The effect of circuit training, fartlek, and small-sided games on maximum oxygen consumption capacity building in futsal players

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How to Cite

Abstract

Purpose: This research aims to assess the effect of circuit training, fartlek, and small-sided games on futsal players’ maximum oxygen consumption capacity.

Material and methods. This research was carried out at the Upik Indoor Futsal Banjarmasin field from May to June. The treatment consists of 16 meetings held three times a week. This research applies a random pre- and post-test control group design. Players from the FFC BSM Junior Futsal Club make up the population.

The results. As a result of the employment of sampling formulas and inclusion and exclusion criteria, forty individuals were included in this study. The adopted instrument is a multistage fitness test with a validity of 0.408 and reliability of 0.875. Data analysis using the help of SPSS includes normality, homogeneity, and hypothesis tests. The findings of this study’s normality test indicated that the mean of each group achieved a significance level of > 0.05. Therefore it can be assumed that the data were normally distributed. Meanwhile, the homogeneity test results got a significance value of > 0.05, which can be considered homogeneous or the same data. This study showed that the three training groups showed a significant increase in the maximum oxygen consumption capacity of futsal players by obtaining a significance value of < 0.05. In contrast, the control group got a significance value of > 0.197, and it can be concluded that there was no significant influence. The study also showed that small-sided game training groups improved better than circuit training groups, fartlek groups, and control groups. The increase obtained from the small-sided games group, judging from the average difference value of the small-sided games training group, increased by 4.11, the circuit training group increased by 3.71, the fartlek group increased by 3.78, and the control group increased by 0.48.

Conclusion. Thus, it can be concluded that circuit training, fartlek, and small-sided games positively impact the improvement maximum oxygen consumption capacity in futsal players. However, the small-sided game training methods group found the greatest improvement in training methods in this study.

Key Words: circuit training, fartlek, small-sided games, maximum oxygen consumption, futsal
Мета: це дослідження має на меті оцінити вплив кругових тренувань, фартлека та ігор з малим складом на підвищення потенціалу максимального споживання кисню у футболістів.

Матеріал і методи. Це дослідження проводилось на полі Upik Indoor Futsal Banjarmasin з травня по червень. Лікування складається з 16 засідань, які проводяться трічі на тиждень. У цьому дослідженні застосовано випадковий дизайн контрольних груп до та після тестування. Гравці складаються з футболістів юніорського футзального клубу ФФК БСМ.

Результати. В результаті використання формул вибірки та критеріїв включення та виключення до цього дослідження було включено сорок осіб. Прийнятим інструментом є багатоетапний фітнес-тест з валідністю 0,408 і надійністю 0,875. Аналіз даних за допомогою SPSS включає перевірку нормальності, однорідності та гіпотез. Результати тесту на нормальність цього дослідження показали, що середнє значення кожної групи досягло рівня значущості > 0,05. Тому можна припустити, що дані були нормально розподілені. Тим часом результати тесту на однорідність отримали значення значущості > 0,05, що можна вважати однорідними або однаковими даними. Це дослідження показало, що три тренувальні групи показали значне збільшення потенціалу максимального споживання кисню гравців у футзал, отримавши значення значущості < 0,05. Навпаки, контрольна група отримала значення значущості > 0,197, і можна зробити висновок, що значного впливу не було. Дослідження також показало, що тренування груп невеликих ігор покращилися краще, ніж групи кругових тренувань, групи фартлека та контрольні групи. Приріст, отриманий у групі малосторонніх ігор, судячи із середнього значення різниці у групі навчання малосторонніх ігор, зріс на 4,11, у групі кругових тренувань збільшився на 3,71, у групі фартлека збільшився на 3,78, а в контрольній групі збільшився на 0,48.

Висновок. Таким чином, можна зробити висновок, що кругові тренування, фартлек та ігри з малим боком позитивно впливають на підвищення потенціалу максимального споживання кисню у футболістів. Однак групи методів тренування з невеликими сторонами виявили найбільше покращення методів навчання в цьому дослідженні.

