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Effect of Plyometrics Hexagonal Drill and Zig-Zag Drill with Muscle Strength towards Leg Muscle Power and Vo2max of the Volleyball Extracurricular Members of SMA Negeri 5 Kota Magelang

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ABSTRACT: This research aims to determine: (1) the effect of hexagonal plyometrics and zig-zag drill training towards leg muscle power and vo2max, (2) the difference in the effect between high and low leg muscle strength towards leg muscle power and vo2max, and (3) the interaction between hexagon plyometrics training and zig-zag drill as well as leg muscle strength (high and low) towards leg muscle power and vo2max.This research method was an experiment with a 2x2 factorial design. In this research, the number of samples was for about 20 students who were selected by using purposive sampling. To measure leg muscle power, the researcher used the vertical jump instrument, for vo2max, used the bleep test (multi stage), and for leg muscle strength, used a leg dynamometer. The data analysis used a two-way ANOVA test with a significance level of 0.05. The results of this research are: (1) there is a significant difference in the effect of plyometrics hexagonal drill and zig-zag drill training towards leg muscle power and Vo2max of the volleyball extracurricular members, (2) there is a significant difference in the effect between low muscle strength and high muscle strength towards leg muscle power and Vo2max of the volleyball extracurricular members with a value < 0.05, and (3) there is no significant interaction between plyometrics training and leg muscle strength (high and low) towards leg muscle power and Vo2max of the volleyball extracurricular members with a value > 0.05.

KEYWORD: hexagonal drill, zig-zag drill, leg muscle strength, leg muscle power, vo2max, volleyball

I. INTRODUCTION

Volleyball is a sport played by everyone, men and women, of all ages. Volleyball is played by teams consisting of six players on each team, the ball is played in the air by passing through the net, each team can only play the ball three times (Munasifah 2009). Basic volleyball techniques include serve, passing, smash, and, block (Hangar, D., & Divine 2018). The goal of volleyball is to achieve victory in a competition by scoring more points than the opponent (Ugrinowitsch et al. 2014). At this time, volleyball clubs should start training the sport of volleyball that has been practiced. Sports coaching should be carried out in stages, starting from the multilateral stage to the specialist stage. To achieve high achievement in sports, one must train with a systematically programmed and structured exercise process that repeats and increases the training load day after day according to the principle of exercise.

Hidayat (2020) stated that training is an activity to provide treatment to individuals to improve talents, skills, physical and emotional conditions in the sports they pursue. The training method is a scientific way by providing programmatic treatment to improve the athlete's talent, athlete's skills and the athlete's physical condition in accordance with the sport performed. Volleyball players certainly need high-intensity exercises that vary and alternate followed by low intensity such as standing and walking. Volleyball requires high physical abilities such as leg strength and arm muscle strength. The power of the limbs is used to perform high jumps in volleyball. While arm muscle strength is used to make punches in volleyball.

Harsono (2015) states that power is a product of strength and speed. Power is the ability of muscles to direct maximum strength in a very short time. In a volleyball game, every time you hit a smash, players must make a high jump so that the ball can be hit hard until it passes through the net. Reinforced by another study that jumps when smashing, volleyball players need good leg muscle power (Munizar, et al, 2016). Players need to develop leg muscle power by doing speed and acceleration movements then with specific movements in sports (McGuigan, 2017: 113).

In addition to developing speed and power, of course, strength endurance needs to be developed (Vassil, K., & Bazanovk n.d.). The physical component related to endurance is the VO2Max component of a good performer. VO2Max is very important in volleyball games to maintain endurance and stamina possessed by a volleyball player. VO2Max can be interpreted as a term for maximal oxygen consumption or maximum oxygen volume. A volleyball player must have a good VO2Max so that the volleyball game can last a long time.

Exercises that can increase leg muscle power in volleyball games one of them is plyometrics exercises. Plyometrics exercise is a form of exercise that can be used to improve a player's biomotor fitness, including strength and speed that has very wide applications in sports activities (Arafat et al., 2018). Training with the plyometrics method is used to train and develop physical abilities such as strength, speed, and power (Asadi et al., 2016). According to Donnald A. Chu & Gregory Myer, (2013). Plyometrics exercises are a popular form of exercise used to improve the performance of athletes, these exercises involve lengthening and shortening muscle units. Examples of plyometrics exercises that can increase leg muscle power and vo2max are plyometrics hexagon drill and zig-zag drill. Plyometrics hexagon drill is an exercise with jumping movements across a hexagon-shaped line and returning centered on the same line then continued by circling each side of the hexagon. Plyometrics zig-zag drill is a jumping exercise using a tool in the form of two parallel straight lines with a width of 60-105 cm and a length of 10 meters, in its implementation using one foot above the line, then jumping forward 4 from one line to another continuously as far as 10 meters (Donnald A. Chu & Gregory Myer, 2013).

Observations made by the author in July 2023 at SMA Negeri 5 Magelang City found that the physical level of children who are still lacking is leg muscle power and vo2max endurance levels in students. This can be seen from the students' jumping ability when doing smashes is still not good and less than optimal. And there are some students at the time of playing still easily tired and lack enthusiasm. Another problem found during observation is the lack of a dose of exercise where there are some children who do not follow the exercise at all times. There needs to be programmed and structured exercises to train the level of physical strength of children, especially at the level of leg muscle strength and vo2max. Based on this, researchers intend to conduct a study to determine the effect of plyometrics hexagon drill and zigzag drill exercises with muscle strength on leg muscle power and vo2max in volleyball extracurricular participants of SMA Negeri 5 Magelang City.

