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Effect of Squat Jump and Bodyweight Squat Training on Leg Muscle Strength in Wushu Taolu Athletes

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Abstract

This study aims to determine the effect of squat jump and bodyweight squat training on leg muscle strength of Kudus Regency Wushu athletes. Quantitative data from a *quasi-experimental design* are used in this study. The sample for this study included 16 individuals between the ages of 15 and 20 who were male and female Wushu Taolu practitioners in the Kudus Regency. The research instrument used pretest-posttest data collection with the vertical jump test. Normality tests, homogeneity tests, and t-test hypothesis tests are all included in data analysis procedures. The comes about appeared that there was a noteworthy impact of squat hop and bodyweight squat preparing on leg muscle quality of Kudus Regency Wushu Taolu athletes. The percentage increase in squat jump training is 15.31%, while bodyweight squat training has a percentage increase of 14.69%. This shows that squat jump training and bodyweight training both have a significant effect on increasing leg muscle strength.

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INTRODUCTION

Wushu Taolu, as a branch of martial arts that combines elements of aesthetics, flexibility, and strength, is experiencing rapid development on the international stage, and has even become part of the Asian Games and prepared for the Olympics. Wushu taolu is a form of competition routine that emphasizes movement aesthetics and accuracy of complex techniques, including high jumps, dynamic kicks, and quick transitions. Research by (Penglin & Yinhang, 2023) states that more than 70% of the key elements in taolu rely on the explosive power of the leg muscles, especially in movements such as "Teng Kong Bai Lian" and "Backflip Butterfly Stance".

Biomechanically, the contributions of leg muscles such as quadriceps, hamstrings, and gastrocnemius muscles play a dominant role in supporting torque and stability during aerial rotation and landing (Liu & Qu, 2023). Athletes with low leg muscle strength tend to experience motor imbalances that can reduce the quality of technical performance and increase the risk of injury. Several studies have shown that more than 40% of taolu athletes experience non-contact injuries related to leg muscle weakness, especially at the knee and ankle (Ghafouri et al., 2020). This confirms that leg strength is not only a performance aspect, but also a protective element in this sport.

Muscle strength is an important component for an athlete in sports. Strength is the amount of energy used by muscles in contraction (Muhammad Soleh Fudin et al., 2022). Leg muscles are muscles found in the lower part of the body, namely the legs which function as a support for the movement of the upper human body. The capacity of leg muscles to support loads on the limbs from the thigh to the ankle is known as leg muscle strength (Weda & Harmono, 2018). Muscle strength training needs to be done by someone in order to help in carrying out daily activities such as lifting heavy loads, kicking or hitting to protect themselves, and also plays an important role in injury prevention (Nasrulloh & Wicaksono, 2020). A workout that targets the lower body is necessary to improve leg muscle strength.

Latihan By enhancing the physical quality, psychological quality, and functional capabilities of athletes, exercise is a process of positive change (Rihatno & Tobing, 2019). Exercise will run according to to the goal if it is programmed according to the appropriate rules. The training program is arranged systematically, measurable, and in line with the goals that need to be accomplished. According to (Satria Nugraha Fikriansyah, 2020) preparing may be a shape of physical movement that's carried out in a arranged way and has a purpose The main purpose of training is to assist athletes in improving their skills, abilities, and achievements as much as possible (Prayoga et al., 2022). In training there are training methods used by trainers to

train their athletes. The training method according to (Lesmana et al., 2016) is an activity in doing the same thing repeatedly with the aim of perfecting a skill. So that the training method is not boring, various training models are needed. An exercise model is a sort of activity that is repeated several times and programmatically with the addition of frequency in each repetition so that there is an increase in training (Haqqo, 2021). A training model is a meticulously designed program by a coach tailored to the specific sport, aimed at enhancing students' physical, technical, and tactical talents and capabilities (Anfidi & Supriyadi, 2019). In this study, the exercise models used were squat jump and bodyweight squat to train leg muscle strength.

A common workout for improving the strength of leg muscles is the squat jump. Combining vertical jumps with squat motions, the squat jump is a kind of plyometric activity. According to (Hananingsih, 2017) Pliometric exercise is a type of isotonic exercise that involves very strong muscle contractions, the strength of the contraction in pliometric exercise comes from the muscle stimulus before contraction, but this stimulus must remain within the limits of physiological muscle length. According to (Komariyah et al., 2020) The biomotor fitness of athletes, including strength and speed, may be improved by the workout approach known as plyometrics. . Pliometrics has several forms of exercises that are often used to train endurance, strength, speed and agility in movements in sports (Justika & Sidik, 2017).A recent study from (Yi et al., 2022) found that squat jumps with moderate to high intensity significantly increased peak power output and rate of force development (RFD) in martial arts athletes.

