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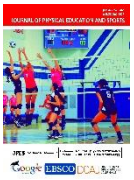

The Effect of Plyometric Exercise and Arm Muscle Strength on Smash Ability of Pervoba Volleyball Athletes

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Abstract

Smash is an attack technique to get the point that requires good jumping power and arm muscle strength. This study aimed to analyze the differences in the effect of plyometric depth jump and plyometric split squat jump exercises, find out the difference in the effect between groups having strong arm muscle strength and weak arm muscle strength, and smash ability of pervoba (a name of volleyball team from Banaran, Semarang) volleyball athletes, analyze the interaction of plyometric exercises and arm muscle strength levels on the smash ability. The population in this study was 24 pervoba volleyball athletes aged 20-24 years in which the sample was 20 athletes taken using a purposive sampling technique. This research used a quantitative descriptive method with a 2x2 factorial design. The calculation method in this experimental research used the Statistical Product and Service Solution (SPSS) program. The results of the study: training method had F_{value} = 6.721 > 3.59 with probability of 0.05, arm muscle strength had F_{value} = 3.814 > 3.59 with probability of 0.05, training method and arm muscle strength had F_{value} = 3.723 > 3.59 with probability of 0.05. Eventually, the conclusions of this research are plyometric depth jump training method is better than plyometric split squat jump, athletes having strong arm muscle strength are better than athletes having weak arm muscle strength, there is an interaction between groups using plyometric training method and arm muscle strength on smash ability of pervoba volleyball athletes aged 20-24.

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INTRODUCTION

Volleyball is a kind of sport loved by the world community (Zakaria, and Mudian, 2018). Volleyball is a team sport played by two teams consisting of six people of each, playing on a field with a size of 18 x 9 meters in which the game is done by reflecting the ball into the air back and forth on condition that the players are clean and each player tries to drop the ball on the opponent's field (Santoso, 2016).

Volleyball is a game played by two teams consisting of 6 players of each on the field, limited by the net, each team has three touches to return the same ball to the opposing team, the match can be played for five sets which means the match can last for 90 minutes in which a player can perform 250-300 actions that are dominated by explosive leg muscle strength. It is an intermittent sport to compete in fast attacks and followed by low intensity and high intensity repeatedly occurring during a match, so the player requires maximum speed and agility both upper body and lower body (VO ^ sub ^ max). In the volleyball game, four aspects need attention, namely: physic, technique, tactic, and mental. The volleyball game is a unique sport because it is a mistake game to get the ball to be hit at the opponent's field to force the opponents to make mistakes in handling the ball (Rohendi, and Suwandar, 2017).

In the volleyball game, one of the techniques that is very crucial to get points is a smash. Smash is a technique for hitting the ball while jumping near the net or an attack by an attacking player to drop the ball on the opponent's field to get points to win.

Smash is the main hit to attack to win (Anam, Nasuka, and Aji, 2015). Smash/Spike is characterized by he ball spike sharply because the ball being hit above the net against the opponent's area, so the opponent is difficult to return the ball even turn off the opponent's defense. (Nasution, 2015).

In doing a smash, the strength of the arm muscles is highly important. Arm muscle strength is the ability of the arm to generate strain in one pressure and lift weights according to Harsono, 2018. Strength is the ability of muscles that use maximum energy to lift weights. Strength is defined as the power used to change the state of motion or shape of an object. (Pate and Rotella, 1993 in Nasution, 2015). Strength can improve components such as speed, agility, and accuracy.

This is caused by the smash movement in the volleyball game is in the form of a swinging arm that starts at the base of the arm which affects to provide punch strength, so it can be more beneficial if the arm muscle strength is available in every volleyball athlete. Additionally, the strength of the arm muscles to support the success of the smash is to do the right start, the right timing, the right pedestal and make the maximum jump to reach the ball above the net lip and make a direct hit on the ball as hard and as fast as possible.

In performing a smash attack, the player does not only use arm muscle strength but also uses power as a support for success in performing a smash. Power or explosive power has two components, namely strength, and speed which are important mobility abilities to support activities in every sport (Widiastuti in Mapato, Nasuka, and Soenyoto, 2015). Power is the muscle's ability to exert maximum strength in rapid time, Harsono (2018). Leg muscle strength is one of the elements forming the leg muscle power, Yuwono in Sardiman, Hidayah, and Soekardi (2017). Leg muscle power is one of the physical components that must be possessed by athletes in which athletes must be able to exert explosive strength in the shortest time (Yoda in Mertayasa, Rahayu, and Soenyoto, 2016). Therefore, power training in weight training should not only emphasize the weight but also emphasize the speed of lifting, pushing, or pulling the weight. The motion form of power is always explosive.

