

Influence Of exercise High Hurdle Jump and Forward and Lateral Hurdle Jump on Increasing Leadstrength and Power Muscle

Mochamad Ilham Agung Prilaksono¹, Oce Wiriawan², Fransisca Januarumi Marhaendra Wijaya³

^{1,2,3} Universitas Negeri Surabaya, Indonesia

Ilhamagung092@gmail.com

Abstract

Treat sports players using a new type of exercise or a method that has been popular in the world of increasing physical abilities in recent years, namely the varied plyometric method so that athletes don't feel bored. Types of plyometric exercises high hurdle jump and forward and lateral hurdle jump are two types of plyometric exercises but their implementation is different. Therefore, it is necessary to provide learning resources and human resources who are able to provide material for plyometric training methods. This study aims to determine the effect of high hurdle jump and forward and lateral hurdle jump exercises on increasing leg muscle strength and power. This research uses a quantitative approach to the type of classroom action research. The research method uses experimental methods. The research design used the none equivalent (pretest and post-test) control group design. The independent variables in this study are high hurdle jump training, forward and lateral hurdle jump exercises, and the dependent variable is leg muscle strength and power. The sample in this study amounted to 30 students of class X who used the random sampling technique. Analysis of the data used in this study to test the effect is paired t-test. Furthermore, to test the difference in effect between the treatment and control groups was carried out using one way ANOVA on the normal data distribution. The test results showed that there was a significant difference in the high hurdle jump experimental group on the variable leg muscle strength and power with a significance value of $p < 0.00 < 0.05$, a percentage increase of 6.79% in the strength variable and 6.22% in the leg muscle power variable. There is a significant difference in the forward and lateral hurdle jump experimental group on the variable leg muscle strength and power with a significance value of $p < 0.00 < 0.05$, a percentage increase of 6.04% in the strength variable and 7.51% in the leg muscle power variable. High hurdle jump exercises are more effective than forward and lateral hurdle jumps to increase strength and forward and lateral hurdle jumps are more effective than high hurdle jumps to increase leg muscle power.

Keywords

insistence; particles;
karo language



I. Introduction

Sport is one of the physical and psychological activities of a person that is useful for maintaining and improving the quality of a person's health after doing sports activities. According to Yuliatin (2012) sport is a series of regular and planned exercise to maintain

motion (maintain life) and improve movement ability (improve quality of life). Sports coaching is one of the factors to improve sports performance, because the development of sports achievements depends on the sports coaching. Therefore, the role of coaching or training must be programmed optimally to organize the course of coaching in accordance with the program.

In sports, exercise is very important to do in helping improve the ability and performance of athletes to carry out sports activities. According to Bompa (2009), training is a process in which athletes are trained to be prepared to achieve the highest stamina. According to Sukadiyanto (2011), in principle, training changes an athlete in a very good direction, namely for psychological quality, body abilities, and physical abilities.

Physical activity is often found in sports activities, both recreational and competitive sports. Sport is defined as any physical activity carried out systematically to encourage, foster and develop physical, spiritual and social potential. In its development, sports for athletes only aim to improve their achievements according to their respective fields. But for someone who is not an athlete or sportsman, the development of sports is only to fill spare time or to entertain themselves.

Physical fitness is formed from physical activity that is often done regularly. Exercises that have been done to get in excellent physical condition and can support daily activities. Physical fitness is the body's ability to do some physical work that is done daily without causing significant fatigue (Wiaro, 2013).

Physical condition exercise plays an important role in maintaining or increasing the degree of physical fitness. The degree of physical fitness of a person greatly affects his physical ability to perform daily tasks. The higher the degree of physical fitness of a person, the higher his physical abilities. In other words, the results of their work will be more productive if their physical fitness increases (Muhajir, 2007).

Physical condition is a unified whole of components that cannot be separated, either improvement or maintenance (Kukuh, 2016). The aspect of physical condition is the most important part in all sports which have the basic components of strength, speed, endurance and flexibility. This aspect is to support other aspects such as technique, tactics and mentality. Physical condition is very decisive in supporting the athlete's task in the match so that they can perform optimally. The physical condition training program must be well planned and systematic and aimed at improving the physical fitness and functional abilities of the body systems so as to enable athletes to achieve good performance.