Bodyweight training is an exercise method that uses the body's own weight as a load to increase muscle strength and endurance. According to (Lena et al., 2022) Bodyweight training is a type of weight training that can be done without using tools, and as a burden using body weight. Examples of bodyweight training, namely crunches, sit ups, lunges, squats, push ups, pull ups, back ups (Lestari & Nasrulloh, 2019). Bodyweight squats are performed with a standing movement then squatting and standing again to the original position. Bodyweight squat training provides an adaptation effect on postural muscles and knee flexors that support stability when performing jumping and landing techniques.

Although scientifically proven effective, the implementation of squat jumps and bodyweight squat exercises in Wushu training at the regional level, such as in Kudus Regency, is still very limited. The study by (Cha & Jee, 2018) exclusively investigated the impact of Wushu on heart function, whereas (Sahli et al., 2021) analyzed elements of postural control without addressing the direct correlation with Taolu performance. Until now, most research on the effectiveness of physical training

in Wushu athletes is still dominated by foreign studies or research on the sanda wushu branch. Thus, this research is important to do not only because it fills a void in the academic literature, but also because it is able to make a direct contribution to improving the quality of training and performance of Wushu taolu athletes in the regions..

The researcher is interested in determining, as per the aforementioned description, whether the leg muscle strength of Wushu Taolu athletes in Kudus Regency is impacted by squat jump and bodyweight squat training. The results of this study are expected to be able to make a practical contribution in coaching athletes and enriching scientific literature related to leg muscle strength training.

METHODS

A quantitative method is employed in this study. Quantitative research methodologies, according to (Sugiyono, 2019), are those that are based on the positivism philosophy and are used to conduct research on particular groups or samples, collect information utilizing inquire about apparatuses, and perform quantitative/statistical information examination with the objective of testing already set up speculations. The methodology employed in this study is quasi-experimental.

The sample of this study amounted to 16 people consisting of male and female Wushu Taolu athletes in Kudus Regency with an age range of 15- 20 years. The treatment was carried out as many as 12 meetings held for 4 weeks and each week practiced 3 times with the form of squat jump and Bodyweight squat exercises. The research was conducted at Sasana Wushu Bangau Putih Kudus. According to (Arikunto, 2013) the sample is part or representative of the population studied. Meanwhile,

A population is a generation area made up of things or people that researchers have established specific amounts and qualities for in order to conduct research and draw conclusions (Sugiyono, 2019).

The research instrument uses pretest-posttest data collection with a vertical jump test. Before data collection and treatment, the sample was first given an explanation of the purpose, purpose, and research process and filled out a willingness to be a respondent form. The test implementation of the entire sample was collected to be given directions and the flow of implementation, after which the samples were lined up in order. The sample performed a vertical jump jump for 2 attempts, and the highest jump was taken. Data analysis and statistical analysis were carried out after obtaining pretest and post-test data. With the aid of the SPSS (Statistical Program for Social Science) version 23 computer software, the data analysis approach makes use of the normality test, homogeneity test, and t-test hypothesis test.

RESULT

The following are the results of research on Squat Jump and Bodyweight Squat on Limb Muscle Strength in Wushu Athletes in Kudus Regency as follows.

Pretest and Posttest Data of Squat Jump Exercise Group

Before receiving therapy in the form of squat jump training, pretest data was gathered, while the posttest was obtained after being given treatment in the form of squat jump training. The findings of the pretest and posttest for squat leap exercise are as follows:

Table 1. Pretest and Posttest of Squat Jump Exercise Group

No Subject	Pretest	Posttest	Difference
1	43	48	5
2	40	54	14
3	54	58	4
4	44	49	5
5	39	52	13
6	55	60	5
7	52	57	5
8	58	66	8
Total	**385**	**444**	**59**
Mean	**48,13**	**55,50**	
SD	**7,43424**	**6,00000**	
Min	**39**	**48**	
Max	**58**	**66**	

Table 1 shows that the average leg muscle strength during the pretest was 48. 125 and has increased in the posttest after 12 exercises so that the posttest average is 55.5. Based on table 1, the pretest and posttest of the squat jump training group can be presented in the following figure:

