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The Effect of Plyometrics Training and Leg Length on Leg Muscle Power in Female Volleyball Athletes, District. Rembang 2023

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Abstract

Physical conditions influence an athlete's performance to achieve achievements. The problems that are often encountered are that athletes tend to get bored when doing strength training separately and there is a lack of variety in training. Therefore, variations are carried out by combining several training models. This study aims to determine and analyze the effect of plyometrics training and leg length on leg muscle power in female volleyball athletes in Rembang Regency. This research method uses quantitative methods with experimental methods. The sample used was 24 athletes who took part in the PORPROV selection for women's volleyball in the District. Rembang. This research instrument uses tests and measurements with the vertical jump test. Data analysis used the two way anova test. The results of the research stated that there was an effect of plyometric box drill and plyometric standing jump training on increasing leg muscle power abilities in female volleyball athletes in Rembang Regency. There is an influence of high and low leg length on increasing the ability of leg muscle power in female volleyball athletes in Rembang Regency. The effectiveness of plyometric box drill, plyometric standing jump and high and low leg length training in increasing leg muscle power in female volleyball athletes in Rembang Regency shows the same level of effectiveness.

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INTRODUCTION

Success in volleyball depends on jumping ability, which allows both attack (gaining great height to attack) and defense (blocking). To do a vertical jump, leg muscle strength is very influential so it is important to increase leg muscle strength training (R. Putra et al., 2023). Good leg muscle strength will produce good jumps making it easier to smash or block (Indrayana, 2018). To improve your vertical jumping ability, it is important to pay attention to exercises to increase explosive power. This is because good vertical jumping ability is influenced by good physical condition, including explosive strength (Wicaksono & Putri, 2020).

Players' physical abilities can be improved through organized training. Exercise is carried out by systems, namely cardiovascular, musculoskeletal and neuromuscular (Sutimin et al., 2021). Types of musculoskeletal exercises commonly used by the public include conventional exercises and weights that emphasize jumping movements to increase explosive power (Hardovi, 2019). Types of skeletal muscle training generally include conventional and weight training, which emphasize jumping movements to increase muscle explosive power. This type of exercise uses repetitive movements such as jumping to increase muscle explosive power (Wahyu et al., 2022). Maximum intensity and good control can increase jump height. In isometric exercises, muscle strength and joint stabilization are trained slowly. With high intensity and good control, this exercise will really help in improving your vertical jump (Fernanda et al., 2018).

One way to train vertical jumps effectively is with plyometric exercises. Plyometric training is a type of exercise where the movements tend to be explosive and will train certain elements such as muscle strength, muscle endurance, flexibility and agility (Riadi, 2020).

Plyometric exercises aim to increase leg muscle strength and speed, which is very important for volleyball players and other sports. This exercise can maximize jump height (Anitha et al., 2018).

A volleyball player who has a high jump height and good leg muscle explosive power will find it easier to hit a smash. It is hoped that with plyometric training students will be better at hitting smashes. Most training programs in volleyball use plyometrics, which are sometimes used in conjunction with other training models to prevent athletes from getting tired while playing (Pevriansyah et al., 2021). Plyometrics is a very intense type of training, so if it is often done repeatedly, athletes will quickly become bored and tired of the monotonous movement variations (Sari et al., 2020). This is different from the circuit training model, where the training model is in the form of posts or circuits.

The Bhina Muda Club is one of the clubs that was formed as a forum for developing outstanding athletes for the volleyball branch in Rembang Regency. This club was founded at the end of 2020. The aim of establishing this club is to make the coaching, supervision and monitoring of athletes' achievements in volleyball more focused, because previously athletes' achievements in volleyball in Rembang Regency were not under one focused supervision. Building the achievements of volleyball athletes in Rembang Regency from observations before the formation of the Bhina Muda club can be said to have not been effective, because the preparation time is too short and it is important to know that for team sports, teamwork requires teamwork, where building relationships within a team requires sufficient time. Previously, volleyball athletes in Rembang Regency grew and developed their talents independently in their respective areas of residence, where we know that the facilities and infrastructure were inadequate. So in further training, when we have gathered and trained together, there is still a lot that needs to be improved. Specifically, in this case the achievement level that is the goal is PORPROV. However, in this case the researchers prioritized researching female volleyball athletes at young Bhina clubs who did not pass the PORPROV selection to improve the regeneration of female volleyball athletes in the future. Researchers want to find out why athletes do not pass the PORPROV athlete selection. From the temporary suspicion it is related to the training program which is related to physical abilities and basic technical skills. It is important to know that an athlete's physical abilities will affect their technical skills, so this is a part of a series.

