

# The Effect of Plyometric Trainings on the Leg Muscle Power Enhancement of Women's Volleyball Junior Athletes

Bayu Santoso<sup>1</sup>, Hari Amirullah Rachman<sup>1</sup>

<sup>1</sup>Departement of Sport Science, Graduate School,  
Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

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**Abstract:** The purpose of this research is to find out the effect of plyometric training on the leg muscle power enhancement of the women's volleyball junior athletes at Yuso Yogyakarta. This research employed experiment methods with the design of "two group's pre-test post-test design". The population in this research were the women's volleyball junior athletes at Yuso Yogyakarta which consist of 30 athletes. The sampling technique was purposive sampling, with following criteria: (1) The chosen athletes have been training more than three years; (2) The athletes were between 14 to 18 years old; (3) The athletes were able to participate in the conducted pre-test, treatment, and post-test. As a result on that consideration, 18 out of 30 athletes were chosen as the participants. Muscle leg power requires vertical jumps with a jump aid and Harman Formulation. The data were analyzed using T test. The result of analysis showed that: (1) There was a significance effect of the front jump plyometric training on the leg muscle power of the women's volleyball junior athletes at Yuso Yogyakarta with t count  $3.357 > t$  table 2.306, significance value of  $0.010 < 0.05$ , enhancement percentage of 8.586%. (2) There was a significance effect of side jump plyometric training to the leg muscle power enhancement of the women's volleyball junior athletes at Yuso Yogyakarta with t count  $3.577 > t$  table 2.306, significance value of  $0.007 < 0.05$ , and enhancement percentage of 3.976%. (3) The front jump plyometric training was more effective to increase leg muscle power with the different percentage of 4.610%.

## 1 INTRODUCTION

Volleyball is one of favourite sports in Indonesia, including in Yogyakarta. In its development, there have been some volleyball clubs in Yogyakarta which actively participate in the regional, province to national levels of championship. Many teenagers joining the clubs have won the championships ranging from junior to senior levels. Each volleyball club in Yogyakarta is currently in the race to develop its athletes which are competitive and eligible in any event and are excellent in any championship.

In volleyball games, there are several factors that influence athletes to excel in order to obtain maximum achievement, namely techniques, tactics, and mental as well as physical condition. LA84 Foundation (2012: 57) describes the components of physical training in volleyball games. They are divided into four categories: endurance, speed, strength and power. All those physical components in volleyball are athletes' need to achieve maximum

performance. Without having a good physique, volleyball athletes will find it hard to achieve maximum performance.

Good physical ability will help athletes to master volleyball techniques, i.e. the smashing technique which is the main weapon of a volleyball player to turn off an opponent and get points. When performing this technique, it takes a high jump as well as a hard and directed blow. For that, the players need power of their legs, arms, back and stomach. Another technique is called blocking. This technique is also the main weapon for defense to stem the opponent's smash and turn off the ball in the opponent's area. In addition, this also requires high jumps and good movement techniques.

The physical component especially the power of legs is very influential for volleyball athletes in jumping when performing smashing and blocking techniques so as to produce a good high jump that can help athletes in doing good smashes and blocks.

Speed and strength when jumping are also important factors in volleyball.

Power training methods can use a variety of strength training or plyometric exercises. Plyometrics is one method of trainings to enhance the power of legs and the height of jumping. Plyometric training is very easy for athletes to do during training in the field. However, the structured plyometric exercises are rarely applied during training sessions.

Plyometric training has many benefits for volleyball athletes, because volleyball games that require good power. Thus, this training can help the athletes when smashing and blocking by increasing the jump height. Donald A Chu (2013: 36) explains that proper plyometric movements have a large impact on increasing power related to sports involving Stretch-Shortening Cycle (SSC). Front jumps and side jumps are the forms of plyometrics that emphasize speed and height of jump.

Yuso is a volleyball team in Yogyakarta which has a tiered coaching. The training program is distinguished from the level of beginners, teens, juniors to seniors. In its implementation the plyometric training program has not been maximally given to junior level athletes. In preparing an exercise program, plyometric training needs to be studied in terms of its dose of exercise that covers the training load, number of sets, rhythm, repetition, and recovery. Those elements are very influential to determine the achievement of a training goal. The preparation of a structured and systematic training program has not been done by many trainers to achieve the training objectives.

Based on the experience during microcoaching and field practice education at the Yuso club, many junior athletes have not got a good leap. In this case, there are many factors which help athletes to have a good leap, one of which is the athlete's physical strength. The junior athletes in that club have not got good physical strength so that they mostly cannot make a good jump.

The forms and types of plyometric training are needed to be presented by volleyball coaches to avoid the athletes' boredom. Plyometric front jump and side jump exercises are the examples of plyometric training to increase the leg muscle power of volleyball athletes. Variations in this exercise are needed when athletes feel bored with strength or speed training.

Based on the underlying background above, a research was conducted in Yuso volleyball club Yogyakarta aimed at using plyometric front jump and side jump exercises to increase the athletes' leg power. The research was entitled "The Effect of

Plyometric Trainings on the Leg Muscle Power Enhancement of Women's Volleyball Junior Athletes".

