

## Effect of Plyometrics and Resistance Band Training towards the Leg Muscle Power Seen From the Leg Muscle Endurance of Wrestling Athletes



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**ABSTRACT:** This research aims to determine: (1) the difference in the influence between plyometrics and resistance band training on leg muscle power in wrestling athletes; (2) the difference in effect between wrestling athletes who have high and low leg muscle endurance on leg muscle power; (3) the interaction between plyometrics and resistance band training as well as high and low leg muscle endurance towards the leg muscle power of wrestling athletes. The type of this research was an experiment using a 2 x 2 factorial design. The research population was the wrestling athletes from Malang City, totaling 40 people. The research sample was 24 people taken by using purposive sampling technique, then ordinal pairing was carried out to divide each group. The instrument used to measure leg muscle power was the standing long jump, while leg muscle endurance was measured by using the squat test. The data analysis technique used the two way ANOVA test. The results of the research show that: (1) there is a difference in the effect between plyometrics and resistance band training towards leg muscle power of wrestling athletes where the F value is at 11.674 and the significance value is at  $p\ 0.003 < 0.05$ . The plyometrics training group is better than the resistance band training group with an average difference at 13.92. (2) There is no difference in the effect between wrestling athletes who have high and low leg muscle endurance towards leg muscle power, where an F value of 0.704 is obtained and a significance value of p is at  $0.411 > 0.05$ . (3) There is no interaction between plyometrics and resistance band training and high and low leg muscle endurance towards the leg muscle power of wrestling athletes, where the F value is at 0.402 and the p value is at  $0.533 > 0.05$ .

**KEYWORDS:** plyometrics, resistance band, leg muscle power, leg muscle endurance

### I. INTRODUCTION

Wrestling is a sport where the competition is carried out by two wrestlers whose aim is to attack each other and knock the opponent to the mat, and the techniques commonly used when grappling are the technique of mastering, slamming and locking the opponent so that the opponent is in a supine position. The sport of wrestling must not endanger the safety of its opponent so the techniques used must be correct [1].

Components of basic physical conditions in sports based on the concept of muscle, namely, strength (strength), endurance (endurance), flexibility (flexibility), balance (balance), explosive power (power), speed (speed), coordination (coordination), and agility (agility) [2]. Based on expert opinion, it can be interpreted that every sport must prepare the athlete's physical condition well, such as in wrestling itself, the physical components that must be prepared by wrestling athletes are cardiovascular endurance, muscle endurance, flexibility, strength and power.

In carrying out throwing techniques in the sport of wrestling, of course, supporting physical abilities are also needed, which is analyzed from the wrestler's movements when throwing, one of the dominant physical ability elements used is the element of power ability in thickness where a wrestler's weakness must have good power so that the wrestler is able to lifting and dropping his opponent. Muscle endurance is the ability of a muscle or group of muscles to perform a submaximal effort repeatedly over a certain period of time [3]. When a wrestler carries out an attack, apart from being supported by the power of the muscle spasm, the endurance of the muscle spasm also supports the spasm when dropping his opponent, because when attacking a wrestler must be able to attack repeatedly until the wrestler is able to lift and drop his opponent.

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Leg muscle power can be increased through training, such as plyometrics training which can have a significant influence on increasing leg power in wrestling athletes [4]. To increase leg muscle power, resistance band training has a significant effect [5]. There is an influence of variations in resistance band training on power [6]. Resistance band training has a significant effect on increasing leg muscle power [7]. Based on the description that has been explained, it can be concluded that plyometrics training and resistance band training can significantly increase an athlete's power. The above background makes researchers interested in examining the effect of plyometrics and resistance band training on muscle power. Review of muscle endurance and fitness in wrestling athletes in Malang City.