Based on the explanation of the theoretical description above, it can be said that physical condition influences athletes' performance in achieving achievements. The problems that are often encountered are that athletes tend to get bored when doing strength training separately and there is a lack of variety in training. Therefore, variations are carried out by combining several training models. As in this case, researchers carried out variations of plyometrics box drills and plyometrics standing jump drills. As well as several other problems regarding the sport of volleyball performance in Rembang Regency, namely the PORPROV club which has experienced ups and downs, this can be assumed to be the problem from the quality of the coaches, the coaching system in this sport, the facilities and infrastructure, as well as the implementation of the training program and finally the the athlete or the athlete's level of awareness in undergoing the training program.

METHOD

In this research, the author used quantitative research with experimental methods. This research design uses factorial design techniques. A factorial experiment is a design that crosses or combines almost or all factor levels with the factor levels in the experiment (Sudjana, 2002:148).

The sample in the study consisted of 24 people with inclusion criteria including athletes who took part in the PORPROV selection for women's volleyball in Rembang District. Rembang who is still active, is aged 18 – 22 years, and is female.

Of the 24 athletes, their leg muscle power was then measured using a vertical jump test, the aim of which was to find out which athletes had high, medium and low levels of vertical jump categories, then after that they were ranked to determine the grouping of the experimental group.

The 24 athletes were divided into 2 groups, 2 experimental groups which would later receive treatment. Group 1 consisted of 11 athletes, group 2 consisted of 11 athletes, the 2 athletes with the highest and lowest pretest results were not included. Group 1 with 11 athletes will receive treatment in the form of plyometrics box drills, group 2 with the same number, namely 11 athletes, will receive treatment in the form of plyometrics standing jump drills.

After the data from the initial test has been arranged based on ranking, it is then divided into two groups, namely the odd ranking group and the even ranking group. Each group received different treatment (Anitha et al., 2018).

After the data was obtained, the researcher then provided treatment by giving different exercises according to the group's requirements based on the research objectives (Suadmaji et al., 2020). This form of plyometric training consists of 6 types of training which are divided into two groups, so each group does 2 different types of training, group 1 is given the plyometrics box drill training treatment and group 2 is given the plyometrics standing jump drill. Please note that this treatment program uses a type of plyometrics training which is implemented with a number of repetitions per set of 15-30 repetitions, a number of sets per training session of 5-15 sets, a frequency per week of 2-3 times per week, and a rest interval of 5 minutes for this type. plyometrics training.

After the initial tests and final tests are collected, the tests are compiled, processed and analyzed statistically. This is done to determine the achievements or results of treatment and the differences (Is & Adi, 2023).

After all the data is collected, the next step is to analyze the data so that a conclusion can be drawn from the data (Adhitya Bagaskara, 2019).

The data analysis technique in this research uses a quantitative experimental type approach. Then the data obtained from the experimental results are processed using the SPSS Anova test or two way analysis (Two way anova), so that it can then be concluded that there are differences in the effects before and after undergoing treatment for the time determined by the researcher. Two-way Analysis of Variance (ANOVA) is a research data analysis technique with a factorial design (Arikunto 2006:42). The conclusion whether H_0 is accepted or rejected is to use the interpretation of the significance value obtained in the test of between subject effect table from the results of variance analysis through the SPSS program. The criteria used in drawing a conclusion are if the probability of error is $p < 0.05$ then H_0 is rejected and H_1 is accepted (Auditya et al., 2020).

