The Effect of Circuit Training Method on Leg Muscle Explosive Power

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Abstract

The purpose of this research was to determine the effect of circuit training method on the leg muscle explosive ability. In this circuit training 4 posts containing exercises for strength and speed were designed. The research method used was experimental research. There were 24 research subjects divided into 2 groups, 12 in the treatment group and 12 in the control group using random sampling method. To obtain the data, pre test and post test were conducted in the treatment group and the control group using vertical jump test instrument. To ensure that this data were normally distributed, a normality test was carried out using the Kolmogorov Smirnov test. The results of this study showed a significant increase in the treatment group by 6.49. Post test data that has been tested through the t test (independent samples test) showed a P value < of α, that is $0.008 < 0.05$ which means that the post test results had a significant increase compared to the control group. This circuit training method that contains strength and speed training can improve leg muscle explosive power.

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INTRODUCTION

Having a good physical condition is everyone's dream, especially those who pursue certain sports. Having a good physical condition is an obligation for those who are involved in the world of sports. This is because the physical components will support the athlete's performance during the match. Some physical components that need to be considered to be developed are cardiovascular endurance, endurance strength, muscle strength (strength), flexibility, speed, stamina, agility , muscle explosive power (power), endurance strength. The physical components are the main things that must be trained and developed by athletes, especially athletes who require sports components (Harsono, 2015). These physical components are the factors of good or bad performance of athletes during a match. To have a good physical condition, athletes must improve their physical abilities by being trained. Exercises to improve the ability of each physical component are not the same, for example training to increase strength is different from training to increase speed, and not all sports must have the same dominant physical component.

Science and technology have made humans to try to overcome all the problems that arise around them (Gumantan. 2020. p53) As the development of science in the field of sports, various models of training models to increase the desired physical components have emerged. This is because the progress of sports achievements in developed countries is inseparable from the physical training process that began at a young age. Michael Jordan, Pete Sampras, Carl Lewis and some of the world's leading athletes have a good track record of physical training, this proves that having high achievements must be based on excellent physical condition (Sidik et al, 2019). In Indonesia, there have been many studies conducted to improve the physical condition of athletes. Training to improve physical condition is very important to be done so that qualified athletes are created, because an achievement is not just born. This must also be balanced with scientific knowledge about sports.

Sports become a lifestyle that can not be separated in everyday life, this is due to the increasing popularity of sport among the people. One example is the sport of basketball. Basketball is a big ball (Wissel 2000). If there is a modern sport that is so fast developing and attracts the lives of humans in general and young people in particular, then the sport is a game of basketball or "Basket Ball" in the original language (Azka, 2010). This game is played by two teams, each team consisting of five people (Mashuri et al, p.43) 2019. In the basketball game other than as an increase in physical fitness and health still has a goal that must be achieved, namely achieving achievements in the field of basketball (Yuliandra. 2019, p.52). Achievement will be achieved if the athlete has the technique and good physical condition. Almost all physical components must be possessed by basketball athletes, one of which is explosive power. Lack of leg muscle ability occurs due to lack of maximum physical exercise (Nugroho, 2020). The physical component of explosive power has a role in defense and offense because basketball is identical to jumping, both when defending or going to score points (Kosasih, 2008). When defending, the ability to play explosive power when jumping takes the ball in the air after an opposing player fails to score points or what is commonly called a defensive rebound. Whereas when attacking, explosive power plays a role when scoring points such as jump shoot, lay up, slam dunk, and also when taking bounce ball in the air after a teammate fails to score points or commonly called offensive rebound.

A high explosive ability is very beneficial for the team and the athletes themselves. But there are still teams that do not have the ability to have high explosive power, and are detrimental to the team due to losing control of the ball in the air (Having rebound). This is due to an error during training that ultimately the capacity of explosive power is not optimal. Training is a systematic process that is repeated over and over again by increasing the amount of load and intensity (Tangkudung, 2012). Based on field observations, there are problems faced by the Indonesian Teknokrat University Basketball Team regarding mastery of the ball in the air (rebound). This results in a reduced amount of possession of the ball when defending and attacking. Another problem found in the field is the trainer's lack of understanding of training methods that can be used to improve physical abilities.

