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Effect of skipping and box jump exercises on leg muscle explosiveness: badminton amateur athletes

Efecto de los ejercicios de salto y salto al cajón sobre la explosividad muscular de las piernas: atletas aficionados de badminton

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Abstract. The explosive power of the leg muscles is a component that must be possessed by athletes, both professional and amateur, in sports, especially badminton. This study aims to find out: 1) the effect of skipping exercises on the explosiveness of leg muscles in extracurricular students, 2) the effect of box jump exercises on the explosiveness of leg muscles in extracurricular students, and 3) the difference between skipping and box jump exercises on the explosiveness of leg muscles in badminton extracurricular students of Liwa 2 Lampung Junior High School. The research method used was an experimental method, with a pre-test and post-test research design, a sample of 24 students who were divided into two experimental groups with ordinal pairing techniques. The instruments used are tests and measurements using vertical jumps. The results showed that: 1) There was a significant effect on skipping exercises on the explosiveness of leg muscles with data analysis of tcount = 18.019 > t_{table} = 2.228 with α = 0.05. 2) There was a significant effect on box jump training on the explosiveness of leg muscles with data analysis of t_{count} = 11.790 > t_{table} = 2.228 with α = 0.05. 3) There is a difference between skipping exercises and box jump exercises on the explosive power of leg muscles with data analysis t_{count} 2.204> t_{table} 2.074 with α = 0.05, N = 24. Judging from the average final test, skipping practice was 44.50 while box jump practice was 39.75. So it can be concluded that the two exercises have a significant impact, but it is recorded that skipping exercises provide more optimal results compared to box jump exercises in supporting the quality of leg muscle explosiveness.
Keywords: Skipping Exercises, Box Jump Exercises, Leg Muscles, Badminton, Athletes

Resumen. La potencia explosiva de los músculos de las piernas es un componente que deben poseer los atletas, tanto profesionales como aficionados, en los deportes, especialmente en el bádminton. Este estudio tiene como objetivo averiguar: 1) el efecto de los ejercicios de salto en la explosividad de los músculos de las piernas en estudiantes extracurriculares, 2) el efecto de los ejercicios de salto al cajón en la explosividad de los músculos de las piernas en estudiantes extracurriculares, y 3) la diferencia entre los ejercicios de salto y salto al cajón en la explosividad de los músculos de las piernas en estudiantes extracurriculares de bádminton de la escuela secundaria Liwa 2 Lampung. El método de investigación utilizado fue un método experimental, con un diseño de investigación pre-test y post-test, una muestra de 24 estudiantes que fueron divididos en dos grupos experimentales con técnicas de emparejamiento ordinal. Los instrumentos utilizados son pruebas y mediciones mediante saltos verticales. Los resultados mostraron que: 1) Hubo un efecto significativo en los ejercicios de salto sobre la explosividad de los músculos de las piernas con el análisis de datos de trecuento = 18,019 > ttabla = 2,228 con α = 0,05. 2) Hubo un efecto significativo en el entrenamiento de salto al cajón sobre la explosividad de los músculos de las piernas con el análisis de datos de tconteo = 11.790 > ttabla = 2.228 con α = 0.05. 3) Existe una diferencia entre los ejercicios de salto y los ejercicios de salto al cajón sobre la potencia explosiva de los músculos de las piernas con análisis de datos t cuenta 2.204> t tabla 2.074 con α = 0.05, N = 24. A juzgar por el promedio de la prueba final, la práctica de salto fue de 44.50, mientras que la práctica de salto al cajón fue de 39.75. Por lo tanto, se puede concluir que los dos ejercicios tienen un impacto significativo, pero se registra que los ejercicios de salto proporcionan resultados más óptimos en comparación con los ejercicios de salto al cajón en el apoyo a la calidad de la explosividad muscular de las piernas
Palabras clave: Ejercicios de salto, Ejercicios de salto al cajón, Músculos de las piernas, Bádminton, Atletas**.**