RESULTS AND DISCUSSION

1) Two-Way Anova Test Results

Table 1. Two Way Anova Test Results

Tests of Between-Subjects Effects

Dependent Variable: Power Otot Tungkai

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	47.343[a]	3	15.781	1.872	.171
Intercept	51514.809	1	51514.809	6110.584	.000
Exercise	9.329	1	9.329	1.107	.307
Length	32.978	1	32.978	3.912	.063
Exercise * Length	4.564	1	4.564	.541	.471
Error	151.748	18	8.430		
Total	54402.000	22			
Corrected Total	199.091	21			

R Squared = .238 (Adjusted R Squared = .111)

From the two-way ANOVA test table in the test of between-subjects effects above, the significance value in practice is 0.307. The significance value obtained is greater than α (0.05) so H_0 is rejected. So it can be concluded that the research data shows no difference between the plyometrics box drill and standing jump drill exercises in terms of their influence on leg muscle power, meaning they both have an effect.

For leg length, a significance value of 0.063 was obtained. The significance value obtained is greater than α (0.05) so H_0 is rejected. So it can be concluded that from the research data there is no difference between high leg length (long) and low leg length (short) in their influence on leg muscle power, so it can be concluded that both have an influence.

In the interaction between plyometrics training and leg length, a significance value of 0.471 was obtained. The significance value obtained is greater than α (0.05), so H0 is rejected. So it can be concluded that from the research data there is no interaction or influence between plyometrics training with high leg length (long) and low leg length (short) on leg muscle power, so it can be concluded that both have an influence.

2) Plyometrics Exercise Test Results

Table 2. Plyometrics Training Test Results

1. Plyometrics Exercises

Dependent Variable: Leg Muscle Power

Plyometrics Exercises	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Plyometrics Box Drill	50.117	.879	48.270	51.964
Plyometrics Standing Jump Drill	48.786	.910	46.874	50.697

From the plyometrics training test table above, with a confidence level of 95%, the average value (means) for the plyometrics box drill training is 50.117. Meanwhile, in the plyometrics standing jump drill exercise, the average value (means) was 48,786.

3) Limb Length Test Results

Table 3. Limb Length Test Results

2. Leg Length

Dependent Variable: Leg Muscle Power

Leg Length	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
High	50.702	.808	49.005	52.399
Low	48.200	.974	46.154	50.246

From the leg length test table on leg muscle power above, with a confidence level of 95%, the average value (means) in the high leg length category is 50.702. Meanwhile, in the low leg length category, the average value (means) was 48,200.

4) Plyometrics Training Test Results with Leg Length

Table 4. Plyometrics Training Test Results with Leg Length

3. Plyometrics Exercises * Leg Length

Dependent Variable: Leg Muscle Power

Plyometrics Exercises	Leg Length	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Plyometrics Box Drill	High	51.833	1.185	49.343	54.324
	Low	48.400	1.298	45.672	51.128
Plyometrics Standing Jump Drill	High	49.571	1.097	47.266	51.877
	Low	48.000	1.452	44.950	51.050

From the plyometrics exercise test table with leg length on leg muscle power above, with a confidence level of 95%, the average value (means) in the plyometrics box drill category with high leg length is 51.833. Meanwhile, in the plyometrics box drill category with low leg length, the average value (means) was obtained at 48,400. Then in the plyometrics standing jump drill category with a high leg length of 49.571. Meanwhile, in the plyometrics standing jump drill category with low leg length, the average value (means) was 48,000.

DISCUSSION

Before testing the data using the two-way anova test, the researcher first carried out a t-test on each variable to see whether there was a significant difference or influence between before and after receiving treatment (Saudini & Sulistyorini, 2017).

The results obtained in the Paired Sample Statistics table mean pretest value on plyometrics box drill is 47.09 and posttest value is 50.27. Furthermore, in the plyometrics standing jump drill the mean score on the pretest was 47.00 and the posttest score was 49.00. The posttest scores from the two forms of training obtained were greater (>) than the pretest scores, so it was concluded that there was a difference and there was an influence (Suadmaji et al., 2020).

