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## Is ladder drill training effective for increasing agility for karate athletes in the 'Kumite' category (14-16 years)?

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### Abstract

The aim of this research is to measure and analyze the effect of ladder training on increasing the agility of karate athletes aged 14 - 16 years. This type of research is experimental research using pre-test and post-test. The agility test used in this research was the hexagonal agility test. The sample was 40 karate athletes with an average age of  $15.1 \pm 0.7$  years and training experience of  $4.1 \pm 5.4$  years. There were 2 groups, namely the control group and the training group using a ladder drill. This exercise was carried out 18 times with 3 meetings a week. The results of this study showed no effect on agility in the control group  $0.049$  ( $p < 0.005$ ) with a time of 17.50 to 17.23 seconds, the average increase was 0.27 seconds and the effect was 37.8%. Meanwhile, there was an influence on agility in the ladder drill training group of  $0.003$  ( $p < 0.005$ ) with a time of 17.48 to 16.47 seconds, the average increase was 1.1 seconds and had an influence of 72%. The importance of this training model can provide variations for coaches to train athletes so that athletes' agility can develop and athletes can develop strategies and tactics during kumite.

**Keywords:** Ladder drill, agility, karate

### Introduction

Combat sports are activities that require a physical component, namely agility. Agility is needed by every combat sports athlete in all situations, such as avoiding enemy attacks, outwitting and then attacking and countering opponent attacks from the narrowest angles of movement [35, 26, 10]. Apart from that, agility is the basis for practicing and improving movement abilities and sports techniques, especially movements that require motor coordination. In combat sports, agility is called the rapid movement of techniques and tactics in all directions while maintaining dynamic balance, speed and precision when attacking or defending by parrying and dodging [25, 11, 5]. So the fighter's ability to carry out movements at the highest possible speed and accompanied by turning direction quickly without losing speed and balance is defined as agility.

In karate competitions, having high agility skills can make it easier for karate athletes to avoid attacks or respond to an opponent's attack with the right position. Thus, without having good agility, it can cause difficulties in trying to dodge and counterattack accurately and create hard and precise attacks. So agility training is needed to make it easier for athletes to avoid attacks and respond to attacks with high precision. Agility in karate fighters is influenced by several factors including muscle strength, speed, muscle explosive power, reaction time, balance and coordination [32, 24, 26]. Then other factors that occur in karate matches such as target size, time, distance, mastery of technique, fast and slow movements, accuracy, strength and weakness of movements, and accuracy are the determining factors for agility [36, 17, 15].

Currently variations of agility training have been carried out in various combat sports and have shown their impact. Examples of agility training such as using ladders, hurdles, cone drills have been proven to be effective in increasing the agility of fighting athletes. The findings of previous studies show that ladder training has been proven to increase a fighter's agility, but

the martial arts that carried out the study were mostly done in pencak silat martial arts. [19, 22, 20, 21, 28]. It was explained that athletes who had undergone a training program using ladders could increase their agility by 21 seconds or 12.92% after carrying out the pre- test and post-test [16].

Meanwhile, training using hurdles is only carried out to measure the combination of power and agility abilities in pencak silat athletes [31]. Then in karate there is still a lack of research studies that analyze training methods for agility. Only one training method for karate was found to show that ladder training can improve the agility of karate athletes for 11 male athletes and 5 female athletes. Based on the results of this research, the average agility of male athletes increased from 18.5 seconds to 16.7 seconds and female athletes 22.4 seconds to 19.3 seconds [12]. Other research that measures the agility of karate athletes uses interval training methods, core training, plyometric-sprints, and T drills which have been proven effective for increasing agility [7, 2, 34, 18, 10].

