

The Effect of Resistance Band Ladder Drill Training Pattern Using Interval and Pyramid Methods on Aerobic Ability Improvement in Futsal

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Abstract Resistance Bands Ladder Drills is a form or a pattern of a training that utilizes the resistance of rubber combined with movements on ladder drills or better known as agility ladder. The purpose of this research was to determine the effect of the Resistance Band Ladder Drill training pattern by using interval and pyramid training methods in improving the aerobic ability. This research is an experimental research with pretest-posttest control group design. The sample of this research was twenty people who were divided into two groups: ten people as the experimental group (interval training method) and ten people as the control group (pyramid training method). The research instrument to determine the aerobic ability was the Bleep Test. The results showed that there were differences in the results of the Resistance Band Ladder Drill training pattern by using the interval method and the pyramid method toward the aerobic ability. The conclusion of this research is that there was an effect of the Resistance Band Ladder Drill training pattern by using the interval method on the aerobic ability and there was no effect of the Resistance Band Ladder Drill training pattern by using the pyramid method on the aerobic ability. These results indicate that the training volume cannot be equated when we use two different methods because each training method has its volume requirements to provide an adaptation effect on the body. It is suggested that further research can be developed through other forms of training.

Keywords Resistance Bands, Ladder Drills, Interval

Method, Pyramid Method, Aerobics, Futsal

1. Introduction

Futsal is a popular sport played by both men and women at both amateur and professional levels [1]. This sport is carried out indoors with dynamic, fast, and precise movements as its characteristics are based on technical, tactical, and physical parameters. Futsal is played by five players who are on the field and nine players who are on the bench. In futsal, the substitutions of players in matches are not limited, which means that a player may be in and out several times as long as the match time has not been finished [2,3]. Judging from the characteristics of the game, futsal is a sport that is carried out in high intensity so that a player is required to have an excellent aerobic physical ability. Therefore, a player must prepare the training needs that match the needs of the match [4]. It is because if the expected goals (achievements) are getting higher, the demand for the training needs will also be even higher [5].

An aerobic physical ability is a basis and is also a very important factor in improving the athlete's performance [6]. The aerobic endurance or resistance performance depends on three important elements, one of them is the maximum oxygen uptake (VO_{2max}). VO_{2max} is defined as the highest oxygen uptake achieved during the training [7,8].

The demand of the VO_2max of a futsal player is at least $50\text{-}55 \text{ ml kg}^{-1} \text{ min}^{-1}$ [2], $0 \text{ ml kg}^{-1} \text{ min}^{-1}$ at the professional or elite athlete level [9-10]. In achieving the oxygen volume demand, a futsal player can perform an endurance or resistance training because it is recommended by the National Health Organization to be incorporated into a comprehensive fitness program that includes aerobic training [11].

A Resistance Training (RT) is a form of training by providing the body's resistance to increase muscle strength and other components of fitness [12-14]. The RT currently becomes a popular training which is recommended by the National Health Organization, such as the American College of Sports Medicine and the American Heart Association, to provide several health benefits, such as lowering blood pressure, increasing metabolic rate, reducing body fat, and so on [15]. In this research, the resistance training used the Resistance Band Ladder Drills. Resistance Band Ladder Drills is a form of training that utilizes the resistance in the form of rubber combined with movements on ladder drills or better known as an agility ladder. The agility ladder is a form of a physical training using stairs to train the agility of the legs and to harmonize movements in a balanced manner [16-17]. The agility ladder is a training tool for coordination, speed, and agility [18]. In this agility ladder, athletes can move their feet quickly in the right motion [19].

There are various training methods for the resistance training. In this research, we used two training methods: interval and pyramid methods. The interval method is an efficient training method because its implementation is carried out with high intensity in a short time interspersed with recovery [20]. The interval training involves repetition and recovery trainings. Meanwhile, the pyramid method is a system that starts from the low intensity with lots of reps (hypertrophy) and ends with high intensity with few reps [21]. The pyramid method involves several sets, but the intensity increases along with each set with a gradual decrease in numbers [22].