Then in the Paired Sample Correlation table, the correlation value obtained in the plyometrics box drill exercise is 0.942 with a sig value. 0,000. Furthermore, in the plyometrics standing jump drill exercise, a correlation value of 0.895 with a sig value was obtained. 0,000. Because in both forms of plyometrics training the significance value is smaller (<) than 0.05, it can be concluded that there is a relationship between the pretest and posttest variables (Proja et al., 2022).

In the Paired Sample Test table the mean value for the plyometrics box drill exercise is -3.182. This value shows the difference between the mean pretest plyometrics box drill and the mean posttest plyometrics box drill, namely 47.09 - 50.27 = -3.182. The difference value is between -4,022 to -2,342. Then in the plyometrics standing jump drill exercise the mean value was -2,000 which shows the difference between the mean of the pretest plyometrics standing jump drill and the posttest plyometrics standing jump drill, namely 47.00 – 49.00 = -2,000. The difference value is between -2,901 to -1,099. Sig value. (2-tailed) in plyometrics box drill training is 0.000 < 0.05 with a t.count value of -8.439 < t.table -2.228 so it can be concluded that there is a significant difference and it can be interpreted that there is an influence of the form of plyometrics box drill training on the results increased leg muscle power. Then the sig value. (2-tailed) in standing jump drill plyometrics

training is 0.001 < 0.05 with a t.count value of -4.944 < t.table -2.228, so it can be concluded that there is a significant difference so it means there is an influence from the form of standing jump drill plyometrics training on results in increased leg muscle power.

1) The Effect of Plyometric Box Drill and Plyometric Standing Jump Training on Leg Muscle Power in Women's PORPROV Volleyball Club Athletes, Kab. Rembang

From the table of two-way ANOVA test results on the test of between-subjects effects, it shows that the significance value for these two types of plyometrics training is 0.307. The significance value shown by the test results is greater than α (0.05) so the conclusion H_0 is rejected (Suriatno & Yusuf, 2022), so the research data shows that there is no difference between the plyometrics box drill and standing jump drill exercises in terms of their influence on leg muscle power, which means that both types of training have the same effect. With the mean (average) value of each type of exercise with a 95% confidence level in the plyometrics box drill exercise of 50.117. Meanwhile, in the plyometrics standing jump drill exercise, the average value (means) was 48,786.

2) The Effect of Leg Length in High and Low Categories on Leg Muscle Power in Women's PORPROV Volleyball Club Athletes, District. Rembang

It can be seen that the leg length test results obtained from the two categories given received a significance value of 0.063. The significance value obtained is greater than α (0.05) so H_0 is rejected (Bakar et al., 2019). So the conclusion is that from the research data there is no difference between high leg length (long) and low leg length (short) in their influence on leg muscle power, so it can be concluded that both have an influence. With a test confidence level of 95%, the average value (means) in the high leg length category was 50.702. Meanwhile, in the low leg length category, the average value (means) was 48,200.

3) Effectiveness of Plyometric Box Drill, Plyometric Standing Jump and High and Low Leg Length Exercises on Increasing Leg Muscle Power in Female Volleyball Athletes in Rembang Regency

There are no significant differences and it can be concluded that both training methods have almost the same level of effectiveness so they can be applied both ways. It can be seen from the results of the interaction between plyometrics training and leg length that a significance value of 0.471 was obtained. The significance value obtained is greater than α (0.05) so H_0 is rejected (A. Y. Putra et al., 2023). So it can be concluded that from the research data there is no interaction or no significant difference in influence between plyometrics training with high leg length (long) and low leg length (short) on leg muscle power, so the conclusion is that both have an influence. This decision is also supported by the table of plyometrics training test results with leg length on leg muscle power with a confidence level of 95% which obtained an average value (means) in the plyometrics box drill category with high leg length of 51.833. Meanwhile, in the plyometrics box drill category with low leg length, the average value (means) was obtained at 48,400. Then the results in the standing jump drill plyometrics category with high leg length obtained a value of 49.571. Meanwhile, in the plyometrics standing jump drill category with low leg length, the average value (means) is 48,000.

