

# The Effect of Plyometric Single Leg Depth Jump to Power and Strength of Leg Muscles in Male Basketball Athletes

Eko Rachlai Arisetiawan<sup>1</sup>, Fepriyanto Andi Nugroho<sup>1</sup>, Agung Supriyanto<sup>1</sup>

<sup>1</sup>Physical Education Study Program, Department of Physical Education STKIP PGRI Sumenep Indonesia

**Keyword:** Plyometric, Single leg depth jump, Basketball.

**Abstract:** The aim of this research is to analyze the effectiveness of plyometric single leg depth jump to increase explosive power and strength of leg muscles in male basketball athletes of PERBASI Sumenep District. The study used experimental research design with one group pretest and posttest design. The subjects were 20 male basketball athletes. The research subjects were given plyometric single leg depth jump for 6 weeks. The results showed a significant effect on the strength and explosive power of leg muscles. This would affect the ability of the athlete to jump.

## 1 INTRODUCTION

Basketball is a game in groups of five persons, or also called as a team. Therefore, it is necessary to establish a good communication and mutual understanding between players in order to achieve victory. Skills of each individual will have a significant impact on the course of the game. Basketball has some basic techniques such as shooting, dribbling, defensive, pivot and soon (Wanena, 2018),

Basketball needs agility and the ability to force a jump (Bal, Parminder and Davinder, 2011). Some components of physical conditions, such as strength, endurance, coordination, balance, speed and explosive power, should be owned by basketball players (Asadi, 2013). Explosive power can be connected with a jump. Jumping is needed to perform jump shooting, block, rebound and slam dunk. Jumping is essential for almost all sports, not to mention in basketball.

One of the components from physical condition that almost every sport needs is a muscle explosive power. In the game of the sport, the explosive power is used in explosive movements like throwing,

resisting, kicking and punching. Power is not a new knowledge in the sports world, because almost all sports require power. In developed countries, power can be increased by using tools of advanced training circuits. However, before increasing power, it is important to improve strength and speed exercises, because power can be generated using strength training and speed in exerting maximum force to overcome the resistance (Munizar, Razali and Ifwandi, 2016).

Plyometric is a form of exercise that can be used to improve muscle explosive power. Plyometric is already known in the coaches and athletes during recent times. Plyometric is related to muscle contractions and repetition, so that it can increase muscle strength (Bal 2011). Plyometric can increase the height of the jump and the speed of leg muscle strength, and improve joints (Shaji, 2009; Arazi 2011). Several studies have shown that plyometric exercise is able to improve muscle strength, especially leg muscle strength (Adibpour, Hojatolah and Naser. 2012; Arazi and Abbas, 2011; Asadi, 2013; bale Parminder and Davinder, 2011; Rajan and Pushparajan, 2010; Shaji and Saluja, 2009; Stojanović, Nikodije and Toplica, 2012).

Basketball is not new in Sumenep district because Sumenep has coaching in the organization. So far, the best achievement in the sport of basketball in Sumenep regency has never completely won at the regional and national levels. This is what should be evaluated in training to basketball athletes in Sumenep regency.

The aim of this research is to increase the explosive power and strength of leg muscles by using the plyometric single leg depth jump. The selection of plyometric training using a single leg jump depth is based on the consideration that it involves muscle groups that are used when the athletes play basketball.

## 2 METHOD

This study was a field experiment. It employed the method of experimentation with the design of one group pretest - posttest design.

### 2.1 Subject

The subjects were male basketball players of PERBASI Sumenep. The subjects in this study were

20 male basketball athletes. The samples were chosen using purposive sampling techniques based on the traits or characteristics that are known in advance by traits or characteristics of the population. Anthropometric subjects were shown in Table 1. The implementation of plyometric single leg depth jump was given for 8 weeks starting March 24th - May 19th 2019.

### 2.2 Tool

Tools used in this research were back and leg dynamometers. They were used to measure the strength of leg muscles. Jump DF was used to measure the explosive power of leg muscles.

### 2.3 Procedure

The first stage of this research prior data collection was giving the subject an understanding of the goals, objectives and procedures of the study. Each subject filled consent letters to declare their willingness to participate in research.



Figure 1: Single Leg Depth Jump

Table 1: Anthropometric research subjects

Physical Physiological Athletes (N = 20)	Mean
Age (years)	19.82 ± 1,121
Height (cm)	172.2 ± 3.72
Weight (kg)	64.89 ± 4:11
Body Mass Index (kg / m2)	22:23 ± 1:23

Table 2: Results plyometric exercise

Variables	Pre Test	Post Test
Leg muscle strength (kg)	169.97 ± 23:04	189.65 ± 23.60 *
Explosive power leg muscle (watt/J)	245.71 ± 15:55	263.16 ± 19:06 *

\*) Different significant ( $p < 0.05$ ) in advance of the pre-test and post-test

The second stage was that each subject was given the initial test carried out by placing a test to examine explosive power of leg muscles using a Jump DF and leg muscle strength using the tool back and leg dynamometer. After that, all athletes were given treatment plyometric single leg depth jump for 6 weeks. It was conducted three times for every week with a total of 18 times of training sessions. In every meeting, the athletes spent 60 minutes, consisting of 10 minutes of warming up, 40 minutes of core exercises, and 10 minutes cooling down.

