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The Effect of Plyometric Exercise on Leg Muscle Explosive Power of Pencak Silat Athletes

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***Abstract*— This study aims to look at the effect of plyometric training to increase the explosive power of leg muscles of youth athletes in the martial arts field of West Sumatra PPLP Pencak Silat Athletes in 2019. This study used the one-group pretest-posttest design method, with the subjects comprising 20 youth athletes in Pencak silat PPLP West Sumatra in 2019. The research instrument was a test of leg muscle explosive power, using the standing board jump test conducted before and after being given plyometric training. Explosive power test results data were analyzed through a t-test (paired sample test) using the application SPSS. 16. The results showed the t value is 11.314 with sig 0.000 <0.05, so Ho is rejected and Ha is accepted. It can be concluded that plyometric exercises have a significant influence on increasing the explosive power of leg muscle ability of West Sumatran Pencak Silat PPLP athletes in 2019.**

Keywords—Plyometric Exercise, Explosive Power, Pencak Silat

I. INTRODUCTION

Pencak silat is a sport and traditional martial arts of indigenous peoples in Indonesia, developed to protect themselves from the dangers that would threaten the body and soul. Along with the times, the martial arts has begun to be unveiled at the event area, nationally and internationally as one of the sport achievement. As a sports game, Pencak Silat requires a process of coaching and training programmed and continuous so that will be able to generate maximum performance.

"Coaching achievements in the sport can be achieved through a programmed exercise, regular and measurable involving various disciplines of science and technology, which is embodied in the form of systematic development. One form of coaching sports achievements, the government engaged in activities through achievement coaching programs in stages" [1]. Coaching and Training Center for Student Sports or shortened by PPLP is one container coaching achievements at the level of adolescent age or age group of students. West Sumatra Province is one of the provinces that have the sport of martial arts are nurtured and trained under the auspices PPLP West Sumatra.

To achieve maximum performance in this branch of martial arts, requires a process over a long period. "Development of a long-term multilateral beginning of phase with the introduction of various sports, the formation stage to stage one of the specialties of certain branches that actually cultivated and prospectively towards the achievement of maximum" [2]. In this development process, the role and function of a very large coach in helping athletes achieve optimal to prepare the physical, technical, tactical, and mental athletes. Fostering physical condition is a very important component in the development process of other components such as component engineering, tactics and mental. Quality techniques and tactics will not decrease if the physical condition has also been declining.

Meanwhile, one of the components of physical conditions that are needed in the game is a martial arts leg muscle explosive power (power). Explosive was a "sportsman's ability to overcome the resistance with a speed of contraction" [3]. High levels of muscle contraction is defined as the ability of muscles strong and fast contraction. So explosive is affected by speed, good speed and the speed of excitatory nerve muscle contraction.

In a match of pencak silat is the need for explosive power during the attack by foot (kick). The need for leg muscle explosive power that produces a high that kicks value and difficult to anticipate the opponent. If the lower leg muscle explosive power, the kick will be weak so that the opponent is easy to handle.

The ability of leg muscle explosive power of martial arts athletes PPLP West Sumatra in 2019 was still in the low category, therefore it takes special training to boost leg muscle explosive power athletes. There are many types of exercises that can be used to enhance the ability of leg muscle explosive power.

Some forms of explosive power exercises such as leg muscles through exercise plyometrik. Plyometrik is or repeat exercises aimed at linking movement speed and power to produce the explosive movements. "Exercise Plyometrik is one method of exercise to improve physical components of power where the favorites performed by the current coach, especially for sports that require explosive power capability leg muscles or arm muscles" [4].

"Plyometrics exercises have been used as a method of exercise is mainly to develop strength, speed, and power" [3]. With this method, "the practice is emphasized in a form of exercise that has the characteristics of muscle contraction in full force as a response to the rapid and dynamic loading" [3], with the working system of the neuromuscular system, among others, related to the stretch reflex, muscle spindles

and Golgi tendon organs. Power, speed and power are a series of very important physical component in various sports. In the martial arts branch, limb muscle power have a greater percentage when compared with the other elements of the physical condition because more dominant limb used in the match.

"The principle of plyometrics exercises can be used in a variety of other sports" [3]. Therefore, with plyometrics exercises can increase the explosive power of muscles of athletes. The type of plyometrics exercises used in this study is plyometrics exercises involving leg muscle in the implementation.The forms used plyometric exercises is to use one foot or two feet as a pedestal, like exercise jump in place, standing jump, multiple hops and jumps.