From these results, the difference in values obtained in proving the third research hypothesis was 2.262 for the two plyometrics training models with the high leg length (Length) category. Meanwhile, the difference between the two plyometrics training models in the low (short) leg length category is 0.400. So the conclusion is that there is no significant difference, so the level of effectiveness of the two plyometrics training models with the specified leg length category is the **same**.

CONCLUSION

There is an effect of plyometric box drill and plyometric standing jump training on increasing leg muscle power abilities in female volleyball athletes in Rembang Regency. This is proven by the sig value. (2-tailed) in plyometrics box drill training is 0.000 < 0.05 and the sig. (2-

tailed) in plyometrics standing jump drill training is 0.001 < 0.05.

There is an influence of high and low leg length on increasing the ability of leg muscle power in female volleyball athletes in Rembang Regency. This is proven by the significance value of 0.063.

The effectiveness of plyometric box drill, plyometric standing jump and high and low leg length training in increasing leg muscle power in female volleyball athletes in Rembang Regency shows the same level of effectiveness. This is based on the average value (means) in the plyometrics box drill category with high leg length of 51,833 while with low leg length it is 48,400. The results in the plyometrics standing jump drill category with high leg length obtained a value of 49.571 while with low leg length it was 48,000.

BIBLIOGRAPHY

Adhitya Bagaskara, B. (2019). Pengaruh Latihan Plyometric Box Jump Dan Plyometric Standing Jump Terhadap Kemampuan Vertical Jump Pada Atlet Klub Bola Voli Effect of Plyometric Box Jump and Plyometric Standing Jump Toward Vertical Jump Ability in Volley Ball Club Athletes. *Medikora*, *XVIII*(2), 64–69.

Anitha, D. J., Kumaravelu, D. P., Lakshmanan, D. C., & Govindasamy, K. (2018). Effect of plyometric training and circuit training on selected physical and physiological variables among male Volleyball players. *International Journal of Yoga, Physiotherapy and Physical Education*, *3*(4), 26–32. https://doi.org/10.22271/sports.2018.v3.i4.07

Arikunto. (2006). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Penerbit Rineka Cipta.

Auditya, R., Pramono, H., & Soegiyanto, &. (2020). The Effect of Training Method and Leg Length on The Vertical Jump Result in The Volleyball Maras Bangka Club Athlete Article Info. *Journal of Physical Education and Sports*, *9*(3), 270–274.

Bakar, A., Nasuka, & imam Santosa. (2019). pengaruh latihan plyometric dan panjang tungkai terhadap smash UKM Bola voli Universitas tadulako. *Journal of Sport Coaching and Physical Education*, *4*(79), 66–74.

Fernanda, A. M. D., Yunus, M., & Saichudin, S. (2018). Pengaruh Latihan Plyometric Standing Jump Terhadap Tinggi Loncatan Pemain Bolavoli Putra Uabv Universitas Negeri Malang. *Jurnal Sport Science*, *8*(1), 7–17.

Hardovi, B. H. (2019). Pengaruh Pelatihan Plyometric Squat Jump Dan Depth Jump Terhadap Daya Ledak Pada Pemain Bola Voli Di Smp Negeri 5 Jember. *Jp.Jok (Jurnal Pendidikan Jasmani, Olahraga Dan Kesehatan)*, *3*(1), 1–12. https://doi.org/10.33503/jp.jok.v3i1.584

Is, Z., & Adi, R. (2023). Pengaruh Latihan Plyometric Terhadap Kekuatan Otot Tungkai Pada Pemain Bola Volly Binaan Dispora Kota Banda Aceh. *Sport Pedagogy Journal*, *12*(1), 6–13. https://doi.org/10.24815/spj.v12i1.31274

Pevriansyah, P., Sugihartono, T., & Arwin, A. (2021). Pengaruh Plyometric Training Dalam Bentuk Circuit Training Terhadap Tinggi Lompatan Mahasiswa Pemain Bola Voli Pantai Prodi Penjas Universitas Bengkulu. *SPORT GYMNASTICS : Jurnal Ilmiah Pendidikan Jasmani*, *2*(2), 201–209. https://doi.org/10.33369/gymnastics.v2i2.17074

Proja, S. H., Romadhoni, W. N., Rani, A., Candra, D., & Priambodo, E. N. (n.d.). *Leg Power , Arm Strength , and Smash Accuracy in Female Volleyball Athletes : A Correlational Study*. 453–462.