II. METHOD

This study used an experimental method using a factorial design with a 2x2 factorial design. The experiment in this study used a factorial design with a 2x2 factorial design. This research model used four different sample groups with each group given different treatment. Before being given treatment, samples are measured using pretest instruments to obtain initial data on samepl. After obtaining preliminary data, the samples were grouped into four groups and given treatment as many as 18 meetings. The instruments in this study used three measuring instruments, namely vertical jump, bleep test, and leg dynamometer. At the end of the study, a study was carried out using a posttest instrument to obtain the final data results on each sample. After getting the next pretest and posttest data, the data is calculated using the help of the SPSS application to get the final results of the study. The results of the research data are then used as a discussion into a good research result.

III. RESULT AND DISCUSSION

RESULT

The results of the study were divided into three factors, namely 1) the difference in the effect of plyometrics hexagon drill and zig zag drill exercises on leg muscle power and vo2max, 2) the difference in the influence of high and low muscle strength on leg muscle power and vo2max, 3) is there an interaction between plyometrics exercises and muscle strength on leg power and vo2max. The results of such studies are presented in the table:

Table 1. Differences in the effect of plyometrics training on leg muscle power and vo2max

Source	*Type III Sum Of Squares*	df	Mean Square	f	Sig
Muscle power	5,000	1	5,000	10,526	,005
Vo2max	5,832	1	5,832	4,938	,041

Based on the results of the data above, it can be presented that there is a difference in the effect between hexagonal plyometric exercise and plyometrics zig-zag drill on leg muscle power and vo2max.

Table 2. The effect of high and low muscle strength on leg muscle power and vo2max

Source	*Type III Sum Of Squares*	df	Mean Square	f	Sig
Muscle power	5,000	1	5,000	10,526	,005
Vo2max	2,592	1	2,592	2,195	,158

Based on the results of the data above, it can be presented that there is a significant difference between high muscle strength and low muscle strength on leg muscle power and vo2max.

Table 3. Interaction between plyometrics training and muscle strength to leg muscle power and vo2max

Source	*Type III Sum Of Squares*	df	Mean Square	f	Sig
Muscle power	,200	1	,200	,421	,526
Vo2max	,338	1	,338	,286	,600

From the results of the data analysis above, it can be presented that there is no interaction between plyometrics exercise and muscle strength on leg muscle power.

DISCUSSION

Effect of plyometrics hexagonal dril and zig-zag drill on limb muscle power and Vo2max in extracurricular volleyball students

In this study, it was proven by the conclusion that there was a significant difference in the effect of plyometrics hexagonal dril and zig-zag drill exercises on leg muscle power and Vo2max in volleyball extracurricular students. With the results of data analysis on leg muscle power produces an F value of 10.526 with a significance value of 0.005 < 0.05. While vo2max produces an F value of 4.938 with a significance value of 0.041 < 0.05. Elsayed, (2012) revealed pliometrics training is a training technique used by observable athletes and plyometrics training can also be performed on all types of sports to increase strength, explosive power that is safe and effective for children and adolescents. Vadivelan, K., & Sudhakar, (2015) state "Plyometrics is a type of training methodology known as "Exercise" that can increase muscle explosive power".

The difference in the effect between high muscle strength and low muscle strength on leg muscle power and Vo2max in volleyball extracurricular students

This study also showed that there was a significant difference in the effect between high muscle strength and low muscle strength on leg muscle power in volleyball extracurricular students. The results of data analysis on muscle power showed that the F value was 10.526 and the significance value was 0.005 < 0.05. While vo2max shows that the F value is 2.195 and the significance value is 0.158 > 0.05. Strength is a resistance due to a load received. Harsono (2015: 177) stated that strength is a very important component to improve overall physical condition. Strength can be increased by exercises that pose resistance, for example, pushing, pulling and lifting (Keller, K., & Engelhardt, 2013).

Interaction between plyometrics exercises and leg muscle strength on leg muscle power and Vo2max in volleyball extracurricular students

This study showed that there was no significant interaction between plyometrics exercise and leg muscle strength (high and low) on leg muscle power and Vo2max in volleyball extracurricular students. The results of the hypothesis test measurement on leg muscle power get an F value of 0.421 and a significance value of 0.526 > 0.05. While vo2max shows results where the F value is 0.286 and the significance value is 0.600 > 0.05, it can be implied that H0 is accepted. From these results, it can be concluded that there is no interaction between plyometrics exercises with leg muscle strength to leg muscle power and vo2max because the two methods of plyometrics hexagon drill and zig-zag drill prove that both exercises are good for increasing power and vo2max in volleyball extracurricular students.

IV. CONCLUSIONS

The conclusion in this study is divided into three parts, namely that:

1. There is a significant difference in the effect of plyometrics hexagonal dril and zig-zag drill exercises on leg muscle power and Vo2max in extracurricular volleyball students of SMA Negeri 5 Kota Magelang.

2. There is a significant difference in the effect between high muscle strength and low muscle strength on leg muscle power in volleyball extracurricular students of SMA Negeri 5 Kota Magelang.
3. There was no significant interaction between plyometrics training and leg muscle strength on leg muscle power and Vo2max in volleyball extracurricular students of SMA Negeri 5 Kota Magelang.

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