

The Effect of Single Leg Hurdle Hops and Alternate Jump Plyometric Exercises on the Speed of the Front Kick at the PSP Club (Pencak Silat Prestasi) Pekalongan City

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Abstract

The purpose of this study was to analyze whether plyometric single leg hurdle hops and alternate jump had an influence on front kick speed. This is a quasi-experimental study using a Non-Randomized Pre-Post-Control Group Design. The population comprises 33 participants, while the sample comprises 33 participants. Saturated sampling was used to collect data. This study's instrument was a front kick speed test (johansyah lubis). The paired sample t test was used to analyze the data, followed by the ANOVA test, all performed using the SPSS (Statistical Program for Social Science) 22.0 computer program. The paired sample t test results for single leg hurdle hops and varying jump speeds for right and left front kicks indicate that the significance level for each variable is $\text{sig } 0.000 < 0.05$. ANOVA indicates that single leg hurdle hops have a plyometric effect on the right foot. $F_{\text{count } 90.452} > F_{\text{table } 4.46}$ and $F_{\text{count } 151.111} > F_{\text{table } 4.46}$, plyometric alternate jump with right leg $F_{\text{count } 63.380} > F_{\text{table } 4.46}$ with left leg $F_{\text{count } 93,389} > F_{\text{table } 4.46}$, it can be concluded that there is a statistically significant difference in the results of single leg hurdle hops and alternate front kick speed jumps across three different groups, with a significance level of $\text{sig } 0.05$. The results of the post-hoc multiple comparisons (LSD) test of independent variables that have a significant effect on increasing the dependent variable showed that the single leg hurdle hops group achieved a right front kick speed of 5.454, while the left group achieved a speed of 6.181, indicating that single leg hurdle hops are more influential. Based on the analysis above, it can be concluded that each group of the single leg hurdle hops plyometric exercise group increases the speed of the right and left front kicks more than the alternate jump plyometric exercise group or the control group exercise.

Keywords

plyometric exercises; single leg hurdle hops; alternate jump exercises



I. Introduction

Pencak silat is an original self-defense derived from Indonesian culture. It incorporates an aspect of self-defense that already exists. Pencak silat is a fighting sport. The type of sparring in this pencak silat match comprises two fighters with varying angles; the most frequently used martial arts technique is the front kick. According to (Nugroho, 2020) at the time of the pencak silat match, the front kick technique has a 47%. The front kick is a single-foot attack; the trajectory is forward with the body facing forward; the impact is on the inside of the toes; the target is the solar plexus and chin (Lubis, 2016),

front kick uses the tip of the foot, the trajectory is forward, and the body position is facing forward, targeting the solar plexus or back (Rahayuni, 2014), to summarize, a front kick is a kick that uses one leg and trajectory forward by lifting the knee first to the level of the target. In order to develop an effective front kick technique, training is required; this training can take place in sports clubs or other locations. The PSP (Pencak Silat Presatasi) club is one place where a fighting class of pencak silat is held. This club is one of the pencak silat clubs in Pekalongan. There are issues with the speed of the front kick, namely the right front kick, where the category proper is 18% and the category less is 81%. While the left front kick was obtained in the 15% category and less than 85% category. Exercises using plyometrics can help you enhance your endurance, strength, speed, explosive power, and muscle elasticity. (Laksana et al., 2016) Plyometric exercises are taught to stimulate various changes in the neurological system of muscles, strengthen muscular groups, and train them to respond more quickly and forcefully to brief and rapid variations in muscle length (Zakaria et al., 2018). Plyometric exercises show the full strength characteristics of muscle contractions with a very fast response so that during working muscles there is no time to relax (Makadada, 2020). In conclusion, plyometric exercise is a type of exercise designed to improve physical quality, particularly the speed and strength of muscle contractions needed to accelerate the front kick. Plyometrics such as single leg hurdle hops and plyometric alternate jumps are ideal for increasing the speed of front kicks since the form of movement is jumping forward with one leg and the shape of the movement is similar to that of the front kick. Single leg hurdle hops are a plyometric exercise that can improve the speed of the front kick. The single hurdle hops training method employs a series of hurdles and barriers ranging in size from (12 to 36 inches or 30.48 cm to 94.44 cm) set up successively (Pujiarti, 2015). This plyometric single leg hurdle hops exercise is performed by standing on one leg and jumping to the maximum height possible. The alternate jump exercise is a type of plyometric exercise that is excellent for improving physical abilities, particularly speed and strength. This exercise begins with one leg (right) up in front and is lifted high before landing on the other leg (left). Both types of exercise will be evaluated for their effect on the front kick's speed. The author makes the assumption that plyometric single leg hurdle hops and plyometric alternate jump have a positive influence on the speed of the pencak silat front kick. In the jump serve, the starting position varies depending on the player, the start of the jump serve is generally done around 3 meters (Janah, 2021). Thus, it is envisaged that this research will contribute to the enhancement of fighters' regional and national achievements.