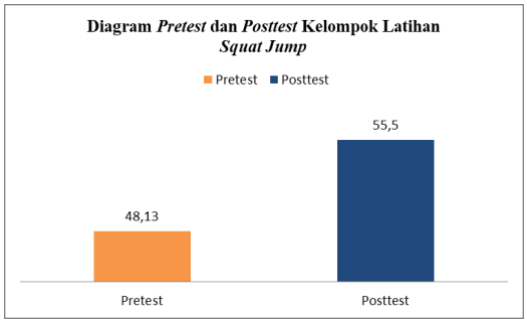

Fig 1. Bar Diagram of Pretest and Posttest of Squat Jump Exercise Group

Pretest and Posttest Data of Bodyweight Squat Exercise Group

Pretest data was collected before receiving treatment, which consisted of bodyweight squat exercises, Posttest data was collected after the treatment, which involved doing squat exercises. Here are the results of the bodyweight squat exercise before and after the test:

Table 2. Pretest and Posttest of Bodyweight Squat Exercise Group

No Suject	Pretest	Posttest	Difference
1	56	65	9
2	60	66	6
3	40	55	15
4	52	60	8
5	58	63	11
6	54	59	5
7	48	55	7
8	54	61	7
Total	**422**	**484**	**68**
Mean	52,75	60,50	
SD	6,31891	4,14039	
Min	40	55	
Max	60	65	

Table 2 shows that before the test, the average strength of leg muscles was 52.75 and increased in the posttest after 12 exercises so that the posttest average was 60.5. Based on table 2, the pretest and posttest of the

Bodyweight jump training group can be presented in the following figuret :

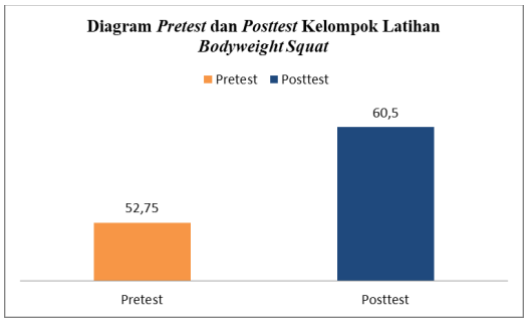

Fig 2. Bar Diagram of the Pretest and Posttest of the Bodyweight Squat Exercise Group

After obtaining the research data, then the data is analyzed to get conclusions from the research conducted. The steps of dataanalysis in this study are as follows :

Normality Test

The objective of the normality test is to ascertain if the variables in the research are normally distributed. Because the sample size of the study is limited, the Shapiro Wilk formula is used to calculate this normality test. Researchers utilized the SPSS computer program to conduct the normality test. The outcomes of the normality test that have been performed are listed below :

Table 3. Normality Test

Group	P	Sig.	Type.
Pretest Squat Jump Group	0,266	0,05	Normal
Postest Squat Jump group	0,852	0,05	Normal
Pretest Bodyweight Squat group	0,368	0,05	Normal
Protest Bodyweight Squat group	0,535	0,05	Normal

Table 3 shows that the pretest data for the squat jump group has a value of 0. 266 and the posttest for the squat jump group is 0. 852, This means the p value is more than 0. 05 means the data is spread out evenly, like a bell shape. The bodyweight squat group had a score of 0. 368 before the test and a score of 0. 535 after the test. This means that the p value is greater than 0. 05, indicating that the data is normally distributed. Based on these results it can be concluded that the pretest and posttest data from the squat jump and bodyweight squat groups are normally distributed. Therefore, for further calculations researchers used parametric statistical techniques..

Homogeneity Test

The purpose of the homogeneity test is to check if the sample is uniform, specifically if the sample variants drawn from the population are uniform. The homogeneity test in this study determines whether the data is homogeneous based on whether the p value is greater than 0. 05. The data is not homogeneous if the p value is less than 0. 05. Here are the findings of the homogeneity test conducted on the pretest and posttest data from the two training groups:

Table 4. Homogeneity test

Group	df1	df2	Sig.	Type.
Pretest	1	14	0,226	Homogenous
Posttest	1	14	0,296	Homogenous

Table 4 shows that the pretest sig. value is 0. 226 and the posttest sig. value is 0. 296, indicating that the data is homogeneous because the pretest and posttest sig. p > 0. 05.