According to Setiawan (2005), athletes who have a good level of physical fitness will avoid possible injuries that usually occur if someone does heavy physical work. If a person has a good physical condition then he is able to perform physical tasks without experiencing excessive fatigue. Physical conditions are very supportive of athletes in competing, so that in competitions athletes do not experience significant fatigue and will avoid injuries that can interfere with their appearance.

Biomotor abilities, agility and power, are abilities that consist of several components of other physical conditions. Agility biomotor ability is a combination of speed, balance and flexibility, while biomotor ability power is a combination of strength and speed.

Sports that require excellent physical and biomotor abilities make sports an activity that is often done by men. But in recent years this has been forgotten, women who usually have a feminine nature now have the freedom to do sports. Good exercise for fitness, health and achievement. This is evidenced by the large number of female athletes who are able to contribute achievements to make their region and even their country proud. The biomotor ability which is the dependent variable will be measured for its effect by

conducting training or treating it using the method plyometric itself. This is because some athletes treat sports using new types of exercises or methods that have been popular in the world of increasing physical ability in recent years, namely the method plyometric varies so that athletes do not feel bored. Birri (2020) Sports and Health Physical Education (Penjasorkes) is a means of encouraging the development of motor skills, physical abilities, knowledge, sportsmanship, habituation of healthy lifestyles and character building (mental, emotional, spiritual and social) in order to achieve the goals of the national education system. Types of exercises plyometric high hurdle jump and forward and lateral hurdle jump are two types of exercises plyometric but different implementation. Sports and Health Physical Education is a learning process through physical activities where each student is obliged to do physical activities to improve his physical fitness (Novianti, 2020).

In principle, exercises plyometric use an initial stretch in the muscle quickly before extrinsic muscle contraction in the same muscle. The training method plyometric needs a study of the muscles, the dose of exercise which includes the training load, the number of sets, rhythm, repetition and recovery. Because these elements are very influential in determining the goal of achieving an exercise to increase agility and power leg muscle.

This training method plyometric has a variety of basic sports movements that can be given to learning and training to improve agility and power leg muscle. Learning and training are activities programmed in an instructional design, to make children learn and practice actively which emphasizes the provision of learning resources. Therefore, it is necessary to provide learning resources and human resources who are able to provide material on the training method plyometric. However, special strategy efforts are needed so that the learning and training process can run well in order to achieve the goals set.

This study was designed with the aim of building on previous results. The novelty in this research is in the Poomsland study, (2015) Effects of 4-week Plyometric Training on Speed, Agility, and Leg Muscle Power in Male University Basketball Players: A Pilot Study. The purpose of this research that is to compare the effect of training plyometric on Speed, Agility, and Leg Muscle Power in basketball athletes.

Based on the above background, I want to know the scientific answer from the comparison of the two types of exercises plyometric on improving the results of physical performance of power and agility, so the researchers took the research title "Influence Of exercise High Hurdle Jump and Forward and Lateral Hurdle Jump on Increasing Lead strength and Power Muscle".

II. Research Methods

This study uses experimental quantitative. The approach in this study is the none equivalent (pretest and post-test) control group design. According to Sriundy (2015: 201) where this design consisted of groups A and B as the experimental group and group C as the control group which were selected without random determination. This study used male students. Therefore it is necessary to take a sample using a random sampling technique. Where according to Maksum (2009:41) random sampling is a technique where all individuals have the same opportunity to be sampled. The sample in this study were male students, totaling 30 students.

The technical analysis of the data used was Calculation of normality of the data in this study using Kolmogorov Smirnov Z. The homogeneity test of variance was carried out to determine whether or not the data collected was homogeneous. In the assessment of the homogeneity of variance test using Leven's test with a significance level of 5%.

