DOI : 10.18843/rwjasc/v9i4/14
DOI URL : http://dx.doi.org/10.18843/rwjasc/v9i4/14

The Effect of Plyometric Exercise using Continual, Interval, and Muscle Power Methods towards Push Kick Frequency on Muaythai Altheles in Mataram, West Nusa Tenggara

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ABSTRACT

The aim of this research is to find out that distinguishes between the variables to check whether they are continual, invertal, and muscle explosive power exercises on dependents variable, namely frequency (speed) of push kick. Seeing from training methodology, including physical, technical, tactic and mental aspects, the physical aspects are the main concerns that must be focused on improving the achievement of athletes. This current research used research and development (R&D) to produce a product in the form of a plyometric exercise model and a true experimental design in the form of a randomized post-only control group to determine the overall level of significance exercise model used. The results of this study indicate that the application of the right plyometric training method will have a significant effect on the results of the frequency of push kick. Continual plyometric training and plyometric exercise interval method in high and low muscle explosive power are variables that influence the frequency of push kick, each variable has implications both jointly and individually.

Keywords: Plyometric Exercise, Continual Method, Interval Method, Muscle Power, Push Kick, Muaythai.

INTRODUCTION:

The process of fostering and developing sports achievements certainly requires athletes who have high potential. To get outstanding athletes, Sports development in Indonesia should always be increased along with the application of various developments in science and knowledge in the major of sports, (Mutohir & Maksum, 2007).

Guidance and training for early childhood and adolescents, both students at the elementary, junior high and high school levels. Early childhood and students as the right Human Resources (HR) to be targeted for the forerunner to the emergence of outstanding athletes in the future. (Tangkudung, 2012) also expressed this as an expert on sports development in Indonesia, stating that students have great potential if their abilities are developed in a higher direction, especially in sports achievement. Monitoring of potential students in sports is closely related to the search for talented athletes so that monitoring needs to be carried out regularly and continuously

This opinion is the rationale for seeing how much potential Pengcab Muaythai in of Mataram in fostering athletes who have considerable potential, especially in sports development in adolescence; this creates a huge opportunity for students who have sports achievements when fostered regularly and continuously.

Achievements in the national arena in each championship followed by athletes of NTB always won

medals. But the results obtained sometimes increase or decrease from the previous championship. As in National Championship Muaythai, which was held in Senggigi, West Lombok, NTB in 2015, won the overall championship with 5 gold medals, and at the PON XIX exhibition in West Java in 2016, NTB was only able to achieve 1 gold, 2 silvers and 3 bronzes.

The ups and downs of the achievement, is the responsibility of the Muaythai sports coach and coach in West Nusa Tenggara. Because the competition will become tighter after this sport held an exhibition on PON XIX in West Java last 2016. The challenge is how to foster athletes so that the highest achievement of championship can be achieved, so that a good and correct training program is needed to see how to increase the power of kick so that athletes have better and harder attack power. A sportsman's achievement is an accumulation of physical quality, technique, tactics, and psychological maturity. To achieve high achievement, it is necessary to prepare a plan with the right objectives, including physical preparation, technique, tactics and psychology. This is in accordance with the opinion (Sukadiyanto, 2011) that to achieve the achievements of the training there are four aspects that need attention: (1) physical exercise, (2) technical training, (3) tactics training, and (4) mental training. The four aspects have a position that is equally important, although each aspect has a different percentage according to the conditions and level of ability of each individual. These aspects are arranged hierarchically, so that physical aspects are one of the important aspects that must be considered first.

The definition of physical ability in sports is the biomotor ability fitness component needed by athletes according to their sport and role. Physical exercise in its implementation is more focused on the process of fostering the athlete's physical condition as a whole and is one of the main and most important factors that must be considered as an element needed in the training process in order to achieve the highest achievement (Hidayat, 2014). Physical is the foundation of the building of achievement, because technique, tactics, and psychology can be well developed if the athlete has good physical quality, (Ambarukmi, 2007). Regular and continuous physical training can make a big contribution to improving the ability to develop techniques in matches. This is in accordance with what was stated by (Mylsidayu & Kurniawan, 2015) that exercise is a process of change in a better direction, namely to improve physical quality, functional abilities of the body's equipment and the psychological quality of the child's training.

