



The Effect Of Plyometric Training On The Improvement Of Leg Muscle Power In The Futsal Extracurricular Program At SMAN 5 Bandar Lampung

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Abstract

This study aims to determine the effect of plyometric training on increasing leg muscle power among futsal extracurricular students at SMAN 5 Bandar Lampung. This research employed an experimental method using a pretest-posttest control group design. The sample consisted of 22 students divided into two groups: an experimental group that received plyometric training and a control group that did not receive any treatment. The instrument used to measure leg muscle power was the Standing Broad Jump test. The data analysis showed a significant improvement in the post-test results of the experimental group compared to the control group. This finding is supported by statistical analysis, which showed a t-value of 4.060, greater than the t-table value of 2.086. Therefore, it can be concluded that plyometric training has a significant effect on increasing leg muscle power in futsal extracurricular students. This training is recommended as an effective method for physical development in school sports extracurricular activities.

Keywords: *Extracurricular, Futsal, Leg Muscle Power, Plyometric Training, Standing Broad Jump*

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INTRODUCTION

Sport is a physical activity that is carried out in a planned and regular manner, aiming to improve fitness, health, and body immunity (Wiasta, 2025). Sports are not only beneficial for maintaining mental health, but also teach important values such as sportsmanship, discipline, patience, accuracy, hard work, and teamwork (Siregar & Akbar, 2021). One type of sport that is popular among students is futsal. Futsal is a ball sport played by two teams, each consisting of five players. The development of futsal sports provides a positive impetus for schools in Indonesia to provide futsal field facilities that support the process of breeding and coaching young athletes. Extracurricular activities participated in by students are positive activities that have a direct impact on their development and are expected to improve student learning outcomes (Yani et al., 2020). These activities not only provide space for students to channel their interests and talents, but also become a forum for fostering achievements outside the academic

aspect. Futsal game techniques include aspects of individual skills, team tactics, and overall game strategy. This sport requires good mastery of basic techniques because of the narrow playing space and fast tempo of the game. futsal is not just about technical skills, but also about teamwork, strong mentality, and enthusiasm (Prabowo, 2024). The basic techniques in the game of futsal, namely the basic techniques of passing, control), chipping, dribbling, and shooting.

Some sports that require leg muscle power such as martial arts, basketball games, volleyball, soccer, futsal and others. In the context of futsal sports, leg muscle power has a major contribution to the implementation of basic techniques such as shooting. In futsal sports, there are a number of biomotor components that are very important for an athlete, including endurance, muscle strength, speed of movement, explosive muscle power, agility, body flexibility, and the ability to maintain balance. According to (Harsono, 2015), shooting is the act of kicking the ball towards the goal with the aim of scoring goals that require a combination of strength, speed, and the right technique. The shooting movement must first pay attention to the basic movements which are in the initial attitude, implementation and further movements and must pay attention to the position of the feet, hands, body and head or view so that the results obtained in carrying out the movement become more optimal (Prakarsa & Umar, 2020). Effective shooting is not only determined by the accuracy of the ball's direction, but also by the power of the kick generated from powerful leg muscles. Therefore, the development of leg muscle power is an important aspect in improving the shooting performance of futsal players.

Leg muscle power is the ability of the muscles in the legs to contract explosively in a short time, which is a combination of strength and speed of movement. According to (Bompa & Buzzichelli, 2019), power is the ability of muscles to produce maximum force in the shortest possible time, especially in activities that require an explosion of power, such as jumps or kicks. Leg muscles play an important role in supporting the upper body and are the main source of various movement activities, including ambulation or displacement. Speed combined with strength will produce power. Therefore, futsal players who have good leg muscle speed and strength will find it easier to kick and other movements that require explosive power. power is the result of a combination of strength and speed. In other words, strength and speed training need to be given first because both already include elements of power formation. Therefore, exercises that are focused on increasing power must emphasize the elements of speed and strength, one of which is through Plyometric training. In futsal training, increasing shooting

power generally involves technical exercises that focus on leg muscle control, accompanied by physical training. Plyometric is a type of exercise that involves explosive movements, such as jumps and fast pushes, which aim to increase muscle strength through a stretching phase followed by rapid muscle contraction. Plyometrics training in a study was shown to be able to improve the accuracy or accuracy of students in shooting (Mukti et al., 2023), especially in futsal sports. This is due to the increase in muscle strength, coordination, and explosive power obtained through regular plyometrics training. Plyometric exercise is one of the training methods that aims to increase leg muscle strength (Taufiq & Witarsyah, 2019). This is in line with the opinion (Anggraini, 2023) that plyometric exercise is very effective if used to increase muscle explosive power.