Hypothesis testing using t-test using the program SPSS 23, namely by comparing the mean between group one and group two. The level of significance used is 5%. Sopiudin Dahlan (2010: 69) After that, it was continued with a difference test between two or more populations which was used to determine whether the samples taken had uniform variances or not (Nisfiannoor, 2009: 92). The test in this study used One Way ANOVA with the help of the application program IBM SPSS Statistics 23 for Windows.

III. Results and Discussion

3.1 Results

Results of the study will discuss the relationship between the independent variables and the dependent variable. The independent variables consist of exercises *High Hurdle Jump* and *Forward and Lateral Hurdle Jump*, while the dependent variable is strength and *power* leg muscle. Data analysis was carried out in two forms, namely descriptive data analysis and inferential data analysis used to answer research hypotheses.

a. Descriptive Data

After the measurements were made, the data obtained from the research on the strength and *power* of the leg muscles in each group was as follows:

1. Strength

Table 1. Strength

	<i>High Hurdle Jump</i>		<i>Forward and Lateral Hurdle Jump</i>		Kontrol	
	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>
Mean	87,25	93,18	88,13	93,46	89,06	90,52
Min	75	78,41	72,5	80,8	70,55	72,43
Max	121	130,38	101,5	103,21	134,21	135,66
SD	13,53	14,95	9,92	7,43	18,34	18,3

From the table above, the results of the group research *High Hurdle Jump* have a pre-test average of 87.25 kg, standard deviation of 13.53 with the lowest value of 75 kg and the highest value of 121 kg, while the post-test of 93.18 kg with a standard deviation 14.95 with the lowest value of 78.41 kg and the highest value of 130 kg. The *Forward and Lateral Hurdle Jump* group had a pre-test mean of 88.13 kg, a standard deviation of 9.92 with the lowest value of 72.5 kg and the highest value of 101.5 kg, while the post-test was 93.46 kg with a standard deviation 7.43 with the lowest value of 80.8 kg and the highest value of 103.21 kg. The control group had a pre-test mean of 89.06 kg, a standard deviation of 18.34 with the lowest value of 70.55 kg and the highest value of 134.21 kg, while the post-test of 90.52 kg with a standard deviation of 18.3 with a the lowest value was 72.43 kg and the highest value was 135.66 kg.

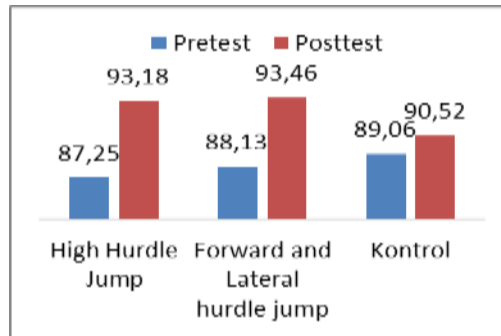


Figure 1. Graph of Strength Results

In the graph above there is an increase in strength in all groups. The group *High Hurdle Jump* experienced an increase of 6.79%, the *Forward and Lateral Hurdle Jump* group experienced an increase of 6.04%, and the control group experienced an increase of 1.63%.

2. Power

Table 2. Power

	<i>High Hurdle Jump</i>		<i>Forward and Lateral Hurdle Jump</i>		Kontrol	
	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>
Mean	49,8	52,9	51,9	55,8	48,6	49,8
Min	43	43	42	48	32	33
Max	56	59	62	65	58	60
SD	4,91	4,84	5,93	4,87	6,85	7,14

From the table above, the results of the group research *High Hurdle Jump* have a pre-test average of 49.8 cm, a standard deviation of 4.91 with the lowest value of 43 cm and the highest value of 56 cm, while the post-test of 52.9 cm with a standard deviation 4.84 with the lowest value of 43 cm and the highest value of 59 cm. The *Forward and Lateral Hurdle Jump* group had a pre-test mean of 51.9 cm, a standard deviation of 5.93 with the lowest value of 42 cm and the highest value of 62 cm, while the post-test was 55.8 cm with a standard deviation of 4.87 with a the lowest value is 48 cm and the highest value is 65 cm. The control group had a pre-test mean of 48.6 cm, a standard deviation of 6.85 with the lowest value of 32 cm and the highest value of 58 cm, while the post-test was 49.8 cm with a standard deviation of 7.14 with the lowest value of 33 cm. and the highest value is 7.14 cm.

