



THE EFFECT OF USE OF PERIODIZATION MODEL UNDULATING IN STRENGTH ON INCREASING POWER

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Abstract

Power is important in every sport, in almost every sport athletes will need the ability to use power at certain times which makes the athlete's movements faster and stronger. To get this, you need a regular and measurable training program to produce maximum power. Periodization is an important component in running a training program. In sports achievement, achieving peak conditions or peak performance in accordance with the time that has been planned is the goal, but this is also the most complex problem, because it is often the peak condition (peak performance) is achieved before or is in progress of the competition. The purpose of this study was to examine the influence of the undulating periodization model on the power increase. In almost every sport, athletes will need the ability to use power at a certain time. The method used in this study was experimental with The One-Group Pretest-Posttest Design by providing external training for eight weeks to 15 students of Sports Science FPOK UPI. The results of this study show that the undulating periodization model provides a significant increase in upperbody and lowerbody power with a significance level of $0.000 < 0.005$ which means that the increase in upperbody and lowerbody power increases significantly.

Keywords:

Sport achievement, Periodization, Undulating, Power, Training Method, Physical Condition

Introduction

Achieving the highest achievement in sports is the goal of every athlete. To achieve this, of course, an athlete must train intensively and systematically well, because high achievements can only be achieved by those who are talented and practice systematically (Sidik et al., 2019). The success of an athlete in achieving achievements is inseparable from internal factors and one of the external factors that affect the athlete itself is physical condition.

Physical condition is a necessary condition in improving the performance of an athlete, it can even be said as a basic need that cannot be postponed or negotiated, therefore athletes who have good physical abilities have a great opportunity to achieve high achievements. One of the physical components that supports athlete performance is strength (Suchomel et al., 2016). Strength training induces increased adaptations in



performance, such as increased strength, increased strength, and muscle twitch speed (Prestes et al., 2009). Muscle mass, strength and power are important factors for performance. To improve these characteristics, periodic resistance training should be used (Gavanda et al., 2019)

Muscular strength has been defined as the ability to exert force on an external object or resistance (Suchomel et al., 2016). Strength is a very important element of physical condition in sports because strength is the basic capital of movement skills and has a major influence on movement speed. As for the development of the physical component of strength, namely speed/power strength. Therefore, to have good strength abilities, good strength is needed as a starting point, because strength depends on the level of strength.

Power is a product of force and speed and is highly dependent on the ability of the neuromuscular system to generate the largest impulse in a given period of time (Nimphius et al., 2014). Power output is arguably the most important characteristic for most athletes to develop (Turner, 2014). In almost every sport, athletes will need the ability to use power (Hori et al., 2005). This proves that the need for power is very important, because power will help athletes produce explosive movements which are a function of the interaction between strength of contraction and speed. contraction associated with muscle explosion. For example, a badminton or volleyball athlete who does a smash, the smash must be hard and fast so that it is difficult for the opponent to anticipate. Whereas for football athletes who use energy to run, jump and kick the ball towards the goal hard and fast so that it is difficult for the goalkeeper to do a push over, therefore the energy requirements for athletes need strength training to increase it, because strength depends on strength level (Suchomel et al., 2016) and since power is work speed, the athlete who is able to complete the work at the highest speed will win (DeWeese et al., 2015b). For this reason the ability to generate or transfer explosive muscle power is a key element of the success of many sporting activities. In many of these activities, explosive power is generated by the legs and hips, which are collectively referred to as the "zone of strength" (Armstrong, 1993). Muscle mass, strength and power are important factors for performance. To improve these characteristics, periodic resistance training is used (Gavanda et al., 2019)

The target in the training methodology is how to achieve peak performance in accordance with the planned time. But the problem is, achievements are often won by athletes before the competition starts, and the unclear implementation that seems often suddenly becomes one of the causes. In addition, mistakes made by a coach in compiling a training program can have long-term consequences, namely in the form of overtraining, hindering the development of athletes, and the inability of athletes to achieve high achievements. Therefore, the use of periodization in the training process needs to be utilized so that the training provided by the trainer has a positive impact on athletes (Rafi & Solaiman, 2019). And periodization is also an effort to achieve maximum results in achievement sports (Antretter et al., 2019).