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Introduction

Sports coaching is currently one of the elements that plays a very important role in the development of the world of sports, both at the community level, schools, and in teaching at the regional, national and even international levels (Jayanto et al., 2015). According to (Darusman & Putra, 2022) Sports coaching is an effort to improve the quality of Indonesia's human beings, improve the physical, spiritual, and spiritual health of the community, as well as develop ideals and ethics. Discipline and sportsmanship to achieve high standards and skill enhancement that can enhance school pride (Arias et al., 2023). Sports are part of the process and achievement of national development goals and the existence and role of sports in the life of society, nation and state must be placed in a clear position in the national legal system (Kasihatun & Sukendro, 2021). In addition, sports can also raise the dignity, dignity and honor of the nation, one of which is through badminton (Bagaskara & Suharjana, 2019). Sports is a physical activity that is carried out with the aim of maintaining health and strengthening the muscles of the body, one of which is badminton (Arrahman, 2017).

Badminton as one of the popular and popular sports games by the people of Indonesia, ranging from children to the level of parents, men and women (Ihzayana & Jatmiko, 2020). Badminton is a sport that chases the coach in all directions, both forward, backward, left and right sides (Sáez-

Michea et al., 2023). Playing badminton correctly, then we must be able to hit the basket, both from the top, from the bottom and from the side (Syamsudar et al., 2020). The types that must be mastered are service, lob, dropshot, smash, netting, underhand, and drive (A. T. Hidayat & Agus, 2021). All of these types of strokes must be done using the grip or grip of the racket and the correct footwork or foot movement, for example when jumping and reaching the shuttlecock. Players are not only required to move explosively but must also have strength and speed, especially in the leg muscles (Syaranamual, 2023).

Mastering basic techniques is essential to improve skills (Andriyan et al., 2023). The smash technique is a skill that must be mastered by someone in a badminton match, not only scoring goals but also doing smashes is one of the keys to victory (Syamsudin et al., 2022). Practicing good smash techniques is not easy, requires a lot of repetition and a lot of time, and must be introduced and trained from a young age to become the basis of good techniques (Nasrullah et al., 2020). In other words, if an athlete can't control the smash correctly, then he won't be able to get a perfect score (Wibawa et al., 2017). Therefore, athletes must pay attention to the training process and deepen the smash technique to get maximum results (Rizki Pebrian et al., 2022). In the current development of badminton, the jumping ability of athletes is very important because many techniques in the game of badminton use jumps (Adirahma et al., 2024). However, not a few students who take part in the Badminton Extracurricular at SMPN 2 Liwa have difficulty in doing jump techniques when doing jump smashes which results in very weak smash results, so the shuttlecock often gets caught in the net and out of the field (out). One of the factors that is the cause, among others, is the player's jumping ability that has not been maximized. One of the factors that affect success in jump smash is the strength of the leg muscles, to produce a maximum jump smash requires explosive power in the leg muscles (Ayu Supriyadi et al., 2023). To produce optimal leg muscle explosiveness, an exercise related to the leg muscles is needed (Gumilar Zakaria, Deni Mudian, 2018).

The results of observations in SMPN 2 Liwa badminton extracurricular students are that the jump movements carried out by students have not been maximized when doing jump smashes, during practice some extracurricular students do smash movements do not jump perfectly and not optimally so that the smash results are very weak, not sharp and deadly and can be returned by their opponents. the exercises given, especially to improve jumping, are still lacking, in the extracurricular SMPN 2 Liwa only relies on technical exercises, so that students' jumps are considered to be still lacking. To find out the results of good and effective training, it is necessary to conduct research on increasing the explosiveness of leg muscles in badminton players. A badminton player when doing a jump smash, the player must jump to the maximum height. The importance of the strength and power factor of the leg muscles in the game of badminton, so an exercise method is needed that is able to increase the strength and power of the leg muscles. One form of exercise to increase power can be done by pleiometric exercises. Plyometric training has been used as a training method primarily to develop strength, speed, and power (Arif & Alexander, 2019).

