

The Effect of Plyometric Double Leg Speed Hop Exercise on Explosive Muscle of Volleyball Players

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Abstract—This study aims to determine the effect of double leg speed hop plyometric exercises on leg muscle explosive power of volleyball players.—The research method used is the pre-experiment design by conducting an initial test, 18 meetings for the treatments and a final test. The sample in this study were 12 volleyball players in Banjarbaru, chosen by using saturated sampling techniques. The results showed that the pretest data of leg muscle explosive power obtained an average = 55.75 cm with a standard deviation = 8.614. In the posttest result, the leg muscle explosive power obtained an average = 59.67 with a standard deviation = 8.988. The analysis results obtained $t_{count} = 15.07 > t_{table} = 2.201$, with Sig. (2-tailed) = 0,000; it turns out that Sig. (2-tailed) < 0.05; thus the t_{count} is significant. The conclusion is that there is an effect of double leg speed hop plyometric training on leg muscle explosive power of volleyball players.

Keywords: training, plyometric, double leg speed hop, explosion power, leg muscles, volleyball

I. INTRODUCTION

Training is a complex, organized, and planned effort with various stages and is carried out continuously with the main objective to optimize the athlete's performance according to the demands that have been set. Many factors can influence the peak of the achievement in a championship, including requiring coaches to be able to understand well about the periodization of training. Periodization comes from the word "period" which means the division of time or portion. Periodization of training was used in the ancient Olympics for the first time (776 BC). The training program is divided into 3 (three) periods, namely: (1) the preparation phase, (2) the competition phase, and (3) the transition phase. The development of sports achievement is inseparable from various aspects of training including physical, technical, strategic tactics, and mental aspect. According to Ahmadi (2007: 64), a very suitable method is needed to increase the physical potential of the player, such as agility of motion, speed, height of jumps, punch strength and so on. In addition, according to [1], the physical condition components of volleyball players are strength, endurance, explosive power, speed, flexibility, agility, coordination, balance, accuracy and reaction. Explosive power is a very important physical component in volleyball games, especially leg muscle explosive power, because players with leg muscle explosive power with a jump will be high and make the smash or block easier to do.

The National Volleyball Federation of Indonesia of Banjarbaru is an organization aiming to develop volleyball in

Banjarbaru City in particular and South Kalimantan province in general.

The achievements obtained in the South Kalimantan Porprov events were as follows; 1) Winning a gold medal for male and female in Porprov 2002 in Banjarbaru, 2) Winning a bronze medal for male and female in Porprov 2006 in Tapin Regency, 3) Receiving a silver medal for male and female in Porprov in 2010 in Kota Baru Regency, 4) Winning a gold medal for male and female in Porprov 2013 in Banjar Regency.

The volleyball players of Banjarbaru, based on anthropometric measurements, have an average height ranging from 165 cm to 180 cm. Furthermore, they have sharp and precise smash abilities; however, the fact shows that the male volleyball players' abilities are still not maximal which can be seen during the regular exercises that are carried out every Monday, Wednesday, and Friday. If the players get tired quickly during drill practice, the smashes often get stuck in the net. Moreover, when competing against Gunung Connect club in the 2015 Brimob Cup volleyball tournament, on Tuesday, 27 October 2015, the players had difficulty conducting attacks through smashes and when defending through blocks, each smash was always hit by a block by Gunung club players in which all players are imported from Cirebon Regency. The result of observations during the match is volleyball players of Banjarbaru City have difficulty making attacks through smashes and surviving through blocks because of low jumps or leg muscle explosive power. The maximum explosive power of leg muscles of Banjarbaru volleyball players due to the application of training methods is still not yet conducted, such as training programs to increase leg muscle explosive power which is still not on target. Many factors play a role in volleyball smash movements such as height, leg muscle explosive power, arm muscle explosive power, flexibility and abdominal muscle strength. In addition, a good trainer qualification should have attended trainer training, for example at the regional or national level. The low explosive power of leg requires the volleyball players to be given training or treatment that can increase the leg muscle power of the volleyball players in Banjarbaru. The researcher tried to provide double leg speed hop plyometric exercises to improve the leg muscle explosive power of volleyball players. This double leg speed hop exercise develops speed and power for hip and leg muscles, especially the hamstring, gastrocnemius, gluteals, and quadriceps muscles at high speed and full force [2]. The results of the study show that double leg speed hop training and single leg speed hop give an

influence on increasing leg muscle explosive power in female students of SMP Negeri 3 Mengwi in the academic year 2013/2014 and there are differences on the impacts between the two training; single leg speed hop training has a greater effect both from double leg speed hop training [3].

As a solution to answer the problem, the researcher chose plyometric double leg speed hop training on the leg muscle explosive power of male volleyball players in Banjarbaru City, which was needed to be immediately assessed through an experimental study. The general objective is to determine the effect of the form of treatment on the dependent variable, namely the explosive power of the limbs of male volleyball players in Banjarbaru City.