In increasing the ability of muscle power to be done carefully, systematically, regularly, and always increasing, following the principles and methods of accurate training (Ardika, Kanca, Sudarmada, 2015, p.2). This is what underlies this research, that increasing the ability of leg muscle power can be done by circuit training. Circuit training is a sequence of exercises with one type of activity in each post between 4-12 posts (Muhajir, 2007). Based on the existing problem, the given circuit training must be precise, containing training posts which aim to improve the power of the explosive power. The Circuit Training method in increasing the explosive power of the leg muscles

and the explosive power of the arm muscles for basketball athletes is the title of previous research and is one of the bases for increasing the explosive power of the leg muscles using a modified circuit training method to make it more effective and efficient. Muscle explosive power is a combination of strength and speed or mobilization of maximum force (Widiastuti, 2011). Therefore the posts that will be given in this training circuit include strength and speed training.

METHODS

The method used in this research is experimental research, while the design used is randomly with the initial test and the final test with the control group (The Radomized pretest posttest control group design) (Zainudin, 2000). The sample used in this study was a member of the University of Indonesia Teknocrat University UKM in 2019/2020 with a total of 24 students from a total population of 33 people. This study consisted of 2 groups, namely the treatment group (circuit training method) of 12 students and 12 control group students (conventional). This circuit training method is given for 16 meetings with frequency of training 2 times a week

This research began in December 2019 and was completed in January 2020. The implementation was carried out at the Nasrullah Yusuf student sports arena of the Indonesian Teknokrat University for 8 weeks (2 months). This circuit training exercise method is carried out on Wednesday and Saturday every week with the aim of giving the body time to adapt in this training process. To obtain data and measure the ability of leg muscle explosive power, researchers used a vertical jump test instrument. This test is done to determine the leg muscle explosive power by measuring how much the leg muscle's ability to work. Data collection techniques are tests and measurements, while the data analysis technique used in this study is to use a normality test to determine whether the data has a normal distribution. The test used is the Kolmogorov Smirnov test. The variant homogeneity test was conducted to test the similarity of the variance in the experimental and control group data. Homogeneity test uses Levene's Test with F test. T test was conducted to determine whether there are differences in variables between the experimental and control groups. If the result of the analysis states that there is a significance difference of less than 0.05 (P <0.05), then a multivariate analysis using the Repeated Measured Test will be carried out to determine whether there is a difference in the leg muscle explosive power in the experimental group.

In this circuit training method, there will be 4 training posts, each of which aims to establish leg muscle explosive power. In post 1, students will do strength training, namely squats for 1 minute then rest for 1 minute. In post 2, students are still doing strength training that is walking lunges for 1 minute and resting for 1 minute. On post 3, students will do strength endurance training, namely skipping for 1 minute and resting for 1 minute. In the last post (post 4) students will do speed training by doing a sprint with a distance of 20 meters and then rest for 1 minute. This circuit exercise is repeated in 6-9 repetitions. The principle of adding weight is done periodically, starting with 6 repetitions in the first 2 weeks and adding 1 repetition every 2 weeks.

RESULTS AND DISCUSSION

The research data on the results of this leg muscle explosive ability came from the vertical jump test results. This test is conducted at the beginning of the study before students run the training process using circuit training or so-called pre test data. Furthermore, a final test is held to retrieve the post test data which is conducted when the circuit training method finishes 16 meetings.

Table 1. Description of Research Results in Leg Muscle Explosion Power

Data Variables	Pre-Test		Post-Test	
	Treatment	Control	Treatment	Control
Total Sample	12	12	12	12
Average	46.67	45.91	53.16	49
Median	47.50	46	53.50	49
Modus	44 & 48	46	55	47, 49 & 50
Highest score	53	51	61	55
Lowest score	40	42	47	44
Standard Deviation	3.74	2.81	3.80	3.21
Variant	14.06	7.90	14.51	10.36
Range	13	9	14	11

Testing of the normality of the research data was also carried out on the increased data from the pre-test data of the explosive power of the leg muscles in the group doing the circuit training method (the treatment group) and the group doing the conventional exercise (the control group). This test uses the Kolmogorov Smirnov test **Table 2**. The results obtained 0.178 and the significance of 0.200 for the treatment group and

the test results for the control group 0.155 with a significance of 0.200. The data is said to be normal if P value (Sig) $< \alpha$ (0.05) and if significant normality test data> 0.05 then the data does not come from populations that are normally distributed (Candiasa, 2004).

In this research, **Table 3** the homogeneity test of the pre test data was also carried out using the Levene test and the data obtained showed a test result of 1.579 for the treatment and control groups with a significance of 0.222. From the test data it is found that the two data are greater than 0.05 (Sig> 0.05) which means that the data comes from homogeneous data.

