

Women's Futsal Ability: VO₂ Max and Futsal Techniques

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Abstract This study aims to determine the effect of futsal training based on small-sided games on increasing VO₂ max, basic futsal techniques, and weight loss in female futsal athletes in Padang. The research method was an experiment with a pre-test and post-test design on 20 athletes aged 18-22 Years. The Multi-stage fitness test instrument measures the athlete's VO₂ max and the futsal technique instrument measures the basic technical abilities of female futsal athletes. The test requirements for data analysis are the normality test and homogeneity test. Data analysis with the t-test is to test whether there is a difference between the estimated values and the statistical results. Data processing for this research used SPSS software version 26. Based on the results of the t test (paired sample test), the Sig (2-tailed) value was 0.000 < 0.05, which means that the futsal training method using small side games increases VO₂ max, futsal techniques in female futsal players and athlete weight loss although not significant. In conclusion, the futsal training method based on small sided-games is effective for increasing VO₂ max and basic futsal technical skills in female futsal players with an increase of 21,16 %. Based on the results of the matches, the athletes experienced an increase in the results of matches against the opposing team as many as two wins and one draw.

Keywords VO₂ Max, Passing, Shooting, Dribbling

1. Introduction

Futsal is a high-intensity game [1]. Physical condition is a component that must be prepared to display maximum physical appearance [2]. Exercise intensity can be assessed by the method of absorption of oxygen (VO₂) [3].

The intensity and rhythm of the futsal game are very high and do not decrease during the game [4]. Futsal is a sport that involves periods of high-intensity physical play for two periods of 20 minutes per match [5]. The level of aerobic fitness of athletes greatly influences the success of playing futsal, and athletes must be able to recover quickly during a match so that a high level of intensity play can be maintained [6]. If a futsal player has a bad physical condition, it will have an impact on techniques and tactics that will not be optimal [7].

Experts revealed that athletes ran around 4500 m during the competition [8]. Futsal players sprint 3-4 times every 20-30 seconds during the game [9]. The average intensity of futsal games is 85-90% of the maximum heart rate and 75% of VO₂ max [8]. Maximum aerobic capacity is an important factor in assisting the recovery of professional soccer athletes [10]. Futsal games require high aerobic and anaerobic energy systems together [8]. High-intensity

exercise endurance (HIEE) or anaerobic exercise are used to develop endurance in American football, futsal, soccer, basketball, and ice hockey [11].

The training model that is currently popular in futsal is an exercise model based on small-sided games. This model is implemented with a futsal game situation so that it can reach all aspects ranging from futsal playing techniques, futsal playing tactics and the physical components needed in the futsal sport. Small side games are one of the branches of the game-based approach. They serve as exercises that emphasize tactics within the game based approach. The game-based approach can enhance skills and improve problem-solving abilities [12]. It has been proven that using a game-based approach provides greater benefits compared to nongame-based approaches [13]. For instance, in a game-based approach, participants will learn by doing while developing their technical skills [14]. The game-based approach also has the potential to increase enjoyment and enhance motivation in learning [15]. Game-based approach also makes exercises more enjoyable with the presence of a reward system that has been proven effective in training [16]. In addition, weight loss is also possible by giving small-sided games-based exercises.

Research results from [17] show that the results obtained VO_2 max of 54.0 mL/kg/minute, and an increase when using the SSG exercise program that is equal to 55.2 mL/kg/minute. It recommends small-sided games exercises to improve aerobic and anaerobic soccer athletes [18].

Training should provide a simulation of the game by manipulating not only the practice area (eg the width and length of the court) but also the goals and rules of the game [19]. Small sided game exercises have been used in pedagogical methodologies to simultaneously develop physiological, physical, technical, tactical, and sociological skills in team sports play [18]. This exercise is used to get physical improvements, techniques and tactics of playing futsal matches [20].

Results of analysis and interviews with Sports Science lecturers, at Padang State University, show that it takes good physical and technical components to be able to play futsal optimally. Although football is a popular sport in Indonesia [21], research on the development of women's futsal and soccer is still lacking compared to the number of studies on men [22]. Coaching futsal athletes requires a training program that suits the characteristics of the sport of futsal, especially for female athletes, which can provide maximum improvement in physical and technical components.

2. Materials and Methods

The participants are 20 semi-professional futsal athletes aged 18-22 years who have participated in at least 2 matches between cities, provinces and universities. The targets in this research are athletes who already have basic technical skills so that selected participants must have a

minimum training age of 5 months. This study aims to see the improvements obtained by athletes after 6 weeks and 9 weeks of training. Physical improvement was measured in terms of body weight, height, BMI, agility, VO_2 max, as well as speed and power. Then, improve basic futsal techniques in the form of passing control, dribbling and shooting. The results of this increase were measured at the first meeting, the sixth meeting, and the ninth meeting. Then the three results were compared to measure the difference in the mean of each data using the Independent Sample T-test. Then proceed with the match analysis which was carried out twice namely at the third week meeting and the ninth week meeting.