II. Research Method

In this type of research, the researcher uses quantitative research methods. The approach used in this study is a quasi-experimental research design using the "Non-Randomize Pre-Test Post Test Control Group Design" design".

Table 1. Research Design Non-Randomize Pretest Post Test Control Group Design

T1 ₁	X ₁	T2 ₁
T1 ₂	X1 ₁	T2 ₂
T1 ₃	-	T2 ₃

Source: Maksum (2012)

Information:

- T1₁ : Group 1 Pretest Treatment 1, Front kick speed test
- T1₂ : Group 2 Pretest Treatment 2, front kick speed test
- T1₃ : Group 3 Pretest without treatment, front kick speed test
- X1 : Plyometric Single leg hurdle hops Exercise
- X2 : Plyometric Alternite jump Exercise
- : Conventional Exercise
- T2₁ : Group 1 Posttest Treatment 1, Front kick speed test.
- T2₂ : Group 2 Posttest Treatment 2, front kick speed test.
- T2₃ : Group 3 No treatment, front kick speed test.

The pre-test is used for the first measurement, and the post-test or final test is used for the second measurement. A pre-test is used to collect sample data prior to training, and a post-test is used to collect data after training. This study included all 33 members of the Pekalongan City PSP (Pencak Silat Achievement) club. The sample for this study comprised 33 aged 15–17-year-old members of the PSP (Pencak Silat Achievement) club in Pekalongan City. 1) The sampling technique used to determine the population, 2) Selecting and determining the sample, 3) Dividing the sample into three groups, 4) Conducting initial tests, 5) Conducting training, 6) Conducting final tests, 7) Obtaining data, 8) Analyzing data and testing hypotheses, and 9) Drawing conclusions. This research uses saturated sampling, which is a technique in which the entire population is used as a sample (Sugiyono, 2015). The data analysis used is the paired sample t test to test whether there is an effect or not the treatment given and the analysis of variance test (ANOVA) with significance = 0.05. To test the difference, if the ANOVA results show a significant difference, the next step to find out which one is better is a post hoc multiple comparisons test using Least Significant Difference (LSD). To meet the assumptions in the ANOVA technique, a normality test and a homogeneity test of variance are carried out (Sudjana, 2005). The normality test was used to verify whether the data in a study were drawn from a normally distributed sample. The homogeneity test is used to determine whether each group's variance is homogeneous.

III. Discussion

The following are the findings from the research, which were based on the front kick speed test (Johansyah Lubis) performed on the experimental group I, experimental group II, and control group. This chapter will describe the data, the conditions for testing the hypothesis, and the outcome of the hypothesis testing. The data will be presented as front kick speed test results prior to (pretest) and following (posttest) treatment for each group, which includes: group I single leg hurdle hops, group II alternate jump, and group III control. The research was conducted on 33 members of the PSP club (Pencak Silat Prestasi) in Pekalongan City, who were divided into three groups of 11 members each.

3.1 Experiment Group I Exercise (Single leg hurdle hops)

Pre- and post-test data for front and left kick speeds were collected during the single leg hurdle hops exercise; data comprised the average mean, maximum value, minimum value, and standard deviation.

Table 2. Description of group data 1

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Pretest kanan	11	15.81	1.32	13	18
Posttest kanan	11	20.63	1.36	18	23
Pretest kiri	11	14.90	1.13	13	17
Posttest kiri	11	21.09	1.22	19	23

The results of the single leg hurdle hops group exercise enhanced the average front kick speed, as shown in Table 2. This is proven by the pretest and posttest data, which show an increase in the speed of the right front kick from 15.81 to 20.63 and an increase in the speed of the left front kick from 14.90 to 21.09.

3.2 Experiment Group II Exercise (Alternate jump)

Pre- and post-test data on the speed of the right and left front kicks were collected during the alternate jump exercise. The data set contains the mean, maximum and minimum values, as well as the standard deviation.

Table 3. Description of Group Data 2

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Pretest kanan	11	15.09	1.36	13	17
Posttest kanan	11	18.72	1.00	17	20
Pretest kiri	11	14.81	0.98	13	16
Posttest kiri	11	18.54	0.82	17	20

Table 3 shows that the results of the alternate jump group exercise increased the average front kick speed. This can be seen from the pretest and posttest data, the speed of the right front kick which was originally 15.09 to 18.72 and the speed of the left front kick which was originally 14.81 to 18.

3.3 Without Exercise Control Group III

In the control group, pretest and posttest data were obtained for both right and left front kick speed. The data includes the mean, maximum value, minimum value and standard deviation.

