

Effect of plyometric exercises on limb muscle power in volleyball players

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Abstract

The necessity of power in volleyball is to support the game's technique. Volleyball players' leg muscles must be strong enough to sustain techniques like smashes, blocks, and serves. Proper workouts, such as plyometric exercises, should be used to reinforce the importance of leg muscular power. The goal of this study is to determine the impact of plyometric side-to-side box shuffle and leap to box exercises on leg muscle power and to determine which workouts are more successful in developing volleyball participants' limb muscular explosiveness. This is an experimental study with a "Two Groups Pretest Posttest Design" as the research design. The sample size for this study was up to 30 female athletes, with Purposive Sampling being employed as the sampling strategy. The samples were randomly split into two groups. The vertical leap test was utilized to determine the strength of the limb muscles in this research. Normality tests, homogeneity tests, and t-tests are all used in data analysis. The results revealed a sig value of 0.918, indicating that there is a difference in enhancing leg muscular strength in footballers between side-to-side box shuffle and leap to box workouts. Jump to box training improves leg muscular strength more than side-to-side box shuffle training, with a ratio of rises of 22.00 percent and 16.73 percent, respectively.

Keywords: plyometric, power, leg muscles, volleyball

INTRODUCTION

Every sports player in diverse sports need the power component of the limbs. In sports, explosive power refers to a muscle's capacity to direct maximal strength in a brief period of time. Further disclosed physical condition components such as limb power is an essential aspect that any athlete who is dominating with strength and speed must consider. Afif & Nasrullah, (2016) emphasized that leg power is required in athletes because methods must be performed in the power support, such as volleyball players who require arm power to conduct serve and smash techniques, as well as leg muscle strength to do block techniques.

The capacity of muscles to direct their full strength in a short period of time is referred to as power. As previously said, power is critical in the game of volleyball. (Sugito, Allsabab, & Putra, 2020) That power is the utmost strength capability required by athletes while they are competing. The capacity of a muscle or set of muscles to overcome a load resistance at a fast rate of speed in a single movement is referred to as explosive power (Williams, 2020). Thus, explosive power refers to a muscle's

capacity to endure weights at a high rate of speed in a single full movement (Bompa & Buzzichelli, 2019).

Muscle explosiveness is a component of physical condition that practically every sport demands (Jaya & Rohmat, 2019). Explosive power is employed in sports practice for explosive motions such as throwing, resisting, kicking, and striking. Power is not a new concept in the world of sports, as practically all sports require it. Currently, any sport requiring a high level of skill is conducted using advanced instruments via the utilization of circuit training facilities. However, in terms of enhanced power, greater strength and speed training must come first, as power may be produced through the outcomes of strength and speed training when applying maximum force to defeat convicts. (Putra, Kiyatno, & Siswandari, 2017) The physical condition of a player is the most critical component in determining their success in the sport of volleyball. Volleyball is a sport that demands a player to understand the methods used on the court, particularly while attacking and defending. (Khalid & Rustiawan, 2020; Toho Cholik Mutohir dan Muhammad Muhyi FaruqVoli, 2012). Additionally, volleyball abilities are aided by physical condition elements such as power, muscle strength, and agility.

Muscle explosiveness is a contributing component, since it results in a feat of forceful and lethal strikes. Muscular explosive power is the result of a multiplication of muscle strength and a person's speed. Thus, a volleyball athlete should possess strength and quickness (Indrayana, 2018). Additionally, the fundamental physical aspects of strength, speed, and explosive power of the limbs (power) as well as coordination of the game's basic methods must be encouraged and developed. Leg muscular power is one of the components that volleyball athletes must possess. The biomotor component of limb power is critical in volleyball. With athletes' advancing ages, the biomotor component of limb power must be developed gradually and continually, since the parts of this biomotor component will deteriorate with age (Henwood, Riek, & Taaffe, 2008). In volleyball, the biomotor components of limb power are required to jump,

both to attack (smash) and defend (block). It will be difficult for athletes who lack limb power to perform explosive motions in a short period of time (Sim, Byun, & Yoo, 2015).

