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THE EFFECT OF CIRCUIT TRAINING ON THE IMPROVEMENT OF LEG MUSCLE EXPLOSIVENESS IN TRAINED BADMINTON PLAYERS OF BADMINTON UKM AT UNESA

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Abstract
This research is being overturned by a performance gap over the last year that has been demonstrated by the way he plays athletes. The circuit training training model is essential in a pile game to increase the explosive strength of the muscles of the membrane. The study aims to determine whether circuit training has an effect on the improvement of the explosive power of the muscles of the limbs on the UKM.Unesa bowling athletes. This research uses a type of experimental quasy research with pre-experimental methods and uses research design two groups pretest and posttest design. As for the sample in this study, there were 20 athletes. The data analysis technique used is a paired sample t-test.The results of the study showed that the influence of training circuit training on the increase in muscle membrane with significance values of 0.027 to 0.027 < 0.05, then H0 is rejected and H1 is accepted. So from the results of the t test indicated there was a significant difference between the addition of the circuit training of the experimental group and the control group. In conclusion, then with the addition of circuit training can have an impact in increasing the explosive power of the muscles of the limbs for the trained bulutangkis players of the State University of Surabaya.

Keywords: *Circuit Training; Leg Muscle Power*

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INTRODUCTION

Sports today are growing very rapidly. Therefore, serious efforts are needed to handle this with careful preparation. Better handling and preparation is needed because sports are currently developing rapidly. Badminton is one of the sports that requires increased training to make its achievements increase (Ilham setiawan et al., 2023). In order for the highest desired achievement to be achieved, planning and support from the government and the whole community are needed (Arnando & Wulandari, 2018). In Indonesia, badminton is very popular because it can be practiced by various age groups, from children to teenagers or adults. As a result,

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various championships are held every year in order to convey the talents and achievements of athletes (Arisman et al., 2021) (Kardani & Rustiawan, 2020).

Physical condition preparation for badminton games is very important to make the quality of the technique improved and optimal. A person's physical condition is defined as their physical ability or the ability of their body to work or exercise. It is important for badminton players to have basic technique skills, as it shows the level of skill a player has. This means that better badminton technique skills are related to the mastery of the sport (Okilanda et al., 2018) (Bayu Purwo Adhi et al., 2017).

According to Sajoto, a badminton athlete must master techniques, strategies, and have excellent physical condition to achieve optimal performance. Physical aspects such as strength, endurance, muscle explosiveness, speed, agility, and balance play a major role in an athlete's performance (Nurhidayah et al., 2019). Leg muscle explosiveness, which allows for quick and powerful movements, is important especially in smash shots. Circuit training, according to Putri et al., effectively increases leg muscle explosiveness, which is crucial in this sport. However, UNESA Badminton UKM athletes have not reached their target achievement due to lack of training consistency. Several competitions such as POMPROV 2023 and UNAIR Open showed unsatisfactory results with only a few medals won. Limited preparation and ineffective training also affect athlete performance.

The results of an interview with one of the badminton UKM coaches explained that leg muscle explosiveness is very important in modern badminton games which increasingly emphasize attacking patterns and speed. Leg muscle explosiveness helps in quick reactions and sharp footwork to support attacks on opponents. In order to increase leg muscle explosive power effectively, variations in training models are needed so that athletes do not feel bored. Circuit training is one method that can be used for this purpose. Based on this explanation, the researcher decided to conduct further research to prove the correlation between

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circuit training and increased leg muscle explosiveness. This research is also expected to provide useful data for further research. The researcher concluded that an in-depth study at UNESA Badminton UKM needs to be done to measure the effect of circuit training on increasing leg muscle power. The results of interviews with one of the badminton ukm coaches during training explained that leg muscle explosiveness is needed so that the pattern of play in the current era because in the current era the game is more mature with a mature attacking pattern and speed is also very important for every athlete to support attacks when playing leg muscle explosiveness is very helpful in every reaction and footwork in every attack - a sharp attack for the opponent. So to increase the explosive power of the leg muscles there must be a varied training model so that later the athlete does not feel bored during training. With an example of varied circuit training exercises to increase leg muscle explosiveness.

Based on the explanation that has been described, the researcher decided to carry out further research so that it can contribute to proving the correlation and influence of circuit training on increasing leg muscle explosiveness in badminton athletes. In addition, this research can later produce data that can be used as a reference for future researchers. The existence of the explanation above, makes the researcher conclude that it is important to conduct more in-depth research at the research institution. So that it encourages the author to find out how the effect of circuit training on increasing*leg muscle* power (*leg muscle power*) on badminton players trained at UKM Badminton Unesa the research.