Table 4. Description of Group Data 3

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Pretest kanan	11	15.27	1.27	13	17
Posttest kanan	11	17.36	1.28	15	19
Pretest kiri	11	15.18	1.16	14	17
Posttest kiri	11	17.45	1.29	16	20

Table 4 shows that the results of the control group experienced an increase in the average front kick speed. This can be seen from the pretest and posttest data, the speed of the right front kick which was originally 15.27 to 17.36 and the speed of the left front kick which was originally 15.18 to 17.45.

3.4 Hypothesis Testing Terms

Following the description of the research data, the next step is to test for normality and homogeneity prior to testing the hypothesis. The objective is to ascertain the data's normally distributed and homogeneous.

a. Normality Test

In this study, the normality test was performed using Kolmogorof Smirnov; if the p-value is greater than 0.05, the data is considered to be normally distributed. The data tested include studies on increasing front kick speed, specifically from the single leg hurdle hops group (K1), the alternate jump exercise group (K2), and the control group.

Table 5. Normality Test

	Metode Latihan Plyometric					
	Single leg hurdle hops		Alternite jump		Kontrol	
	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri
Sig	.200	.200	.200	.191	.200	.200
Ket	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
Status	Normal	Normal	Normal	Normal	Normal	Normal

According to the data in Table 5, the normality test for the research data on increasing the speed of the right and left front kicks obtained from the single leg hurdle hops (K1) exercise group obtained significant values all greater than p-value 0.05, indicating that the data is normally distributed; the alternate jump exercise group (K2) obtained significant values all greater than p-value 0.05, indicating that the data is normally distributed.

b. Homogeneity Test

The homogeneity test was conducted in this study using the Lavene Test in the SPSS program on the mean different data from each group. If the statistical value greater than 0.05, the data have homogeneous variance.

Table 6. Homogeneity Test

	Metode Latihan Plyometric											
	Single leg hurdle hops				Alternite jump				Kontrol			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri
	df1	df2	df1	df2	df1	df2	df1	df2	df1	df2	df1	df2
	1	20	1	20	1	20	1	20	1	20	1	20
Sig	.782	.080	.053	.843	.053	.115						
Ket	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05						
Status	Homogen	Homogen	Homogen	Homogen	Homogen	Homogen						

Table 6 shows that the significant value for all data is greater than 0.05, it can be assumed that the data are homogeneous once it is established that the generated data is normally distributed and homogeneous, the research data can be used for further study.

c. Hypothesis Test

When evaluating the hypothesis of different dependent variables on paired samples, the t-test analysis is used, which is referred to as the paired t-test in SPSS. While using analysis of variance (ANOVA) to test the hypothesis of different dependent variables between groups.

d. Paired Sample t Test Results

The table below summarizes the findings of the t-test conducted in each group:

Table 7. Paired Sample Mean Difference Test (Paired Sample t Test)

<i>Paired Sampel Test</i>					
Kelompok	Tendangan Depan	Tes	Mean	t	Sig. (2tailed)
K1	Kanan	<i>Pretest</i>	5.454	34.641	.000
		<i>Posttest</i>			
	Kiri	<i>Pretest</i>	6.181	34.000	.000
		<i>Posttest</i>			
K2	Kanan	<i>Pretest</i>	3.363	22.112	.000
		<i>Posttest</i>			
	Kiri	<i>Pretest</i>	3.727	19.116	.000
		<i>Posttest</i>			
K3	Kanan	<i>Pretest</i>	2.090	12.857	.000
		<i>Posttest</i>			
	Kiri	<i>Pretest</i>	2.272	16.137	.000
		<i>Posttest</i>			

According to table 7, the level of significance for each variable is sig <0.05, indicating that there is a significant effect or difference between the pretest and posttest values for the dependent variable (front kick speed) in each of the experimental groups I, II, and III. Thus, it may be inferred that there is a difference between those who received a single leg hurdle hop exercise program, alternate jump exercise program, and in control group.

e. ANOVA Test Results

The data used in the different test were the mean differences between the three groups tested collectively. The difference test was conducted in this study using the Anova test (F), and the purpose was to discover whether there were differences in the mean different results for each group simultaneously. The results are listed in the table below.

Table 8. Analysis of Variance (ANOVA) Test

VARIABEL	Kelompok	Tendangan Depan	F	Sig
Kecepatan Tendangan	Single leg hurdle hops	Kanan	90.452	0.000
		Kiri	151.111	0.000
	Altermite jump	Kanan	63.380	0.000
		Kiri	93.389	0.000
	Kontrol	Kanan	14.694	0.001
		Kiri	18.713	0.000

According to the results in the table above, the Anova Test has a significant value of sig <0.05 for front kick speed. As a result, significant differences in kick speed findings exist between the three groups.

