

Effect of Circuit Training to Increase VO_2 max for Futsal Player

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Abstract—Endurance can be trained by low or small load, with a lot of frequency and in a long duration of time. The purpose of this research is to know the effect of circuit training to increase vo_2 max for futsal player of RedFox club in Malang City after given treatment. The research used was quasi experiment with control group pretest design, posttest design. Sampling method is using matching sampling, then sample is all of the population. Based on the results of data analysis t_{count} of 5,579 > $t_{table} = 2,178$ by significant level $\alpha = 0,05$ means significant.

Keywords—circuit training, vo_2 max, futsal

I. INTRODUCTION

The futsal game is a combination of several individual techniques and teams that are integrated into an overall collaboration. Basically futsal is a very fast and dynamic game. In addition, futsal toys require players to continue to pass (passing), while dribbling (dribbling) is not much done because of the small size of the field. Physical condition is one of the most dominant components in achieving sports achievements. Amiq[1] suggests that several types of components of Physical condition is one of the most dominant components in achieving sports achievements. Amiq[1] suggests that several types of components of physical conditions that must be owned by a player are: strength, endurance, muscular power, speed, flexible power (flexibility), agility (coordination), coordination (coordination), balance (balance), accuracy (accuracy), reaction (reaction).

One way to assess a player's fitness in performing activities is to measure VO_2 max. People who have good fitness have higher VO_2 max values and can do activities stronger than those who are not in good condition. This measurement of VO_2 max can be used to analyze the effects of a physical training program. Based on the background described, the researchers were attracted to conduct research to determine the impact of training using the circuit training method to improve physical condition and endurance of futsal players. Therefore, the researcher took the title "Effect of Circuit Training on Increasing VO_2 max for Malang City RedFox Club Futsal Players". The purpose of this study was to determine the effect of circuit training on increasing VO_2 max for Malang RedFox club futsal players after being treated.

According to Sugiharto[2] research is a form of investment in human resources that requires systematic and programmed structuring, so that the sporting activities carried out have a positive impact on health and optimal achievement improvement. According to Ismaryati et al.[3], the physiological research of exercise focuses on changes in skeletal muscle, however, some studies that focus on the neuromuscular junction motoneuron are equally important, even more important, because it was found that these two neural structures show changes as a result of the practice. It can be concluded that exercise is a hard work process of an athlete who experiences changes in physical abilities with sufficiently long training and stimulates physiological adaptations to maximize the performance and abilities of athletes so that they can achieve maximum results.

According to Budiwanto[4] said to achieve increased physical and technical abilities in a sport, a process and time needed. The training program needs to be prepared by paying attention to the basic principles of training through phasing, regular and continuous. Oxygen is delivered throughout the body in the cardiovascular system which consists of heart rate, lungs and blood circulation in the blood circulation. Exercise must have the right dose, both intensity, frequency, endurance, speed, reaction, ability, oxygen uptake, muscle strength, including the heart to control blood pressure and pulse. It was concluded that the cardiovascular system is the heart organ that helps the body to take oxygen in carrying out strenuous activities or exercises when the body is experiencing fatigue.

According to Harsono[5] circuit training is a system of exercises that can improve the overall fitness of the body simultaneously, namely the elements of power, endurance, strength, agility, speed, and other physical components. VO_2 max is the ability of the athlete's body to be able to breathe oxygen to the maximum, by breathing in oxygen the maximum the athlete can overcome the exercise without experiencing extreme fatigue. Circuit training is an exercise program consisting of several stations and at each station the player will perform a predetermined type of exercise. According to Paiman[6] is the effect of exercise on the body: improve general health and heart muscle, increase blood volume, increase blood volume pumped to the heart, improve blood pressure, improve blood state, improve arterial blood pressure, improve red blood cells, improve respiration,

improve the muscular system (muscular), improve the digestive system and disposal, improve the endocrine system, maintain body temperature and improve the nervous system. Exercises involving large muscles will also spur improvement in muscle quality. Therefore, VO2 max is an important role for athletes who need high intensity time in doing exercises or matches.