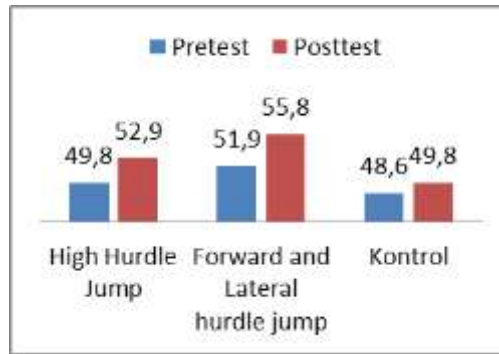


Figure 2. Graph of Strength Results

In the graph above, there is an increase *power* in leg muscle in all groups. The group *High Hurdle Jump* experienced an increase of 6.22%, the *Forward and Lateral Hurdle Jump* group experienced an increase of 7.51%, and the control group experienced an increase of 2.46%.

b. Hypothesis

There are two conditions to test the hypothesis, these conditions are that the data must be normally distributed and the data must be homogeneous. Then the test of normality and homogeneity must be done first.

1. Normality Test

The calculation of the normality test is intended to determine whether the variables in the study have a normal distribution or not. The calculation of this normality test uses the formula *Kolmogorov-Smirnov Z*, with processing using the SPSS 23 computer program.

Table 3. Normality Test *Kolmogorov-Smirnov Z*

	<i>High Hurdle Jump</i>		<i>Forward and Lateral Hurdle Jump</i>		Control	
	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>	<i>Pre Test</i>	<i>Post Test</i>
Power	0,200	0,179	0,200	0,145	0,024	0,019
<i>Limb Muscle Strength</i>	0,200	0,200	0,200	0,200	0,078	0,83
Information	Normal	Normal	Normal	Normal	Normal	Normal

From the results of the table above, it can be seen that the data for all variables has a value of p (Sig.) > 0.05 , so all variables are normally distributed. Since all data are normally distributed, the analysis can be continued with parametric statistics.

2. Homogeneity Test

The homogeneity test is useful for testing the similarity of the sample, namely uniform or non-variant taken from the population. The homogeneity rule if $p > 0.05$, then the test is declared homogeneous, if $p < 0.05$ then the test is said to be inhomogeneous. The results of the homogeneity test of this study can be seen from the following table.

Table 4. Homogeneity Test

	Levene Statistik	df1	df2	Sig.	Information
Power	0,929	2	27	0,407	Homogen
Limb Muscle Strength	0,148	2	27	0,863	Homogen

From these results, it can be seen that the table *test of Homogeneity of Variances* for the strength value has a sig value. $p 0.407 > 0.05$ and the value *power* of leg muscle has a sig value. $p 0.863 > 0.05$, so the data is homogeneous.

3. Hypothesis Test

To prove the truth of the hypothesis that has been proposed, a hypothesis test will be carried out. Hypothesis testing using inferential in the form of T-Test of the same sample and one-way ANOVA.

4. Similar sample T-Test (*Paired Sample T-Test*)

In this analysis, the presence or absence of differences in similar samples will be tested. The decision making of this test is the probability of error = 0.05, H_0 is accepted if the value of sig. > 0.05 , then between the variables of strength or *power* there is no significant difference before and after doing the exercise, H_0 is rejected if the value of sig. < 0.05 , then between the strength and variables *power* there is a difference before and after exercise.