Hypothesis Test

A t-test was used to check the idea in this study. The researchers checked their idea by using a t-test on the scores from before and after the test. The t test in this study used a paired sample t test to compare the pretest and posttest means for squat jump and bodyweight squat workouts. The following are the results of the t test for the squat jump and bodyweight squat groups :

T tes of Pretest and Posttest Test of Squat Jump Exercise Group

The t test compares the scores from the pretest and posttest of the squat jump exercise group to see if there is a difference between the two averages. The results of this t test are important if the t value is greater than the number in the t table and the significance level is met. Less than 0.05 the t-test results are considered not important if the t value is less than the value in the t table and the significance level is not reached 0.05. You can see the test results in the table below:

Table 5. Hypothesis Test of Squat Jump Exercise Group

Group	Average	t-test				
		t count	t table	Sig.	Difference	%
Pretest	48,13	5,265	2,365	0,001	7,73	15,31 %
Posttest	55,50					

According to table 5, the squat jump training group has an average pretest score of 48. 13 and an average posttest score of 55. 50, both of which have a difference of 7.73. The table shows that the t value is 5. 265 and the t table is 2. 365, with a significance level of 0. 001. This shows a big difference between the test taken before and after the squat jump training group since the t count is larger than the t table and the significance value of 0. 001 is less than 0. 05.

T Test of Pretest and Posttest of Bodyweight Squat Exercise Group

The purpose of the t test of the bodyweight squat exercise group's pretest and posttest is to ascertain if there is a difference between the average pretest and posttest. The findings of this t test are considered to be statistically significant if the t value is higher than the t table and the sig. is less than 0. 05. It is said that the t test yields insignificant results if the t value is less than the t table and the sig. > 0. 05. The results of the test are shown in the table below:

Table 6. Hypothesis Test of Bodyweight Squat Exercise Group

Group	Average	t-test				
		t count	t table	Sig.	Difference	%
Pretest	52,75	5,282	2,365	0,000	7,75	14,69 %
Posttest	60,50					

Based on Table 6, it can be seen that the average pretest score for the bodyweight squat exercise group was 52.75 and the average posttest score was 60.50, with a difference of 7.75. From the table, it can be seen that the calculated t-value was 5.282 and the table t-value was 2.365 with a significance of 0.000. Since the

calculated t-value > t-value and the significance level of 0.000 < 0.05, this indicates that there is a significant difference between the pretest and posttest scores of the bodyweight squat exercise group.

DISCUSSION

This study aims to determine the effect of squat jump and bodyweight squat training on leg muscle strength of Kudus Regency Wushu athletes. Based on the results of the research and data analysis above, the results of the increase in squat jump and bodyweight squat training on the leg muscle strength of Kudus Regency Wushu athletes by giving Treatment for 4 weeks with a frequency of 1 week 3 meetings. The results show that :

Squat Jump

Squat jump training greatly improves leg strength for Wushu athletes in Kudus Regency. After doing squat jump training, leg muscle strength increased by 15. 31% The findings of this study match with many research ideas (Tofikin et al., 2021) about how squat jump training greatly helps improve leg muscle power in Pencak Silat athletes at STKIP Rokania Commissariat.

According to this theory, squat jump training is very useful for increasing leg muscle strength. According to (Ihsan, 2020) squat jump training is done to train endurance and leg muscle power. Squat jump training has the benefit of tightening the thigh and buttock muscles because this exercise focuses on jumping movements that are done repeatedly so that it can increase the leg muscle stretch reflex, so leg muscle strength will also increase.

Bodyweight Squat

Bodyweight squat training has a significant increase in leg muscle strength for Kudus Regency Wushu athletes. Beasrnay increase in leg muscle ability after being given bodyweight squat training is by 14.69%. The findings of this investigation support a variety of research theories (Vina Devi Kurniawati & Widarti, 2023) on the effect of bodyweight squat training on leg muscle strength in elderly women.

According to this theory, bodyweight squat training is very useful for increasing leg muscle strength. According to (Yoshiko & Watanabe, 2021) Bodyweight squat training causes an increase in several activities in the lower leg muscles such as the thigh muscles significantly increased at 4 weeks of training. That is why bodyweight squat training will affect leg muscle strength.

CONCLUSION

Based on the comes about of the information examination and talk over, it can be concluded that there is a significant effect of squat jump and bodyweight squat training on the level of leg muscle strength ability of Kudus Regency Wushu Taolu athletes. Squat jump training has a percentage increase of 15.31%, while bodyweight squat training has a percentage increase of 14.69%.

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