During plyometric training of single leg depth jump, athletes were asked to stand in one foot on the box measuring 30.48 centimeters (12 inches) to 45.72 cm (18 inches) with fingers close to the edge. Athletes stepped out of the box and down the land with one foot. They then performed advanced motion jump as high as possible and landed with one foot just as well as maintained contact with the ground.

## 2.4 Data Analysis

The tests for normality and homogeneity were required prior to testing hypothesis testing. The analysis of the data on this research was done using t-test statistical methods (Independent-samples t-test) with significance level of 0.05.

## 3 RESULT

The result of leg muscle strengths before performing plyometric was  $169.97 \pm 23:04$  (kg) and  $189.65 \pm 23.60$  (kg) after exercise, for 6 weeks. The explosive power of leg muscles was  $245.71 \pm 15:55$  (Watt / J) before training and  $263.16 \pm 19:06$  (Watt / J) after exercise, for 6 weeks. Results from the study showed a significant difference ( $p < 0.05$ ) in the leg muscle strengths between pre-test and post-test plyometric single leg depth jump. Likewise, there is a significant result ( $p > 0.05$ ) in explosive power of leg muscles between pre-test and post-test plyometric single leg depth jump. Overall, study results were shown in Table 2. These results showed effective plyometric single leg depth jump to improve the ability of the subjects.

## 4 DISCUSSION

Basketball is a sport that requires muscle strength and good endurance because displacement of the ball is very fast and also the displacement position of the attacking and defending players are fast enough.

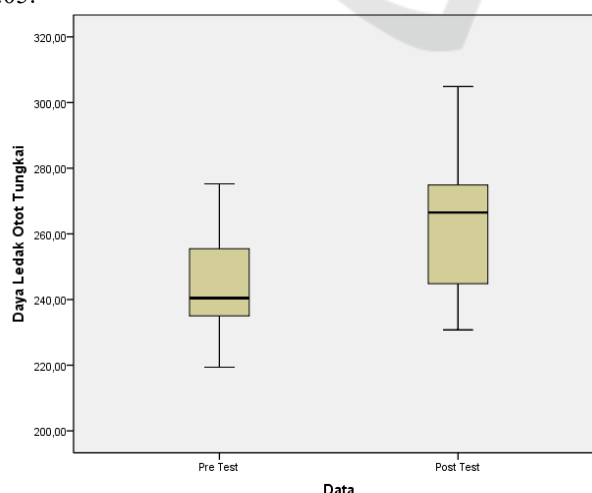


Figure 2: Effectiveness plyometric single leg depth jump to the increased explosive power leg muscle

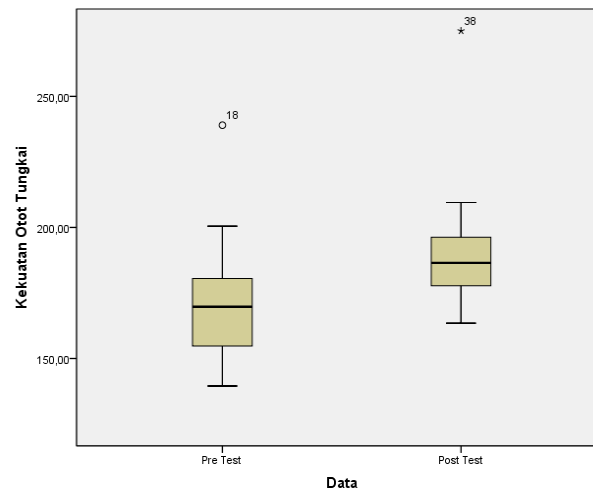


Figure 3: Effectiveness plyometric single leg depth jump to the to the increased leg muscle strength

The results showed that there was a significant effect on strength and explosive power of leg muscles on male basketball athletes using plyometric single leg depth jump. The results of this study was also similar to several previous studies which stated that plyometric exercises can improve athletes' muscle explosive power and strength (Adibpour, Hojatolah and Naser. 2012; Arazi and Abbas, 2011; Asadi., 2013; bale Parminder and Davinder, 2011; Rajan and Pushparajan, 2010; Shaji and Saluja, 2009; Stojanović, Nikodije and Toplica 2012).

Increasing muscle explosive power was related to the ability of the athlete to jump (Stojanović, Nikodije and Toplica. 2012; Rajan, and Pushparajan 2010). The jumping in basketball was used for defending or attacking. The strength and explosive power of players also depends on the anatomy and physiology of the athletes (Stojanović, Nikodije and Toplica. 2012).