II. METHODOLOGY

The method used in this research is pre-experiment design [4]. It used pre-experiment design because this research design is not yet a real experiment, or there are still external variables that influence the formation of the dependent variable. Researcher has tried to limit the sample of the study in order to reduce physical activity. Hence, the experimental results which are the dependent variable are not merely influenced by the independent variables which have been minimized. In this study, there were no control variables because the sample in this study was classified into a small sample of only 12 athletes or volleyball players to represent Banjarbaru city. Finding the control group was quite difficult because the requirement of the control group was they must have the similar ability each other.

The design in this study used One-Group Pretest-Posttest Design; before the treatment was given, there was a pretest, and after the treatment was carried out, the posttest was conducted. Thus, the results of the treatment can be known more accurately because it can compare the conditions before and after the treatment was given.

III. RESULTS AND DISCUSSION

Based on the data analysis, the average explosive power of leg muscles before treatment was 55.75 and after treatment was 59.67 which means an increase in leg muscle explosive power after being given plyometric double leg speed hop training reaching an average of 3.92. The results prove that there is a positive and significant influence of double leg speed hop plyometric training on the explosive power of limb muscles of the male volleyball players in Banjarbaru City.

This research proves that double leg speed hop plyometric training can significantly increase ($p < 0.05$) leg muscle explosive power of male volleyball players in Banjarbaru City. This is proven by $t_{count} = 15.07 > t_{table} (11; 0.025) = 2.201$, and then H_0 is rejected. Whereas with Sig. (2-tailed) = 0,000; apparently Sig. (2-tailed) = 0,000 < 0.05 , then H_0 is rejected. Thus, the t_{count} is significant and the hypothesis proposed in this study is proven true.

According [2], double leg speed hop exercises are exercises that develop speed and power for leg and hip muscles, specifically the workings of the gluteals, hamstrings, quadriceps, and gastrocnemius exercises with high speed and full of power. This theory supports the fact that the exercise can increase leg muscle explosive power.

In the double leg speed hop movement, here are the initial positions done: take a relaxed standing, straight back, foresight, and shoulders leaning slightly forward, arms at the sides and bent up to 90 degrees and thumb position up. Then, the implementation is conducted by starting jumping up as high as possible, bending the legs fully to the position of the feet under the buttocks, putting pressure on the maximum force by bringing the knee up and forward on each test, and after landing jump up quickly with the same leg movements, using the arms to help the maximum force. This series of movements must be done as quickly as possible to achieve maximum height and distance, but not at the expense of rhythm of implementation.

The advantages of double leg speed hop plyometric training compared to other exercises are (1) in terms of movement, it is not too difficult to do, (2) the possibility of injury is very small because it is done on a flat field, (3) the training does not require a large space, (4) the movements performed emphasize the jump to reach the maximum height and maximum speed of leg movement, which is in accordance with the characteristics of volleyball, and (5) this exercise does not require tools [3].

Furthermore, the energy system used in double leg speed hop plyometric training is anaerobic energy system which is a series of various chemical reactions that occur in the human body that do not require oxygen. The first energy source used in every form of muscle activity is ATP (adenosine triphosphate), which is only able to sustain work for about 5 seconds, so that muscle work is able to last longer. A PC (phospho creatin) is needed to extend work for about up to 10 seconds. Because this double leg speed hop plyometric exercise movement is an explosive rhythm (suddenly fast), the duration of work is no more than 10 seconds. The maximum work intensity and its activity produce ADP (adenosine diphosphate) + energy using the anaerobic energy system alactics [5].

Moreover, every physical exercise must be guided by the principles of training so that the training program provided does not harm athletes or can achieve maximum results. In this exercise, the researcher applies the principles of training, such as: 1) the principle of individualization (considering the player's age, training age, training history, health status and abilities of each individual; 2) the principle of specialization (producing physiological adaptations in the leg muscles and then an increase in the ability of the leg muscles of the volleyball players because in this exercise the focus is on the limbs); 3) the principle of overload (increasing the work of the training day by day, so that achievement can be increasing and the workload must be above the threshold of sensitivity); 4) the principle of exercise variation (applying the intensity between 30% - 60% and the frequency of the exercise three times a week). According to [6], for resistance training to be focused on increasing power, the lifts must be made more dynamic in natural. A form of squatting known as the jump squat is an example of this type of exercise. In this type of exercise, the athlete uses a load of approximately 30 to 60 percent of 1 RM. It can be interpreted as follows for training against the load towards increasing explosive power (power); the force must be carried out more dynamically and naturally. Squat exercise is done while jumping. In this type of training, athletes use a

training load of about 30 to 60 percent of a maximum repetition (1 RM). In this study, the treatment of applying the training load of 30% to 60% of the maximum repetition (RM) conducted samples with a form of plyometric double leg speed hop training. The implementation was as follows: 1) in the first week, the intensity was 30%, 35%, and 40%; 2) in the second week, the intensity was 35%, 40%, and 45%; 3) at the third week, the intensity was 40%, 45%, and 50%; 4) at the fourth week, the intensity was 45%, 50%, and 55%; 5) at the fifth week, the intensity was 40%, 55%, and 60%; 6) at the sixth week, the intensity was 55%, 50%, and 45%. It can be seen that the researcher applied the intensity of the maximum repetition (RM) with an increase of 5% at each meeting, but at the initial meeting each week, there was a 5% decrease in intensity, so that the adaptation occurred for the volleyball players of Banjarbaru City.