Plyometric workouts are believed to be the most effective in increasing muscular power capabilities. In agreement with this, (Husein & Nurkholis, 2018) Pliometric Exercises, he stated, may significantly boost one's power or endurance abilities. According to this study, the power capability of athletes' limbs may be significantly increased when plyometric katihan is performed using a variety of different approaches. Additionally, there is an improvement in the ability of athletes trained utilizing the side-to-side box shuffle to generate limb power (Kholil Halbatullah., Budaya Astra., 2019). Additionally to leaping to box exercises, it is believed that it can strengthen the physical ability of trained athletes' leg muscle power (Jaya & Rohmat, 2019). Thoiban & Tohidin, (2019) indicated that in order to increase the strength of the limbs, a plyometric workout regimen is expected to be used. Further explanation of workout techniques demonstrates a difference in results between those who receive therapy and those who do not receive treatment for limb power capacity (Bompa & Haff, 2009). In this study took several types of pliometric methods that are less noticed by researchers or trainers in performing pliometric exercises, this study uses jump to box groups that can increase power, research (Akhmad & Hasibuan, 2020) states jump to box is a technique that can increase the strength of the limb muscles that can be seen from the characteristics of the exercise.

In terms of limb power, which is one of the components that volleyball players must possess, the issue discovered by the skin during observations is not maximum or still falls within the group of volleyball athletes with poor power capacity at Johar VC Deli Serdang. The importance of power in the physical component in women volleyball athletes used in their activities in volleyball to support their skills. Power in volleyball is used for a variety of techniques such as service and smash. Furthermore, research (Husein, M, Akbar, 2020) explains the ability of

power in athletes is very important to have, because power is a component that must be owned by every volleyball athlete. Thus, the author wishes to conduct research on how plyometric activities including the side-to-side box shuffle and leap to box models may help Deli Serdang of Johor VC volleyball increase her limb strength.

METHOD

The study employed a quasi-experimental design with two groups receiving distinct treatments. In accordance with (Haqiyah & Riyadi, 2018), Experimental study is conducted to ascertain whether a person is influenced by something. According to, the design utilized is a two-group pretest-posttest design (Arikunto, 2010) "a pretest-posttest design involving two groups is a study done on two comparison groups."

The research population consists of all athletes from Johor VC Deli Serdang Volleyball. Simple random sampling with inclusion and exclusion criteria was utilized as the sample strategy. Female athletes aged at least 15 years and up to 25 years are eligible. Not having any active athletes or those who are currently injured, and not engaging in any other training programs. According to the technique, a total sample of 30 female volleyball athletes was employed. This study employed plyometrics side-to-side box shuffle and jump to box activities that were trained for 16 sessions, with an initial test to determine the leg muscle strength and a final test following the treatment, for a total of around 2 months. In this study, the variable bound (dependent) is the power limbs of Johor VC volleyball athlete Deli Serdang. Data collection is accomplished by the administration of a vertical leap test, which generates research data that will be analyzed to evaluate hypotheses. Prior to hypothesis testing, the prerequisites of the distribution normality analysis are met. After ensuring that the analytical conditions are satisfied, a hypothesis test using a different mean analysis approach is conducted (test t).

Research Prosedur

The research procedure used pliometric exercise methods to increase leg muscle strength in the study subjects, with the female sex. The course of research conducted initial tests to find out the power of the limb muscles using vertical jumps, then after conducting the initial test of the study subjects in random divided to be given treatment into research treatment groups. Furthermore, after being given treatment for 16 research meetings continued to post test to be able to find out the improvement of the results of the treatment given.

RESULT

The average, standard deviations, and variance acquired from the results of exercise tests (treatment) provided to each group, namely the group that receives side-to-side box shuffle exercises and the group that receives leap to box exercises, are discussed in the data description. The results of the test will then be recorded and computed according to the group and form of exercise used. The results of the two groups will be examined using these data (side-to-side box shuffle group and jump to box group). For windows, analysis is performed using spss 25.0 calculations. then the following table might be used to expound on the data from the study's findings:

Table 1. Pretest data description of the exercise group side-to-side box shuffle

A	N	Mean	SD	Variance
Pretest	15	30,27	9,41	88,50

In table 1 above, it can be described that from the average value of the leg muscle power test using a vertical jump test before being treated in the form of side-to-side box shuffle (pretest) exercises of 30.37; with a variant value of 88.50; Standard deviation 9.41.

