The Effect of Circuit Training and Interval Training on Leg Muscle Endurance on Women's Volleyball Athletes at Velocita

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Abstract.
This experimental research that aims to examine whether there is an influence of circuit training and interval training on leg muscle endurance of Velocita volleyball women athletes in Banggai regency. This is motivated by the low achievement of women's volleyball in the Banggai regency which is due to a lack of ability to maintain the quality of the game due to low leg muscle endurance. The population is all Velocita women's volleyball athletes in Banggai district, totaling 12 people, while the sample uses the total sampling method so that the total is 12 athletes. The research data were obtained by giving a leg muscle endurance test in the form of squat jump test through the pretest and posttest after the athlete was given the training treatment. Data analysis techniques using t-test analysis. Based on the results of the analysis, it is discovered that (1) there is an influence of circuit training on leg muscle endurance of Velocita volleyball women athletes in Banggai regency with a t_{count} of 12,593 > 2,571 t_{table} and a p value of Sig. 0.000 is smaller than 0.05, (2) there is an influence of interval training on leg muscle endurance of Velocita volleyball women athletes in Banggai regency with a t_{count} of 7,906 > 2,571 t_{table} and a p value of Sig. 0.001 is smaller than 0.05, and (3) there is no difference in the influence of circuit training and interval training on leg muscle endurance of Velocita volleyball women athletes in Banggai regency where the results of the t test show t_{count} 1.958 smaller than t_{table} value 2.228 with a significance value of 0.079 greater than the value of α 0.05. It can be concluded that there is an influence circuit training and interval training on leg muscle endurance in Velocita women's volleyball athletes Banggai Regency significantly.

A. INTRODUCTION

Volleyball has become a sport that is growing rapidly and is very familiar among Indonesian people. This is due to the ease of playing volleyball among children, adolescents and adults as well as volleyball as a fun recreational activity and achievement sport. As an achievement sport, the development of the game of volleyball requires athletes to have complex abilities. This sport is easy to play, but in terms of achievement it requires proficient skills in every basic movement.

Likewise the condition of volleyball in Banggai district. Volleyball has become a very popular sport and is growing rapidly. This can be seen from the existence of playing fields in almost all villages and is marked by the improve performance. Banggai Regency women's volleyball achievements continue to grow especially at the level of the Central Sulawesi

Provincial Sports Week where Banggai in the 2010 Porprov won a Bronze medal and in 2019 won a Silver medal.

Athlete development must be carried out in a structured, organized and sustainable manner because volleyball games require almost all components of muscle strength in every basic movement of the game, whether serving, passing, smash, and dams and must be owned by athletes. So that in carrying out the game, athletes are required to have good muscle strength so that they can apply the basic volleyball movements in the game to the fullest. However, muscle strength alone is not enough in playing volleyball which demands high intensity along with the times, especially in games with a 3-set winning system. In addition to physical strength and playing skills, muscle endurance is very much needed so that a player can maintain his playing technique at a high level. In line with what was stated by Ahmadi (2007) that the physical parts that must be developed by volleyball players include endurance and muscle endurance, strong energy, dexterity, flexibility, explosive power, coordination, response and accuracy. All of these physical parts are used in volleyball games, but there are some more prominent elements such as power and leg muscle endurance.

Training programs are not only structured to provide opportunities for athletes improve his skills, but more importantly increase in strength, power and the athlete's muscular endurance is still lacking. Because it is the physical condition that will sustain the quality of the game. Therefore, the preparation of the training program must really be aimed at increasing muscle endurance which is still lacking in athletes as a whole, regardless of the uncertain competition schedule. The training program must be prepared based on the principles of training by focusing on increased strength and endurance of the athlete's limb muscles.

Mylsidayu and Kurniawan (2015) explain that the term training comes from English words that can contain meanings such as practice, exercise, and training. Word exercises practice is an activity to improve sports skills by using various equipment in accordance with the goals and needs of the sport. This means that in practicing motion skills activities always use various supporting equipment. The meaning of practice comes from the word exercise is a daily training activity to improve the quality of the function of the organ systems of the human body so as to make it easier for athletes to perfect their movements. While the notion of exercise comes from the word training is a process of improving the ability to exercise that is prepared based on theory and practice, using methods, as well as implementation rules with a scientific approach.