METHOD

Research Type

This research is a quasi-experimental research with pre-experimental method using Two Group Pretest and Posttest Design. The aim is to determine the effect of circuit training on the explosive power of leg muscles of badminton players. Two groups were used in this study, where one group was given circuit training and one group did not receive treatment. Before treatment, leg muscle

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explosive power was measured using the Jump DF test, then after 6 weeks of treatment, measurements were taken again as an evaluation. The data obtained from the initial and final measurements were analyzed to see the changes that occurred. The Two Group Pretest and Posttest design allows more precise identification of changes by comparing results before and after treatment (Akhir, 2017). The results of the study are expected to provide clear conclusions regarding the effectiveness of circuit training (Putra et al., 2020).

Research Variables

Silaen (2018: 69) argues "research variables are concepts that have various values or have varying values, namely a trait, characteristic or phenomenon that can show something to be observed or measured whose values vary or vary."

Independent variables are defined as variables that influence and determine changes in other variables (Yudhi Setyantara & Vivin, 2021). Conversely, the dependent variable is defined as the variable that is influenced and becomes the effect of changes in the independent variable (Ilham Agustian et al., 2019). In this study include:

1. The independent variable (X) is Circuit Training
2. Related variable (Y), namely Limb Muscle Explosive Power Performance

Research Instruments

Arikunto 2006 in (Candra et al., 2023) suggests that research instruments are tools that are used in systematic data collection and facilitate the research process. In order to ensure the success of the research, the instrument must be carefully designed in order to produce accurate data in accordance with the objectives and expectations of the research. In order to be relevant to the sample, one test instrument is used, namely circuit training. In badminton skills aims to measure the increase in leg muscle explosive power in badminton athletes trained by UKM Badminton Unesa including tests, tools, and test implementation.

Data Analysis Technique

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Data analysis or data processing is an important step in research. In analyzing the data using the t-test formula, previously the difference must be known. After all the data is collected, the next step is to analyze the data. The data analysis technique aims to answer the research problems that have been formulated. Data analysis was carried out using SPSS software. Before conducting hypothesis testing, researchers first conduct a requirements test, which includes normality test and homogeneity test.

RESULT AND DISCUSSION

Table 1. Statistical Results of Pretest and Posttest Data

GROUP NAME	N	Minimum	Maximum	Mean	Std. Deviation
Control *Pretest Group*	10	70.00	114.58	94.8750	12.66890
Control *Posttest Group*	10	83.48	113.72	100.8230	10.71134
Eksperimen *Pretest Group*	10	92.45	108.16	101.4530	4.75800
Eksperimen *Postest Group*	10	96.15	136.36	111.7400	12.55412

Table 1 shows that the average value of leg muscle explosive power in the control group at the beginning of the meeting was 94.8750 Nm with a standard deviation of 12.66890, a minimum value of 70 Nm, and a maximum value of 114.58 Nm. In the experimental group, before being given circuit training exercises, the average value was 101.4530 Nm with a standard deviation of 4.75800, a minimum value of 92.45 Nm, and a maximum value of 108.16 Nm. After the circuit training treatment, the average value of leg muscle explosive power in the experimental group increased to 111.7400 Nm with a standard deviation of 12.55412, a minimum value of 96.15 Nm, and a maximum value of 136.36 Nm. This increase shows the effectiveness of circuit training in increasing leg muscle explosive power in the experimental group.

Analysis Prerequisite Test

Normality Test

The normality test is carried out so that normally distributed data or not can be known (Handayani & Subakti, 2020). The type of test used by researchers is the

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Shapiro-Wilk test because the number of samples is less than 30. The results of the normality test of the dynamic balance measurement data are as follows

Table 2. Nomality Test Results

	class	*Shapiro-Wilk*		
		Statistic	*df*	*Sig.*
Limb Muscle Explosive Power Value	Control *Pretest Group*	.956	10	.743
	Control *Posttest Group*	.927	10	.417
	Experiment *Pretest Group*	.880	10	.132
	Experiment *Posttest Group*	.928	10	.428

Based on the table, the significance values in the pretest and posttest control groups are 0.743 and 0.417 respectively, while in the pretest and posttest experimental groups are 0.132 and 0.428 respectively. The significance value is greater than 0.05, so the leg muscle explosive power data in both groups, both pretest and posttest, are normally distributed.

Homogeneity Test

If the data has been declared normally distributed, then homogeneity testing is carried out which serves to determine whether the groups made and formed samples are sourced from similar (same) populations or not. The homogeneity test is presented in the following table.