Table 2. Pretest data description of the Jump to box Exercise group

B	N	Mean	SD	Variance
Pretest	15	27,27	9,21	84,78

In table 2 above, it can be described that from the average value of the leg muscle power test using a vertical jump test before being treated in

the form of jump to box (pretest) exercises of 27.27; with a variant value of 84.78; Standard deviation of 9.21.

Table 3. Posttest data description of the exercise group side-to-side box shuffle

A	N	Mean	SD	Variance
Pretest	15	47	11,69	136,57

In table 3 above, it can be described that from the average value of the leg muscle power test using a vertical jump test after being treated in the form of side-to-side box shuffle (posttest) exercises of 47; with a variant value of 136.57; Standard deviation 11.69.

Table 4. Posttest data description of the Jump to box exercise group

B	N	Mean	SD	Variance
Pretest	15	49,27	7,46	55,64

According to table 4, the average value of the leg muscle power test results obtained using vertical jump tests following treatment with leap to box (posttest) exercises is 49.27; with a variant value of 55.64; and a standard deviation of 7.46.

As a result, it is possible to deduce that the test results of the two treatment groups differ (side-to-side box shuffle and jump to box groups). This is demonstrated by the fact that the average post-test result for the two types of workouts is greater than the average pretest value (treatment). This indicates that the therapy of each group (side-to-side box shuffle and leap to box groups) had an effect on limb muscular power development in ball athletes. The outcomes of enhancing the power capability of volleyball players' limb muscles are summarized below in terms of the average gain value gained.

Table 5. Results of calculation of increased muscle strength of volleyball players' limbs

Nama Kelompok	Jumlah
Kelompok Latihan side-to-side box shuffle	
Nilai Mean pretest	30,27
Nilai Mean Post test	47
Peningkatan	55,3%
Kelompok Latihan jump to box	

Nilai Mean pretest	27,27
Nilai Mean Post test	49,27
Peningkatan	80,7%

The things needed to know the analysis in this study are as follows :

1. Normality Test

To test the normality of data distribution, one of them is by using SPSS calculations, namely the One-Sample Kolmogorov-Smirnov Test. This test is done by looking at the value of the difference obtained between the accumulative opportunities from observation and theoretical opportunities. To determine whether the distribution of data is normal or not, it can be seen from the Sig value compared to the α value. If the value $> \alpha$ then the data is normal. For more details can be seen in the normality test table according to spss calculations below.

Table 6. Description of Normality test results

Variabel	Sig.	α	Keterangan
Pretest side-to-side box shuffle	0,024	0,05	Normal
Pretest jump to box	0,200	0,05	Normal
PostTest side-to-side box shuffle	0,113	0,05	Normal
PostTest jump to box	0,120	0,05	Normal

2. Homogeneity Test

To find out whether the description of existing data is homogeneous or cannot be known by means of SPSS calculations as follows:

Table 7. Homogeneity test results of pretest data on limb muscle strength

Levene Statistic	df1	df2	Sig.
0,013	1	28	0,910

From the results of homogeneity analysis obtained the data used is homogeneous, because Sig is greater than α ($0.910 > 0.05$).

Tabel 8. Homogeneity test results of data posttest strength of the limb muscles

2	Levene Statistic	df1	df2	Sig.
	2,262	1	28	0,144

From the results of homogeneity analysis obtained the data used is homogeneous, because Sig is larger than α ($0.144 > 0.05$).

3. Test t

5 Based on the results of the t test (paired t test) for each exercise against increased leg muscle power before pretest and after administration (posttest) showed that: Sig value for side-to-side box shuffle exercises by 0.000 smaller than α by 0.05, in other words there was a significant influence on side-to-side box shuffle exercises for pretest and posttest against increased limb muscle power in footballers, and jump to box exercises of 0.000 smaller than α of 0.05, in other words there is a significant influence on jump to box exercises for pretest and posttest on the increased strength of the limb muscles in volleyball athletes.