Elements of physical conditions that need to be trained and improved in accordance with their respective sports in accordance with their needs in games and matches. In improving physical conditions it is necessary to train several physical elements, including general physical elements including strength, endurance, speed, and flexibility, and special physical elements include explosive power, reaction, coordination, accuracy and balance. (Harsono, 2015) states that the planning process of an exercise program must refer to procedures that are well organized, methodical, and scientific, so that the program can help athletes to achieve the highest achievement.

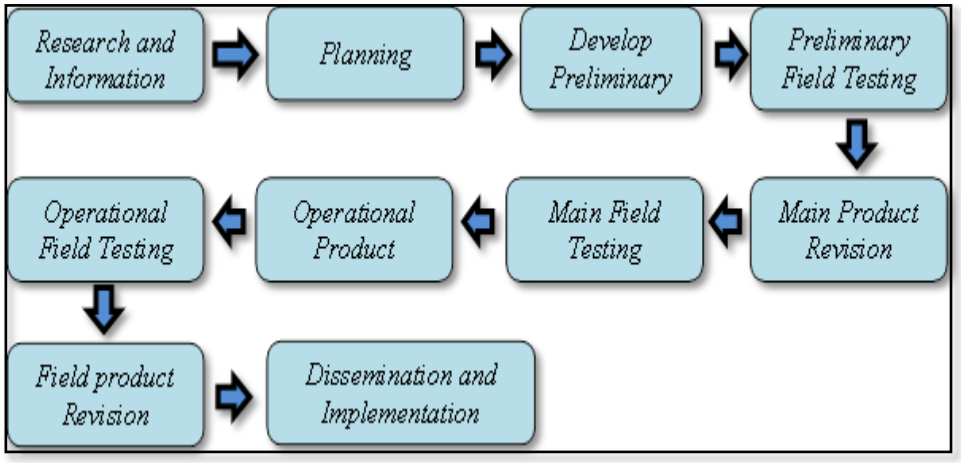
(Bompa & Haff, 2009) is no exception in Muaythai martial arts, because leg muscle power is very useful in fighting at Muaythai which uses a direct body contact system with attack and defense movements that require strength, speed, agility, balance and stability, especially when carrying out attacks using legs (kicks). Power of the leg muscles is very important in Muaythai martial arts, especially in carrying out attacks using kicks, because the scoring system in Muaythai Martial Arts is a power no point. To increase the frequency (speed) kicks can be done by weight training, either using external loads such as using tools (weight training) and can also use self-loads such as jumping exercises or what is known as plyometrics.

To increase strength, speed, muscle endurance and explosive power are not always in the form of external loads using equipment such as barbells, pulleys and vests. But it can also be in the form of one's own weight as a burden, especially if you are trained by beginner athletes. This is in line with the opinion (Rai, 2009) that various weight-training movements can be used only by using our own bodies. Besides being practical, this is good news for those of us who have a limited budget for muscle tightening. However, in the training process, we must not forget certain laws and principles that have been empirically and scientifically proven and clearly tested along with the development of coaching,

(Lumintuarso, 2010).
The training method used as an experiment in this study is a continuous plyometric training method and an interval as a free variable in the frequency (speed) kick as a dependent variable. While the leg muscle explosive power as an attribute independent variable consisting of two levels, namely the group of high limb muscle explosive power and low muscle explosive power group

METHODOLOGY:

This current research is research and development (R&D) methods, which will be used to produce the product design. (Gall, Joyce, & Borg, 2003) R&D model has ten steps in conducting research as follows: 1) preliminary study and data collection (literature review, observation, research framework); 2) planning (research objectives, funds, time, research procedures, various forms of participation; 3) develop preliminary product (drafting the preliminary product); 4) preliminary field testing (product drafting in short area); 5) main product revision; 6) main field testing (trying in widely area); 7) revisions to compile operational products; 8) operational field testing (product effective tests); 9) field product revison (revisions effective products); and 10) dissemination and implementation of product development (the goal is that the products that have just been developed can be widely used by sportspeople, teachers at Early Education, and the community).