Ключові слова: кругове тренування, фартлек, малосторонні ігри, максимальне споживання кисню, футбол

Анотація

Занзабіл Адва Фітріан, Али Сатья Граха, Ахмад Насрулло, Али Мунір, Мірза Асмара, Науфаллатхуф Якуттул Ірсіяд. Вплив кругових тренувань, фартлека та ігор з малим складом на підвищення потенціалу максимального споживання кисню у футболістів.

Мета: це дослідження має на меті оцінити вплив кругових тренувань, фартлека та ігор з малим складом на підвищення потенціалу максимального споживання кисню гравців у футбол.

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Ключові слова: кругове тренування, фартлек, малосторонні ігри, максимальне споживання кисню, футбол

Здоров'я, спорт, реабілітація

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Introduction

Futsal is a game sport widely loved by people worldwide [1]. Meanwhile, according to [2], futsal is a sport played by two teams of 5 people and includes a popular sport where the interest in this sport exceeds 30 million players from 100 countries. According to [3], futsal is a sport similar to football, and it can be seen from the basic techniques used in the game also requires stamina, mental strength, and strategy. However, what distinguishes the futsal game is the modification of the game's rules, the field, and the number of players.

Futsal is a game sport that involves players constantly moving in terms of attack and defence so that futsal can cause fatigue; therefore, futsal is a high-intensity game sport [4]. Rapid and spontaneous position changes with high playing intensity and prioritizing every technical ability to support the success of playing futsal are the hallmarks of the sport of futsal games [5, 6]. The assertion is true since futsal is an intermittent sport in which 75% of the energy consumed during the game is supplied by aerobics [7]. As to the statement from [8], the features of intermittent futsal need high levels of physical, technical, and tactical skill throughout the game, with a focus on the athletes' ability to make quick judgments and the creativity of the athletes. So it can be concluded that in a futsal game, good physical condition is critical to support player performance. The physical condition is supported by several other components such as strength, agility, power, speed, flexibility, reaction, accuracy and endurance [9–11]. In addition, it can be seen from the characteristics of the futsal game, namely a high-intensity game and a game that involves fast passes from foot to foot. It may be concluded that endurance is futsal's most important physical condition component.

Endurance is the capacity of a person to utilize the performance of the heart and blood circulation effectively and efficiently for an extended period [12]. Meanwhile [13] explained that endurance is a condition where the body can work or train for a long time but remain in good condition after training or work. Endurance is the capacity of the heart and lungs to deliver oxygen to working body components for an extended period [14]. Good endurance is the maximal ability to meet oxygen consumption, and it is characterized by a maximum oxygen volume [VO2Max] [15].

VO2Max is an indicator of a person entering oxygen, and this is related to the ability to use oxygen [16]. VO2Max is a crucial indicator for assessing health and exercise performance [Matabuena et al., 2018]. Research [17] proves that people with high VO2Max can perform high-intensity activities for longer. It is also helpful to see the ability to perform activities. High-intensity exercise, although if performed for a few seconds, will acclimatize the body to generate aerobic and anaerobic ATP. VO2Max capability is regarded as one of the most important aspects of exercise [18]. The benefits of VO2Max are as the essential capital of a person or athlete to achieve achievements, especially endurance can describe motor power, resulting in delayed fatigue, and will restore physical freshness faster after activities [19].

Futsal players require a high VO2max to suit their needs during each game [20]. A high VO2Max greatly assists an athlete's performance [21]. However, futsal players' physical, mental, and technical preparedness improves due to increased VO2Max during training [22]. Although every human is not actively exercising or doing daily activities, vital abilities, heart, and lungs will increase only a little [23]. However, the high VO2Max capacity is essential for athletes since it plays a big role in performing repeated and continuous sprints, such as in futsal games. Continuous sprints are the work of someone who needs good VO2Max capacity capabilities because sprints include high-intensity movements [24]. Therefore, it is necessary to have special training to increase VO2Max capacity, especially in this study for futsal players. Therefore, it can be concluded that VO2Max-increasing training is vital to boost the performance of athletes in their pursuit of high achievements.