However, to improve the agility of karate athletes, variations of agility training are needed that are appropriate to the characteristics of karate fighting. Based on the results of observations, the agility of karate athletes under the age of 16 years is still less than optimal, as proven by the hexagonal agility test at the karate dojo in Lampung City, Indonesia. Previous research studies did not explain the age of the sample which analyzed the effect of ladder training on increasing the agility of karate athletes, therefore this research study can be a reference for future karate coaches and athletes. So the importance of this research is as a basis for developing models or variations of agility training for karate, especially kumite, that are scientifically published [30, 4]. Then the basic training method used in this research uses ladder drill training, because currently there are 13 training models known to have modified ladder training models [14]. The aim of this research is to test and analyze the effect of ladder training on increasing the agility of karate athletes aged 14 - 16 years. It is hoped that this research will become the basis for subsequent research on the effect of agility training on the abilities of karate athletes which will have an impact on the achievements of these karate athletes.

## Methods

### Research Design

This type of research is experimental research which aims to see any differences after treatment is given to the dependent variable. This research design uses a pre-test and post-test design, meaning that before and after being treated, a test is carried out to determine the agility of karate athletes aged 14 - 16 years. The agility test used in this research was the hexagonal agility test.

The population of this study were karate athletes from the city of Lampung and the sample was karate athletes from various universities who were willing to be sampled, a total of 40 athletes aged 14 - 16 years with an average age of  $15.1 \pm 0.7$  years and training experience of  $4.1 \pm 5.4$  years. The qualifications for this research sample are those who have experience competing and winning medals, and are not sick or injured.

### Research Procedure

The first step is to carry out a pre-test, after the results are known then the sample of karate athletes is paired with the A-B-B-A technique. After pairing the samples, they were grouped into 20 athletes who were treated with ladder drills and 20 athletes became control variables, meaning that these

athletes were free to train using ladder drills and did not depend on sets, repetitions and volume.

This treatment was carried out 18 times or 6 weeks, with 3 training sessions a week. Training was carried out on Monday, Wednesday and Friday from 16.00-17.30 and was assisted by several coaches who participated in this research. There are 5 types of ladder exercises that are applied, namely 1) one in the hole, 2) two in hole, 3) lateral two in hole, 4) two in, two hole, 5) skip or jump.

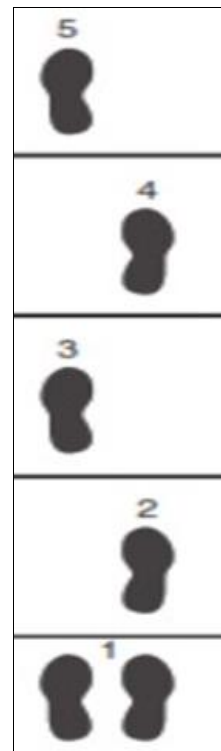


Fig 1: One in the hole

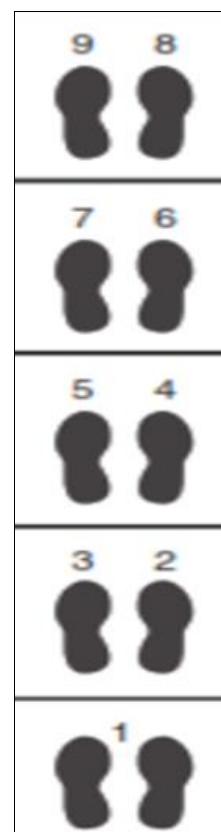


Fig 2: Two in the hole



Fig 3: Lateral two in hole

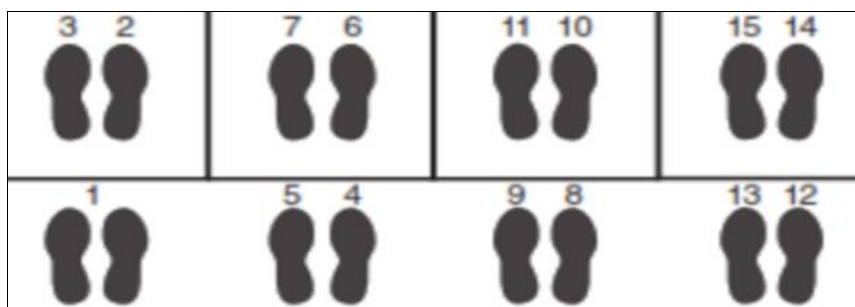


Fig 4: Two in, two out

The rhythm in this exercise must be fast, so it is considered high intensity. The following is the training dose given:

Table 1: Training Dosage

Meeting	Dosage (sets)	Notes
1	3	Lift thighs forward
2	3	
3	4	
4	4	Lift thighs, facing forward and to the side
5	6	Open - close the legs
6	7	
7	7	Open - close the legs, change legs
8	8	Variation: Jump twice, step back once
9	8	
10	9	
11	9	
12	3	
13	3	
14	4	
15	5	
16	6	
17	4	
18	3	

**Statistical Analysis**

Data analysis in this study used SPSS version 26. After the pre-test and post-test data were collected, the conditions for testing the hypothesis were the normality test using Shapiro-Wilk and the homogeneity test using the Levene test. Next, a sample paired t test was carried out by looking at the significance value and the coefficient of determination value or adjusted R Square.

**Result**

After the pre-test and post-test data have been collected, testing will then be carried out to test the effect of ladder training on increasing the agility of karate athletes aged 14 - 16 years.

Table 2: Normality test result

Tests of Normality				
Variable	Test	Shapiro-Wilk		
		Statistic	DF	Sig.
Control Group	Pre	0,970	20	0,746
	Post	0,943	20	0,270
Ladder Drill Group	Pre	0,957	20	0,493
	Post	0,975	20	0,861

Based on the results of the normality test using Shapiro-Wilk in table 2, it can be seen that the significance value for the control group in the pre-test was 0.746 and the post-test value was 0.270 or both had a value of ( $p>0.05$ ). Then the significance value for the concrete ladder group in the pre-test was 0.493 and the post-test value was 0.861 or both had a value of ( $p>0.05$ ). So the control group and ladder drill group have normal data.

**Homogeneity Test**

Table 3: Homogeneity Test Result

Test of Homogeneity				
Variable	Levene Statistic	DF1	DF2	Sig.
Control Group	0,230	1	38	0,634
Ladder Drill Group	0,492	1	38	0,487

Based on the results of the homogeneity test using Levene in table 3, it can be seen that the significance value for the control group is 0.634 or has a significance value ( $p>0.05$ ). Then the significance value for the ladder drill group is 0.487 or has a significance value ( $p>0.05$ ). So the control group and ladder drill group have homogeneous data.

## Hypothesis Test

**Table 4:** Test Result

Paired Samples Test				
Variable	Test	t	DF	Sig. (2-tailed)
Control Group	Pre - Post	1,857	19	0,049
Ladder Drill Group	Pre - Post	3,402	19	0,003

Once the data is known to be normally distributed and homogeneous, the next step is to test the hypothesis with the t test. Based on the results of table 4, the significance value for the control group is 0.049 or ( $p < 0.005$ ), meaning there is no influence on the agility of karate athletes aged 14 - 16 years who train in the control group.

Then the significance value for the ladder drill group is 0.003 or ( $p < 0.005$ ), meaning that there is an influence on the agility of karate athletes aged 14-16 years before and after being given training treatment using ladder drill.

## Statistical Sample

**Table 5:** Statistical Sample Result

Paired Samples Statistics					
Variabel	Test	Mean	N	Std. Deviation	Std. Error Mean
Control Group	Pre test	1750,50	20	187,503	41,927
	Post test	1723,25	20	160,758	35,947
Ladder Drill Group	Pre test	1748,05	20	186,700	41,747
	Post test	1647,00	20	113,098	34,470

The results in table 5 aim to calculate the average (mean) increase in karate athletes aged 14 - 16 years before and after being given treatment. The control group had an average pre-test agility result of 17.50 seconds and a post-test result of 17.23 seconds, with an average increase of 0.27 seconds. Then the ladder drill group obtained an average pre-test agility result of 17.48 seconds and a post-test result of 16.47 seconds, with an average increase of 1.1 seconds.