Picture 1: Steps of Research and Development

Meanwhile, to find out the significant level of the resulting training model, it will be used a true experimental design with the form of the randomized post-only control group, which aims to obtain information. For the purposes of analysis, it needs placement in blocks in the form of diagrams; each block contains the same subject and homogeneous. Therefore, this research is factorial design which is the experimental units are treated in more (Sugiyono, 2011). Thus the design used in this study is factorial 2x2, with the following design;

Table 1: Factorial 2x2 Design

Method (s) / Power	Continual Exercise(A1)	Interval Exercise (A2)
High Power(B1)	A1B1	A2B1
Low Power (B2)	A1B2	2B2

The research planned to be carried out in several places, in carrying out the development of the Plyometric training model, will be held at the training site of the Indonesian Muaythai athletes in Mataram, West Nusa Tenggara who trained at UKM Muaythai IKIP Mataram, Raja Muaythai Mataram Camp and Rodex Muaythai Sumbawa Camp. Meanwhile, for weight training the plan is at

Arena Fitness Mataram and for plyometric training and push kick tests at Raja Muaythai Mataram Camp and a test of muscle explosive power at the FPOK IKIP Sports Laboratory Mataram.The treatment in this study is planned for 8 weeks with the frequency of exercise three times a week. Thus, the total number of meetings (exercises) is 24 meetings.

Technique of data analysis used Statistical analysis to find out the effect of the independent variable (continual plyometric exercise, interval, and muscle explosive power) on the frequency (speed) push kick. In processing of statistical testing, the researcher used the Statistical Product and Service Solution program (SPSS 22), (Kadir, 2015). In this research is carried out some analyses as follow:

1. Descriptive Statistics

a. Description of subject (N), mean (pretest, posttest, and delta).
b. Normality by using Kolmogorov-Smirnov Test
c. Homogeneity by using Leven's Statistics Test

2. Inferential Statistics/testing hypothesis

To finding out the effect of treatment (before and after), the researcher used Analysis of variance (ANOVA) statistics, at a significant level $\alpha = 0.05$. In addition, calculating the data is supported by using SPSS 22.0 program and manual calculations

FINDINGS AND DISCUSSION:

Need Analysis:

Based on need analysis by using observation and interview methods to Muaythai coach then the following information is obtained as follows:

1. The athletes is not being maximized in empowering the frequency of push kick caused, it caused by the constant training method and inefficient time allocation in applying the exercise
2. The coach is being used the conventional method which is based on his experience without sports science approach
3. The plyometric training method by using continual and interval methods is not fully applied /implemented.
4. The evaluation process is carried out general description without examining specifically
5. Needs analysis that has been summarized by researchers from observations and interviews, from both instruments that found some problems that must be solved immediately.

Description of Preliminary Drafting :

Preliminary drafting of plyometric training model should be in accordance of field need analysis. In this study the product to be developed is a plyometric exercise model with a continual and interval methods, then the next step is to describe the preliminary product draft which contains all the plyometric training stages with continual and interval methods that will be applied to increase the frequency of push kicks. The preliminary draft model of plyometric exercises includes sections, such as: (1) Introduction, (2) The purpose of plyometric exercises, (3) Plyometric exercise procedures, and (4) Plyometric exercise programs

Suggestion from the Expert and Practitioners:

The preliminary draft of the plyometric training model with continual and interval methods on the frequency of push kick as Muaythai athlete training is given to expert and practitioners. The expert is appropriate on his major, they are: a) the expert of physical training method (Dr. Mastur Riadi, M.Pd,); b) the expert of self-depense (Dr. M. Salabi, M.Pd); and c) practitioners from the NTB muaythai trainer (Ahmad Yusup). The experts suggested can be seen in following table;

Table 2: The suggestion from the experts

Experts	Suggestion
Expert 1: the expert of physical training method (Dr. Mastur Riadi, M.Pd)	1. Plyometric training model must be adapted to existing training theories / references to support the validity of the training model used 2. Preparation of plyometric training models must be easily understood by trainers and athletes so that the application can be maximized 3. The application of the plyometric training model must be in accordance with the applicable rules 4. Time allocation in plyometric training must be efficient
Expert 2: the expert of self-depense in push kick (Dr. Salabi, M.Pd)	1. Explanation in performing in frequency of push kicks must be fully understood by the athlete. 2. The athletes must be considered when doing the frequency of push kick to minimize technical errors in kicking. 3. The coach explains the right way of push kick.
practitioners from the NTB muaythai trainer (Ahmad Yusup)	1. The athletes should understand the explanation in frequency push kick kick 2. The model of exercise to be applied must be able to make athletes interested, seriously, and have an effect in improving push kicks

Preliminary Drafting:

The instrument used in taking the data are preliminary drafting, feasibility scale test, and observing the effectiveness of the training model. The following table show the instrument contents validation as follows;