In an effort to achieve peak performance, periodization is the first step in planning athlete training before and during competition. Periodization is a program design/implementation strategy developed to maximize the effects of physical training through planned variations in the main training variables, especially volume and intensity, during predetermined training cycles (Holliday et al., 2008). Periodization is so important in the process of improving the athlete's condition to be in peak condition, therefore periodization is considered as an integral part of the training process and provides a conceptual framework for designing training programs (DeWeese et al., 2015b).

Periodization also plays a very important role in strengthening the strength component in periodization training because periodization is one of the most written and discussed topics in strength and conditioning circles (Rhea & Alderman, 2004a). Then it is necessary to train the strength component with a planned periodization of variable acute programs which have been shown to be more effective in increasing strength and body mass than programs without periods (Rhea et al., 2003)



In practice, Periodization allows trainers to organize training into successive phases and cycle time periods to increase the potential for achieving certain performance goals and objectives while minimizing the potential for overtraining (Deweese et al., n.d.). The main concept of periodization is to divide training (strength, power, strength endurance) towards the athlete's highest level of development with the aim of achieving peak condition at the right time and avoiding stagnation, injury, or overtraining (Stone et al., 1981). agree with this (Fleck, 1999) Periodic strength training refers to varying the training program at regular intervals in an effort to produce optimal strength, power, motor performance, and/or muscle hypertrophy. Note that periodization and programming are difficult to separate, each focusing on a different aspect of the training process. Periodization introduces variation through phases and cycle time periods, while programming consists of structuring training variables (load, sets, repetitions, and exercise selection) in phases to enhance the training effect (DeWeese et al., 2015a). in Periodization training programs are designed and developed according to two different models: the linear model and the non-linear model (Rhea & Alderman, 2004b). One of them is nonlinear periodization or wavy periodization.

Undulating periodization is the variation of intensity and volume that varies more every day or every week (Prestes et al., 2009) and uses maximum repetitions to determine the intensity of the exercise (Buford TW, Rossi SJ, Smith DB, 2010). In undulating periodization, it is divided into two models depending on the volume and intensity of exercise manipulated daily (DUP) and weekly (WUP) (Harries et al., n.d.), both of which can be used for anyone depending on the subject, meaning that the whole plan is based on needs athlete, athlete's developmental status, and athlete's overall strengths and weaknesses (Bompa & Haff, 2009). in this model for changes in intensity and volume of exercise that are more frequent than the linear model (Niknafs, 2008). In practice, exercise volume and intensity increased and decreased regularly but did not follow the traditional pattern of increasing and decreasing volume during the meso cycle (Fleck & Kraemer, 1997). This makes it possible to control various training objectives, such as hypertrophy, maximal strength, endurance endurance or explosive power. Thus, wavy periodization may have various advantages in terms of better compatibility in training, planning and implementation, as well as more flexible individualization (Harries et al., n.d.), since the Corrugated (Non-Linear) Model allows variations in intensity and volume in each cycle of 7-10 days by rotating different protocols to train different components of the neuromuscular system (eg strength, power, local muscular endurance) (Jiménez, 2009). Instead of making changes for several months, this periodization model changes every week or even every day (Abdu, 2018). The model in this study uses the daily model (DUP) adapted by (Rhea & Alderman, 2004a) to describe large changes in volume and varying intensity in short periods aimed at maintaining high levels of performance during long training periods.

As a reference material in this study, the authors refer to previous research, such as research (Prestes et al., 2009). The results of this study indicate that nonlinear periodization (undulating) for 12 weeks is more effective in increasing strength, and the results of the study. (Monteiro et al., n.d.) demonstrated that nonlinear (wavy) periodization over 8 weeks was more effective in increasing upper and lower body strength for trained subjects using separate routines. Both of these studies provide results regarding strength in general, but research to find out more specifically about the part of strength, namely power, requires further research.

Methods

This research uses Pre-Experimental Designs, namely designs that are not yet real designs because there are still external variables that influence the formation of the dependent variable (Fraenkel et al., 2012)). The design used in this research is The One-Group Pretest-Posttest Design. In a one-group pretest-posttest design, one group is measured or observed not only after being exposed to the type of treatment, but also before. So



the researcher wants to know the effect of using the wave periodization model (undulating) in power to increase in power.