Explosive power is a person's ability to use the maximum power deployed in the shortest possible time (Chaniago & Arnando, 2023). The legs are one of the lower limbs of the body that have an important role in sports performance. The limb involves the bones that form the muscles of the leg both upper and lower. The bones that form muscles include, leg bones, tibia and fibula bones, and femur bones (Utamayasa, 2020). On this occasion, the researcher hypothesized that there was a significant influence on the skipping and box jump training processes whose main purpose was to increase the explosive power of the leg muscles.

Skipping exercises are simple cardio exercises that have a big impact on leg muscle power so that the exercise is expected to provide effectiveness and increase jump smash results (A. S. Hidayat & Gemael, 2018). According to (Jayanto et al., 2018) It is stated that jumping rope is known as skipping is an activity that uses a rope with both ends of the rope held with both hands and then swung over the head to the feet while jumping over it. Then according to research researched by (Perikles et al., 2017) This form of skipping sports involves many body muscles so that it is more effective than other sports. So this exercise requires the muscles of the thighs, calves, shoulders and biceps at the same time. The goals or objectives in jumping rope are to increase endurance, increase the power and strength of the leg and arm muscles, increase cardiovascular strength, help understand the rhythm of movement through this activity, help develop hand-foot coordination, help develop good body balance (Wicaksono & Putri, 2020). From some of the expert opinions above, it can be seen that skipping exercises have an important role in increasing the power of the leg muscles so that a person's skills in playing badminton will be much better.

According to (Yana Putra et al., 2017) Box jump exercise is a form of jumping up the block box then jumping back down like the initial stance by using both legs together and the training program to develop muscle strength and explosiveness can be done with resistance exercises, where we have to lift, push or pull a weight, the load can be in the form of exerternal resistance, or his own limbs. So from the opinions of several experts, it can be concluded that coaching science needs to be studied because active protein to become an achievement requires a process. For this reason, it is very necessary to design the right exercises to improve

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jumping, it is very necessary to conduct research so that the exercises carried out can be useful and not damage the athlete's body, because wrong and incorrect exercises can make athletes injured and not get the results that should be achieved (Rizki Pebrian et al., 2022). To create a training method to increase the appropriate jump, of course, a coach must pay attention to various aspects, namely the selection of the model or type of training intensity, recovery, duration, sets and reps must be appropriate and in accordance with the components of the training (Ayu Supriyadi et al., 2023).

Method

The research method used was an experimental method, with a pre-test and post-test research design, a sample of 24 students who were divided into two experimental groups with ordinal pairing techniques. The distribution is carried out by conducting a pretest test with a predetermined ranking. In addition, there are several inclusion criteria that must be met by athletes, including: (1) students who are still active in participating in learning, (2) not in a state of illness, (3) able to participate in the training program that has been arranged, (4) students who are 12-15 years old.

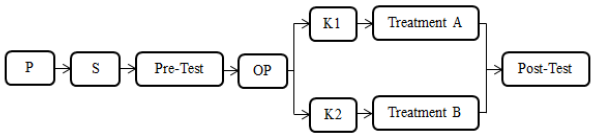

Figure 1.
Research Design

P	: Population
S	: Sample
Pre-Test	: Initial Test
OP	: Distribution *Ordinal Pairing*
K_1	: Exercise Groups *Skipping*
K_2	: Exercise Groups *Box Jump*
Post-Test	: Final test

The instruments used are tests and measurements using vertical jumps. Where athletes will make a jump on the measuring device that has been prepared and make the highest jump. So that the researcher will get data to calculate the results of the initial test (pretest) and final test (posttest). The t-test data analysis technique will first be carried out with the requirements for the use of t-tests such as normality tests and homogeneity test.

Results And Discussion

To determine the influence of skipping exercises and box jump exercises on the explosive power of leg muscles of badminton extracurricular students of SMPN 2 Liwa, an experiment was carried out in this study so that the data obtained was a comparison of the data of the experimental group (skipping exercises and box jump exercises). Before data analysis using the t-test (t-test) will be presented with a description of the data of the research results.