Table 3: Content Validations by Aiken's V

Experts	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14		Item 15	
	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s
1	4	3	4	3	3	2	4	3	4	3	4	2	4	3	4	3	3	2	3	2	3	2	3	2	4	3	3	2	4	3
2	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	2	4	3	4	3	4	3	4	3	3	2	4	3	3	2
3	4	3	4	3	4	3	4	3	3	2	3	3	3	2	4	3	4	3	3	2	4	3	3	2	4	3	3	2	4	3
∑s	**9**		**9**		**8**		**9**		**8**		**8**		**8**		**8**		**8**		**7**		**8**		**7**		**8**		**7**		**8**	
V	**1**		**1**		**0.889**		**1**		**0.889**		**0.889**		**0.889**		**0.889**		**0.889**		**0.778**		**0.889**		**0.778**		**0.889**		**0.778**		**0.889**	
Ket.	**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**		**Valid**	

(Aiken, 1985)Aiken's V's formula to calculate the *content validity coefficient* based on the experts assessment (**n)**to which the item represents the measured construct. he formulas proposed by (Azwar, 2012).

V	**=**	***Σs / [n(c-1)]***
s	=	*r – lo*
lo	=	*Low validation assessment(1)*
c	=	*High validation assessment (4)*
r	=	*Score*
n	=	*Sample*

Results of Testing in Plyometric Exercise Model:

The data obtained in the feasibility scale test in the field can be presented as follows:

Tabel 4: Feasibility Scale

No	Experts	score	Maximum Score	Percentage
1	Expert 1	35	40	87.5
2	Expert 2	33	40	82.5
3	Expert 3	36	40	90

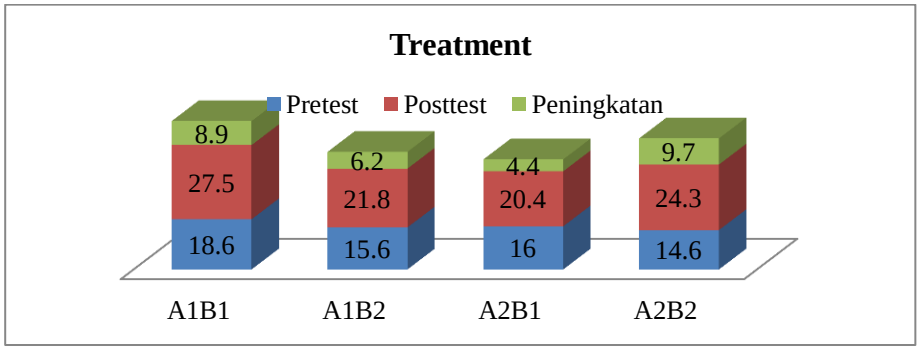
The result of feasibility scale test obtained in expert 1 is 35 and maximum score is 40 from 10 items, while the percentage of feasilibilty is 87.5% with minimun is>75%. The assessment of Expert 1 is feasible (87.5%>75%). The assesment of expert 2 gives the maxmum is 33 with percentage of feasilibilty is 82.5% with minimun is >75%. The assessment of Expert 2 is feasible (82.5%>75%). The last assesment given by expert 3 gives maximum score is 36 with percentage of feasilibilty is 90% with minimun is >75%. The assessment of Expert 3 is feasible (90%>75%).

Test the Effectiveness of Plyometric Exercise Models:
The following is an explanation of the data description, Descriptive Statistics, testing hypothesis, and research discussion

Data Description:
The description of the results of data analysis is test results of the frequency of push kick in the Muaythai athletes of Mataram, which are carried out in accordance with the groups compared are presented as follows

Table 5: Result of Pretest and Posttest

Treatment	*Power* Level	Statistic	Pretest	Posttest	Improvement
Continual Training Method	**High A1B1**	Total	186	275	89
		Mean	18.6	27.5	8.9
		SD	0.96	1.17	0.21
	Low A1B2	Total	156	218	62
		Mean	15.6	21.8	6.2
		SD	1.89	2.78	0.89
Interval Training Method	**High A2B1**	Total	160	204	44
		Mean	16	20.4	4.4
		SD	1.56	1.57	0.01
	Low A2B2	Total	146	243	97
		Mean	14.6	24.3	9.7
		SD	1.83	1.82	0.01



Picture 2: Histogram the Improvement of Pretest and Post

Testing Hypothesis:

The testing hypothesis used two way ANOVA (2x2), 2x2 is used to test the main effect between variables.