In increasing leg muscle power to increase the volleyball smash ability, there are training techniques to increase power by using a form of plyometric training. Plyometrics comes from the Greek words "plio" and "metric," which means "more' and "size" respectively. Plyometrics refers to exercises characterized by strong muscle contractions in response to rapid and dynamic

burden or stretching of the muscles involved (Furqon, and Doewes in Adhi, Sugiharto, and Soenyoto, 2017).

Plyometric is a popular exercise among sports coaches in which this exercise has the characteristics of training with jumping or reflecting limbs. It was first introduced in 1975 by Fred Wilt by one of America's track and field trainers and derived from the Latin language, Plio + Metrics mean measurement of improvement (Beachle in Wiguna, 2017).

Plyometric is a training method to develop or increase explosive power which is an important component of most sports achievements or performance. (Hananingsih, 2017). Every sport requires or needs the power that is a combination of maximum speed and strength in which the swimming sport is no exception.

Besides arm muscle strength and leg muscle power, physical conditions also affect the ability to improve a volleyball smash. Physical condition is a substantial element and the basis in developing techniques, tactics, and strategies in playing volleyball, according to Harsono (2018). The physical condition can reach its optimal point if training starts at an early age and is carried out continuously (Wiguna, 2017). The physical condition elements possessed by volleyball athletes are strength, speed, flexibility, and endurance. (Hananingsih, 2017) Based on these characteristics, volleyball players must train and strengthen themselves with physical training in which the purpose of physical training is to help athletes develop their potential and skills as much as possible.

Based on observations in the field conducted on January 13 to January 20, 2019, many athletes often make mistakes in the training such as service that does not pass through the net, poor defense, inadequate leg repulsion, and punches against the ball when making improper smash, and some other technical errors caused by not focusing.

Then the researchers conducted interviews with the coach of the volleyball team about the physical techniques carried out during training. The coach said that in training, the athletes are directly given contact with the ball when performing serve as well as in passing, smashing, and blocking exercises. The trainer focuses on drilling using direct ball contact, without step exercise or increases power in the repulsion of arm and leg muscles.

Accordingly, the problem is the ability of plyometric training on smash ability by coaches and athletes has been known yet, which results in improper volleyball smash results and influences the athlete's achievement. Based on this, the researcher aimed to analyze specifically about exercises that are suitable to improve the smash achievements of pervoba athletes in volleyball game by training the strength of leg muscles with a form of plyometric training. So, the researchers were interested in conducting research entitled"The effect of plyometric exercise and arm muscle strength on smash ability of pervoba volleyball athletes."

Depth Jump

This exercise requires a box or bench as high as about 25-45 inches or 60-100 cm. We need to use a resilient floor surface such as a grassy field of wrestling mattresses. This exercise is very good for the quadriceps and hip girdle muscles, and also for the lower back and hamstring. Depth jump can be applied to various sports because it uses strength and leg speed. The exercises can be seen as for the starting position, the athlete starts with a standing posture at the end of the box, and the toe sticks out. Keep your knees slightly bent and your arms at your sides relaxed, for implementation, dropping the body from the box to the ground (don't jump). Land with your legs and knees bent to overcome the shake when landing. After landing on the ground, immediately start jumping by swinging your arms up and stretching yourself as high and as far as possible. This exercise requires intensity and maximum work to achieve optimal results. (Chu in Santoso, 2016).

Figure 2. Plyometric Depth Jump

Figure 3. Plyometric Split Squat Jump

Split Squat Jump

Box jump. Split squat jump is an exercise to increase leg muscle explosive power. Split squat jump is an advanced version of the squat jump. (Gusfirnando, Supriyadi, and Saichudin, 2015). Split squat jump is carried out on a flat surface. This exercise affects the lower back muscles, hamstrings, gluteals, quadriceps, extensors, and flexors of the lower limbs. Split squat jump is very good to develop the power of step muscle for running and ski cross country. This exercise is also specifically for developing the "split" shape and beat part. The implementation of this exercise can be seen as for the initial position, take a standing position with one leg stretched forward and the other foot slightly directed behind the body's midline as in the implementation of the long step or stride. The front legs are bent at a 90-degree angle, for implementation, jumping as high and as straight as possible using your arms to swing up to add height. After landing, keep your legs wide open, bend the knees of the front legs to deal with shaking. After getting balance, repeat this movement several times. After completing this series, do the movements for the other limbs.