Basically the explosive power of leg muscles was used to jump, when an athlete is doing the shooting. Leg have advantages to hold athletes' weight, so the leg muscles are required to have explosive power due to the influence of the Earth's gravity, (Annuri, 2014),

One of thing that must be understood is that an important factor affecting the explosive power of the muscle is muscle and nervous systems (Stojanović, Nikodije and Toplica. 2012). This is because a good explosive power can occur because of good coordination muscle groups. It was supported by the nervous system that manages these muscles (Stojanović. Nikodije, and Toplica. 2012).

There is another factor affecting the high jump and explosive power, namely the power of anaerobic muscles and individual athletes (Adibpour, Hojatolah and Naser. 2012). The higher the jump, the higher the anaerobic. The stronger the muscles, the more explosive the power. This could inform to the coaches to make exercise program to increase the athletes' capacity of anaerobic strength.

Plyometric can be done in the water and in the land. (Arazi and Abbas, 2011) revealed that plyometric workouts in the water and in the land were able to increase the power of speed performance of athletes, especially in the power of jump. The combination of training location will also make the athlete more enjoy and do not feel depressed. It could increase the spirit of the athletes (Arazi and Abbas, 2011).

The combination of exercise resistance and plyometric can improve muscle movement speeds and cause a faster transition from eccentric to concentric contraction (Arazi and Abbas, 2011). However, plyometric has the risk of injury that can be caused by external forces that are too big happens in the joints, bones, muscles, ligaments and tendons (Arazi and Abbas, 2011). It can inhibit the development of the athletes' skills themselves.

A coach was demanded to be able to improve the athletes' performance. A coach is advisable to consider a number of factors when planning a training program for their athletes' explosive power. Among them, one of the considerations is the athletes' characters, the level of skills, position, and playing time. Explosive power program should fit the needs of any player on the team; therefore, a

number of explosive power and conditioning program can be developed and implemented for individual team members during the annual season (Duran et al., 2019).

## 5 CONCLUSION

The conclusion of this study is a significant increase which occurs in strength and explosive power of leg muscles on male basketball players using plyometric single leg depth jump. These results indicated that the ability of the athletes, especially at the increase jump ability. The coaches are suggested to add some exercise about plyometric to improve athletes' jump ability.

## REFERENCES

- Adibpour, N., Hojatolah NB and Naser B. 2012. *Comparison of the Effect of Plyometric and Weight Training Programs on Vertical Jumps in Female Basketball Players*. World Journal of Sports Sciences 7 (2): 99-104
- Annuri, U. 2014. *Relationship Explosive Muscle Power Muscle Limbs Limbs And Capabilities Shooting Basketball Athletes*. YOGYAKARTA STATE UNIVERSITY. Available at: <https://eprints.uny.ac.id/16505/1/SKRIPSI.pdf>.
- Arazi, H., and Abbas A. 2011. *The Effect of Aquatic And Land Plyometric Training on Strength, Sprint, And Balance In Young Basketball Players*. Journal of Human Sport & Exercise Volume 6 Issue 1
- Asadi, A. 2013. *Effects Of In-Season On Sprint Plyometric Training And Balance Performance In Basketball Players*. Sport Science 6 (1): 24-27
- Bal, BS, Parminder JK, and Davinder S. 2011. *Effects Of A Short Term Plyometric Training Program Of Agility In Young Basketball Players*. Brazilian Journal of Biomotricity, Vol. 5, No. 4 ,, pp. 271-278
- Duran, G. et al. 2019. *Scheduling Argentina's professional basketball leagues: A variation on the Traveling Tournament Problem*, European Journal of Operational Research, 275 (3), pp. 1126-1138. doi: 10.1016 / j.ejor.2018.12.018.
- Munizar, Razali and Ifwandi 2016. *The contribution of the Power Muscle Limbs And Power Muscles Legs Against Stroke Smash In Players Volleyball Club HIMADIRGA FKIP UNSYIAH*, Journal of Student Scientific Physical Education, Health and Recreation Faculty of Teaching and Education Unsyiah, 2, pp. 26-38. Available at: <https://media.neliti.com/media/publications/187919-ID-kontribusi-power-otot-tungkai-dan-power.pdf>.
- Rajan, SR, and Pushparajan, A. 2010. *Effects Of Plyometric Training On The Development of The Vertical Jump In Volleyball Players*. Journal of Physical Education and Sport Vol 28, No 3.
- Shaji, J. and I. Saluja 2009. *Comparative Analysis of Plyometric Training Program and Dynamic Stretching on Vertical Jump and Agility in Male Collegiate Basketball Player*. Al Ameen J Med. Sci, Volume 2, No.1,
- Stojanović, N., Nikodije J, and Toplica S. 2012. *The Effects Of Plyometric Training On The Development Of The Jumping Agility In Volleyball Players*. Physical Education and Sport Vol. 10, No. 1, pp. 59-73
- Wanena, T. 2018. *Contributions power leg muscle, leg muscle strength and hand-eye coordination to the ability of the student basketball jump shot Nikken Uncen Year 2017*, JPOS (Journal of Power Of Sports), 1 (2), pp. 8-13.