Participant

The participants in this study were 15 students of Sports Science at the Indonesian University of Education. The criteria for this study participant were healthy and not injured, active in sports, never used the undulating periodization model in strength, and were not undergoing a strength training program outside of the study.

Population & Sample

The population of this research is Sports Science students class of 2019, totaling 118 people. In determining the number of samples to be used, the researcher used a purposive sampling technique of 15 people, because this sample was taken with certain considerations.

Instrument

The measuring instrument that the researchers used to measure leg power was using a vertical jump, Vertical jump testing has been shown to be a valid and reliable measure of lower-body explosive power (Rodríguez-Rosell et al., 2017) with a reliability value of 0.93 and a validity value of 0.78 (Nurhasan & Cholil, 2007). The purpose of this test is to measure leg muscle strength Tools used: scale board, chalk powder Implementation procedure:

1. A scale board is hung on a wall 150 cm high
2. Before doing the jump, hands sprinkled with chalk powder.
3. The sample stands in front of the scale board in a sideways position.
4. The hand to be used is attached to the scale board so that it remains imprinted and can be read on the scale board. This mark is point A
5. Perform lower body movements by bending both knees.
6. Make a jump up as high as possible and at the peak of the jump, clap or stick your hands on the scale board, the mark that makes an impression on the scale board is point B.

and to measure Seated Medical Ball Throw test. with a reliability value of 0.81 and a validity value of 0.77 (Nurhasan & Cholil, 2007). Therefore, a more direct and isolated method of power measurement (i.e. peak velocity of the MB during a throw) may provide more valid and reliable assessment of upper body explosive ability (Beckham et al., 2019)

How to do the test:

1. Subject sits on a bench
2. The subject throws a 5kg medicine ball
3. Subjects were instructed to keep their upper back tucked in bench, staying in touch during the full throw using maximum effort.
4. The assistant marks the spot where the medicine ball landed
5. The assistant measures and records the distance from the front foot (when released) to where the ball landed



Procedure

At the beginning of the study, the sample did a pretest to find out the initial conditions before being given treatment, after that the researchers looked for 1RM which was carried out to determine the intensity of the exercise program using the undulating periodization model. The training program is planned for eight weeks which is carried out three training sessions in one week, changes in intensity are carried out daily on micro cycles as shown. On Monday with an intensity of 30% with the goal of hypertrophy, on Wednesday with an intensity of 80% for neural purposes and 60% intensity with a goal of power on Friday with the treatment of strength training using external weights, there are five forms of exercise to train upper body muscle strength and body muscles low part.

The volume and intensity of the exercises arranged in the first week number of sets for each form of exercise, namely 3 sets of 14 repetitions for 30% intensity and 1-2 minutes rest, 4 repetitions for 80% intensity, 3-4 minutes rest, and 8 repetitions for 60% and Rest 3-5 minutes. In the following week the training volume was increased by increasing the number of sets, adding the number of sets for every 3 micro cycles of training loading, 1 micro unloading as recovery.

In the daily training program in one training session there are five forms of weight training using external weights including bench presses, preacher curls, dumbbell triceps extension to train the upper body muscles, leg press and leg curls to train the lower body muscles. After being given the strength training treatment for eight weeks using the undulating periodization model (Andau, 2015), then all samples underwent a post-test, which aims to determine the effect of the treatment after the sample has undergone treatment. After that the researcher conducted an analysis, at this stage the researcher conducted an analysis of the results obtained after the treatment was given. Then the data is processed to produce results from the research and presented in statistical form which will then be analyzed.

Data Analysis

Based on the research objectives, this study uses data analysis methods with a quantitative approach. The statistical analysis used to answer all of the problem formulations is a paired sample t-test, the data obtained is normally distributed (parametric). This statistical analysis was carried out with the help of SPSS 26 software.