METHODS

This experimental research used a quantitative descriptive method with a 2x2 factorial design (Nazir, 2014). The used the Statistical Product and Service Solution (SPSS) program. The population in this study was 24 pervoba athletes of 20-24 years age group in Semarang, Central Java. A total of 20 volleyball athletes from the age group of 20-24 years were selected based on purposive sampling technique with a category of high arm muscle strength and low arm muscle strength. The variables of this study consisted of two independent variables, namely plyometric training and arm muscle strength, and one independent variable, namely the ability to smash the volleyball.

The instruments in this study used a hand dynamometer test to calculate the level of muscle strength in an athlete's arm and used a volleyball battery test to obtain volleyball smash results.

RESULTS AND DISCUSSION

Based on the results in table 1, the F_{value} in the exercise method was 6.721, the F_{value} in the arm muscle strength was 3.814, and the F_{value} in the exercise method and arm muscle strength was 3.723.

The differences in the effect between groups using the plyometrics depth jump training method and the plyometrics split squat jump training method.

The calculations results of the analysis using SPSS showed that F_{value} = 6.721 while F_{table} at a significance level of 0.05 was 3.59, which means F_{value} was greater than F_{table} ($F_{value} > F_{table}$). It obtained the data from the result of group analysis of depth jump training method with an average value of 17.300 and plyometric split squat jump training methods with an average value of 15.600. Thus it can be concluded that the hypothesis stating there is a difference in effect between groups using the plyometric depth jump training method and the plyometric split squat jump (H_1) exercise is accepted.

Table 1. Result of Two-Way ANOVA test

Source	Type III sum of squares	df	Mean square	F	Sig.
Exercise method	14.450	1	14.450	6.721	.020
Arm muscle strength	6.050	1	6.050	3.814	.113
Exercise method * Arm muscle strength	.050	1	.050	3.723	.881

R squared = .374 (Adjusted R squared = .257)

The calculations results using SPSS show the data of group analysis result of plyometric depth jump training method with an average value of 17.300, and the plyometric split squat jump training method obtained an average value of 15.600 indicating that groups using the plyometric depth jump training method are better than groups using plyometric split squat jump in pervoba volleyball athletes in the age group of 20-24 years in Semarang.

By consulting the value of Sig. 2-tailed and α = 0.05, it can be concluded that H_0 is rejected and H_1 is accepted because of the value of Sig. 2-tailed 0.000 < α = 0.05. In other words, there is a significant difference between the results of leg muscle power before and after depth jump training given. It can be said that the provision of depth jump training has a significant effect on leg muscle power results.

The difference in the effect between athletes having high arm muscle strength level and low arm muscle strength level to the volleyball smash ability.

The result of the calculation using SPSS showed that F_{value} = 3.814 while F_{table} at the 0.05 significance level = 3.59 means F_{value} is higher than F_{table} ($F_{value} > F_{table}$). Then, it was found that athletes are having high arm muscle strength with an average value of 17.000 and athletes having low arm muscle strength with an average value of 15.900. Thus, it can be concluded that the hypothesis stating there is a difference in the effect between athletes having high arm muscle strength level, and athletes having low arm muscle strength level (H_1) is accepted.

The results of SPSS showed that athletes having high arm muscle strength level with an average value of 17.000 and athletes having low arm muscle strength level with an average value of 15.900 showed that groups having high arm muscle strength level is better than the group having low arm muscle strength level in pervoba volleyball athletes in age group of 20-24 years in Semarang. This is evidenced by looking at the average of arm muscle strength test level that has high arm muscle strength level, and it that has low arm muscle strength level has a significant difference of 1.100.

The interaction between groups using the training method of plyometric depth jump and plyometric split squat jump and the level of arm muscle strength on the volleyball smash ability.

The result of SPSS showed that F_{value} = 3.723 while F_{table} at the significance level of 0.05 = 3.59, F_{value} is higher than F_{table} ($F_{value} > F_{table}$). Thus it can be concluded that the hypothesis stating that there is an interaction between groups using the training method of the plyometric jump to box and plyometric split squat jump and the level of arm muscle strength on volleyball smash (H_1) is accepted.

After conducting research and calculating the data, it was found that there is an interaction between the plyometric training method and the arm muscle strength level on the ability of volleyball smash. The average number of sample increase having high levels of arm muscle strength with depth jump training method is better than samples having high levels of arm muscle strength with the split squat jump training method whereas the sample having low arm muscle strength level with a depth jump training method is better than the sample having low arm

muscle strength level with the plyometric split squat jump training method.

