

## The Effect of Squat Training with Barbell and Resistance Band on Leg Power of Volleyball Athletes



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**ABSTRACT:** The purpose of this study was to determine (1) the effect of squat training with barbell on increasing leg power of volleyball athletes, (2) the effect of squat training with resistance band on increasing leg power of volleyball athletes, (3) the difference in the effect of squat training with barbell and resistance band squats on increasing leg power of volleyball athletes. The type of research is experimental. The sample used is volleyball athletes totalling 20 athletes with an age range of 14-16 years. The leg power test instrument uses a vertical jump. Data analysis techniques using Paired Sample Test and Independent Samples Test. The results showed that (1) There is a significant effect of squat training with barbell on leg power of volleyball athletes ( $p < 0.000 < 0.05$ ), (2) There is a significant effect of squat with resistance band on leg power of volleyball athletes ( $p < 0.000 < 0.05$ ), (3) There is a significant difference in squat training with barbell and resistance band squats on increasing leg power of volleyball athletes. Squat training with resistance band is better than squats with barbell on increasing the leg power of volleyball athletes, with a difference of 1.30. The implication of the research results that to increase the leg power of volleyball athletes can be done by applying squat training with barbell and resistance band. This means that athletes are given exercises that are in accordance with their characteristics so that in the training process they feel happy and motivated to follow the training process, so that the training objectives will be maximised. Then another implication is that by encouraging coaches to apply suitable exercises can trigger athlete involvement in training.

**KEYWORDS:** squats with barbell weighting, resistance band squats, leg power

### INTRODUCTION

Volleyball is a team sport played by six people per team. In volleyball matches the height of the net for men is 2.43 metres and for women is 2.24 metres (Hiskya & Wasa, 2019; Lima et al., 2019; Ogilvie & McCormack, 2021). Volleyball games will run well and smoothly if each player has mastered the basic techniques of the game. Some basic volleyball techniques include; serving, passing, smashing, and blocking (Fikri et al., 2021; Zonifa, 2020). In addition to mastering the basic techniques of volleyball in general, each player is also required to have a good physique. While spiking & blocking a player has to jump vertically in order to make contact with the ball from maximum height. The characteristics of volleyball are a game that requires players to jump, so strong power is needed (Kumar et al., 2016). Explosive power (muscular power) is a person's ability to use maximum strength exerted in the shortest time possible (Gumbira, 2021; Jariono et al., 2022). Power is a combination of strength and speed or the maximum exertion of muscle force with maximum speed, strong and fast abilities are needed especially for actions that require maximum power capabilities such as smash movements.

Getting a good power ability, must be done structured and continuous training. Training is the process of doing sports activities based on a systematically arranged training programme, aiming to improve the athlete's ability in an effort to achieve the maximum possible achievement, especially carried out in preparation for a match (Wijaya et al., 2020). Methods for training leg muscle power, including plyometric exercises, half squats, squats, lunges, up and down the bench, and others (Mesfar et al., 2022). One of the methods that will be applied in this study is barbell squats and resistance band squats. Squats are a very simple movement. This movement can be started from a standing position then squat and return to a standing position as before.

The second weight training is a form of power training using resistance bands. Resistance bands are an efficient and portable fitness tool made of rubber with a hand grip that becomes a support. Rubber resistance bands have various elasticities, in this study medium-sized resistance bands can be used for training to increase power. Good training is not enough to only provide technical material, but improving the quality of physical conditions, one of which is power, is important. In the field there are still

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many coaches who do not know the form of power training using rubber resistance bands. The combination of resistance band exercises is very effective in increasing jump height and leg strength, increasing speed, agility and power (Agopyan et al., 2018; Aloui et al., 2020; Katushabe & Kramer, 2020). In addition, training using resistance bands can also increase joint strength and can be used for aerobic exercise.

Based on the background that has been stated above, the researcher is interested in conducting research with the title "The Effect of Squat Training with Barbell and Squat Resistance Band on Increasing Limb Power of Volleyball Athletes". The objectives to be achieved in this study are: (1) the effect of squat training with barbell on increasing the leg power of volleyball athletes, (2) the effect of squat training with resistance band on increasing the leg power of volleyball athletes, (3) the difference in the effect of squat training with barbell and squat resistance band on increasing the leg power of volleyball athletes.

### METHODS

This type of research is experimental. Experimental research is research conducted to determine the effects caused by a treatment given intentionally by the researcher (Rogers & Revesz, 2019). The population as well as the sample used are volleyball athletes totalling 20 athletes with an age range of 14-16 years. The instrument to measure leg power uses a vertical jump with centimetres. Data analysis techniques include descriptive analysis, prerequisite tests (normality and homogeneity tests), hypothesis testing using paired sample tests and independent sample tests. Analysis using SPSS version 20.0 for windows software. The squat training programme with barbell and resistance band squats on increasing leg power is presented in Table 1.