Based on the results of field observations and coordination conducted by the researcher with the extracurricular futsal coach at SMAN 5 Bandar Lampung, it was found that during the training activities, it was seen that every match played showed a low number of goals created. Based on observations and discussions with the coach, the main cause of this phenomenon is thought to stem from weak leg muscle power when dribbling, as well as the lack of kick power produced by students. In addition, the training program implemented has not been specifically designed to improve leg muscle strength, and the frequency of training that is not well scheduled is also an influencing factor. Therefore, this study aims to determine the effect of Plyometric training on increasing leg muscle power in futsal extracurricular students at SMAN 5 Bandar Lampung.

METHOD

This research uses methods using experimental methods. According to (Arikunto, 2014) states that experimentation is a way to find the cause - effect (causal relationship) between two factors that are deliberately caused. This study used the Pretest-Posttest Control Group Design research design for its research design. In the Pretest posttest control group design research design, the sample will be divided into two groups: the experimental group, namely the sample that receives treatment (treatment) and the control group, namely the sample will be tested before and after treatment. This study was conducted for 6 weeks and 16 meetings. The number of 16 meetings refers to the principle of effective physical training, where improvements in biomotor components such as explosive power can be achieved through a training program for at least 4-6

weeks (Bompa, 1994). This research was attended by extracurricular Futsal students of SMA Negeri 5 Bandar Lampung, totaling 22 people. The data obtained in this study were Pre-Test data for the control and experimental groups before the sample was given plyometric treatment, and Post-Test data for the control and experimental groups after the sample was given Plyometric treatment. The instrument used is the Standing Broad Jump. This test is a forward jump test performed without a prefix by students and aims to measure the explosive power (explosive power) of the leg muscles. Data is analyzed using the t-test formula, after a prerequisite test is carried out which includes normality test and homogeneity test. The standing board jump norms are as follows:

Table 1. Norms of Standing Broad Jump for SMA / SMK Students

No	Category	Male	Female
1	Excellent	>223	>177
2	Good	195-223	153-177
3	Medium	165-194	129-152
4	Less	136-164	104-128
5	Very poor	< 136	< 104

(Kemendikbud, 2023)

RESULTS AND DISCUSSION

Result

The data in this study were obtained through Pre-Test and Post-Test results to measure leg muscle power. Pre-Test to determine the initial ability of the sample and grouping the sample into two groups, namely the experimental group and the control group. After that, the experimental group samples were given treatment, namely Plyometric training for a certain period, while the control group was not given treatment. Furthermore, a Post-Test was conducted to determine the increase in leg muscle power.

Table 2. Descriptive Statistic of Experimental Group

Data	<i>Pre-Test</i>	<i>Post-Test</i>
Mean	147,91	193,18
Median	147	196
Modus	154	198
Std. Deviation	17,22	16,72
Minimum	126	166
Maximum	185	229

The table above shows that the average Pre-Test results of leg muscle power in the experimental group were 147.91, with a standard deviation of 17.22, a median of 147, a mode of 154, a maximum value of 185, and a minimum value of 126. Meanwhile, the Post-Test results of leg muscle power in the experimental group after being given Plyometric training treatment showed an increase with an average of 193.18, a standard deviation of 16.72, a median of 196, a mode of 198, a maximum value of 229, and a minimum value of 166.