At present, there are many research studying the effect of the Resistance Band Ladder Drill training pattern by using interval and pyramid methods to improve the aerobic ability. Jeong [23] states that the resistance training using low-intensity elastic bands shows no changes in body weight, body mass index, and fat, but there is an increase in muscle mass, muscle endurance, and balance. The researcher of this research suggests to measure its effect by increasing the intensity of the training or increasing the frequency of the training. Oranchuk [24] says that the training with Sport Specific Resistance Band provides a significant increase in the speed of throwing and strength. Chandrakumar and Ramesh [19] and Pratama, Mintarto and Kusnanik [25] claim that the training using the Ladder Drill is able to improve the speed and the agility skills. Barbero-Alvarez et al. [26] also state that there is a need for

high-intensity aerobic trainings for female futsal players. Furthermore, Gharbi et al. [27] state that the aerobic fitness is an important factor affecting the ability to withstand fatigue during the repetitive sprint training in team sports. For training with ladder drills, only the speed and the agility that were studied, while the aerobic ability had not been studied yet. Therefore, we were interested in using the Resistance Band training pattern combined with ladder drills by using interval and pyramid methods to improve the aerobic ability in futsal players

2. Materials and Methods

The method used in this research was a true experimental method with pretest-posttest control group design [28]. The population and the sample in this research were twenty female futsal athletes in the Futsal Student Activity Unit (UKM), Universitas Pendidikan Indonesia who were divided into two groups; ten people as the experimental group (interval training method) and ten people as the control group (pyramid training method) with a sampling technique that is saturated sampling. As for the consideration of sampling in this study, athletes who have been trained have good achievements. The procedure in this research is the initial stage of the implementation we conducted the initial test and the measurement to determine the initial condition of the subjects. Then, we divided them into two groups to receive the Resistance Band Ladder training with interval and pyramid methods; one group with the interval method and one group with the pyramid method. The research was conducted for sixteen meetings. The treatment was carried out for 6 weeks with meetings 3 times a week on Tuesday, Thursday and Saturday at 07.00 until finished. This research was conducted at FPOK UPI Padasuka. After completing the treatment of the two sample groups, we then carried out the test and the measurement of the final stage in the final test to see the progress of the results of the treatment. The steps taken in the data collection were in accordance with the test procedure. Aerobic capacity data collection was carried out using a test instrument, namely the bleep test. The type of the data was quantitative data. The data that have been obtained were analyzed using SPSS software. This test is conducted to test whether there is a difference or influence. In looking at the effect of increasing the training method with resistance band ladder drills training patterns on aerobic ability, the first step is to perform a normality test using the Kolmogorov-Smirnov One-Sample Test. Then because the distribution of the subjects was normal and homogeneous, it was continued with descriptive data testing using Paired Samples Statistics. The research steps can be seen in Figure 1. The analysis technique used is Paired Sample t-test.

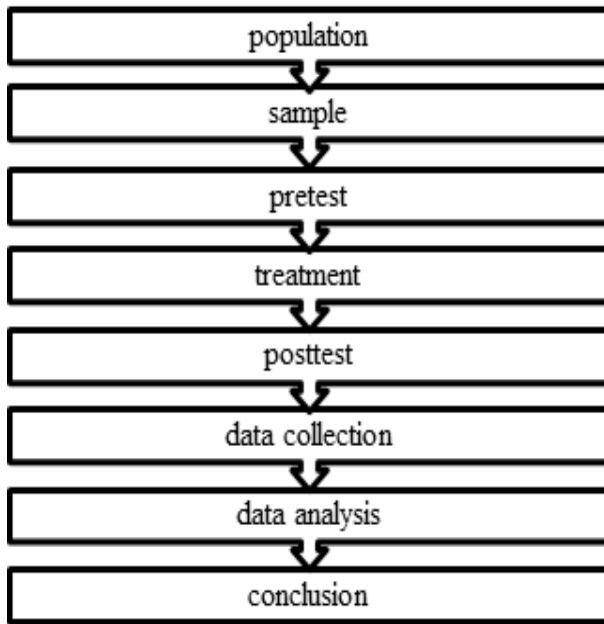


Figure 1. The Research Steps

3. Result

Table 1. Descriptive Statistics (Height, weight, age and BMI)

	Mean	
	Interval	Repetition
	N = 10	N = 10
Height	155	156
Weight	48	52
Age	22	22
BMI	20	21

Table 1 shows that the average height in the experimental group sample (interval) is 155cm and in the control group (repetition) is 156 cm. Then the average

weight for the experimental group was 48 kg and the control group was 52 kg. The average age in the experimental group and the control group is 22 years. The average BMI value of the experimental group was 20 lower than the control group, which was 21. However, overall the average BMI value is included in the normal weight category.