According to Harsono (2018) "*good physical condition is prerequisite for all sports athletes"* (p. 3). Physical condition is a very important element in almost all competitive sports such as football, badminton, volleyball and so on(Subarjah, 2013). Physical condition training described by Harsono (2015) aims to assist athletes in improving their skills and achievements as much as possible.

Circuit training was first introduced by Morgan and Adamson (1959) from Leeds University as a method of training to develop overall body fitness (general fitness). For example elements of agility, strength, flexibility,

speed, endurance with forms of training such as running back and forth, zig-zag, jumping, rolling (roll), pull-up, weight training and others (Harsono, 2018).

Circuit training planning as described by Bowers & Fox (1993) begins with determining training objectives, selecting and determining exercise items to determine exercise intensity. Then arrange the sequence of the exercise items in the circuit to avoid giving exercises on the same section sequentially. Exercise dose can be determined by paying attention and based on individual or group principles. If it's for a group, then the weight is determined by the coach, but if you use the principle overload which recognizes individual differences, the weight of the load is determined by the participants themselves. Then determine the training rations by means of each participant doing the exercise items with maximum repetitions (maximal repetition = MR), then subtract a quarter, a third or half of the maximum repetitions. The time objective needs to be determined to determine the amount of time used to perform each item of exercise, namely the maximum repetition reduced by a quarter, a third or half according to the practice times multiplied by three. If the time goal has been reached (exceeded), then the MR is taken again, then the training quota and time goal are determined (Budiwanto, 2012, p. 71).

Harsono (2018) explains interval training is a training system interspersed with intervals in the form of rest periods between training activities. For example running, the implementation is run - rest - run again - rest - run again - and so on. Interval training highly recommended by well-known coaches because the results are very positive for the development of endurance and stamina of athletes. The form of exercise can be running (interval running) or swimming (interval swimming) can anyway weight training, circuit training and other forms of exercise.

According to (Bompa & Buzzichelli, 2015) endurance is the ability of the muscles to maintain physical activity over a long period of time. So it can be concluded that muscle endurance is the ability to work muscles or organs of the body continuously for a certain (long) period of time without experiencing excessive fatigue.

The limbs are a means of locomotion of the human body which includes the lower limbs and consists of several bones. The leg bones include the femur, patella, tibia and fibia as well as the foot (Abdurachman et al., 2017).

The game of volleyball has become one of the sports game that is known by all levels of society, from remote villages to the international world, because volleyball has been widely competed and easy to play. It turns out that the game of volleyball is a combination of several big all games put together, namely: basketball, handball and baseball (Mulyadi et al., 2020).

The purpose of this study was to determine the effect of circuit training and interval training as well as the differences between the two exercises on the leg muscle endurance of women’s volleyball athletes in Velocita, Banggai regency.

B. RESEARCH METHOD

This type of research is quantitative with experimental methods. The experimental method

is used to search treatment effect (treatment) given to other things under controlled conditions (Sugiyono, 2014). The design or research design used is quasi experimental design. The research design was carried out by measuring research subjects with initial tests (pretest) before being treated (treatment) and then re-measure the subject after the treatment with the final test (posttest).

The research sample was the Velocita women's volleyball athlete, Banggai Regency, using the method total sampling 12 athletes were divided into two groups with 6 athletes in each group. Data collection techniques through observation, documentation and measurement tests with test instruments squat jump. Quantitative data analysis through prerequisite tests for normality and homogeneity and hypothesis testing using paired sample t test with the help of the SPSS 25 application.

C. RESULTS AND DISCUSSION

The research results obtained from the data of the initial test and the final test of leg muscle endurance in Velocita volleyball athletes, Banggai Regency are described as follows.