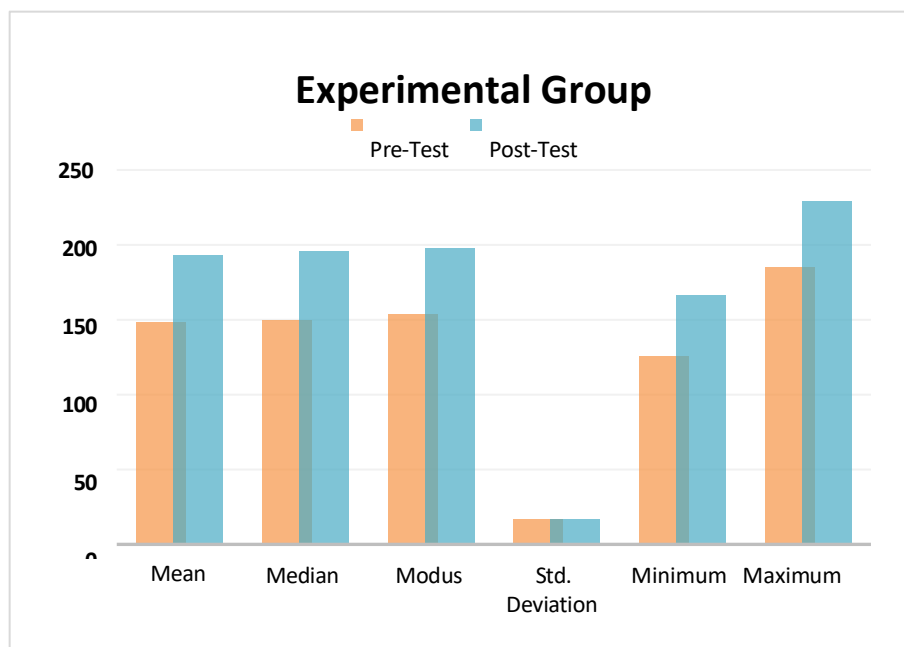


Figure 5. Bar Chart of Pre-Test and Post-Test Results for the Experimental Group

Table 3. Frequency Distribution of Limb Muscle Power Results of Experimental Group

Category	Skor	Frequency		Percentage	
		Pre-Test	Post-Test	Pre-Test	Post-Test
Excellent	>223	0	1	0%	9%
Good	195-223	0	5	0%	45%
Medium	165-194	1	5	9%	45%
Less	136-164	7	0	64%	0%
Very poor	< 136	3	0	27%	0%
Total		11	11	100%	100%

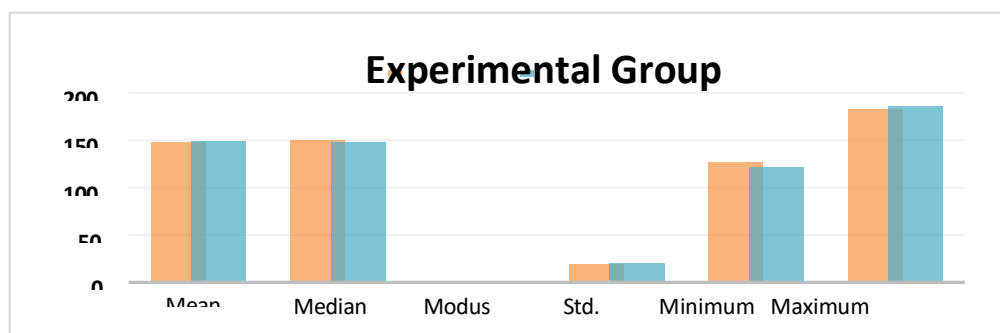
When displayed in the form of assessment norms, the results of leg muscle power in the experimental group who received Plyometric training are presented in table 3 above, showing that Pre-Test leg muscle power in the experimental group was in the “excellent” and “good” categories of 0% (0 people), the “moderate” category of 9% (1 person), ‘less’ by 64% (7 people), and “very less” by 27% (3 people). Post-Test results of leg muscle power in the experimental group after treatment, were in the “excellent” category by 9% (1 person), “good” by 45% (5 people), “moderate” category by 45% (5 people), ‘less’ and “very less” by 0% (0 people).

1. Results of the Pre-Test and Post-Test of the Control Group

Table 4. Descriptive Statistic of Control Group

Data	<i>Pre-Test</i>	<i>Post-Test</i>
Mean	148,55	149,64
Median	150	148
Modus	-	-
Std. Deviation	19,33	20,45
Minimum	127	122
Maximum	183	186

The table above shows that the average Pre-Test results of leg muscle power in the control group were 148.55, with a standard deviation of 19.33, a median of 150, a maximum value of 183, and a minimum value of 127. Meanwhile, the Post-Test results of leg muscle power in the control group after not being given Plyometric training treatment, showed results with an average of 149.64, a standard deviation of 20.45, a median of 148, a maximum value of 186, a minimum value of 122, and the data did not have a mode because no value appeared more than once.



