4: Hypothesis Test</th>
<th>Df</th>
<th>t-table</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest-Postest VO2max</td>
<td>13</td>
<td>-14.464</td>
<td>0.000</td>
</tr>
</tbody>
</table>
As seen in the above table, high-intensity interval training and fartlek training have an impact on the VO\textsubscript{2}max of pratama family futsal players. With a significant result of 0.000; 0.05, this t-test validation rejects hypothesis H0 and accepts hypothesis H1. The amount of the increase in VO\textsubscript{2}max from fartlek and high-intensity interval training was then calculated in this study using the percentage increase. The analysis’ findings are shown in table 5 below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Difference</th>
<th>Percentage Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO\textsubscript{2}max</td>
<td>45.64</td>
<td>49.77</td>
<td>4.13</td>
<td>61.9%</td>
</tr>
</tbody>
</table>

According to the study in the table, fartlek and high-intensity interval training raised VO\textsubscript{2}max by 61.9%. This study looked at the effect of high-intensity interval training on VO\textsubscript{2}max in the Jambi Pratama family futsal players. The findings of the study's statistical analysis of the variable VO\textsubscript{2}max level of fartlek and high-intensity interval training. As many as 14 athletes who were sampled obtained a minimum pretest value = 41.1 and a posttest value = 50.2, maximum pretest value = 44.5 and post-test = 52.8. Mean (average) pretest = 45.64 and posttest = 49.77. Then the pretest standard deviation = 2.23, and the posttest standard deviation = 2.14. Based on the data, it is then tested by testing the hypothesis where the validation produces a significant value of 0.000 <0.05, then the H0 hypothesis is rejected and the H1 hypothesis is accepted. Then do the effectiveness test, and the results showed that high-intensity interval training and fartlek training increased VO\textsubscript{2}max by 61.9%. These outcomes are consistent with those discovered (Festiawan et al., 2020) [8], that after doing high-intensity interval training and the fartlek method, a person can achieve a better VO\textsubscript{2}Max and exercise longer. Therefore, the fartlek look at and high-intensity interval training are both effective for raising VO\textsubscript{2}max. According to this perspective, futsal players need to develop their technical skills, strategies, and physical fitness in order to have good physical abilities. (Fathoni & Rachman, 2020) [9]. Therefore, today’s futsal coaches and players can use fartlek and high intensity interval training as a guide. In order to get better and more meaningful results to raise the VO\textsubscript{2}max of futsal athletes, bigger samples can be employed in future research instead of varied exercises.

4. Conclusions

On the basis of the six-week study's findings, it can be said that the Fartlek training method and high-intensity interval training significantly affect the VO\textsubscript{2}Max level of Jambi Pratama Family futsal players. This study shows an increase in VO\textsubscript{2}max of 61.9% in futsal players. In order for research in the same subject to advance, it is anticipated that this study will serve as a source of reference for other researchers.

5. References