II. RESEARCH METHODOLOGY

In accordance with the objectives to be achieved is to look at the effect or influence of plyometrics exercises to increase leg muscle explosive power athletes, this study used an experimental method. an experimental method of research to provide treatments or treatment methods to the sample, and then compare the test results before treatment and after treatment to see how big an effect of the treatment given. In this study, all subjects given the same treatment or not divided into an experimental group and a control group. "Design This study is known as one group pretest-posttest design" [5].

In the pre-test phase of testing the ability of leg muscle explosive power using a standing board jump test. At this stage of treatment or treatment performed plyometrics exercises 16 times, with the number of the implementation of its 3 times per week. Exercise / treatment given in the form of a combination of plyometrics exercises involving leg muscle in the implementation of the motion. Plyometrics workout consists of exercises performed in place jump, standing jump, multiple hops and jumps, box drills and depth jumps. In the post-test phase will be held back test the ability of leg muscle explosive power to look at the effects of exercise or treatment given.

This research subject is the whole martial arts athletes PPLP West Sumatra in 2019 numbered 20 people. With details of nine athletes and 11 athletes daughter's son. The timing of the studies were conducted in March and April 2019, at the Environment UPTD PPLP West Sumatra

"The data collection technique using a standing board jump test" [6], at the stage of pre-test and post-test. Test data were processed using comparative analysis. To test the hypothesis with t test (paired sample test) with the analysis requirements for normality using the Kolmogorov-Smirnov test in though using SPSS.16 application.

III. RESULTS

Based on the test results of leg muscle explosive power of martial arts athletes PPLP West Sumatra in 2019 on the stage of pre-test, the average value obtained male athletes at 235.1 cm with a standard deviation of 6.674, and a standard error of 2.111. The average value of female athletes is 192.3 cm with a standard deviation of 17.664 and a standard error of 5.586. After the implementation of plyometrics exercises as much as 16 sessions, conducted tests of leg muscle explosive power back. It aims to take the post-test the data that will be used to see the effects of plyometrics workout results to components of leg muscle explosive power for the pencak silat athletes PPLP West Sumatra in 2019. average score of leg muscle explosive power of male athletes amounted to 244.6 cm with a standard deviation value of 7.763 and a standard error of 2.455. The average score of leg muscle explosive power of female athletes 201.1 cm with a standard deviation of 16.656 and a standard error of 5.267. Detailed data is shown in Table 1.

Table 1. Explosive Power of Leg Muscles Athlete

		Pre-test	***Post-test***
Male	***Mean***	235.1	244.6
	Std. error	2,111	2,455
	Std. deviation	6.674	7.763
	N	10	10
Female	***Mean***	192.3	201.1
	Std. error	5.586	5.267
	Std. deviation	17.664	16.656
	N	10	10

. Using a measurement parameter for the Kolmogorov Smirnov test for normality, with the conclusion If the value asymp. Sig (2-tailed) obtained is> 0.05, then Ho is accepted and Ha rejected. In the table are listed the amount of pre-test data values are Sig 0.846> 0.05 and posttest Data sig. 0431> 0.05. In conclusion, the data pre-test and post-test of leg muscle explosive power of male athletes normal distribution. Using a measurement parameter for the Kolmogorov Smirnov test for normality, with the conclusion If the value asymp. Sig (2-tailed) obtained is> 0.05, then Ho is accepted and Ha rejected. In the table are listed the amount of pre-test data values are 0678 Sig> 0.05 posttest data and sig. 0802> 0.05. In conclusion, the data pre-test and post-test of explosive power leg muscle in female athletes normal distributiondetailed data is shown in table 2.