Data collection techniques before and after treatment were carried out using a multi-stage fitness test (MFT) instrument to measure VO_2 max and a futsal technique instrument to measure the basic futsal technical abilities of female futsal athletes. Data analysis performed was t-test. Test the analysis requirements using the normality test and homogeneity test, then the t test (paired sample test) and improvement analysis. This research data processing uses SPSS version 26 software.

Research Design

Researchers want to see the effect of small-sided games on VO_2 max and basic techniques on female futsal athletes in the city of Padang, so this study uses the one-group pre-test and post-test method. The data on the research subjects were carried out at the beginning of the meeting, then treatment was carried out in the form of an exercise program based on small-sided game. At the third and ninth meetings, the subject data was measured again using the same instrument at the beginning of the meeting.

3. Results and Discussion

Table 1 shows the results of statistical calculations for the variables weight, height, body mass index, VO_2 max, agility, speed and power in 3 measurements (pretest, 6-week and 9-week). It can be seen that a significant increase occurred after 9 weeks of training.

The following is information about changes over a 9-week period in the variables tested. Each variable represents a different aspect of fitness or physical health. Here's a summary of the changes: Body Weight Effect Size: There was a weight loss of 2.1 kg over a 9-week period. Height: There was an increase in height of 0.6 cm units over a 9-week period. Body Mass Index (BMI): There is a decrease in BMI by 1 kg/m unit over a 9-week period. VO_2 max: There was an increase in VO_2 max capacity of 4.6 ml/kg/min over a 9-week period. Agility: There is an increase in agility skills of 6.2 second over a 9-week period. Speed and Strength: There is an increase in speed and strength skills by 5 m/s over a 9-week period. These changes represent the effect size or magnitude of change

for each variable over a specified time period. They can be useful for evaluating the effectiveness of interventions or programs aimed at improving aspects of health and fitness. Based on Table 1, the variable that has experienced the greatest increase is the agility variable.

Table 2 shows the results of statistical calculations for the variables passing-stopping, dribbling, and shooting in 3 measurements (pretest, 6-week and 9-week). It can be seen that a significant increase occurred after 9 weeks of training. For the passing-stopping variable, the increase in passing-stopping skills over a period of 9 weeks (by 8.5). For the dribbling variable, the increase in dribbling skills over a period of 9 weeks (by 18.8). For the shooting variable, the increase in shooting skills over a period of 9 weeks (by 11.1). Based on Table 2, the variable that has experienced the greatest increase is the dribbling variable.

The results of the futsal training program on body weight, height, body composition, VO₂ max, agility, speed and power can be seen in Table 1. After nine weeks of giving the exercise program, there were significant improvements

in VO₂ max, agility, speed and power. Meanwhile, there was no significant increase in body weight, height and body composition. Although there was a change in weight, height and body composition, the difference in estimates did not change significantly on average.

The results of the calculation on the basic techniques of passing, shooting and dribbling can be seen in Table 2. After nine weeks of giving the training program, the passing-stopping results showed an increase in the average ability of the athlete's basic passing-stopping technique. The results of the research on the dribbling technique showed that there was an average difference in the athlete's dribbling ability. Furthermore, the results of the shooting research show that there is a significant increase in the average shooting ability of athletes.

The test matches which were carried out twice can be seen in Table 3. Based on the results of the match, the athlete experienced an increase in the results of the match against the opposing team, two wins and one draw.

Table 1. Physical Condition Research Results

Variable	Pre-means (SD)	6-week	9-week	Effect size
		Hasil mean (SD)	Post mean (SD)	
Weight	53,3 ± 6,1	53,1 ± 5	51,2 ± 3,6	2,1
Height	154,8 ± 2,8	155,4 ± 2,1	155,4 ± 2,1	0,6
Body mass index	22,2 ± 2,2	22 ± 1,8	21,2 ± 1,1	1
VO ₂ max	28,9 ± 1,8	30,1 ± 2,2	33,5 ± 3,5	4,6
Agility	27,9 ± 4,1	24,7 ± 4	21,7 ± 4,5	6,2
Speed and power	19,4 ± 2,6	16,5 ± 1,9	14,4 ± 2	5

Table 2. Futsal technique research results

Variable	Pre-means (SD)	6-week	9-week	Effect size
		Hasi mean (SD)	Post mean (SD)	
Passing-stopping	10,2 ± 2,0	14 ± 3,1	18,7 ± 4,1	8,5
Dribbling	43,1 ± 5,4	33,8 ± 6,2	24,3 ± 5,7	18,8
Shooting	19,2 ± 3,1	22,2 ± 3,1	30,3 ± 3,7	11,1

Table 3. Match trial results

Match	Match -1	Result	Match 2	Result
PFA vs UNP	2 vs 4	Fail	2 vs 1	Win
PFA vs Ceklis Fc	0 vs 5	Fail	2 vs 2	Draw
PFA vs Onix fc	2 vs 2	Draw	4 vs 1	Win