Futsal is a multi-level invasion game activity that is played five to five people in a certain duration of time played on food, goal and ball which is relatively smaller than a soccer game that requires moving, fun and safe to play and the winning team is a team that always scores more goals against his opponent's goal. It can be concluded that futsal is a game that is played with both teams consisting of each of the five players per team, with a certain duration of time that uses a relatively smaller field and ball than the game of football with faster and more dynamic games followed by rules more stringent in accordance with FIFA guidelines.

II. METHODS

This study is a quasi-experimental study using the pretest control group design, posttest design. The research was conducted at the RedFox Club in Malang City on the street Letjend S. Parman No. 75, Malang City.

The population of this research is the players of the RedFox futsal Club in Malang, which number 24 players. Of the 24 players randomly divided into two groups, namely: the experimental group as many as 12 people were treated with a circuit training exercise program and a control group of 12 people without treatment. The sample in this study was aged 22 years to 24 years with a total of 24 players from all RedFox Club Malang futsal players. Sampling of this study was carried out by means of matching sampling which is dividing 2 from the entire sample. Group 1 self from the experimental group and group 2 consisted of the control group.

The instrument used in this study used a beep test instrument. Data collection in this study was in the form of observation, documentation and beep test as a test for VO2 max at the beginning of the study and at the end of the study after being treated with circuit training exercises. Data collection is divided into 2 stages, namely the preparation and implementation stages.

Data analysis techniques for descriptive statistical tests, normality tests using Kolmogorov smirnov instrument data with the help of SPSS at a significant level (α) of 0.05. For homogeneity test using test data (leven's homogeneity-of variance test) with $\alpha = 0.05$ (significance level / confidence) and paired t test and independent t test.

III. RESULTS

Table 4.1 Description of Pretest and Posttest VO2 max Experimental Groups

Data Type	N	Score Min	Score Max	Mean	SD
Pretest	12	34.30	42.60	38.06	2.45
Posttest	12	36.00	43.30	40.34	2.16

In Table 4.1 it can be seen that RedFox Club Malang City players. Before receiving the VO2 max test results obtained from the Bleep test with a minimum VO2 max result of 34.30 ml / kg / min and a maximum VO2 max test result of 42.60 ml / kg / min. The number of players is 12 people, with a standard deviation on the results of the pretest that is worth 2.45. After obtaining treatment in the form of circuit training exercises at RedFox club obtained an increase in VO2 max measured through the bleep test, with VO2 max a minimum of 36.00 ml / kg / min and VO2 max maximum of 43.30 ml / kg / min. The number of players is 12 people, with a standard deviation in the posttest result which is worth 2.16.

Table 4.2 Description of Pretest and Posttest data VO2 max Control Group

Data Type	N	Min Score	Max Score	Mean	SD
Pretest	12	34.70	42.60	37.81	2.56
Posttest	12	35.40	43.30	38.00	2.49

In Table 4.2 it can be seen that RedFox Club players in Malang City. The group that did not get the VO2 max test results obtained from the Bleep test with a minimum VO2 max result was 34.70 ml / kg / min and the VO2 max 42.60 ml / kg / min test results. The number of players is 12 people, with a standard deviation on the pretest results which is worth 2.56. Not getting treatment in the form of circuit training in RedFox club players obtained VO2 max results measured through the bleep test, with VO2 max of at least 35.40 ml / kg / min and VO2 max maximum of 43.30 ml / kg / min. The number of players is 12 people, with a standard deviation in the posttest result which is worth 2.49.

Table 4.3 Description of the mean mean pretest and posttest VO2 max experimental group data

Data Type	Total Score	N	Mean	Mean difference
Pretest	456.80	12	38.06	2.28
Posttest	484.10	12	40.34	

From Table 4.3 it can be stated that the mean score at pretest is 38.06 while the mean score at posttest has a higher score of 40.34. It can be concluded that the mean difference between pretest and posttest is 2.28. This indicates that the difference in increase in VO2 max pretest and posttest has increased because RedFox Club futsal players in Malang City

conduct circuit training exercises, after the treatment has been better than before getting treatment for circuit training.

Table 4.4 Description of the mean mean pretest and posttest VO2 max control group data

Data Type	Total Score	N	Mean	Mean difference
Pretest	453.80	12	37.81	0.19
Posttest	456.00	12	38.00	

From Table 4.4 it can be stated that the mean score at pretest is 37.81 while the mean score at posttest has a higher score of 38.00. It can be concluded that the difference in mean between pretest and posttest is 0.19. This indicates the difference between the experimental group and the control group. The higher experimental group received the circuit training exercise.