Result

Through descriptive analysis it was explained that the initial strength capacity of the upper body and lower body power was explained before strength training was carried out using the undulating periodization/wave cycle model. The lowest upper body power initial test value is 2.2 meters, and the lower body power test is 43.0 centimeters, then the highest value for the final upper body power test is 3.5 meters, and the lower body power endurance test is 52.0 centimeters. The average scores for the upper and lower body were 2,800 and 51,133, respectively. Then after doing the exercises using the undulating periodization model, the average upper body strength is 3,613 and the lower body is 59,600.

Hypothesis testing In this study, hypothesis testing used a paired sample t-test to find out whether there is an effect of the undulating periodization model on the strength of increasing upperbody and lowerbody power. Based on the formulation of the problem, the research hypothesis is as follows:



H0 = There is no effect of the undulating periodization model in strength on increasing upperbody and lowerbody power.

H1 = There is an influence of the undulating periodization model in the strength of the increase in upperbody and lowerbody power.

After conducting data analysis, the following results were obtained:

1. The effect of undulating periodization in strength on an increase in upperbody power: The results of data analysis using a paired samples t-test on the upperbody power variable show that the value of Sig. (2-tailed) $0.000 < 0.05$ then H0 is rejected. It can be concluded that there is an influence on the periodization model undulating strength towards a significant increase in upperbody power.
2. Effect of undulating periodization in strength to increase lowerbody power:

From the table above, the results of data analysis using paired samples t-test on the power upperbody variable, the results of the analysis show that the value of Sig. (2-tailed) $0.000 < 0.05$ then H0 is rejected. It can be concluded that there is an influence on the periodization model of undulating strength on a significant increase in lowerbody power

Data on the results of the pre-test and post-test power Upper body

Fig 1. Graphic Power upperbody test results

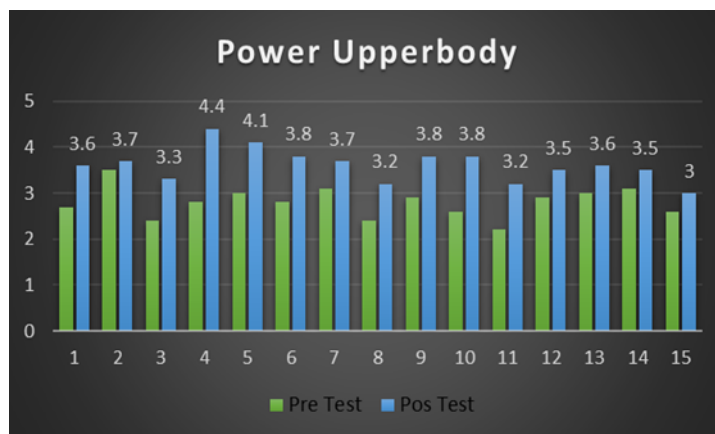
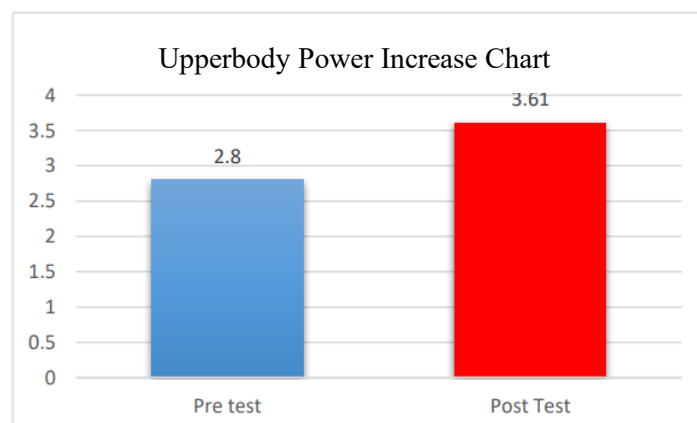