Putra, A. Y., Putra, M. A., & Kusuma, A. A. (2023). Sport Education and Health Journal Universitas Pasir Pengaraian PENGARUH LATIHAN PLYOMETRIC JUMP TO BOX DAN DEPTH JUMP TERHADAP POWER OTOT TUNGKAI PADA SISWA EKSTRAKURIKULER SEPAK BOLA SMP NEGERI 5 RAMBAH SAMO KABUPATEN ROKAN HULU. *Sport Education and Health Journal*, *4*(1), 36–45.

Putra, R., Janiarli, M., & Putra, M. A. (2023). PENGARUH LATIHAN PLYOMETRIC SQUAT JUMP TERHADAP POWER OTOT TUNGKAI ATLET PUTRA BOLA VOLI PORKES UPP: plyometric squat jump, power …. *Journal Of Sport Education*

and …, *4*(1), 30–35.

Riadi, B. (2020). Model Program Latihan Plyometric Permukaan Matras Dan Pasir Untuk Meningkatkan Eksplosif Power Tungkai Dan Kecepatan Pada Cabang Olahraga Beladiri Kempo. *Jurnal UNY*.

Sari, A. N., Maulang, I., Darwis, A., & Sari, A. N. (2020). Effect of plyometric depth jump exercise toward vertical jump changes of volleyball players UKM, Hasanuddin University. *Journal of Physics: Conference Series*, *1529*(3). https://doi.org/10.1088/1742-6596/1529/3/032028

Saudini, A. F., & Sulistyorini. (2017). Pengaruh Latihan Squat Terhadap Peningkatan Power Otot Tungkai. *Indonesia Performance Journal*, *1*(2), 71–75.

Suadmaji, Arifin, S., & Warni, H. (2020). *The Effect of Plyometric Double Leg Speed Hop Exercise on Explosive Muscle of Volleyball Players*. *407*(Sbicsse 2019), 66–69. https://doi.org/10.2991/assehr.k.200219.018

Suriatno, A., & Yusuf, R. (2022). Pengaruh Latihan Pliometrik Side Hop Dan Tricep Extansion Terhadap Kemampuan Smash Dalam Permainan Bola. *JOURNAL SPORT SCIENCE HEALTH AND TOURISM OF MANDALIKA (JONTAK) e-ISSN 2722-3116*, *3*(1), 90–94. https://doi.org/10.36312/jontak.v3i1.238

Sutimin, Muhamad Syafei, Didik Rilastiyo Budi, Kusnandar, Topo Suhartoyo, & Panuwun Joko Nurcahyo. (2021). Plyometric Double Leg Tuck Jump: Pengaruhnya Terhadap Power Otot Tungkai Atlet Bola Voli. *SPRINTER: Jurnal Ilmu Olahraga*, *2*(1), 112–119. https://doi.org/10.46838/spr.v2i1.92

Wahyu, R., Studi Pendidikan Jasmani Kesehatan dan Rekreasi, P., Rokania, S., Plyometrik, L., & Otot Tungkai, P. (2022). PENGARUH LATIHAN PLYOMETRICS TERHADAP POWER OTOT TUNGKAI PADA ATLET BOLA VOLI KLUB DESA KOTA RAYA Kata kunci. *Jsr*, *2*(2), 114–124.

Wicaksono, T., & Putri, W. S. K. (2020). Pengaruh Latihan Burpee dan Box Jump Terhadap Daya Ledak Otot Tungkai dan Kecepatan Renang. *JOSSAE : Journal of Sport Science and Education*, *5*(1), 39. https://doi.org/10.26740/jossae.v5n1.p39-47