Table 5. T-Test Results

Paired Samples Test			
High Hurdle Jump		Sig. 2-tailed	Keterangan
Power	<i>Pre test_Kek – Pos test_Kek</i>	0,000	Different
Limb Muscle Strength	<i>Pre test_POT – Pos test_POT</i>	0,000	Different
Forward and Lateral Hurdle Jump			
Power	<i>Pre test_Kek – Pos test_Kek</i>	0,000	Different

<i>Limb Muscle Strength</i>	<i>Pre test _POT – Pos test _POT</i>	0,000	Different
Control			
Power	<i>Pre test _Kek – Pos test _Kek</i>	0,013	Simmilar
<i>Limb Muscle Strength</i>	<i>Pre test _POT – Pos test _POT</i>	0,090	Simmilar

In the table there are T-Test calculation results for similar samples, the group *high hurdle jump*, the variable strength and *power* leg muscle have sig. <0.05 has the meaning of rejecting Ho, then there between strength and *power* leg muscle before and after doing the exercise *high hurdle jump* is a significant difference. the *forward and lateral hurdle jump group*, the variable strength and *power* leg muscle had sig. <0.05 has the meaning of rejecting Ho, then there between the strength and *power* of the leg muscles before and after doing the exercises *forward and lateral hurdle jump* is a significant difference. The control group for the variable strength and *power* leg muscle had sig results. > 0.05 has the meaning of accepting Ho, then between the strength and *power* of the leg muscles before and after doing control exercises there are significant similarities.

5. (One-way ANOVA One Way ANOVA)

To find out the difference in variation that arose due to several interactions from the three groups, the ANOVA test was carried out. Determination of the decision in the analysis is the value of the error rate = 0.05, Ha is rejected if the *p* value > 0.05 then between the three types of exercise on the strength or *power* of the leg muscles is the same, Ha is accepted if the *p* value < 0.05 then between the three the type of exercise on strength and *power* leg muscle has a significant difference.

Table 6. The Results of the One-way ANOVA

ANOVA			
Kekuatan		Sig.	Keterangan
Selisih	<i>Between Groups</i>	0,880	Ha ditolak (sama)
Power Otot Tungkai		Sig.	Keterangan
Selisih	<i>Between Groups</i>	0,082	Ha ditolak (sama)

Based on the table above, the variable strength and *power* leg muscle get sig. > 0.05 thus rejecting Ha, it can be concluded that between the three exercises the strength and *power* of the leg muscles are significantly the same.

3.2 Discussion

Purpose of this study was to determine whether there was a significant effect of giving methods of training *high hurdle jump* and *forward and lateral hurdle jump*

on strength and *power* leg muscle. The subjects in this study were students of SMK Al-Furqon. SMK Al-Furqon students were chosen as research subjects because in a study conducted, especially experimental research, they were often found in male research subjects. The selection of male students is also because the student is a class X student at SMK Al-Furqon. Then the data obtained will be able to become a benchmark for students, coaches and teachers to measure and use the applied training method, because in this study using three groups, namely the group *high hurdle jump*, *forward and lateral hurdle jump* and the control group.

a. Group (*High Hurdle Jump*)

In the group, the *high hurdle jump* variable strength and *power* leg muscle had sig. <0.05 with the meaning of rejecting H_0 , then there is a significant difference between strength and *power* leg muscle before and after doing the exercise *high hurdle jump*. Subjects in the group *high hurdle jump* performed an exercise that started with the initial stance of parallel feet behind the goal after which they made a forward jump until they passed 6 hurdles, back and forth for 2 minutes. These instructions are intended to maximize the height of the jump with limited time and ground (Gehri, et al, 1998).

Improving the biomotor ability strength and fast strength *power* of leg muscle requires the development of training and *output* high power, this is because strength and *power* leg muscle is a movement that is able to support the body in order to change direction with these biomotor components. exercise *High hurdle jump* is a method of plyometric exercise that increases the eccentric strength of the thigh muscles, a common component in deceleration phase changes or speed reduction.

Nervous adaptation and increased muscle performance are other mechanisms that can lead to increased ability when performing tests *power* (Thomas, France, 2003) & Philip, 2009; Miller, et al., 2006). Maximum and explosive movement in the knee and ankle joints overall movement support the results of previous studies that plyometric performance can significantly increase *power* lower extremity (Ashley & Weiss, 1994; Sheppard et al., 2008; Vanezis & Lees, 2005).