Fig 1.2





Data on the results of the pre-test and post-test power lower body

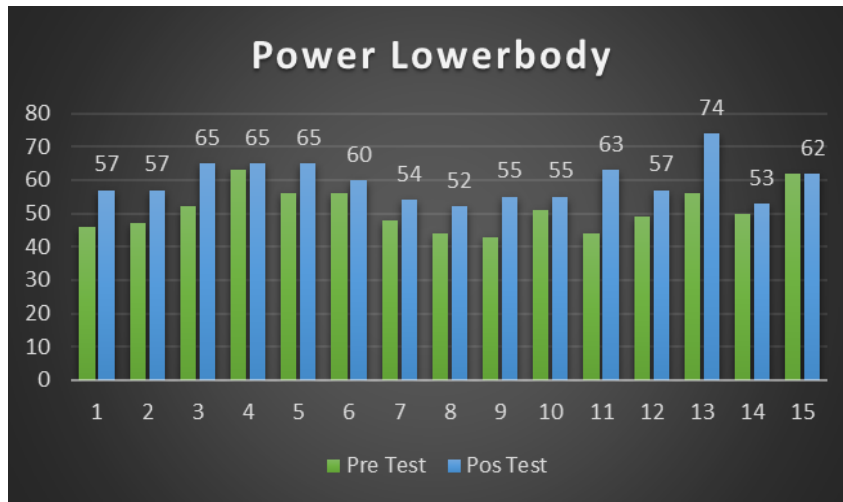
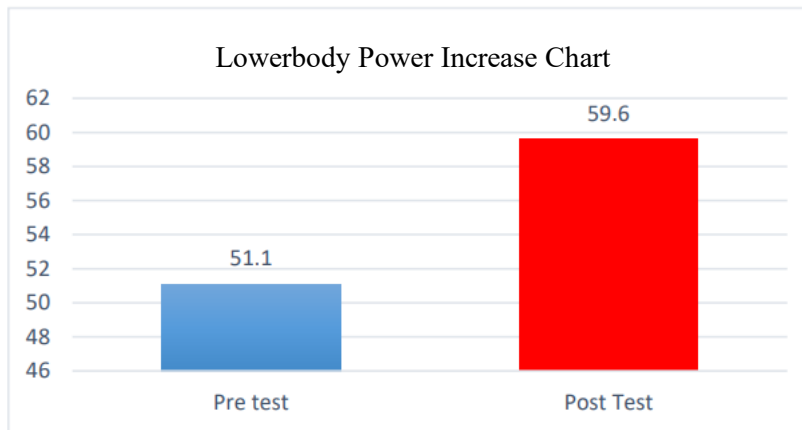


Fig 2.1 Graphic Power Lowerbody test results

Fig 2.2



Discussion

In the research conducted by previous researchers, changes in intensity were carried out more frequently, the wavy periodization model, changes in volume and intensity were carried out every day on a micro cycle. The undulating periodization of the intensity change micro-cycle is designed daily on Monday training with 30% load intensity done 12-14 maximum reps (RM), Wednesday with 80% load intensity total 4 RM repetitions, and Friday with 60% total load intensity reps 8 RM. The program above can put a lot of pressure on the neuromuscular system due to the rapid and continuous change of program variables. It is this pressure that theoretically makes the program effective in obtaining an increase in the strength component (Rhea et al., 2002).



Based on the results of the processing and analysis of the data findings previously described, this study obtained the result that the undulating periodization model had a significant effect on increasing upperbody and lowerbody power abilities with a significance level of 0.000 less than 0.05, which means that the periodization model This undulating effect has a significant increase in upperbody and lowerbody power. This finding is in line with previous research conducted by (Rhea et al., 2003), when changes in intensity were carried out every day in the undulating periodization model the results showed a more significant increase in strength compared to the linear periodization. That the process of short high-volume training emphasizes the hypertropic response, interspersed with short periods of high-intensity training that emphasizes the neural response. Thus, by combining high-intensity exercise with alternating periods of high-volume and low-intensity exercise, the resulting increase in strength can be optimal (Baker et al., 1994).

This research and previous studies show that Undulating Periodization is an effective training program to increase power in both untrained and trained individuals. For the next researcher to be able to develop this research even better, not only on one component of the physical condition in an effort to improve the performance of athletes in a competition, as well as adjusted or more specific to the branch of the sport.

Conclusion

On the basis of the results of data processing and data analysis that has been done, the researcher can conclude that there is a significant effect of using the undulating periodization model on strength in the micro cycle for 8 weeks with changes in intensity designed daily on increasing upperbody power and lowerbody power because it can provide considerable stress on the neuromuscular system with rapid and continuous program variable changes.

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