As a result of the difference in influence between the three groups, the data analysis can be continued using the post hoc multiple comparisons test with Least Significant Difference (LSD) analysis in the SPSS series 22.0 program. This test is used to determine which independent variables have a significant effect on the increase in the dependent variable.

Table 9. Post Hoc Multiple Comparisons Least Significant Difference (LSD) Test

VARIABEL	(I)	(J)	Mean Diference (I-J)	Sig	95% Confidence Interval		
					Lower bound	Upper bound	
Kecepatan Tendangan Depan Kanan	<i>single leg hurdle hops</i>	<i>alternite jump</i>	2.091	0.000	1.64	2.55	
		kontrol	3.364	0.000	2.91	3.62	
	<i>alternite jump</i>	<i>single leg hurdle hops</i>	2.091	0.000	2.55	1.64	
		kontrol	1.272	0.000	0.82	1.73	
	kontrol	<i>single leg hurdle hops</i>	3.364	0.000	3.82	2.91	
		<i>alternite jump</i>	1.272	0.000	2.73	0.82	
	Kecepatan Tendangan Depan Kanan	<i>single leg hurdle hops</i>	<i>alternite jump</i>	2.455	0.000	1.95	2.96
			kontrol	3.909	0.000	3.41	4.41
<i>alternite jump</i>		<i>single leg hurdle hops</i>	2.455	0.000	2.96	1.95	
		kontrol	1.455	0.000	0.95	1.96	
kontrol		<i>single leg hurdle hops</i>	3.909	0.000	4.41	3.41	
		<i>alternite jump</i>	1.455	0.000	1.96	0.95	

According to table 9, there is a significant difference in mean difference on the right and left front kick speed variables between the single leg hurdle hops group, the alternate jump group, and the control group. According to these findings, the single leg hurdle hop exercise has a greater influence on the speed of the right and left front kicks than the alternate jump exercise or the control group.

V. Conclusion

It is important to understand the most effective training methods for increasing front kick speed. The results of the analysis using the ANOVA test on the mean of the three separate exercises of single leg hurdle hops, alternate jump, and control group obtained sig <0.05, indicating a significant difference in the speed of the right and left front kicks in the three different groups. The Pos Hoc LSD test revealed a difference in mean difference for the right and left front kick speed variables between the single leg hurdle hops, alternate jump, and control groups. According to these findings, the single leg hurdle hop exercise has a significant influence on the speed of the right and left front kicks than the alternate jump exercise or the control group. Comparing single leg hurdle jumps to alternative jump plyometric exercises.

There is a difference in the effect of the right and left front kicks, with the single leg hurdle hops exercise being better compared to the alternate jump exercise. This is because the single leg hurdle hops exercise results in increased muscle contraction in the legs, as opposed to the alternate jump exercise in muscle contraction. When theoretical investigations are conducted on the basis of "front kick speed, specifically a front kick with a high firing speed,"(Rahayuni, 2014). According to this theory, a fighter with a fast front kick can provide a significant advantage during a match.

Thus, when performing the movement, the leg muscle effort will be increased, making the single leg hurdle hop exercise more stressful on the leg muscles than the alternate jump exercise. The result is stress, since the leg muscles are worked harder during the hurdle hop exercise, resulting in a higher load on the leg muscles. Thus, the rise in speed of the right and left front kicks was different between the single leg hurdle hops and alternate jump exercises, with the single leg hurdle hops group experiencing an increase in leg muscles.

The findings of the training and mean test indicated that the single leg hurdle hop exercise had a greater effect on the speed of the right and left front kicks in participants of

the PSP (Pencak Silat Prestasi) club in Pekalongan City than the alternate jump exercise. This can be seen and analyzed in the single leg hurdle hops exercise process, which involves repeatedly jumping over parallel hurdles while supporting the body weight on one leg, and results in improved muscle functional adaptation and muscle coordination, whereas the alternate jump exercise is a little easier because there are no obstacles. According to the posthoc test results, there is a significant difference in the effect of single leg hurdle hops and alternate jump exercises on the speed of the right and left front kicks in participants of the PSP (Pencak Silat Prestasi) club in Pekalongan City. This is consistent with the findings of a study done by (Satria et al., 2021) that when plyometric exercises are used to increase kick speed, it adds to increased performance by concurrently increasing kick speed and motion awareness. In line with the research findings (Maćkała et al., 2021) that plyometrics can help the individual improve their speed, jumping ability, leg muscular strength, and power.

Thus, the single leg hurdle hops group outperforms the alternate jump and control groups, as the single leg hurdle hops movement jumps forward or forwards through the goal with one leg that does not alternate as a pedestal, whereas the alternate jump performs a forward jumping motion with alternating legs as a support by analyzing the motion biomechanically and thus that is the big influence for the difference between the single leg hurdle hops group and the alternate jump and control group.

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