Exercise is a complex process carried out systematically and continuously for individuals, groups, and teams that aim to learn and improve physical and psychic development techniques to achieve maximum sports achievements [25]. The objective of the exercise is to develop the athlete's talents in a particular activity so that he or she can reach the pinnacle of performance by focusing on physical, mental, tactical, and technical factors that can affect the exercise's objectives under the direction of the coach. Instead, the exercise principle should focus on the activity's weight, the exercise's intensity, and the management of rest time [26]. While the frequency of exercises, according to Annarino [1976] and Bowers [1992] in the book states that three exercises a week can increase endurance, strength, and flexibility. According to sports experts, a person or athlete who participates in a rigorous physical exercise program for 6 to 8 weeks before the start of the season will have much greater strength, flexibility, and endurance [19].

An excellent exercise to improve VO2Max is a type of cardio or aerobic exercise, an exercise that spurs the heart rate, lungs and muscle system [27]. Exercise should last a relatively long but moderate intensity [28]. Many studies have related efforts to increase vo2max capacity, including; slow,
that this exercise can equally improve the ability [29]. Researchers found in some research reviews that various exercises to increase VO2max can be performed by using a treadmill and running at speed [30], a 15-minute running exercise [31], the fartlek method [32–35], circuit training [20,36], and small-sided games exercises to increase VO2Max [37–40].

Based on the previous explanation that in the futsal game, there are many high-intensity actions interspersed with short rest periods, physical exercise is needed to increase the athlete's VO2Max capacity. As previously explained, many training methods can increase VO2Max capacity, so this research uses circuit training, fartlek, and small-sided game methods. This research is also motivated by the low VO2Max capacity of futsal club FFC BSM Junior players. This statement was found when the researcher observed and saw the VO2Max data given by the trainer. The VO2Max category of players is still relatively low, which is in line with the test norms in the book "101 Performance Evaluation Test by Brian Mackenzie". In addition, it was also shown when the futsal club FFC BSM Junior played in one of the U-23 age category tournaments and did not qualify for the group stage due to two defeats. In every match, the FFC BSM Junior team always wins points. However, the opposing team could always overturn the FFC BSM Junior team's advantage because many players were tired. The coach also confirmed the statement that the cause of his team's defeat was a decrease in player concentration due to fatigue.

Based on the description and problems that exist and remember that in the sport of futsal endurance or VO2Max plays an essential role in player performance, this study aims to find out the influence and compare which training method is better to increase VO2Max capacity in FFC BSM Junior futsal players.

Material & methods

Participants

Experimental research is a method that examines something to determine the treatment's consequences [41]. This experimental study aims to determine and compare which training technique is superior in increasing the VO2Max capacity of FFC BSM Junior futsal players. In this study, the Multistage Fitness Test [MFT] instrument was implemented by [42] with a validity value of 0.408 and a reliability value of 0.875. This study consisted of 16 meetings, with three weekly sessions and two meetings outside of training to collect VO2Max data before and after treatment between May and June 2022. The Upik Indoor Futsal Field in Banjarmasin became a practice and data collection place. Data analysis in this study used SPSS Version 25, which included a normality test, homogeneity test, paired sample t-test, and ANOVA test. The population in the study was the FFC BSM Junior futsal club, and sampling used the formula [43], Which can be seen below in table 1.

| Table 1 |
| Sample Count Retrieval Formula |

\[
(t-1)(r-1) \geq 15
\]

Information: 
- \( t = \) The quantity of treatment groups,
- \( r = \) Quantity of Samples

The minimum quantity of samples used in this study, each group of at least 6.5, is rounded to 7 based on the formula's computations. To compensate for dropouts, the researchers chose to sample ten participants from each group, bringing the total sample size in this study to forty. Sampling was also based on inclusion criteria, including FFC BSM Junior futsal club players, athletes aged 15-20 years, willing to be research subjects, and participating in training until the end. As for the criteria, exclusion included athletes who were sick or injured and did not attend training until the end.