Based on the results of the research and discussion, it was found that the exercise was *high hurdle jump* able to increase the biomotor ability and *power* leg muscle for the students of SMK AL-FURQON DRIYOREJO.

b. Group (*Forward and Lateral Hurdle Jump*)

In the group *forward and lateral hurdle jump*, the variable strength and *power* leg muscle has sig. <0.05 with the meaning of rejecting H_0 , then there is a significant difference between the strength or *power* of the leg muscles before and after doing the exercises *forward and lateral hurdle jump*.

The principle in performing the method *forward and lateral hurdle jump* forward is to jump and sideways. In this movement, the exercise begins with the starting position of the feet parallel to the back of the goal, then jumps forward and sideways until they pass 6 goals, back and forth for 2 minutes.

Plyometric training is widely used to improve the ability of skeletal muscles to generate power. This method involves a series of repetitive movements each consisting of a rapid change of body direction, followed immediately by a brief transitional phase and rapid acceleration in the opposite direction. This rapid combination of extrinsic and concentric muscle activity involves repeated *stretch-shortening cycles* (SSCs), which provide physiological benefits because the muscle strength developed during the concentric phase is amplified by previous extrinsic actions (Tofas et al., 2008;

Chatzinikolaou, et al. , al, 2010). The biomotor ability strength and *power* of leg muscle increases due to movement with acceleration in the opposite direction which will increase the muscle's ability to reduce movement and make the muscles stronger to support the body.

Forward and lateral hurdle jumps from plyometric exercises increase the speed of concentration from the extrinsic phase to the concentric phase (Honoshia, 1984). Therefore the strength and height of the vertical jump are increased. The ability to jump is increasing, supported by the ability of the muscles to perform movements *explosive* so strength and *power* that the resulting leg muscle will be able to increase.

c. Differences in the Effect of the Exercise *High Hurdle Jump* and *Forward and Lateral Hurdle Jump*

Based on the results of the analysis that has been done, it is found that the variable strength and *power* leg muscle has a sig value. > 0.05 with the meaning rejected H_0 . So it can be concluded that there is no significant difference between the three exercises on strength and *power* leg muscle.

Plyometric training methods or those that use the principle of eccentric and concentric muscles have an influence in increasing jump results (Kashmira, 2011). However, in the research that has been done, there are significant similarities. The results of the training programs *high hurdle jump* and *forward and lateral hurdle jump* are significantly more effective for increasing strength and *power* leg muscle. The principle of different treatment with the same principle of movement is the reason why there is a significant similarity in increasing the strength and *power* of the leg muscles.

The training duration of 16 meetings was chosen because it is known that muscle adaptation can occur within a certain time span (Miller, et al., 2006; McClenton, Brown, Coburn, & Kersey, 2008; Thomas, et al., 2009). In accordance with research conducted, the selection of exercises for 16 meetings was able to improve the performance of the lower extremities.

Another thing that must be considered in training with the plyometric method is the effect of plyometric training on muscle performance on the nature of the surface during training. The implementation of plyometric training in an aquatic environment with the same training method in improving muscle performance was later observed to be able to induce pain than plyometric training on a hard surface (Robinson, Décor, Merrick, & Buckworth, 2004; Arazi & Asadi, 2011; Arazi, et al. , 2012).

So the results of the research that has been done found that the exercises *high hurdle jump* and *forward and lateral hurdle jump* can increase the biomotor ability strength and *power* of leg muscle by having the same effect.

IV. Conclusion

Based on the results of the research and discussion described in the previous chapter, some conclusions can be drawn as follows:

1. The exercise *high hurdle jump* has a significant increase strength and *power* in leg muscle in SMK Al-Furqon Driyorejo students.
2. Exercises *Forward and lateral hurdle jump* have a significant increase strength and *power* in leg muscle in SMK Al-Furqon Driyorejo students.
3. There are similarities in the results of the research conducted between the *high hurdle jump*, *forward and lateral hurdle jump* groups and the control group on increasing strength and *power* leg muscle.

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