## II. METHODS

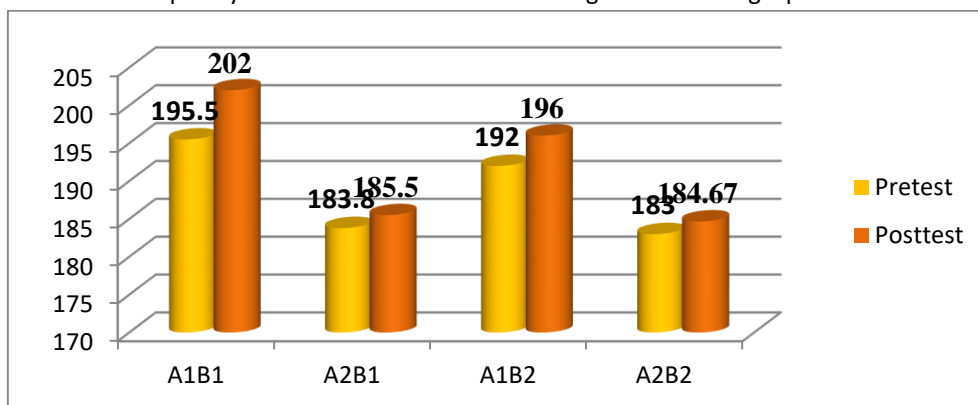
This research uses an experimental method with a 2x2 factorial design, namely manipulating the 2 main variables given the intervention. Then simultaneously calculate the attribute variables to find out the main independent variables separately or together, the impact of the attribute variables, and the interaction of the independent variables with the attributes on the dependent variable. Factorial design is a modification of a true experiment, by looking at the existence of a moderator variable that influences the treatment (independent variable) on the results of the dependent variable (dependent variable) [8]. The factorial design in this study was A1B1, a high fitness muscle endurance group that was given plyometrics training; A2B1, is a high neck muscle endurance group that is given resistance band training; A1B2, is a low muscle endurance group given plyometrics training; A2B2, is the low muscle endurance group given resistance band exercises. The research was conducted at the Rachman Camp Gulat, Pakisaji area, Malang, East Java. The research was carried out on March 18-April 17 2024. The training was carried out in 16 meetings; a week at the training site; Exercises are carried out by adjusting and varying the training dosage settings. Before the exercise, a pretest was carried out once, then at the last meeting there was a posttest once. The population in this study was 40 wrestling athletes from the city of Malang. The sample in the study consisted of 24 people who were part of four groups with each group consisting of six people. Hypothesis testing in this study used the two-way Anova test. This analysis technique is often called Two Way Anova.

## III. RESULTS

**Table 1. Statistical description of pretest and posttest**

Leg Muscle Power					
Group	N	Minimum	Maksimum	mean	Std. Deviation
Pretest A1B1	6	187	201	195,5	6,1
Posttest A1B1	6	195	207	202	5,3
Pretest A2B1	6	164	200	183,8	13,7
Posttest A2B1	6	166	201	185,5	13,6
Pretest A1B2	6	170	203	192	12,9
Posttes A1B2	6	176	206	196	11,4
Pretest A2B2	6	172	196	183	7,8
Posttest A2B2	6	175	197	184,67	7,4

A description of the research data will be depicted in table 1. The research process is divided into three stages, namely the first stage is taking a pretest as an assessment of leg muscle endurance and leg muscle power. The second stage is to provide treatment which lasts for 6 weeks with a frequency of 3 times a week. The third stage is conducting a posttest.



**Figure 1. Pretest-posttest improvement diagram**

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on Figure 1, the diagram explains that the leg muscle power in the A1B1 treatment group obtained an average pretest value of 195.5 cm and then increased at the posttest by 202 cm, the A2B1 treatment group obtained an average pretest value of 183.8 cm. and then experienced an increase at the posttest of 185.5 cm, the A1B2 treatment group obtained an average pretest value of 192 cm and then experienced an increase at the posttest of 196 cm, and the A2B2 treatment group obtained an average pretest value of 183 cm and then experienced an increase at posttest of 184.67 cm.

**Table 2. Normality test**

Group	P	Leg Muscle Power	
		Significance	Information
Pretest A1B1	0,117		Normal
Posttest A1B1	0,114		Normal
Pretest A2B1	0,713		Normal
Posttest A2B1	0,564	0,05	Normal
Pretest A1B2	0,128		Normal
Posttes A1B2	0,160		Normal
Pretest A2B2	0,735		Normal
Posttest A2B2	0,805		Normal

Based on table 2 that has been presented, it can be interpreted that all pretest and posttest data on leg muscle power are normally distributed, where from the results of the normality test the significance value is  $p > 0.05$

**Table 3. Homogeneity Test**

Levene Statistic	df1	dft2	Sig
1,680	7	40	0,307

Based on table 3, it can be interpreted that the data group has homogeneous variants, because the results of the homogeneity test with the Levene test obtained a significance value of  $p > 0.05$ , namely  $0.307 > 0.05$ . In this way, there is similarity or homogeneity in the study population.