Table 1.
Recapitulation of Explosive Results of Students' Leg Muscles

Data	Group			
	Skipping Practice		Box Jump Exercise	
	beginning	End	Beginning	End
Average	37,67	44,50	37,67	39,75
< Average	5	6	6	6
> Average	7	6	6	6
Std. Deviation	4,46	5,96	4,33	4,49
Min.	31	36	31	33
Max.	44	54	43	45

Based on the results of the data above, it can be seen that the recapitulation of the results of the explosive power of the leg muscles owned by students, in the skipping exercise group has an initial average score of 36.67 with a standard deviation value of 4.46 and has a minimum score of 31 and a maximum of 44. In contrast to the final result, which got an average score of 44.50 with a standard deviation value of 5.96 and had a minimum score of 36 and a maximum of 54. So that the training process in the skipping exercise group can be concluded that there is a significant increase in the explosive power of the leg muscles possessed by the students.

Furthermore, the results of the recapitulation of the explosive power of the leg muscles owned by the students, in the box jump exercise group had an initial average score of 37.67 with a standard deviation value of 4.33 and had a minimum score of 31 and a maximum of 43. In contrast to the final result which got an average score of 39.75 with a standard deviation value of 4.49 and had a minimum score of 33 and a maximum of 45. So that the training process in the box jump exercise group can also be concluded that there is a significant increase in the explosive power of the leg muscles possessed by the students. The following is the result data obtained for each athlete in the diagram below.

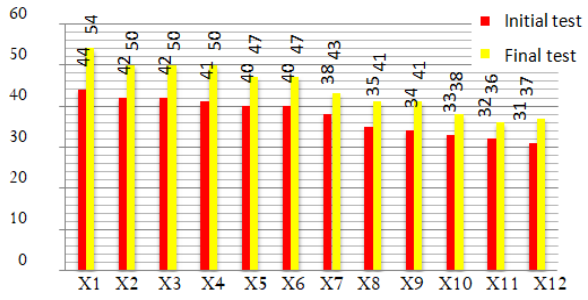

Figure 2. Group and Individual Skipping Practice Start And End Test Diagram

Based on the results of the diagram above, it can be seen that the skipping exercise group experienced a significant increase in each individual, where in athletes X_1 to athletes

X_{12} experienced an average increase of 6.83. Furthermore, the box jump practice group will be displayed in the diagram below.

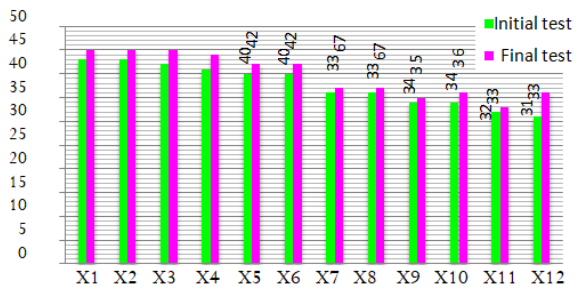

Figure 3. Group and Individual Box Jump Exercise Initial And End Test Diagram

Based on the results of the diagram above, it can be seen that the box jump training group experienced a significant increase in each individual, where in athletes X_1 to X_{12} experienced an average increase of 3.50. So based on the results of the two variables above, both exercises have a significant impact on athletes in an effort to increase the explosive power of leg muscles, especially for amateur athletes.

Table 2.
Normality Test

No.	Variable	L_{count}	L_{table}	Conclusion
1.	Skipping initial test	0,142	0,242	Usual
2.	Skipping final test	0,138	0,242	Usual
3.	Initial test of box jump	0,150	0,242	Usual
4.	Final test of box jump	0,230	0,242	Usual

The normality test above shows that in the initial skipping test variable, the L_{count} is calculated at 0.142 and the L_{table} is 0.242. Then in the final test, the L_{count} of the calculation was 0.138 and the L_{table} was 0.242. And in the initial test variable of the box jump, the L_{count} was calculated as 0.150 and the L_{table} was 0.242. Then in the final test, the L_{count} was calculated as 0.230 and the L_{table} was 0.242. Because the value is more than 0.05. Then each variable is normally distributed.