Table 2 shows the results of the pretest and the posttest of the aerobic ability using the interval method. With an average value of 43.27 <44.14, there is a difference in the average results of the training. Afterwards, the correlation coefficient value of the aerobic ability with the interval method is 0.778 with a significance value of 0.008. Looking at the value of Sig <Probability of 0.05, it can be said that there is a relationship between the pretest and the posttest variables. Meanwhile, for the pyramid method with an average value of 36.82 <36.95, it is considered to have a difference in the average training results. Furthermore, the correlation coefficient value of the aerobic ability with the pyramid method is 0.710 with a significance value of 0.021. Looking at the Sig <Probability value 0.05, it can be said that there is a relationship between the pretest and the posttest variables. In order to prove the difference, we need to test the paired sample t-test. The result is presented in Table 2.

Based on Table 3, it is known that the Sig. (2-tailed) of the aerobic ability with the interval method is 0.041 <0.05, then null hypothesis (H₀) is rejected and alternative hypothesis (H_a) is accepted. Thus, it can be concluded that there is an average difference between the pretest and the posttest, which means that there is an effect of the Resistance Band Ladder Drills training pattern by using the interval method in improving the aerobic ability. In contrast, the Sig. (2-tailed) of the aerobic ability with the pyramid method is 0.847 > 0.05, then H₀ is accepted and H_a is rejected. Thus, it can be concluded that there was no effect of the Resistance Band Ladder Drill training pattern by using the pyramid method in improving the aerobic ability. The results can be seen in figure 2.

Table 2. The Results of the Average Test and the Correlation of the Aerobic Ability

Component	Method	The effect of resistance band ladder drills training pattern using interval and pyramid methods			
		Mean		Correlation	Sign
		Before	After		
Aerobic Ability	Interval Method	43.27	44.14	.778	.008
	Pyramid Method	36.82	36.95	.710	.021

Table 3. The Results of Paired Sample T-Test

Component	Method	The effect of resistance band ladder drills training pattern using interval and pyramid methods	
		Result	Sign.
Aerobic Ability	Interval Method	There is an Influence	.041
	Pyramid Method	There is no Influence	.847