a. **Testing Hypothesis I:**

Testing Hypothesis I to find out the effect of plyometric exercise towards continual and interval methods, it can be shown in following table;

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Table 6: Data Analysis of ANOVA (push kick)

Univariate Tests							
Dependent Variable: Kick Frequency							
	Sum of Squares	**df**	**Mean Square**	**F_{test}**	**F_{tabel}**	**Sig.**	**Ket.**
Contrast	52.900	1	52.900	14.149	> 4.11	0.001	< 0.05
Error	134.600	36	3.739				

The result of data analysis is obtained that the value of F_{test} 14.149 is higher than F_{tabel} is 4.11 (F_{test}> F_{tabel}) with significant level is 0.05. It means, the alternative hypothesis is accepted and null hypothesis is rejected.

b. **Testing Hypothesis II:**

Testing Hypothesis II to find out the effect of plyometric exercise towards continual and interval methods in muscle explosive power. It can be shown in following table

Table 7: Data Analysis of ANOVA (muscle explosive power)

Univariate Tests							
Dependent Variable: Kick Frequency							
	Sum of Squares	**df**	**Mean Square**	**F_{test}**	**F_{tabel}**	**Sig.**	**Ket.**
Contrast	252.050	1	252.050	129.997	> 4.41	0.000	< 0.05
Error	34.900	18	1.939				

The result of data analysis is obtained that the value of F_{test} 129.997 is higher than F_{tabel} is 4.11 (F_{test}> F_{tabel}) with significant level is 0.05. It means, the alternative hypothesis is accepted and null hypothesis is rejected.

c. **Testing Hypothesis III:**

Testing Hypothesis III to find out the effect of plyometric exercise towards continual and interval methods in low muscle explosive power, it can be shown in following table;

Table 8: Data Analysis of ANOVA (low muscle explosive power).

Univariate Tests							
Dependent Variable: Kick Frequency							
	Sum of Squares	**df**	**Mean Square**	**F_{test}**	**F_{tabel}**	**Sig.**	**Ket.**
Contrast	31.250	1	31.250	5.642	> 4.41	0.029	< 0.05
Error	99.700	18	5.539				

The result of data analysis is obtained that the value of F_{test} 5.642 is higher than F_{tabel} is 4.11 (F_{test}> F_{tabel}) with significant level is 0.05. It means, the alternative hypothesis is accepted and null hypothesis is rejected.

d. **Testing Hypothesis IV:**

Testing Hypothesis IV to find out the interaction between muscle explosive powerstowards push kick. It can be shown in following table;

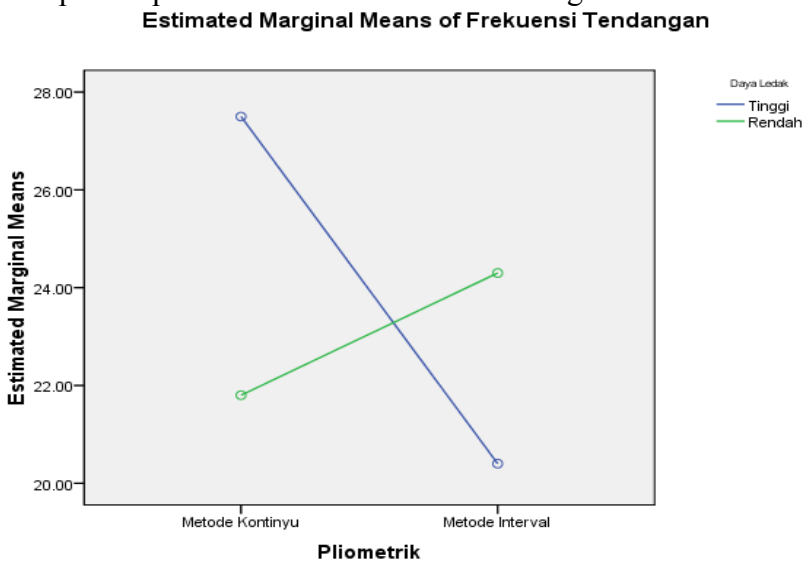
Tabel 9: Data Analysis of ANOVA (interaction and push kick)

Tests of Between-Subjects Effects							
Dependent Variable: Kick Frequency							
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F_{test}**	**F_{tabel}**	**Sig.**	**Ket.**
plyometric exercise (explosive power)	230.400	1	230.400	61.623	> 4.11	0.000	< 0.05
Error	134.600	36	3.739				

Plyometric Exercise (explosive power)					
Dependent Variable: Kick Frequency					
Plyometric Exercise	**Power**	**Mean**	**Std. Error**	**95% Confidence Interval**	
				Lower Bound	**Upper Bound**
Continual Method	High	27.500	.611	26.260	28.740
	Low	21.800	.611	20.560	23.040
Interval Method	High	20.400	.611	19.160	21.640
	Low	24.300	.611	23.060	25.540

The result of data analysis is obtained that the value of F_{test} 61.623 is higher than F_{tabel} is 4.11 (F_{test}> F_{tabel}) with significant level is 0.05. It means, the alternative hypothesis is accepted and null hypothesis is rejected.