CONCLUSION

Based on the results, several conclusions can be drawn: there is a difference in the effect of the plyometric depth jump and plyometric split squat jump training methods on the result of athlete's smash of pervoba volleyball aged 20-24. This is proven by research and calculation result that the average value of the plyometric depth jump training method is better than that of the plyometric split squat jump training method, there is an effect between athletes having high arm muscle strength level and athletes having low arm muscle strength level on the smash ability of pervoba volleyball athletes aged 20-24 years old. Research and calculation results evidence this that the average value of high arm muscle strength level is better than athletes having low arm muscle strength levels, there is an interaction effect between the plyometric training method and arm muscle strength level on the results of the smash ability of pervoba volleyball athletes pervoba aged 20-24 years old.

REFERENCES

Adhi, B., Sugiharto, & Soenyoto, T. (2017). Pengaruh metode latihan dan kekuatan otot tungkai terhadap power otot tungkai. *Journal of Physical Education and Sports*, *6*(1), 7-13. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpes/article/view/17315

Anam, K., Nasuka, & Aji, T. (2015). Klub bola voli putra ivokas kabupaten semarang. *Unnes Journal of Sport Sciences*, *4*(1), 40-49. Retrieved from https://journal.unnes.ac.id/sju/index.php/ujss/article/view/8637

Gusfirnando, D., Supriyadi, & Saichudin. (2015). Pengaruh latihan split squat jump dan box jump terhadap peningkatan daya ledak otot tungkai pada ekstrakurikuler bola voli di smkn 3 malang. *Jurnal Sport Science*, *5*(1). Retrieved from http://journal2.um.ac.id/index.php/sport-science/article/view/5242

Hananingsih, W. (2017). Pengaruh pelatihan pliometrik dan pelatihan beban terhadap peningkatan kekuatan dan explosive power otot tungkai. *Jurnal Ilmiah Mandala Education*, *1*(2). Retrieved from http://ejournal.mandalanursa.org/index.php/JIME/article/view/14

Harsono. (2018). *Latihan kondisi fisik untuk atlet dan kesehatan*. Bandung: PT Remaja Rosdakarya.

Mapato, M. S. D. G., Nasuka, & Soenyoto, T. (2018). The effect of leg length plyometric exercise on increasing volleyball jump power at public senior high school 1 parigi motong. *Journal of Physical Education and Sports*, *7*(3), 274-279. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpes/article/view/25096

Mertayasa, K., Rahayu, S., & Soenyoto, T. (2016). Metode latihan plyometrics dan kelentukan untuk meningkatkan power otot tungkai dan hasil lay up shoot bola basket. *Journal of Physical Education and Sports*, *5*(1), 24-31. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpes/article/view/13275

Nasution, N. S. (2015). Hubungan kekuatan otot lengan dan percaya diri dengan keterampilan open spike pada pembelajaran permainan bola voli atlet pelatkab bola voli putri kabupaten karawang. *JUDIKA* (*Jurnal Pendidikan Unsika*), *3*(2). Retrieved from https://journal.unsika.ac.id/index.php/judika/article/view/211

Nazir, M. (2014). *Metode penelitian*. Bogor: Ghalia Indonesia.

Rohendi, A., & Suwandar, E. (2017). *Metode latihan dan pembelajaran bola voli untuk umum*. Bandung: CV Alfabeta.

Santoso, D. A. (2016). Pengaruh latihan plyometric split squat jump dan depth jump terhadap power otot tungkai pada pemain bolavoli. *BRAVO'S* (*Jurnal Prodi Pendidikan Jasmani & Kesehatan*), *4*(2). Retrieved from https://ejournal.stkipjb.ac.id/index.php/penjas/article/view/221

Sardiman, Hidayah, T., & Soekardi. (2017). Pengaruh latihan plyometric dan panjang tungkai terhadap peningkatan power lompatan dan smash kedeng sepak takraw. *Journal of Physical Education and Sports*, *6*(3), 286-290. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpes/article/view/15098

Wiguna, I. B. (2017). *Teori dan aplikasi latihan kondisi fisik*. Depok: Raja Grafindo Persada.

Zakaria, G., & Mudian, D. (2018). Pengaruh latihan plyometrics jump to box terhadap peningkatan power tungkai siswa kelas x pada permainan bola voli. *Biormatika: Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, *4*(1). Retrieved from http://ejournal.unsub.ac.id/index.php/FKIP/article/view/211