Table 3. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Limb Muscle Explosiveness Score	Based on Mean	2.866	3	36	.051
	Based on Median	2.162	3	36	.109
	Based on Median and with adjusted df	2.162	3	27.486	.115
	Based on trimmed mean	2.847	3	36	.051

Homogeneity testing was carried out on pretest posttest data on muscle explosiveness values using Levene testing. Based on the table above, the significance value is obtained with the provisions of a significance level of more than 0.05 so that it can be said that the data on the value of leg muscle explosiveness

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in the control and experimental groups both pretest and posttest have the same variant or homogeneous.

Hypothesis Testing

Paired Samples Test

Based on the results of the prerequisite analysis test that has been carried out, it is found that the data obtained meets the requirements of the homogeneity test and normality test. Therefore, hypothesis testing is carried out with parametric statistics with t test analysis with paired sample test because it helps to see if there is a significant difference between two measurements taken from the same sample. The hypotheses tested in this study are:

H_1 : The use of *circuit training* methods is effectively used in badminton training for badminton players trained by UKM Badminton Surabaya State University.

H_0 : The use of *circuit training* methods is not effective in badminton training for badminton players trained by UKM Badminton Surabaya State University.

The criteria for knowing the test results in this study are:

a. If the value of $Thitung$ <0.05, it indicates that there is an influence on each variable given the treatment.
b. If the value of $Thitung$ > 0.05, it indicates that there is no influence on each variable given the treatment.

Table 4. Test Statistics Pairred sample T-test

	GROUP	Sig (2-Tailed)
Pair 1	Control Group Pretest - Control Group Posttest	.040
Pair 2	*Experimental Group Pretest - Experimental Group Posttest*	.027

Referring to the results of the calculation, it was found that the significance value in the control and experimental groups was 0.040 and 0.027, respectively, the

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significance value of the experimental group was smaller than the control group. This means that it is rejected and accepted, so that from the results of the t test it is stated that there is a significant difference between the results of the addition of circuit training to the experimental group and the control group. In conclusion, the addition of circuit training can have an effect in increasing the explosive power of leg muscles for badminton players trained by badminton UKM Surabaya State University.

Independent Sample T-Test

The *Independent Sample T-Test* test in this study is intended to determine the average difference between the two unpaired samples or two samples with different treatments, namely the *pre-post* results of the experimental group and the *pre-post* results of the experimental group.

Table 5. Independent samples T-Test

Independent Samples Test					
		F	t	df	Sig. (2-tailed)
Result	Equal variances assumed	10.606	1.345	18	.004

Based on the results of the independent sample t-test test, the sig. (2-tailed) of 0.004 which means <0.05 so it can be concluded that there is a difference in the average pre-post results between the experimental group (Circuit training) with a game approach) and the control group (conventional training).

Discussion

Based on the results of the study, the average value of leg muscle explosive power in the experimental group before being given circuit training was 101.4530 Nm with a standard deviation of 4.75800, a minimum value of 92.45 Nm, and a maximum value of 108.16 Nm. After being given circuit training, the average value increased to 111.7400 Nm with a standard deviation of 12.55412, a minimum value of 96.15 Nm, and a maximum value of 136.36 Nm. This increase occurred due to the training load with an interval ratio of 3:1 and a training frequency of three times a week for 16 meetings. Meanwhile, the control group experienced a smaller

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increase with a maximum value of 108.16 Nm and a minimum of 70.00 Nm due to conventional training.

Circuit training exercises that include plyometrics and strength training such as squat jumps and lunges have been shown to be effective in increasing muscle explosiveness and explosive strength in badminton athletes. This exercise is carried out intensively and intermittently, which is in line with the research of Garber et al. (2018). This training program is very relevant in badminton, because leg muscle explosiveness plays a very important role in player performance (Pratama et al., 2022). An organized and continuous program is able to provide positive results in the development of muscle strength and proper technique (Maretno & Arisman, 2020).

The results of the effectiveness test showed a significant effect of circuit training on increasing the explosive power of leg muscles of UNESA UKM badminton athletes, with a p-value <0.05. Training for 18 meetings with the right dosage provides a significant increase in leg muscles. The preparation of exercises in each post pays attention to the use of balanced muscles with controlled repetitions, sets, and recovery time. This study proves that the circuit training model can significantly improve the strength and performance of badminton athletes.

CONCLUSION

Based on the results of the study, it can be concluded that there is a significant effect of circuit training on increasing leg muscle explosiveness in trained badminton athletes at Badminton UKM Surabaya State University. This exercise is proven to be effective in increasing muscle strength and explosive power, which has a positive impact on athlete performance in the field.

Based on these findings, the researcher provides several suggestions. First, coaches are expected to choose the circuit training method to improve leg muscle explosive power because this exercise helps players increase speed and strength while playing. Second, future researchers who want to conduct similar research are

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advised to consider using more varied subjects, both in terms of quantity and quality, to get more comprehensive results.

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