## 2 RESEARCH METHODS

### 2.1 The Type of Research

This research was a quasi-experimental research, meaning that the sample was not quarantined or dormant. According to Suharsimi Arikunto (2010: 36) experimental research is a study that is intended to determine whether there is a result of something imposed on the subject. The research design used in this study was "Two Groups Pre-test Post-test Design"; the design of the study that had a pretest before being treated and posttest after being treated.

### 2.2 Time and Place of Research

The research was conducted on February 18 - March 29, 2018. The pretest was held on February 17, 2018 and posttest on March 30, 2018. The treatment was carried out for 18 meetings with a frequency of exercise of three times in a week; on Tuesdays, Thursdays and Saturdayso at the Yuso volleyball court in Yogyakarta.

### 2.3 Research Subject

The population in this study were Yuso Yogyakarta volleyball athletes, totaling 35 athletes. According to Sugiyono (2011: 120), sample is part of the numbers and characteristics possessed by the population. The sample can be taken from a population. According to Sugiyono (2011: 126) purposive sampling is a technique of determining samples with certain considerations. The criteria for determining this sample include the Yuso's female volleyball athletes: (1) who has been training for more than 3 years, (2) whose ages are between 14 to 18 years old, (3) who are willing to take the pretest, treatment and posttest. Based on these criteria, 18 athletes were chosen as they were suitable to be the research participants.

### 2.4 Instruments and Data Collection Techniques

The research instrument is a tool used by the researchers in collecting data so that their work is easier and the results are better, in the sense of being meticulous, complete, systematic, and easy to process (Suharsimi Arikunto, 2010: 192). The

instrument was for the initial measurement (pretest) and final measurement (posttest) using the vertical jump test from Brian Mac (2012: 4) with the Harman formula. The purpose of the test is to measure the leg muscle power.

## 2.5 Data Analysis Technique

The data in this study were analyzed by conducting normality, homogeneity and hypothesis testings with the help of SPSS 20.

### 2.5.1 Normality Test

The purpose of the normality test is to test the normal distribution of the data to be analyzed.

### 2.5.2 Homogeneity Test

The purpose of the homogeneity test is to ensure that the groups that make up the sample come from a homogeneous population.

### 2.5.3 Hypothesis Testing

After the prerequisite test is fulfilled, the hypothesis is tested. Hypothesis testing uses the t-test with the help of SPSS 20, namely by comparing the mean between pretest and posttest. If the value of t count is smaller than t table, then  $H_a$  is rejected, if t count is greater than t table then  $H_a$  is accepted.

## 3 RESEARCH RESULTS AND DISCUSSION

### 3.1 Research Result

The results of data analysis could be described as follows:

#### 3.1.1 Group A (Front Jump Plyometric Exercise)

Group A for front jump plyometric training consists of 9 athletes. The results of the study are known as follows. Based on the data analysis, the pretest on the leg power resulted in the mean value of 794,689, minimum value of 592.2, and the maximum value of 1028.8, while the posttest resulted in the mean value of 826,922, minimum value of 608.3, and maximum value of 1038.5. In addition, the pretest on vertical jump resulted in the mean value of 44.22, minimum value of 38, and maximum value of 55, while the posttest resulted in the mean value of 46.78,

minimum value of 42, and the maximum value of 56.

#### 3.1.2 Group B (Pliometric Side Jump Exercise)

Group B for side jump plyometric training consists of 9 athletes. The results of the study are known as follows. Based on the data analysis, the pretest on the leg power resulted in the mean value of 787,989, minimum value of 542.1, and maximum value of 1016.9, while the posttest resulted in the mean value of 819,322, minimum value of 581.7, and the maximum value of 1017.4. In addition, the pretest on vertical jump resulted in the mean value of 44.33, minimum value of 39, the maximum value of 53, while the posttest resulted in the mean value of 45.44, minimum value of 41, and maximum value of 53.

#### 3.1.3 Prerequisite and Data Analysis of the Test Results

The normality test was done using the Shapiro-Wilk formula with the SPSS 20. The data are said to be normally distributed if the significance value obtained is greater than 0.05. The following are the results of normality test calculations:

From the data above, it can be seen that all data (pretest and posttest) have p value (Sig.) of more than 0.05 ( $> 0.05$ ). It can be concluded that the data are normally distributed.

The purpose of the homogeneity test is to find out the similarity of variance or test that the data obtained come from homogeneous samples.

From the table, the Sig. value scores 0.884 and 0.814 which are greater than 0.05. This means the data are homogeneous.

The hypotheses proposed in this study are: (1) There is a significant effect of applying plyometric front jump training on enhancing the leg muscle power of women's volleyball junior athletes at Yuso Yogyakarta. (2) There is a significant effect of applying plyometric side jump training on enhancing the leg muscle power of women's volleyball junior athletes at Yuso Yogyakarta. (3) Polyometric front jump exercises are more effective than side jump exercises in increasing leg muscle power.