Gambar 6. Diagram Batang Hasil *Pre Test* dan *Post Test* Kelompok Kontrol

Table 5. Frequency Distribution of Control Group Limb Muscle Power Results

Category	Skor	Frequency		Percentage	
		<i>Pre-Test</i>	<i>Post-Test</i>	<i>Pre-Test</i>	<i>Post-Test</i>
Excellent	>223	0	0	0%	0%
Good	195-223	0	0	0%	0%
Medium	165-194	2	2	18%	18%
Less	136-164	5	5	45%	45%
Very poor	< 136	4	4	36%	36%
Total		11	11	100%	100%

Based on the assessment norms in the table above, it shows that the Pre-Test results of leg muscle power in the control group are in the category of "very good" and "good" by 0% (0 people), "moderate" by 18% (2 people), "less" by 45% (5 people), and the category "very less" by 36% (4 people). And the Post-Test results of leg muscle power in the control group are in the category of "very good" and "good" by 0% (0 people), "moderate" by 18% (2 people), "less" by 45% (5 people), and the category "very less" by 36% (4 people).

Analysis Requirements Test

1. Normality Test

Table 6. Normality Test Results

Kelompok		L_{count}	L_{table}	Description
Experiment Group	<i>Pre Test</i>	0,158	0,249	Normal
	<i>Post Test</i>	0,205	0,249	Normal
Control Group	<i>Pre Test</i>	0,187	0,249	Normal
	<i>Post Test</i>	0,170	0,249	Normal

The Normality Test aims to test whether the data is normally distributed or not. Good data is to have a normal or near normal data distribution. Based on table 6 of the normality test results with the Liliefors Test above, it is known that the experimental group Pre-Test variable data shows that the $L_{hitung} = 0.158 < L_{tabel} = 0.249$, and the Post Test variable data shows the $L_{hitung} = 0.205 < L_{tabel} = 0.249$. While the control group Pre-Test variable data shows that the

Lhitung = 0.187 < Ltabel = 0.249, and the Post-Test variable data shows the Lhitung = 0.170 < Ltabel = 0.249. Because all Lcount < Ltabel values, it can be concluded that the data in both groups, both experimental and control, are normally distributed. Thus, the residual data in the model has met the assumption of normality and is suitable for further parametric statistical analysis.

2. Homogeneity Test

Table 7. Homogeneity Test Results

Variabel	F _{count}	F _{table}	Description
Experiment Group	1,061	2,978	Homogen
Control Group	1,119	2,978	Homogen

The homogeneity test is carried out to obtain information on whether the two sample groups have homogeneous variances or not. Based on the homogeneity test results, from table 7 above, it is known that the Pre-Test and Post-Test variable data of the experimental group shows the value of Fhitung = 1.061 < Ftable = 2.978, and the Pre-Test and Post-Test variable data of the control group shows the value of Fhitung = 1.119 < Ftable = 2.978. Because the Fcount value in both groups is smaller than Ftable, it can be concluded that all data have homogeneous variances, or in other words come from populations that have similar variances. This indicates that the assumption of homogeneity is met and the data is suitable for further analysis with parametric tests.

Hypothesis Test Results

The research data analysis used to test the hypothesis is using the T-test. The following are the results of data analysis using the Paired Sample T-Test which will be described in the table below:

Table 8. Test Results of the Effect of Experimental Group and Control Group

Data	T _{count}	T _{table}	Description
Experiment Group	46,080	2,228	There is a Significant Effect
Control Group	1,096	2,228	No Significant Effect

The data from the Pre-Test and Post-Test results of the experimental and control groups are intended to determine whether there is an effect of Plyometric training on increasing the leg muscle power of the Futsal Extracurricular SMAN 5 Bandar Lampung. Based on table 8 above, it can be seen in the Experimental Group that the value of $T_{hitung} = 46.080 > T_{tabel} = 2.228$, this means that there is a significant difference in the data from the Pre Test and Post Test results of the Experimental Group. And in the Control Group that the value of $T_{hitung} = 1.096 < T_{tabel} = 2.228$, this means that there is no significant difference in the data from the Pre Test and Post Test results of the Control Group. Thus it can be explained that there is a significant effect on Plyometric training on increasing the leg muscle power of Futsal Extracurricular SMAN 5 Bandar Lampung.