In accordance with the theory by [2], it is stated that double leg speed hop plyometric performed 3-6 sets, the number of repetitions was 10-12 times, and rest periods were between 1-2 minutes between sets. It became the determination for the researcher applying the sets and rest periods which used 3-6 sets and the rest period between sets was 2 minutes. For the implementation, it is explained as follows: 1) in the first and second week, 3 sets, 4 sets, and 5 sets were applied; 2) on the third, fourth and fifth week, 4 sets, 5 sets and 6 sets were applied; 3) at the sixth week, 5 sets, 4 sets, and 3 sets were applied. In this study, it applied a set with an increase of 1 set each meeting and a decrease in sets after the application of the maximum intensity that was on the fifth week. However, in the first and second week, the set was the same. There was an increase in the set in the third week, but in the third, fourth and fifth week with the application of the same set, there was a set of sets in the fifth week so that there was an adaptation to the volleyball players and no muscle fatigue occurred during the final test or posttest so that the results will be maximum.

The impact of exercise done 18 times in 6 weeks with a frequency of 3 times a week was a significant increase in leg muscle power. The results of the initial test calculation with an average leg muscle explosive power before treatment reached to 55.75 cm and the final test after treatment reached to 59.67 cm. With these results, it can be found that double leg speed hop plyometric training can increase leg muscle explosive power by 3.92 cm. The results of this study reinforce the theory, and are supported from the results of research by [3] that the training of single leg speed hop and double leg speed hop affects the increase in leg muscle explosive power in female students of SMP Negeri 3 Mengwi in the academic year 2013/2014.

According to [2], double leg speed hop plyometric exercises develop speed and power for leg and hip muscles, especially the workings of the gluteals, hamstring, quadriceps, and gastrocnemius muscles with high speed and full of power. The increase that occurs after doing double leg speed hop plyometric exercises makes the muscles contract very strongly which is in response to the rapid dynamic loading of the muscles involved in the movement. Imposition on the exercise will result in muscle hypertrophy. Hence, the consequences

arising from muscle hypertrophy will result in an increase in leg muscle strength. An increase in muscle strength is due to an increase in the amount of contractile protein, actin filaments and myosin and an increase on the strength of connective tissue and ligaments. In addition to increasing leg muscle strength, leg muscle speed will also increase by doing the jumping movements that are carried out quickly and repeatedly.

Consequently, with an increase in muscle strength and speed of leg muscles, it will directly affect the increase in leg muscle explosive power. It is based on two important elements that are in explosive power, namely muscle strength and muscle speed. Double leg speed hop plyometric exercises were chosen to increase the leg muscle power of the volleyball players in Banjarbaru City, in order to be able to smash and block more optimally. Double leg speed hop plyometric training is very useful in volleyball games especially when doing smashes and blocks. When a player smashes and blocks, good leg muscle explosive power is needed to be able to smash and block properly and maximally. The stronger the explosive power, the better the volleyball smash because the higher the jump of volleyball players, it is easier for them to smash and block.

The findings have answered the hypothesis, but there are some problems encountered during the research. Some of the subjects of the study did not know what double leg speed hop plyometric exercise is. As the solution, an explanation and example of the movement were given to them and they were asked to try the exercise until all subjects understood and were able to perform double leg speed hop plyometric movements well. After that, the maximum repetition test was carried out and was continued on the training program. The other problem was since the research subjects were mostly students, the training schedule collided with the class schedule. The training program then was held on Monday, Wednesday, and Friday.

IV. CONCLUSION

Based on the data analysis, hypothesis testing, and discussion of the results, it can be concluded that there is a positive and significant influence (Sig. (2-tailed) = 0,000 $< \alpha = 0.05$) plyometric double leg speed hop exercise on the leg muscle explosive power of the male volleyball players in Banjarbaru City. The implications of this study are as follow; 1) For volleyball players, especially male volleyball players, to increase the potential for leg muscle explosive power, double leg speed hop plyometric exercises can be carried out within the periodization of special training preparations intensively so that the resulting increase in leg muscle explosive power is more leverage. 2) For volleyball coaches, it is useful to make plyometric double leg speed hop training becomes a training program for volleyball players by increasing application and repetition.

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