Table 1. Description of Research Data

Statistic	The Leg Muscle Endurance			
	Circuit Training		*Interval Training*	
	Pretest	*Posttest*	*Pretest*	*Posttest*
N	6	6	6	6
Mean	20.67	27.50	21.33	24.67
Median	20.5	26.5	21	24
Minimum	18	24	19	23
Maximum	23	32	24	28
Std. Deviation	1.751	2.950	2.338	1.966
Range Statistic	5	8	5	5

The data normality test through statistical tests was carried out to find out whether the data obtained was normally distributed or not as a condition of analysis to test the hypothesis. So, the data that has been collected in this study, before the statistical analysis of hypothesis testing is carried out, the normality requirements test is first carried out with the Kolmogorov-Smirnov Z test at a significant level of 0.05. From the results of the tests performed, the results of the data normality test were obtained pretest and posttest leg muscle endurance of Velocita female volleyball athletes in Banggai Regency in the circuit training group (circuit training) obtained a probability value of 0.200 which is greater than the value of α 0.05 which indicates that the data is normally distributed.

The data homogeneity test was aimed at testing the similarity of variance in leg muscle endurance in women's volleyball athletes Velocita Banggai Regency. This homogeneity test serves as a requirement in testing samples from homogeneous populations. The rule or condition for data homogeneity if the p value is greater than the α value of 0.05 then the data is declared homogeneous. The result is as follows.

Table 2. Homogeneity Test Results

Group	Lavene statistic	df1	df2	F.table	Sig.
Leg Muscle Endurance Group of Circuit Training	1.935	1	10	4.965	0.194
Leg Muscle Endurance Group of Interval Training	0.727	1	10	4.965	0.414
Leg Muscle Endurance Group of Circuit and Interval Training	1.160	1	10	4.965	0.307

Based on the table above, the results of the homogeneity test of athlete's limb muscle endurance women's volleyball Velocita Banggai Regency with ANOVA test (Analysis of Varians) obtained a Sig p value greater than the α value of 0.05 so it can be concluded that the data on the

results of leg muscle endurance are homogeneous or come from the same abilities and results.

The results of the analysis of the initial test data before treatment and the final test data after being given treatment circuit training on the leg muscle endurance of Velocita women's volleyball athletes, Banggai Regency, the t-test value was obtained 12.593 > 2.571 t-table value and a df value of 5 with a significance value of p Sig. (2-tailed) of 0.000 <0.05, then this result indicates that the hypothesis is accepted So that there is a significant influence from the treatment circuit training on leg muscle endurance in women's volleyball athletes Velocita Banggai Regency.

While the results of the analytical results of group leg muscle endurance interval training Velocita volleyball athletes in Banggai Regency obtained a value of t-test value 7.906 > 2.571 t-table value and a df value of 5 with a significance value of p Sig. (2-tailed) of 0.001 is smaller than the value of α 0.05, so these results indicate the hypothesis is accepted. So that there is an influence of treatment interval training on leg muscle endurance in women's volleyball athletes Velocita Banggai Regency.

The results of the final test data after treatment in the group circuit training and groups interval training on the leg muscle endurance of women's volleyball athletes Velocita Banggai Regency based on the results of the analysis the independent t test obtained a df value of 10 and a t-test value1.958 is smaller than the t-table value 2.228 with a significancevalue of 0.079 greater than the α value of 0.05, then this result indicates the hypothesis is rejected. That is, there is no difference in the effect of the circuit training group and the interval training group on the leg muscle endurance of Velocita volleyball athletes, Banggai Regency.

Based on the statistical analysis of the hypothesis of the research data described above, it is necessary to study further by providing an interpretation of the situation and the link between the results of the analysis obtained and the theories underlying this research. This study is intended to obtain the suitability of the theory that has been put forward with the research results achieved. The results achieved can be explained as follows:

1. The Effect of Circuit Training on Leg Muscle Endurance in Women's Volleyball Athletes Velocita Banggai Regency

The results of hypothesis testing show that there is a significant effect of circuit training on leg muscle endurance in women's volleyball athletes at Velocita, Banggai Regency. According to the test results*paired sample t test* the endurance of the leg muscles of women's volleyball athletes Velocita Banggai Regency obtained the value of $t_{count}$of 12,593, the value of t_{table} of 2,571 and the df value (degree of freedom) is 5 with a significance value of 0.000 which is less than the α value of 0.05. These results indicate that there is a significant effect on power endurance of female volleyball athletes' limbs after being given circuit training treatment which can be proven from the average value before treatment of 20.67 and the average value after treatment of 27.50. This means that there is an increase in the average value of 6,833 or 33.04 percent after the athlete is given circuit training treatment. Furthermore, it can be seen from the average value of the leg muscle endurance of Velocita women's volleyball athletes, Banggai Regency, after being treated for approximately

two months or eight weeks, there was a significant difference. So, the difference in the average value of leg muscle endurance in women's volleyball athletes at Velocita Banggai Regency is significant.