Table 4.5 Results of the Pretest and Posttest Normality Test Experiments

Improvement test of VO ₂ max	Kolmogorov Smirnov	Sig	Category
Pretest and posttest	0.668	0.764	Normal

Based on Table 4.5 the Kolmogorov Smirnov normality test for each experimental group pretest and posttest score showed a significance greater than $\alpha = 0.05$. The significance values of the pretest and posttest were obtained 0.764 greater than $\alpha = 0.05$. Thus it can be concluded that the test score data falls into the normal category.

Table 4.6 Results of Pretest and Posttest Normality Tests of the Control Group

Improvement test of VO ₂ max	Kolmogorov Smirnov	Sig	Category
Pretest dan posttest	0.629	0.824	Normal

Based on Table 4.6 the Kolmogorov Smirnov normality test for each control group pretest and posttest score showed significance greater than $\alpha = 0.05$. The significance value of the pretest and posttest was obtained 0, 824 greater than $\alpha = 0.05$. Thus it can be concluded that the data obtained in the normal category.

Table 4.7 Pretest Homogeneity Test and Posttest VO2 max Experimental Group

Test Data	Signifikansi	Explanation
Pretest dan Posttest	0.159	Homogen

Based on Table 4.7 the homo-genital test of leven's test on the pretest and posttest of the experimental group above shows that the significance value of the pretest and posttest is $0.159 > \alpha = 0.05$. Thus it can be concluded that the test score data is in the homogeneous category.

Table 4.8 Pretest Homogeneity Test and Posttest VO2 max Control Group

Test Data	Signifikansi	Explanation
Pretest dan Posttest	0.002	Heterogen

Based on Table 4.8 the homo-genital test of leven's test on the pretest and posttest of the control group above shows that the significance value of the pretest and posttest is $0.002 < \alpha = 0.05$. Thus it can be concluded that the test score data is in the heterogeneous category.

Table 4.9 Paired Test Results of VO2 max Experimental Group

Jenis Data	t-hitung	t-tabel	df	Sig 2-tailed
Pretest dan Posttest	5.579	2.178	11	0.000

Based on Table 4.9 above the results of the t-count increase in VO2 max for respondents or training players were obtained $5.579 > 2.178$, meaning that tcount 5.579 is greater than the results of ttable 2.178. While the probability (sig 2-tailed) $p = 0,000$ with the level of sigifsi $\alpha = 0.05$ indicates that the results of the initial test and the final test results have significant differences ($p > \alpha$).

Table 4.10 Results of the Independent VO2 max Control Group t-Test

Jenis Data	t-hitung	t-tabel	df	Sig 2-tailed
Pretest dan Posttest	0.722	2.178	11	0.485

Based on Table 4.10 above the results of the t-count increase in VO2 max for respondents or training players were obtained $0.722 < 2.178$, meaning that tcount 0.722 is less than the results of ttable 2.178. While the probability (sig 2-tailed) $p = 0.485$ with $\alpha = 0.05$ indicates that the results of the initial test and the final test results are different ($p < \alpha$).

Table 4.11 Results of the Independent VO2 max t-Test Experiment Group and Control Group

Jenis Data	t-hitung	t-tabel	df	Sig 2-tailed
Pretest dan Posttest	2.199	2.085	11	0.039

Based on the distribution table in the attachment section, obtained t-table value is 2.085 (df: 11 and two-sided significant level 0.05), because t count $>$ t table is $2.199 > 2.085$ then Ho is rejected. Thus Ha is accepted, meaning that the average VO2 max index between the experimental group and the control group is not the same or there are differences in the average VO2 max index between the experimental group and the control group.

Based on the results of the statistical calculation of the SPSS 22.0 for MS program. Windows, it can be concluded that there is an effect of increasing VO2 max between pretest and posttest after being treated in the form of circuit training in RedFox Club futsal players in Malang City.