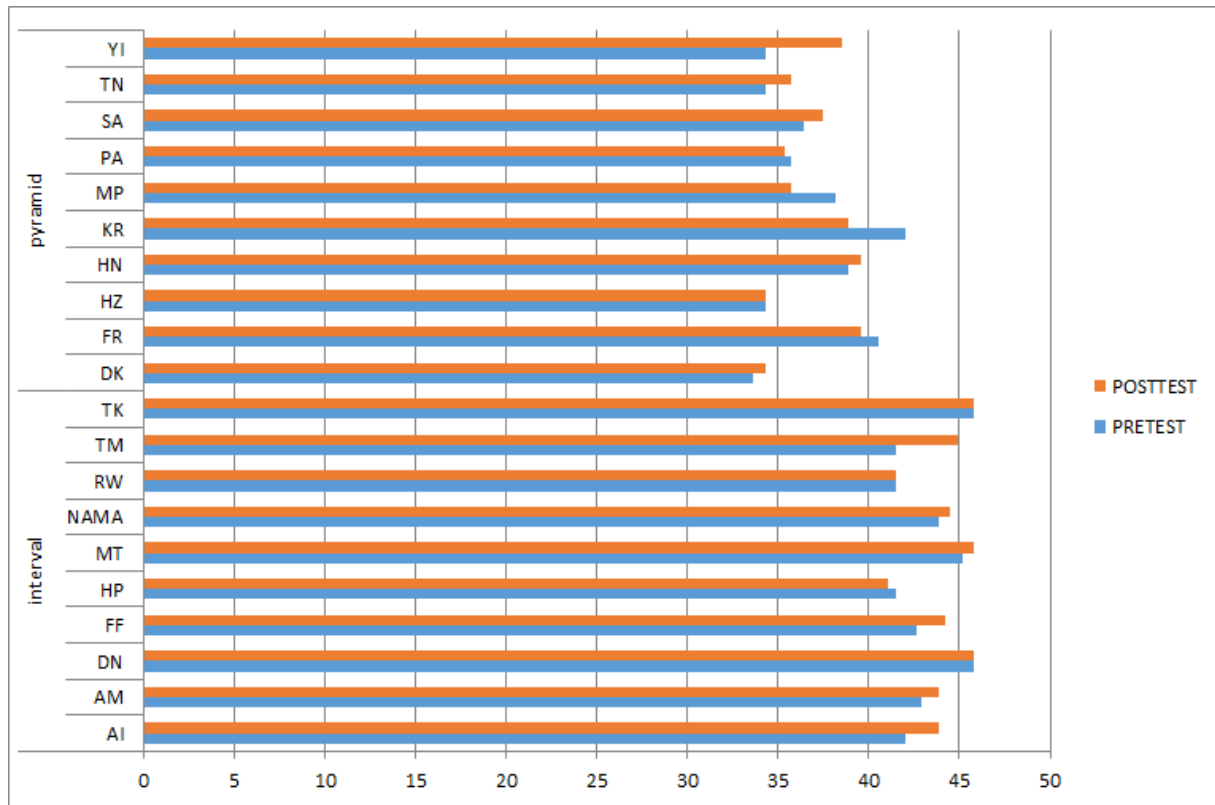


Figure 2. The percentage of the pretest and the posttest aerobic ability using interval and pyramid methods

4. Discussion

Based on the results above, indicated by the average aerobic ability with interval and pyramid methods, there is a difference in the average score. The difference in the mean score for the interval method is 0.87 and the difference for the pyramid method is 0.13. When we see the follow-up analysis with the difference test for the Resistance Band Ladder Drill training pattern with the interval method, the result has an effect toward the aerobic ability. Kraemer, Ratamess, and French [11] argue that during the training, the increase of the endurance in physical function and the athlete's performance are associated with the increase of the muscle strength and the muscle endurance. Then, we combined the resistance training using ladder drills. The ladder drill is a training tool using a ladder placed on the floor. The trainees are doing the movements with one or two legs by jumping and running quickly [29]. The ladder agility is a form of physical training using stairs to train the agility of the legs and to harmonize movements in a balanced manner [16]. A resistance training combined with ladder drill was done by using the interval method. The interval method is a high intensity training method. Gibala and McGee [30] say that the physical activity is carried out with high intensity. The training that is often referred to as a high intensity interval training is shortened to HIIT or HIT. Kessler, Sisson and Short [31] define HIT as a vigorous training performed at high intensity for a short period of time accompanied by a

recovery interval. Then, Baechle et al. [32] say that the interval training is based on the concept that a greater amount of work can be done at a higher training intensity with the same fatigue. The benefits of HIT, according to Rakobowchuk et al. [33], are to improve the aerobic ability, burn the fat during and after exercise, and increase muscle mass. On that basis, the interval training is performed repeatedly by pressing the physiological system that will be used during certain types of the endurance or resistance training to a greater degree [34]. Therefore, the results of this research refer to the previous research which stated that the resistance training could increase muscle strength combined with ladder drills to train the leg agility by using the interval method performed at high intensity, which was very effective in improving the aerobic ability. This statement is mentioned along with the futsal game that is played in a high intensity way, with fast, and dynamic movements that have a standard of VO_{2max} above $50 \text{ ml kg}^{-1} \text{ min}^{-1}$ for elite athletes.

For the group received pyramid method, indicated from the average value, there is an increase in the score, 0.13. However, looking at the follow-up analysis of the difference test for the Resistance Band Ladder Drill training pattern with the pyramid method, it can be seen that there was no effect on the aerobic ability because the average of the increase was small. Judging from the characteristics of the pyramid method, the intensity changes up then down, rest, and distance traveled can change each repetition and set. According to Sidik [21] the

pyramid method is a system that starts at low intensity with many reps (hypertrophy) and ends with high intensity with few reps. Charro et al. [22] also states that the pyramid method involves several sets, but the intensity increases with each set with a gradual decrease in numbers. Another factor that can influence the results is to consider the incomparable volume of the training. In this research, the amount of the interval method training volume and the pyramid training volume was same. The only difference was the rest time for each movement because the rest in the interval method is consistent or fixed. In contrast, the rest time in the pyramid method is changeable. Therefore, with this result, the training volume cannot be equated when we use two different methods because each training method has a different volume requirement that can provide an adaptation effect on the body.

5. Conclusions

The conclusion of this research is that there was an effect of the Resistance Band Ladder Drill training pattern using the interval method on the aerobic ability and there was no effect of the Resistance Band Ladder Drill training pattern using the pyramid method on the aerobic ability. According to these results, the training volume cannot be equated when we use two different methods because each training method has its volume requirements that can provide an adaptation effect on the body. For further research, scientific development in coaching is suggested to be more effective and efficient. Therefore, this research can be developed through other forms of training in accordance with the principles and norms of training.

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