The results of the t-test on group A, it can be seen that t count values 3.357 and t table values 2.306 ( $df = (n-1) = 9$ ) with a significance value (p) of 0.010, and a percentage increase of 8.586%. Therefore, this result showed that there is a significant difference in group A (front jump training).

From the results of the t-test on group B, it can be seen that t count values 3.577 and t table values 2.306 with a significance value of p of 0.007. Because t count 3.577 is  $>$  t table 2,306, a significance value of 0.007 is  $<$  0.05, and a percentage increase of 3.976%, this result showed a significant difference in group B (side jump training).

From the results of the t-test it can be seen that t count values 2.455 and t table values 2.306 with a significance value of p of 0.040. Therefore t count 2.455 is  $>$  t table 2.306, the significance value 0.040 is  $<$  0.05, and the difference in percentage increase is 4.61%. This means that there are significant differences between group A and group B. Thus, the front jump training applied for group A is more effective in enhancing leg muscle power.

### 3. 2 Discussion

This study aimed at determining the effect of front jump and side jump pliometric trainings on enhancing the leg muscle power of women's volleyball junior athletes at Yuso Yogyakarta.

The statistical results show that group A athletes who received the treatment of pliometric front jump training and group B who received treatment for pliometric side jump training for 18 meetings both experienced the enhancement of leg power. By joining the training process for 18 times, it can enhance the power of the legs significantly.

#### 3.2.1 Increased Group a Leg Muscle Power (Front Jump Exercise)

The results of the analysis showed that there were effects of leg power before and after the pliometric front jump exercise. This was indicated by the value of t count 3.357 and t-table 2.306  $df = 8$ , while the p value is 0.010 (table 5). Because t count 3.357 is  $>$  t table 2.306 and p value 0.010 is  $<$  0.05, it means that there is a significant effect.

This means that the front jump pliometric exercise has a significant influence on the leg power enhancement of women's volleyball junior athletes at Yuso Yogyakarta. This enhancement is due to the activity of pliometric front jump, i.e. is to jump forward in explosive movements with different heights every week. The example of pliometric front jump training is to jump in a motion that explosively passes through as many as 10 obstacles with a height of 30cm by paying attention to repetitions, sets, recovery, and intervals. Each repetition is given a complete recovery time (t.r) and interval time (t.i) (complete recovery). Comparison of recovery time

(t.r) 1: 5, while for interval time (t.i) 2 minutes. The pliometric front jump exercise is similar to a vertical jump test, so that the trained muscular spindles will be the same.

#### 3.2.2 Increased Group B Leg Muscle Power (Side Jump Exercise)

The results of the analysis showed that there was a significant influence of side jump training on enhancing the leg power of women's volleyball junior athletes at Yuso Yogyakarta. This was indicated by the value of t count of 3.577 and t table 2.306 while the significance value of p 0.007 (table 6). Because t count 3.577 is  $>$  t table 2,306 and significance value p 0.007 is  $<$  0.05, it means that there is a significant effect.

The athletes' leg power has increased in side jump pliometric exercises because this movement involves Stretch Shortening Cycle (SSC). This is in accordance with the statement of Donald Chu (2013: 36) that a proper plyometric movement involving Stretch Shortening Cycle (SSC) has a large impact on increasing power.

#### 3.2.3 Front Jump Exercise is More Effective in Increasing Leg Muscle Power

The results of the analysis showed that there is a significant difference on the leg power enhancement of women's volleyball junior athletes at Yuso Yogyakarta. This was indicated by the increase in the percentage of group A (front jump exercises) by 8.586% greater than the increase in the percentage of group B (side jump exercises) which is 3.976%, with a difference in percentage of 4.610% (table 7).

Plyometric front jump exercises are more effective because in these exercises, the athletes move forward to jump high in accordance with the movement of the leg power tests including vertical jumping and muscular spindle training.

## 4 CONCLUSIONS AND SUGGESTIONS

### 4.1 Conclusion

Based on the research findings and discussions, some conclusions can be drawn as follows: a) There is a significant effect of applying plyometric front jump training on enhancing the leg muscle power of women's volleyball junior athletes at Yuso Yogyakarta; b) There is a significant effect of

applying plyometric side jump training on enhancing the leg muscle power of women's volleyball junior athletes at Yuso Yogyakarta; c) Polyometric front jump exercises are more effective than side jump exercises in increasing leg muscle power.

## 4.2 Implications of Research Results

Based on the research findings, discussions and conclusions, there are several implications that can be stated as follows: 1) It is needed to provide good understanding for volleyball coaches in particular and other kinds of sport coaches whose movements resemble volleyball games such as basketball, badminton, soccer and other sports in general about the effect of plyometric front jump training on enhancing athlete's leg power; 2) Front jump training is a variation of training used to increase the athletes' power especially their power of legs.

## 4.3 Suggestion

By referring to the research findings and discussions, it suggested that: 1) It is best to do a research using larger samples; 2) The research should be carried out when the athletes have no activity or no event held in the near future; 3) The presence of strength training is needed before applying plyometric exercise, because strength is the prior requirement for plyometric exercise; 4) There is a need for other researchers to conduct the plyometric training for the upper body to increase the power of athletes.

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