The following interactions between two factors are plyometric exercise and muscle explosive power towards push kick. The profile plots can be seen in the following below:



Picture 3: Form interaction between plyometric exercise and muscle explosive power

After testing the interaction between the plyometric training method and the explosive power on the frequency of push kick, it is necessary to do further testing using the Pairwise Comparisons test. The following results of further tests can be seen in the table below

Table 9: Pairwise Comparisons Testing

Pairwise Comparisons				
Dependent Variable: Kick Frequency				
(I) Intraction	**(J) Intraction**	**Mean Difference (I-J)**	**Std. Error**	**Sig.[a]**
A1B1	A1B2	5.700*	0.865	0.000
	A2B1	7.100*	0.865	0.000
	A2B2	3.200*	0.865	0.001
A1B2	A1B1	-5.700*	0.865	0.000
	A2B1	1.400	0.865	0.114
	A2B2	-2.500*	0.865	0.006
A2B1	A1B1	-7.100*	0.865	0.000
	A1B2	-1.400	0.865	0.114
	A2B2	-3.900*	0.865	0.000
A2B2	A1B1	-3.200*	0.865	0.001
	A1B2	2.500*	0.865	0.006
	A2B1	3.900*	0.865	0.000

Based on the table results of Pairwise Comparisons calculation, the asterisk (*) indicates that pairs that interact or pairs that are significantly different (significant). The results of variance analysis show that there are five pairs that have significantly different interactions, namely: (1) pairs A1B1 with A2B1, (2) pairs A1B1 with A1B2, (3) pairs A2B1 with A2B2, (4) pairs A1B1 with A2B2, and (5) pair A1B2 with A2B2. Whereas couples who do not interact or pairs that are not significantly different are: (1) pairs A1B2 with A2B1.

CONCLUSION:

Based on the results of the research and the results of the data analysis that has been done, the conclusions are as follows;

1. There is a significant difference in overall effect between the results of plyometric training, the continual method, and plyometric training with the interval method on the frequency (speed) of push kick in Muaythai athletes in West Nusa Tenggara. Plyometric exercises with continual methods have a better improvement than the plyometric exercise with the interval method, with an increase in each of which is a plyometric exercise with a continual method of 24,650 and a plyometric exercise with an interval method of 22,350
2. There is a difference between the plyometric exercise and the continuous method which has high muscle explosive power and the plyometric exercise with the interval method that has high muscle explosive power the frequency (speed) of push kicks in Muaythai athletes West Nusa Tenggara. Continual plyometric exercise with high muscle explosive power has a better improvement than the interval method plyometric exercise with high muscle explosive power, with each increase in the average method of plyometric training with a high muscle explosive power of 27,500 and exercise plyometric interval method with high muscle explosive power of 20,400

3. There is a difference between the plyometric exercise and the continual method, which has low muscle explosive power and the plyometric exercise with interval method which has low muscle explosive power the frequency (speed) of the push kick in Muaythai athletes in Mataram West Nusa Tenggara. Plyometric exercise interval method with low muscle explosive power has a better improvement than the continuous plyometric exercise method with low muscle explosive power, with each increase in average, plyometric exercise interval method with low muscle explosive power of 24,300 and exercise plyometric continual method with low muscle explosive power of 21,800.
4. There is an interaction between the plyometric training method and the explosive power on the frequency (speed) of the push kick in Muaythai athletes of Mataram West Nusa Tenggara. Here are five pairs that have significantly different interactions, namely: (1) pairs A1B1 with A2B1, (2) pairs A1B1 with A1B2, (3) pairs A2B1 with A2B2, (4) pairs A1B1 with A2B2, and (5) pairs A1B2 with A2B2. Whereas couples who do not have interactions or pairs that are not significantly different are: (1) pairs A1B2 with A2B1.

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