**Table 1. Squat Training Programme with Barbell**

sessions	intensity	Rep	Set	Rec	Interval	rhythm
1-4	5 kg	5	4	30 Second	2 minutes	Quick
5-8	5 kg	5	5	30 Second	2 minutes	Quick
9-12	5 kg	5	6	30 Second	2 minutes	Quick
13-16	5 kg	5	7	30 Second	2 minutes	Quick

**Table 1. Squat Training Programme with Resistance Band**

sessions	intensity	Rep	Set	Rec	Interval	Rhythm
1-4	Medium	5	4	30 Second	2 minutes	Quick
5-8	Medium	5	5	30 Second	2 minutes	Quick
9-12	Medium	5	6	30 Second	2 minutes	Quick
13-16	Medium	5	7	30 Second	2 minutes	Quick

### RESULTS

The research process was carried out for 16 meetings over 8 weeks. The results of descriptive statistical analysis of pretest and posttest leg power of volleyball athletes are presented in Table 2.

**Table 2. Results of Descriptive Analysis of Pretest and Posttest Statistics of Limb Power**

Data Power Tungkal		N	Minimum	Maximum	Mean	Std. Deviation
squats with barbell	Pretest	10	31.00	38.00	34.60	2.01
	Posttest	10	32.00	40.00	36.00	2.26
squats with resistance band	Pretest	10	32.00	38.00	34.60	2.01
	Posttest	10	33.00	42.00	37.30	2.98

Based on the descriptive statistics of Table 1, it shows that the leg power of volleyball athletes training squats with barbell at the pretest averaged 34.60 at the time of the posttest increased by an average of 36.00, and the leg power of volleyball athletes training squats with resistance band at the pretest averaged 34.60 at the time of the posttest increased by an average of 37.30. The data normality test uses the Shapiro-Wilk method with a significance level of 0.05. The results of the normality test are presented in Table 3:

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**Table 3. Normality Test Analysis Results**

Data Leg Power		Shapiro-Wilk		
		Statistic	df	Sig.
squats with barbell	Pretest	.967	10	.858
	Posttest	.964	10	.833
squats with resistance band	Pretest	.954	10	.717
	Posttest	.963	10	.821

Based on statistical analysis of normality tests that have been carried out using the Shapiro-Wilk test, data on leg power of volleyball athletes training squats with barbell and squat resistance bands during pretest and posttest obtained normality test results with a significance value of  $p > 0.05$ , which means the data is normally distributed.

The homogeneity test uses the Levene Test with a significance level of 0.05. The results of the homogeneity test are presented in Table 4:

**Table 4. Results of Homogeneity Test Analysis**

Test of Homogeneity of Variances				
leg power	Levene Statistic	df1	df2	Sig.
Pretest squats with barbell	0.015	1	18	0.314
Pretest squats with resistance band	0.015	1	18	0.273

Based on the results of the analysis in Table 4, it can be seen that the pretest-posttest leg power of volleyball athletes training squats with barbell and squat resistance bands obtained sig.  $p > 0.05$ , so the data is homogeneous.

Hypothesis analysis using t-test, t-test used is Paired Sample Test and Independent Samples Test. Analysis using the help of SPSS version 20.0 for windows at a significance level  $< 0.05$ . The results of the hypothesis test are presented in Table 5:

**Table 5. Results of Analysis Paired Sample T Test**

Paired Samples Test								
Data	Paired Differences				t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower				Upper
Pretest - Posttest squats with barbell	-1.40	0.70	0.22	-1.90	-0.90	-6.332	9	.000
Pretest - Posttest squats with resistance band	-2.70	1.49	0.47	-3.77	-1.63	-5.713	9	.000

Based on the analysis results in Table 5, the pretest-posttest squat with barbell obtained a t value of 6,332 with a significance value of  $p$  of  $0.000 < 0.05$ . These results indicate that "There is a significant effect of squat training with barbell on the leg power of volleyball athletes".

Based on the analysis results in Table 5, the pretest-posttest squat with barbell obtained a t value of 5.713 with a significance value of  $p$  of  $0.000 < 0.05$ . These results indicate that "There is a significant effect of squat training with resistance band on the leg power of volleyball athletes".

The difference in the effect of squat training with barbell and resistance band squats on increasing the leg power of volleyball athletes, presented in the following table:

**Table 6. Results of Analysis Paired Sample T Test**

Data	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
	-2.492	18	.023	-1.300	.52175	-2.39615	-.20385

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Squats with barbell and resistance band squats	-2.492	12.760	.027	-1.300	.52175	-2.42933	-.17067
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Based on the results of the analysis in Table 6, the calculated t value is 2.492 with a significance value of  $p$  of  $0.023 < 0.05$ . These results indicate that "There is a significant difference in squat training with barbell and resistance band squats on increasing leg power of volleyball athletes. Squat training with resistance band is better than squats with barbell on increasing the leg power of volleyball athletes, with a difference of 1.30.