Meanwhile, based on the percentage of increased muscle power of the jump to box training limbs is better than side-to-side box shuffle training which is 22.00% and 16.73% and based on the two-group test (test) obtained a sig value of 0.918 greater than $\alpha = 0.05$, in other words there is a difference between side-to-side box shuffle and jump to box exercises in increasing leg muscle power in footballers.

DISCUSSION

According to the findings of the research and analysis, there is a significant effect on side-to-side box shuffle exercises for pretest and posttest against increased leg muscle power in footballers, and jump to box exercises for pretest and posttest against increased leg muscle power in volleyball athletes. According to two-group testing, jump to box exercise models are superior than side-to-side box shuffle training. This outcome is supposed to provide references or a theoretical foundation for determining

the ability of each handball athlete's limbs, which can subsequently be used to construct or create training programs using plyometric training models.

Anwar et al., (2020) According to the research, pliometric workouts provide training outcomes by pitting a strength barrier against the limb power of SMAN 3 Banjarmasin futsal players. Additional information will be provided if there are results comparing the power limbs of futsal players trained using plyometric tuck jump models to those who do not. Saputra et al., (2019) revealed that box jump, burpee, and tuck jump exercises have a significant effect on increasing the strength and speed of the leg muscles, as determined by the sample paired t-test test, and that there is a significant difference in influence between box training and jumping, burpee, and tuck jump exercises on increasing the strength and speed of the leg muscles. (Jaya & Rohmat, 2019) found that tuck jump workouts can help players improve their smashes in volleyball games by improving their leaping ability and limb force. Lindblom et al., (2021) As a result, training involving tuck leaps can help athletes increase their capacity to perform limb power. Additionally, it was shown that tuck jump workouts might help athletes recover from knee injuries even when they are performed in varied segments and under supervision. The practice of tuck jumping is well-suited for inclusion in a fitness routine. Over a 12-week period, core stability training significantly improves the kinematic jump tuck in young soccer players with dysfunction (Di Cagno et al., 2018).

(Anwar et al., 2020; Parta, Wiria Dinata, Kesehatan, & Rekreasi, 2020) found that limb muscle strength is a critical factor that has a significant impact on handball athletes' ability to attack, and that tuck jump jumping workouts are capable of increasing limb power in handball athletes. The ability of handball athletes has increased as a result of the influence of pliometric and leaping workouts on physical performance in young male handball players (Mazurek et al., 2018). Saparia, (2020) shown that plyometric activities such as tuck jump models are capable of enhancing voly athletes' limb power, which influences their smash

outcomes when compared to athletes who have not yet used plyometric workouts. Basketball and handball athletes' leaping ability has an effect on their performance on the court, which is beneficial if training is required to develop the limbs' power (Barrera-Domínguez et al., 2021).

Singh et al., (2019) revealed that plyometric training with a single tuck jump model in combination with sprint activities are capable of improving handball athletes' looks. Additionally, the two components have an effect on athletes' performance. Arunsankar et al., (2020) demonstrated that training designed to increase leaping ability through the use of the plyometric tuck jump model have a substantial effect on how an athlete's limb power performs on the field. The plyometric and stationary training components of the program have a statistically significant effect on the development of the specified criterion variables, namely power ability and speed, in athletes (Joseph & Praveen, 2019). Plyometric workouts are frequently utilized in sports using big balls, such as volleyball and handball. To leap in large ball games, you must have strength. Thus, volleyball and basketball both require horizontal and vertical components. (Dharani, Wiriawan, & Mintarto, 2020). In this study limited in the number of samples and gender, researchers hope in the future to conduct similar studies by looking at the limitations of this study by increasing the number of samples and treating men and women so that the influence can be seen properly. Furthermore, researchers in the future can develop other methods that can increase the strength of the limb muscles by adding other methods so as to improve other pliometric models.

CONCLUSION

The study's conclusion is that both types of training can help volleyball players improve their limb muscle strength. The improvement is remarkable when compared to the side-to-side box shuffle exercise model. This research can serve as a reference for how to develop limb muscle strength using pliometric training models combined with leap to box models.

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