This research applies a random pre- and post-test control group design with three experimental and one control group. This study's design randomly assigned subjects to one of four groups: an experimental group employing the circuit exercise technique, a fartlek exercise method group, a small-sided games exercise method group, and a control group or group that received no additional treatment (only carrying out daily activities). The study's design is presented in detail in Table 2 below.
Next, proceed with conducting a prerequisite test. The two prerequisite tests for this study are the normality and homogeneity tests. The normality test determines whether or not data have a normal distribution and which statistical test to use. In this study, normality was determined using the Shapiro-Wilk test. Table 4 demonstrates the results of the normalcy test:

Based on the normality test results, which are displayed in the table significance Value of > 0.05, it may be stated that the data follows a normal distribution. Therefore, the hypothesis is examined using a paired t-test and an ANOVA.

The second required test is a homogeneity test that determines whether or not the data is homogeneous. This study utilized the Levene test. The results of the homogeneity test are listed below (Table 5).

Based on the results of the Levene test shown in the table, the significance value of 0.105 > 0.05, it can be stated that the data is homogeneous. After the prerequisite test has been carried out, the next stage is to test the hypothesis to determine the influence of each treatment group and determine which is a better exercise to increase the VO2Max capacity of FFC BSM Junior futsal players. In hypothesis testing, researchers use paired t-tests and ANOVA tests. Table 6 below shows the results of the paired t-test. According to the table of paired t-test results for each group of training methods, which include circuit exercises, fartlek, and small-sided games, have a significance level of <0.05. Thus, the three exercises affected the VO2Max capacity of the FFC BSM Junior futsal team. Meanwhile, the control group gets a sig value. > 0.05, which was concluded, there was no significant effect on the increase in VO2Max.

Then, compare each group to see any differences between the four groups. In this study using the ANOVA test, the following are the results of the ANOVA test.

The results of the Anova test indicated that Significance of 0.112 > 0.05. Therefore, there is no statistically significant difference between the circuit training, fartlek, small-sided games, and control groups. However, judging from the average difference in the small-sided games group, it gave a better increase than other groups.
Discussion

This study was conducted to determine the effect and compare which exercise is better for increasing the VO2max capacity of futsal players. The results of this study reveal that the Circuit training group, the Fartlek group, and the Small-Sided Games group can boost futsal players’ VO2Max capacity. In contrast, there is no statistically significant rise in the control group. This result is comparable to the previous study, in which three training techniques boosted futsal players’ VO2Max capacity. Nevertheless, each exercise method’s VO2Max enhancement has distinct advantages.

In the training group given circuit training, athletes perform various movements adapted to the training program, keep the athlete active, and bring out their full potential. The advantages of the circuit training method, in addition to increasing VO2Max capacity, are also increasing and developing physical fitness related to strength, speed, and endurance. It follows the statement [44] that circuit training improves cardiovascular endurance, flexibility, strength, and muscle endurance. Circuit training involves three variables at once, namely intensity, repetition, and duration. These circuits train athletes and coaches to manage various exercises, save time and tolerate individual differences. The heart of someone who exercises frequently is bigger than that of someone who does not. Thus, the blood volume from the pulse (Stroke Volume = SV) will increase. With increased blood volume, the heart does not need to pump at a high rate to meet oxygen demands or remove carbon dioxide. Therefore, athletes are trained in aerobic endurance, whose pulse will be at least under 60 beats per minute, even lower than 50