**Table 4. ANOVA test results between plyometrics and resistance band training on leg muscle power**

Source	Type III Sum of Squares	df	Mean Square	F	Sig
exercise group	1162,042	1	1162,042	11,674	0,003

Based on table 4, it can be explained that there is a difference in the influence between plyometrics and resistance band training on leg muscle power in wrestling athletes. This is proven because the significance value is  $p < 0.05$  where the significance value is  $0.003 < 0.05$ .

**Table 5. ANOVA test results for wrestling athletes who have high and low leg muscle endurance regarding leg muscle power**

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Leg muscle endurance	70,042	1	70,042	0,704	0,411

Based on table 5, it can be explained that there is no difference in influence between wrestling athletes who have high and low leg muscle endurance. This is proven because the significance value is  $p < 0.05$ , where the significance value is  $0.411 > 0.05$ .

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Table 6. ANOVA test results of the interaction between plyometrics and resistance band training and high leg muscle endurance

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Training method*Leg muscle endurance	40,042	1	40,042	0,402	0,533

In table 6 it is explained that there is no interaction between plyometrics and resistance band training as well as high and low leg muscle endurance on the leg muscle power of wrestling athletes. This is proven because the significance value is  $p < 0.05$  where the significance value is  $0.533 > 0.05$ .

### IV. DISCUSSION

#### There is a difference in the influence between plyometrics and resistance band training on leg muscle power in wrestling athletes

There is a significant difference in the influence between plyometrics and resistance band training on leg muscle power in wrestling athletes. So it can be concluded that both plyometrics training and resistance band training provide an increase in leg muscle power. Plyometrics exercises tend to be more effective in increasing leg muscle power than resistance band exercises. Plyometrics training and resistance band training can also be used as choices because they can provide benefits for increasing leg muscle power, by paying attention to the content of the exercise, intensity, duration and frequency of exercise. The research results are supported by several opinions namely, contractions muscles to lengthen and shorten quickly can increase muscles and tendons which produce maximum strength and power in a relatively short time [9]. Plyometric training methods have been significantly proven to affect leg muscle power [10]. Plyometric training on the legs for 6 weeks can help increase strength in the lower extremity muscles to support leg muscle [11]. Resistance band training with special periods can contribute to increasing leg muscle power and is effective after eight weeks of training [12].

#### There is no difference in the influence between wrestling athletes who have high and low leg muscle endurance on leg muscle power in wrestling athletes

There is no difference in the influence between wrestling athletes who have high and low leg muscle endurance on leg muscle power. In this study it was discovered that leg muscle endurance cannot be used as a reference in increasing leg muscle power, because the group of athletes who had high leg muscle endurance and athletes who had low leg muscle endurance both experienced an increase in leg muscle power after being given exercise. The research results are supported by several opinions namely, muscle endurance is the activity of a group of muscles capable of contracting for a long duration or many repetitions but without experiencing significant fatigue [13]. muscle endurance is the ability of a muscle or group of muscles to perform a submaximal effort repeatedly over a certain period of time [3].

#### There is no interaction between plyometrics and resistance band training and high and low leg muscle endurance on the leg muscle power of wrestling athletes

There is no interaction between plyometrics and resistance band training and high and low leg muscle endurance on the leg muscle power of wrestling athletes. This means that plyometric exercises and resistance band exercises have the same goal, namely to increase leg muscle power and the exercises can be applied to someone who has high and low leg muscle endurance. Power is one of the important biomotor components in sports activities, because explosive power will determine how hard a person can hit, how far they can throw, how high they jump, how fast they can run and so on [2]. Power or explosive power tends to be a determining factor for success in carrying out various activities starting from almost all sports where power is a condition that helps the body work to complete a certain activity [14].

### V. CONCLUSIONS

The conclusion of this research is

1. There is a difference in the influence between plyometrics and resistance band training on leg muscle power wrestling athletes. The plyometrics training group was more effective than the resistance band training group in increasing leg muscle power.
2. There is no difference in the influence between wrestling athletes who have high and low leg muscle endurance on leg muscle power wrestling athletes.

## Effect of Plyometrics and Resistance Band Training towards the Leg Muscle Power Seen From the Leg Muscle Endurance of Wrestling Athletes

3. There is no interaction between plyometrics and resistance band training and high and low leg muscle endurance on the leg muscle power of wrestling athletes.

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