Table 2. Normality and paired t samples test

		Pre-test	***Post-test***
Male	***Kolmogorov-smirnov***	.614	.431
	Assymp 2 tailed	.846	.992
	t- paired	10,045	
	df	9	
	Sig 2 tailed	.000	
Female	***Kolmogorov-smirnov***	.720	.643
	Assymp 2 tailed	.678	.802
	t- paired	6,487	
	df	9	
	Sig 2 tailed	.000	

value of t = 10.045 db = 9 and figure Sig or p-value 0.000 <0.05, then Ho is rejected and Ha accepted. Thus concluded that there are differences in the ability of leg muscle explosive power of male athletes sport martial arts PPLP West Sumatra between before and after exercise plyometrics. Directions positive relationship that there is a significant improvement between the before and after exercise plyometrics given value of t = 6.487 db = 9 and figure Sig or p-value 0.000 <0.05, then Ho is rejected and Ha accepted. Thus concluded that there are differences in the ability of leg muscle explosive power of female athletes sport martial arts PPLP West Sumatra between before and after exercise plyometrics. Directions positive relationship that there is a significant improvement between the before and after exercise plyometrics given.

IV. DISCUSSION

"Explosive power leg muscle or power is needed in a variety of sports including sport martial demanding heavy activity and fast to be done in the shortest possible time with a load of maximum strength, to be able to carry out the activities of a merger between the strength and speed of leg muscle deployed collectively together to solve hold the load in a relatively short time" [7]. Explosive power is an element among the component elements of the physical condition of the ability of human biomotorik, which can be increased to a certain extent by performing certain exercises accordingly.

After analyzing the test data of leg muscle explosive power at the time of the pre-test and post-test concluded that plyometrics exercises are effective to improve the ability of leg muscle explosive power of martial arts athletes PPLP West Sumatra in 2019 significantly. This is proved by the data post-test results is increased and is positive. In theory plyometrics exercise is an effective exercise to improve explosive power.

Progress from the exercise due to the application of plyometrics exercisesThis follows the principles of practice in sports coaching achievements. Besides, jenis exercises used are exercises that involve leg muscle in the implementation process of motion that is plyometrics exercises aimed at improving the ability of leg muscle explosive power athletes.

The principles of exercise presented here is the most fundamental principle, but it is very important to implement. One of the principles of exercise is the active principle and sincerity [2]. In its application, the exercises are designed so that all the athletes are always active motion exercises according to the instructions given and they do exercise activities with enthusiasm and earnest. This concept has been understood by all athletes so that this exercise has a positive impact.

The principle of overload (over-load principle) is an increase in training load given to the athlete gradually. If no increase in training load, the exercise did not have a good impact. If the exercise is done systematically it is expected that the athlete's body can adapt as closely as possible to the training provided, and can withstand the case posed by the exercise stress both physical and mental stress. "So long as the workload and challenges received still within the limits of human ability to cope, and not too tight, causing excessive tension during which the process of physical and mental development of man is still possible without harming them" [8].

The principle of specificity (specialization) has any sense he participated sport athlete purpose and motive usually is to specialize in the sport, therefore the specialization gained success and prominence in the sport. "Specialization also means to devote all its capabilities, both physically and mentally at the sport" [8].

The principle requires that the entire concept of the exercise individually prepared in accordance with the peculiarities of each individual to exercise goals can be achieved. Factors such as age, sex, and psychological traits must all participate in consider in designing the training for athletes. So the conclusion is that the exercise had to be planned and tailored to each individual so that the exercise can yield the best results.

The intensity of exercise is a dose or ration exercises to do an athlete according to a specified program[9]. Exercise intensity can be measured by counting the pulse formula Maximum Pulse (DNM) = 220-age (in years)[8]. In this study the dose of exercise uses 80% - 90% of DNM. Implementation of this research is still limited in its implementation, the sample involved and the types of treatments or treatment given, as well as the type of experimental research with one group pretest-posttest design.

This research is still need for further development, their budget and time constraints become one of the obstacles the implementation of this study. Nevertheless the results of this study can be used as a reference and for the coach to put together a program of exercise, especially exercise that is dedicated to improving the ability of leg muscle explosive power athletes. Then plyometrics exercise is an exercise that is recommended to be used for this exercise has been shown to increase leg muscle explosive power significantly athletes.

The results also did not rule out the kind of explosive power exercises for the leg muscles more. Because the need to do further research that this research becomes more proven its reliability. Based on the results of previous translation can be concluded overall bahwasannya effective plyometrics exercises to improve the ability of leg muscle explosive power of martial arts athletes PPLP West Sumatra in 2019 significantly.

V. CONCLUSION

Based on the analysis and discussion that has been done, data can be concluded that pliometric exercise a significant influence on the improvement of the ability of leg muscle explosive power of martial arts athletes PPLP 2019 West Sumatra.

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