2. Independent Samples T-Test

The following are the results of data analysis using the Independent Paired Sample Tes which will be described in the table below:

Tabel 9. Comparison Test of Post-Test and Pre-Test of Experimental Group and Control Group

Data	T_{count}	T_{table}	Description
Pre-Test	0,060	2,086	No Significant Difference
<i>Post-Test</i>	4,027	2,086	There is a Significant Difference

The experimental and control group data is intended to determine whether there is a difference in the results of the Pre-Test and Post-Test on increasing the leg muscle power of the Futsal Extracurricular SMAN 5 Bandar Lampung. Based on table 9 above, it can be seen in the Pre-Test of the Experimental and Control Groups that the value of $T_{hitung} = 0.060 < T_{tabel} = 2.086$, this means that there is no significant difference in the Pre Test data of the Experimental and Control Groups. Whereas in the Post-Test of the Experimental and Control Groups that the value of $T_{hitung} = 4.027 > T_{tabel} = 2.086$, this means that there is a significant difference in the data from the Post Test of the Experimental and Control Groups. Thus it can be explained that

there is a significant difference in the final test of the group given Plyometric training which can increase the leg muscle power of the Futsal Extracurricular SMAN 5 Bandar Lampung

Discussion

The results of this study indicate that Plyometric training has a significant effect on increasing leg muscle power in futsal extracurricular students of SMAN 5 Bandar Lampung. Evident from the increase in standing broad jump test results between before and after treatment, the experimental group experienced a significant increase in performance compared to the control group. This indicates that the Plyometric training method given for 16 meetings is able to stimulate the development of explosive abilities in students' leg muscles, which are needed in futsal sports. Exercises such as squat jump, tuck jump, lateral jump over barrier, and split switch jumps are able to increase explosive strength through the principle of stretch-shortening cycle which involves rapid eccentric and concentric muscle contractions. In the context of futsal games, this increase in leg muscle power is very important in activities such as kicking the ball, jumping, and making sudden accelerations. Therefore, these results prove that Plyometric training is effective for supporting the basic physical abilities of futsal players.

This finding is in line with research conducted by Chess Wahyu Priyanto (2020) The results showed that the paired sample test output value found the Sig. (2-tailed) is $0.015 < 0.05$, it can be concluded that the stretching training method, plyometric training, and jumping jacks have a high influence. In addition, research by Ginanjar Dwi Setia Aji (Aji, 2023) also supports the results of this study. In his research, he revealed that Plyometric training has a positive effect on shooting accuracy in soccer players. Although the focus of the variable studied was the accuracy of the kick, the basic element trained was leg muscle power, which is the same as in this study. Plyometric training is proven to have an impact not only in the aspect of strength, but also on technical abilities in game sports such as soccer and futsal.

Thus, the results of this study do not stand alone, but are supported by previous findings that demonstrate the effectiveness of Plyometric training in increasing leg muscle power, both in the context of futsal, and other forms of physical activity. The similarity of results from all three studies provides additional validity to the use of Plyometric methods in the physical training of students or young athletes. Previous researchers have also concluded that explosive exercises such as those used in this study are capable of significantly improving biomotor performance. However, there are some limitations in this study. The number of samples used was only 22 and

limited to one school, so the generalization of the results is still limited. Differences in environmental conditions, facilities and student motivation in other schools may affect the results if this study is replicated in different places. In addition, the measurement method only uses a standing broad jump test that measures one aspect of power, so it does not reflect the overall physical components that may be affected by Plyometric training. The duration of training conducted for sixteen meetings within five weeks did provide significant results, but it cannot answer whether the effect lasts in the long term or not. Therefore, further research with a longer duration and follow-up measurements after several weeks post-training should be conducted to see the durability of training results over time.

Based on data analysis conducted in the field, Plyometric training is proven to significantly increase leg muscle power in futsal extracurricular students of SMAN 5 Bandar Lampung. This finding is supported by relevant theories and previous research, and provides empirical evidence that this method is effectively used in the physical development of students. Plyometric training is proven to not only increase physical strength, but also has the potential to improve technical abilities such as shooting, jumping, and acceleration in futsal games. Therefore, it is recommended that sports coaches or teachers include Plyometric exercises in extracurricular coaching programs in a routine and structured manner. This exercise is proven to be cheap, easy to implement, and provides significant results.

CONCLUSION

Based on the results of data analysis and discussion that has been carried out, it can be concluded that Plyometric training has a significant effect on increasing leg muscle power in extracurricular futsal students at SMAN 5 Bandar Lampung. This is evidenced by the increase in the average value of the Standing Broad Jump test results after the Plyometric training treatment compared to before treatment, as well as significant differences between the experimental group and the control group. This exercise is recommended as an effective physical coaching method in extracurricular sports activities at school.

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