Discussion

This research was conducted during the Covid-19 pandemic, so it was difficult to get parental approval so that their children could attend the training. Finally, the sample for this study was limited to 20 people who were willing and got permission from their parents. In this study, the results obtained VO_2 max of $28,9 \pm 1,8$. The VO_2 max result after being given a small-sided games training program was $33,5 \pm 3,5$. The magnitude of the effect obtained is 21.16%. The resulting increase is quite large but does not match the target set according to the VO_2 max capacity needed by the athlete. The non-compliance with the target may be influenced by several factors, such as athletes being absent several times due to illness, food that is not fully controlled, and others.

The VO_2 max capacity needed by soccer athletes is 54 mL/kg/minute [23]. In addition, futsal players with higher aerobic strength can play longer given the average game demands of 48.6 (40.1–57.1) ml kg min [24]. Meanwhile, the VO_2 max results for futsal athletes in Indonesia are very far from the VO_2 max capacity needed to play futsal. The VO_2 max of athletes at the women's futsal club in the city of Bengkulu is at an average value of 30.61 mL/kg/minute [25]. The average VO_2 max result for female athletes at Padang futsal Academy in Padang city is 30.5 mL/kg/minute [2].

The results of this study were also strengthened by research conducted by (Leandro et al) that the total influence of technical action techniques was higher in Small Sided Games (+ 18.4%, $p = 0.001$) than in generic games. Passed higher in SSG (+16%; $p = 0.01$) compared to GG. The higher technical action of SSG compared to GG shows that the SSG model is a suitable technical and physiological stimulus for the development of female futsal players [26].

Apart from small-sided games, circuit training and interval training also provide an increase in VO_2 max, and the difference between circuit training and interval training affects the VO_2 max of futsal players by providing two treatments that are more effective for increasing VO_2 max, and for increasing VO_2 max, circuit training is better than interval training [27].

Apart from improving VO_2 max, agility, speed and power, small-sided games-based training also provides improvements in passing-stopping, dribbling and shooting techniques. This study proves that there is a significant increase in the basic technical skills (passing-stopping) of female futsal athletes. The improvement obtained in the passing-stopping technique is 8.5. The basic dribbling technique increased by 18.8, and the shooting technique increased by 11.1.

Research related to small sided games and futsal was also carried out by Amani, the results showed that small sided game-based programs also produce better technical performance, so they are an effective alternative for developing aerobic capacity and anaerobic strength in

futsal [17]. However, research results from Costa et.al 2021 showed that there was no increase in shooting, dribbling and disarming actions, but the number of passes ($p = 0.016$) increased in small sided games [26].

Women's futsal in the city of Padang is still lagging compared to women's futsal from Riau, Bandung, and Jakarta. The cause of the underdevelopment of women's futsal in Padang city is influenced by many factors, namely funding sponsors, less active organizations and the culture of the people at Padang city itself. Most of the female futsal athletes at Padang city are new students from Universitas Negeri Padang with a background in volleyball, basketball and athletics. This is due to the limited training space for female futsal athletes. This causes the VO_2 max needs of female futsal athletes at Padang city still cannot meet the basic needs of futsal compared to other futsal athletes.

Social identity shapes women's experiences of power and social injustice in sport development. [28] It creates a stereotype in a patriarchal society that soccer is only suitable for men to play, because in his view women are seen as weak creatures. Although some people have a bad view of women who play soccer, women are still interested in playing soccer. In terms of health, soccer is considered effective in lowering blood pressure for women, which is based on research conducted by [29]. Professor from the University of Exeter, Peter Krustup suggests that in addition to lowering blood pressure, soccer in women is also able to lose weight and reduce the amount of cholesterol if it is done regularly. Although female soccer players are at a higher risk of concussion as well as exposure to repeated head injuries from heading the ball [30].

Social views like that are currently starting to change little by little. Through continuous coaching and collaboration from various parties, it is hoped that it can provide good input for the development of women's futsal at Padang city. One of them is by accommodating women's futsal players for training, and matches and providing interesting training programs so that women's futsal players can continue to be consistent in developing futsal at Padang city.

4. Conclusions

After nine weeks of giving the training program results obtained a significant increase in VO_2 max, agility, speed and power. Meanwhile, there was no significant increase in body weight, height and body composition. Despite changes in weight, height and body composition, the difference in estimates did not change significantly on average. The result of passing-stopping is an increase in the average passing-stopping ability of athletes. The results of research on the dribbling technique showed that there was an average difference in the athlete's dribbling ability. Furthermore, the results of shooting research show that there is a significant increase in the average athlete's

shooting ability. The match trials which were carried out twice can be seen in table 3. Based on the results of the matches, the athletes experienced an increase in the results of matches against the opposing team as many as two wins and one draw.

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