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<th>Calculation</th>
<th>VO2Max PRE Small-side games Group - VO2MAX POST Small-side games Group</th>
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<td>VO2MAX PRE</td>
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<tr>
<td>POST Circuit Training Group</td>
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<tr>
<td>VO2MAX PRE</td>
<td>-5.059</td>
<td>9</td>
<td>-5.059</td>
<td>0.001</td>
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<tr>
<td>POST Fartlek Group</td>
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<td>-1.392</td>
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<td>VO2Max Results</td>
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beats per minute [45]. The circuit training method is a combination method that incorporates many activities to increase physical quality [46, 47]. The circuit training method develops strength and endurance [48]. According to [36], the circuit training program increased the research subjects’ muscular strength, agility, anaerobic capacity, and cardiovascular endurance. Circuit training incorporating aerobic and anaerobic exercise synergises cardiorespiratory and muscular fitness [49].

The fartlek training group in this study also increased the VO2Max capacity of futsal players. These results are supported by research [50], which shows that fartlek training significantly affects the cardiovascular endurance of futsal extracurricular students at Madrasah Aliyah AIAI Sungaiselan. This statement is because fartlek training is one of the most appropriate endurance training techniques, especially VO2Max, to develop, improve, and maintain the physical condition of an athlete. The advantage of fartlek training is that the athlete can set the speed of the assessment skills. Athletes are also free to experiment with speed and endurance and experience a change of pace. In addition, this exercise can also be helpful as an exercise to improve speed and coordination in male futsal athletes [51]. According to [34], fartlek permits athletes to run at any distance and speed, change the intensity, and occasionally run at high intensities. This sort of exercise focuses on aerobic and anaerobic energy pathways. Aerobic exercise is known to boost VO2Max capacity.

As for the small-sided games training group, where this exercise is different from the two exercises in this study because this training method involves games, it turns out that in the study of the small-sided games, it is also able to increase the vo2max capacity of futsal players. These results are similar to studies [52, 53]. This study concludes that Small-sided games that combine skills, and sports-specific movements, with sufficient intensity encourage aerobic adaptation and improve cardiovascular and metabolic in players. In this exercise, VO2Max increases due to training methods that reduce the size of the field so that it makes athletes keep moving to be involved in the game. Other advantages, in addition to the increase in VO2Max capacity in this exercise, also contribute to improving other abilities, such as the player's tactics and techniques [40]. As for the control group, there is no increase.

According to the findings presented in Table 7, the circuit training, fartlek, and small-sided games groups significantly affect the VO2Max capacity of futsal players. In comparison, the control group did not experience a significant rise in VO2Max capacity. However, judging from the difference in the average of each group in this study, small game exercises improved more than the other groups. The small game group increased by 4.11, and the circuit exercise group increased by 3.71, the fartlek group by 3.78, and the control group by 0.48. However, in the control group, although it increased but was not significant, this was because the vital capacity of the lung and heart size developed due to lifestyle and daily activities [23].

Thus, from this study, to increase the VO2Max capacity, futsal players can use the circuit training method, fartlek, and small-sided games as a variation of training. However, based on the research findings, it is recommended that futsal players exercise in small-sided games to increase their VO2Max capacity, as these activities are nearly similar to actual games [54,55]. However, what differentiates it is the change in the game's rules [56,57] So that the players will practice as if they were in an actual match situation. However, it will simultaneously improve physical performance, technique, and tactics. The statement is in line with [52,58,59], Small games can provide opportunities to develop specific technical and tactical elements and physical capacities, such as endurance [aerobic and anaerobic], strength and agility.

**Conclusions**

A significance level of < 0.05 indicates that the three workout approaches have a favourable effect on raising VO2Max capacity, as determined by research and hypothesis tests. Meanwhile, the control group obtained a significance value of > 0.05, which was stated to have no significant effect. However, this study also found that small-sided games training provided a better increase in terms of increasing VO2Max capacity in futsal players. Therefore, the three exercise methods in this study can be used as variations of the exercise program in terms of increasing VO2Max capacity.

**Conflict of interest**

The authors declared no conflicts of interest in preparing this article.
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