IV. DISCUSSION

Circuit training is a series of exercises that have been determined and designed in sequence, the series will be designed to shape the development of physical conditions and sports skills that have been determined. According to Arif Cahyanto[7] that circuit training is an exercise program consisting of several stations and each station an athlete performs a predetermined type of exercise

In the research data obtained from 24 players who will follow the bleep test. Each player will take the test alternately until it's finished, after all the players have done it, the data will be randomized by matching sampling during the bleep test. Significant influence between the experimental group and the control group with the mean was shown by the experimental group value 40.34 ml / kg / min and the control group 38.00 ml / kg / min. So it can be concluded that the experimental group had a higher mean value than the control group because the experimental group was given treatment while the control group was not treated. Muhammad Ba'tra[8] the effect of circuit training on the increase in VO₂ max referees of the PSSI Jombang District Association that circuit training exercises have a better influence compared to conventional training, this is evidenced by the difference in average obtained by each group.

This is based on the results of data analysis can show that the experimental group with the number of 12 RedFox club futsal players in Malang City treated (treatment) in the form of circuit training with 6 posts after malakukan bleep test showed a value of 2.28 ml / kg / min while for kelom - control boxes that were not treated (treatment) in the form of circuit training with 6 posts after performing the bleep test showed a value of 0.19 ml / kg / min. With this it can be concluded that the comparison of the increase in VO₂ max experimental group with the control group experienced a very significant difference with different values.

People who have good fitness have a higher VO₂ max value and can do activities more strongly than those who are not in good condition. Based on the results of the t-test calculation with the confidence level showing t-calculation 5.579 while the t-table shows 2.178 with a significant level ($p < \alpha = 0.05$), which means there is a significant difference between the pretest and posttest. The hypothesis test results prove that the specified hypo-thesis is acceptable. This fact can provide an understanding of treatment research that applies circuit training, can provide an effect in the form of an increase in VO₂ max for RedFoxClub futsal players in Malang City.

The results obtained from this study in the treatment group with the average endurance at the initial test (pretest) and the final test (posttest) had a significant mean of 39.06 ml / kg / min this result was better than the results the mean of the control group was 36.00 ml / kg / min, there was a greater increase in the treatment group than the control group. So that after the calculation is done, it can be concluded that the provision of circuit training training can increase the durability of VO₂ max. Some who are influenced by physical training have very significant benefits in achieving a goal and goal of

training to improve the quality of a player's basic physical performance.

According to Sukadiyanto[9] said the basic physical quality is determined by the level of energy fitness including the aerobic and anaerobic systems that are lactite and allactite and muscle fitness includes detention, strength, speed, power, flexibility, balance, and coordination. So that during the exercise process physical conditions must also increase positive reactions to the body and these changes are evidence that the training load always gets a positive response to the body's abilities. In the face of a regular training load, the body will respond to improve cardiovascular performance caused by the level of VO₂ max with HR which gives a positive influence on the player with the training load given. If the lower the VO₂ max, the higher the HR tendency and vice versa if the higher the VO₂ max has the lower the trend of HR. So that the process of body weight training experiences muscle contraction, and this can be known from the outside, namely by calculating the pulse and the ability of the heart and blood vessels to function optimally in a state of rest or exercise to take oxygen and then distribute to the tissue for use in the body's metabolic processes.

It showed that experimental group data at the initial pretest HR (pulse) with an average of 69.7 and at the time after the bleep test showed the final pretest HR (pulse rate) with an average of 141.83. Whereas for the posttest results the experimental group showed the results of the initial HR posttest (pulse) data with an average of 66.7 and at the time after the bleep test showed the final HR posttest (pulse) with an average of 138.83. It can be concluded that the experimental group showed an average initial HR pretest and final HR greater than the initial HR posttest and final HR. According to Syahrial Bakhtiar[10] that the pulse is an indicator that is very important to see the effectiveness of exercise activities, the heart rate zone generally must reach 170-180 beats per minute, when finished doing the circuit. Because the more the pulse rate tends to the better the fitness level of VO₂ max and the less the pulse, the better the fitness level of VO₂ max. Factors that will affect the results of VO₂ max and HR are caused due to activities outside of training, such as players doing bagadang, lack of rest, illness, and poor fit condition. So that it will affect the fitness level of VO₂ max and HR.

V. CONCLUSION

Based on the results of research on the effect of circuit training on increasing VO₂ max for RedFox Club Malang futsal players. From the results of the data during the research period. Thus it can be concluded that there is an influence from the provision of circuit training to the increase of VO₂ max for RedFox Club Malang futsal players.

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