### DISCUSSION

Based on hypothesis testing, it is known that there is a significant difference in the effect of squat training with (barbell and resistance band) on leg power. Based on the analysis, it turns out that the squat training group with resistance band is better than the squat training group with barbell on leg power. Although the resistance band training group is better than the free weight training group, both groups experienced an increase in athlete's leg power. As stated (Stricker et al., 2020) that strength improvements can be obtained through various types of resistance training methods and equipment, including bodyweight, free weights, resistance bands, kettlebells, medicine balls, and machines. Increased strength with resistance programmes has shown improvements in several performance measures, such as vertical jump, countermovement jump, and sprint time as well as increased maximal oxygen uptake with the combination of resistance and aerobic training programmes.

Squats are a very simple movement. This movement can be started from a standing position then squatting and returning to a standing position as before. Squats are a sport to train muscle strength and endurance of the leg muscles, especially the muscles in the legs. People who do squats will get an ideal body shape and even athletic, squats can also accelerate fat burning in the body. By doing squats regularly, it will train the speed of movement and strength of the leg muscles found in the legs. Squat training is essentially a form of weighted exercise to increase and develop leg muscle strength. Squat training is a form of exercise that is done systematically and repeatedly using internal or external loads. Squat training is a form of plyometric exercise, especially to increase leg muscle strength. In general, squats are performed in a squatting position, standing back to squat again, either by using only your own body weight or using additional weights such as resistance bands. The movement and load that the body is exposed to during squats will make the muscles of the knees, thighs, chest, back, and arms work to perform the perfect squat movement. The benefit is that exercises that are done regularly and correctly can provide real results to build muscle and burn fat without causing injury.

The exercise form of squat training with resistance band is a physical exercise that provides additional weight to increase leg muscle strength, and the portion of the exercise must also be increased regularly (Elinopita & Setiana, 2021). Training using resistance bands is basically to increase muscle strength and furthermore resistance bands can also be increased to train muscle power. Studies (Wiriawan, 2021) showed that there was a significant effect of the squat jumps resistance band training form on leg muscle power. Research results (Yoon et al., 2017) showed that the use of elastic bands provided significant improvements in the levels of cognitive function, physical function, and muscle strength. Study (Aloui et al., 2020) add weekly elastic band exercises to a standard conditioning regimen produces small gains in actions that may have an important influence on handball performance, especially the ability to run, change direction, and make repeated changes in direction. Therefore, such simple exercises can be used as part of handball training.

Analysis study conducted by (Lopes et al., 2019) showed that resistance training using elastic bands has an effect on increasing muscle strength similar to conventional resistance training using weight machines and dumbbells in adult individuals. Resistance bands have advantages including being cheaper when compared to conventional resistance devices such as weight machines and dumbbells, easy to use and easy to carry. Research (Foley et al., 2017) This study investigated the effects of loop resistance bands, placed around the distal thigh, on medial knee collapse and muscle activity during barbell back squats. More specifically, these bands were evaluated in relation to training status (trained or untrained) and load (3RM or BW). Interestingly, there was a significant influence of load intensity (3RM or BW) on lower extremity muscle activity.

(Guillot et al., 2019) proved that elastic band training significantly improved sit-and-reach (29.16% increase,  $p = 0.01$ ) as well as side split stretch performance (2.31% increase,  $p < 0.001$ ) (Figueiredo et al., 2018) states that resistance training is the most effective method for increasing muscle mass. (Stricker et al., 2020) suggests that resistance training is a specialised method of conditioning that involves the use of various modes of training with a variety of resistive loads, from body weight to barbells. Resistance training programmes can include the use of free weights (barbells and dumbbells), weight machines, medicine balls, kettlebells, elastic hoses, or the body's own weight to provide the resistance needed to increase strength. This resistance band is an exercise tool made of rubber with the rubber ends becoming a fulcrum and causing the muscles to contract against external loads in order to increase endurance, strength, and muscle mass. Training using resistance bands has been shown to increase muscle activation and be an effective method of increasing muscle mass. The better the power the athlete has, the better the

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athlete will be able to perform technical movements in sports, because it is known that power will allow muscles to perform physical work explosively.

### CONCLUSIONS

Based on the results of the research and the results of the data analysis that has been done, the conclusions are obtained (1) There is a significant effect of squat training with barbell on the leg power of volleyball athletes ( $p < 0.000 < 0.05$ ), (2) There is a significant effect of squat training with resistance band on the leg power of volleyball athletes ( $p < 0.000 < 0.05$ ), (3) There is a significant difference in squat training with barbell and resistance band squats on increasing the leg power of volleyball athletes. Squat training with resistance band is better than squats with barbell on increasing the leg power of volleyball athletes, with a difference of 1.30. The implication of the research results is that to increase the leg power of volleyball athletes can be done by applying squat training with barbell and resistance band. This means that athletes are given exercises that are in accordance with their characteristics so that in the training process they feel happy and motivated to follow the training process, so that the training objectives will be maximised. Then another implication is that by encouraging trainers to apply suitable exercises can trigger athlete involvement in training.

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