The improvement of the various components of the physical condition is in line with the purpose of circuit training put forward by Harsono (2018, p. 183) that circuit training is a training system that can simultaneously develop physical conditions in the form of endurance, strength, flexibility, muscle endurance and others. . The main exercise is not to improve skills or movement techniques, but more importantly to improve fitness or physical condition.

2. The Effect of Intrval Training on Leg Muscle Endurance in Women's Volleyball Athletes Velocita Banggai Regency

The results of hypothesis testing show that there is a significant effect of interval training on leg muscle endurance in women's volleyball athletes at Velocita, Banggai Regency. According to the test results paired *sample t test* the endurance of the leg muscles of women's volleyball athletes Velocita Banggai Regency obtained the value of $t_{count}$of 7,906, the value of t_{table} of 2,571 and the df value (*degree of freedom*) is 5 with a significance value of 0.001 which is smaller than the α value of 0.05. These results indicate that there is a significant effect on the leg muscle endurance of female volleyball athletes after being given interval training treatment which can be proven from the average value before treatment of 21.33 and the average value after treatment of 24.67. This means that there is an increase in the average value of 3.34 after the athletes are given interval training treatment.

Interval training has a significant effect on the leg muscle endurance of Velocita women's volleyball athletes, Banggai Regency where interval training is a series of exercises surrounded by a certain period of time to carry out activities with variations in loading, variations in intensity and forms of rest for the components of the load, as stated by (Prakoso & Sugiyanto, 2017). The same thing was also stated by Harsono (2018, p. 22) that interval training as an exercise is highly recommended in training athlete endurance because the results of this exercise can guarantee an increase in athlete's stamina and physical condition including athlete's muscle endurance.

It was also stated by Yasriuddin (2018) in his research that there was a significant correlation between running and leg muscle explosive power which could be interpreted as running exercises carried out continuously at intervals to help increase leg muscle endurance. The effectiveness of interval training was also stated in research results (Wibowo, 2019) that these exercises are very effective in increasing leg muscle endurance in athletes when applied regularly, programmed, discipline and continuously. That is, effectiveness of interval training greatly influenced by the implementation of comprehensive training program.

3. Difference in Influence Circuit Training and Interval Training on Leg Muscle Endurance in Women's Volleyball Athletes Velocita Banggai Regency

The results of the t-test analysis of the final leg muscle endurance test data for the circuit training group and the interval training group for volleyball athletes in Velocita, Banggai Regency, obtained a df value of 10 and a t-test value1,958

is smaller than the t-table value 2.228 with a significance value of 0.079 greater than the α value of 0.05, then this result indicates the hypothesis is rejected. That is, there is no difference in the effect of the circuit training group and the interval training group on the leg muscle endurance of Velocita volleyball athletes, Banggai Regency.

This result is due to the fact that it is not supported by empirical data, including the number of samples in the small study, namely 12 samples and divided into two groups. If the number of samples is larger, the results of the analysis may be different. However, the effect of circuit training and interval training on leg muscle endurance has differences that are supported by differences based on average values. Where in the circuit training group an average score of 27.50 was obtained with a difference of 6.833 or 33.04 percent with the average value before being given treatment and in the interval training group an average value of 24.67 score had a difference of 3.34 or 15.66 percent with an average value averaged before treatment. So it can be explained that circuit training is better at increasing leg muscle endurance athletes when compared to interval training. This also depends on the implementation of the training program provided.

D. CONCLUSION

Based on the results of the research and discussion that has been described, it can be concluded that there is an influence *circuit training* and *interval training* on leg muscle endurance in Velocita women's volleyball athletes Banggai Regency significantly. And there is no difference in the effect between circuit training and interval training caused by research that is not supported by empirical data.

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