After the normality test was carried out, then a homogeneity test was carried out which aimed to find out whether several population variants were the same or not. Where the results are in the table below.

Table 3.
Homogeneity Test

No.	Variable	L_{count}	L_{table}	Conclusion
1.	Initial skipping and box jump tests	1,058	2,818	Homogeneous
2.	Final test of skipping and box jump	1,759	2,818	Homogeneous

Based on the results above, it can be concluded that in the variables of the initial skipping and box jump tests, the L_{count} as 1.058 and the L_{table} is 2.818. And in the final test of skipping and box jump, the value of L_{count} as 1.759 and the L_{table} was 2.818. Because the data is in accordance with the rules of homogeneity testing, it can be concluded that the data is homogeneous.

Discussion

The results of data analysis in the skipping exercise group showed that there was a significant influence of skipping exercises on the explosive power of leg muscles of badminton extracurricular students of SMPN 2 Liwa. According to (Jayanto et al., 2015) *Skipping is a form of CV (Cardio Vascular) exercise that is very strenuous and can increase endurance, power and speed. In addition, according to* (Rizki Pebrian et al., 2022) The goals or objectives of skipping exercises are (1) developing endurance (2) developing leg and arm strength (3) developing cardiovascular strength (4) helping to understand the rhythm of movement through these movements (5) helping to coordinate hand and foot movements (6) developing body balance. Skipping exercises that are done with a frequency of 3 times in 1 week for 16 meetings can increase the explosive value of leg muscles. Skipping exercises stimulate the muscles of M. Sartorius, M. Gracillis, M. semitendinosus to always contract quickly and with movements that are done repeatedly and the intensity of the exercise increases at each meeting, it can indirectly increase the strength of the lower extremities (Gumilar Zakaria, Deni Mudian, 2018). Skipping exercise is a form of pleiometric exercise, where the exercise uses repetitive jumping movements to strengthen tissues and train nerve cells that stimulate muscle contraction (Utamayasa, 2020). This exercise develops the ability of the muscles to produce increased strength.

The box jump exercise group showed that there was a significant influence of box jump training on the explosive leg muscles of badminton extracurricular students of SMPN 2 Liwa. In this study, the researcher applied a type of plyometrics box jump exercise. According to (Kasihatun & Sukendro, 2021) Box jump exercise is an exercise of jumping up the block box then jumping back down like the starting stance by using both legs together. This is because box jump training is a jumping exercise to increase the intensity of jumping by using a box by using both legs together. Related to this description, there is an interaction between jump to box exercises and increasing leg muscle power. The height of the box depends on the size of the athlete, the surface, the direction and the purpose of the program. This exercise box may involve one or more and can even alternate legs. In addition, box jump exercises affect jump height where height is a benchmark for leg muscle power. Box jump is a low-intensity exercise. In the exercise athletes

jump to increase the intensity of jumping and jump by using a box by using both legs together. According to(Wicaksono & Putri, 2020) Box jump exercises are very good for increasing leg muscle power. One of the studies conducted by (Ihzayana & Jatmiko, 2020) proving that box jump exercises are usually used to increase jump height in athletes. As we know, one of the plyometric training techniques that many athletes use to increase leg muscle power is jumping, the type of exercise itself is a jump box.

Conclusion

Based on the results of the above study, it can be concluded that skipping exercises have a very significant impact on the explosive component of the leg muscles on students, this is because skipping exercises stimulate all muscles to always contract quickly, in contrast to box jump exercises. Box jump exercises only affect the legs to be able to increase power by providing power to the intensity of the exercise given. So the importance of the role of the coach in choosing various training models to be able to improve these components. Because with the application of the appropriate training model, it can provide maximum results.

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