Here are the results of normality test results on the post test results using the Kolmogorov Smirnov instrument **Table 4**. For the treatment group the results obtained were 0.149 with a significance of 0.200, and the control group got the results of 0.211 with a significance of 0.145. Both of these data are said to be normal due to Sig$>\alpha$ (0.05).

After conducting a normality test and a homogeneity test, a two-difference test was also performed using the independent samples test or what is commonly called a t-test to test the significance of the two post-test average results of the treatment and control groups **Table 5**. T test results obtained with a value of 2.894 with a significance of 0.008. This result is significant because the P value <of α which is 0.008 <0.05

This circuit training method is given as many as 16 meetings over 2 months, with a frequency of training twice a week. Based on the results of data analysis, this study showed an increase in the two groups (treatment and control). In the control group showed the pre-test average data of 45.91 and 49 post-test average data with an increase of 3.09. Whereas the group that received the circuit training method was 46.67 pre-test results and 53.16 post-test results. The increase that occurred in the treatment group was 6.49. In table 5 it can be seen that the results show significant data. This shows the method used to improve the ability of leg muscle explosive power with circuit training exercises obtain more maximum results than the results in the control group.

The results of this study are similar to a study entitled the effect of circuit training in resistance training and plyometric on muscular strength among Annamalai University netball players, in that study said that there were significant differences between the treatment and control groups on muscle strength (Shelvam, 2014, p. .1). There are changes in leg muscles caused by the exercise process in the form of increased muscle mass and the addition of muscle fibers.

This is because the weight training given during the circuit training method is squats and walking lunges. Both of these exercises are weight training that uses body weights, so they can stimulate muscle changes. Leg muscle explosive power is the ability of muscles to contract quickly, therefore there is speed training in the form of a 20 meter sprint to stimulate muscles to react quickly. This circuit training also included plyometric training in the form of skipping exercises to support the leg muscle explosive power.

Explosive power is a significant characteristic of basketball players and it is one of the most important factors for achieving maximum sports performance. Apart from the innate coefficient, explosive power development can be realized through planned, rational and well-organized training. Positive correlation between explosive power and running at short distances, jumps and throws are determined. This is because this is an effective way that contributes to the efficiency of basketball players (Aksovic, 2020, p.131). The results of this study are supported by Nasrulloh's research entitled the effect of circuit weight training on muscle strength and endurance. In this study mentioned weight training provided by the latian cuit training method can provide stimulation to the muscles that aim to be able to increase muscle strength and endurance. The results of this study show a significant increase that has a significance of 0,000 less than 0.05. This was also shown by the mean pre-test data of 20,544 and the post-test mean of 22,203. Can be seen the difference between the average pre-test and post-test data of 1.759 (Nasrulloh, 2012, p.11)

This research is also supported by a study entitled Effect of Concurrent Endurance and Circuit Resistance Training Sequence on Muscular Strength and Power Development. The Journal of Strength and Conditioning Research. It was mentioned in the study that circuit training can produce a significant increase in muscle strength, strength and explosive strength, and strength endurance. Therefore, a circuit type program that uses individual intensity to ensure maximum effort in a short amount of time is a useful training strategy to increase overall strength. (Chtara, 2008, p.8).

CONCLUSION

From the results of the discussion that has been done, it can be concluded that the circuit training method can improve the explosive power of leg muscles. The training posts that are in the training circuit must be in accordance with the objectives to be achiev ed. In improving the

explosive power of leg muscles, the training post must contain strength and speed training in the leg muscles. The circuit training method when given with the correct dose (volume, intensity, frequency) can give significant results.

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Table 2. Pre-Test Data Normality Test Results with the Kolmogorov Smirnov Instrument

Data	Kolmogorov Smirnov			
	Statistic	Df	Sig	Explanation
Treatment	0.178	12	0.200	Normal
Control	0.155	12	0.200	Normal

Table 3. Homogeneity Test Results with the Levene Test Instrument

Data	Levene Test		
	F	Sig	Explanation
Pre Test	1,579	0,222	Homogent

Table 4. PostTest Data Normality Test Results with Kolmogorov Smirnov Instrument

Data	Kolmogorov Smirnov			
	Statistic	Df	Sig	Explanation
Treatment	0.149	12	0.200	Normal
Control	0.211	12	0.145	Normal

Table 5. T test results for the post test data

Data	Independent Samples Test		
	t	Df	Sig	Explanation
Data Post Test	2,894	22	0.008	Significant