## Coefficient of Determination (Adjusted R Square)

**Table 6:** Adjusted R Result

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.340 <sup>a</sup>	.0384	.0378	86,156
2	.761 <sup>a</sup>	.0724	.0720	55,473

In the results of table 6, the aim is to measure the contribution or influence of training in the control group and ladder drill group on the agility of karate athletes aged 14 - 16 years. In this research, the value that will be used is Adjusted R Square. With this value, the control group obtained a value of 0.378, meaning that the effect of training in the control group on agility was 37.8%. Then the influence in the ladder drill group obtained a value of 0.720, meaning that the influence of training in the ladder drill group on agility was 72%.

## Discussion

Agility is very necessary for karate martial arts, especially fighting or kumite. The lack of publications related to agility research for karate athletes is the topic of discussion in this research. From the results of this research, the agility component is really needed for kumite karate athletes aged 14 - 16 years. Each martial arts sport requires different bio-motor

abilities, although agility is needed for all combat martial arts athletes [8]. In the kumite category of karate, the element of agility is very necessary to anticipate the opponent's attack, outwit and even attack the opponent from an unexpected direction.

The development of agility training through ladder drill training has been carried out in a clear program and with increasing intensity and sets. Then the right training method also influences increasing agility and is supported by the right training program. An effective training program will have an impact on increasing agility [35, 27, 6].

As in this research, just practicing ladder drills without monitoring such as sets, intensity or volume is still not enough to increase agility. The results obtained had no effect on increasing agility and the average increase was 0.27 seconds. Then the effect of ladder drill training without clear program monitoring was only 37.8%. For certain situations in a karate fight, the time difference of a fraction of a second can affect the number of attacks and can even counter the enemy's attack [30]. Therefore, with a very small increase in time it is still not enough to win the match. Apart from that, based on monitoring during training, ladder training without supervision from the coach is just doing the exercise, meaning that an athlete's movement speed is not optimal. The physical component of speed is very necessary in training agility, apart from the components of good coordination and balance, so it will be very difficult to improve agility if the three components are not trained simultaneously and with the supervision or guidance of a trainer [9].

From the ladder drill training group, the right training program can provide good improvements to agility. This requires treatment using ladder drills from 3 sets to 9 sets and with variations adapted to the athlete's condition during kumite. Training in this group is monitored directly by the coach, so that the intensity carried out by the athletes can be maximized. In this group's training, the trainer provides instructions in the form of movements that really require agility during kumite. The circumstances during kumite battles for junior and senior athletes are also different, so it would be appropriate if training is adapted to the athlete category. Good agility definitely requires excellent physical condition, so it is possible that with well-programmed agility training, the condition of karate athletes will also improve [26, 13]. Based on the results of research tests, ladder training with a clear and measurable program can have an effect on increasing the agility of kumite karate athletes aged 14 - 16 years. The average increase in time was 1.1 seconds with the contribution of ladder drill training to agility being 72%. Results with a clearly measurable and monitored training program are very different from training of the same type but without a clear program. The difference in time between karate athletes who do training with a program or sets and without training sets is 0.83 seconds. This time difference may not be noticeable if you feel it, but for experienced martial arts athletes it will be very valuable for attacking the opponent and can even result in several attacks on the opponent.

It must be admitted that agility training is tough training because it is high intensity training, so it definitely requires excellent physical condition. Apart from that, agility training must also pay attention to the periodization stage of training even though the athlete has become a professional athlete and is supported by a qualified trainer [3, 29]. Agility is also indirectly closely related to power [23], because by attacking the opponent using power, the opponent will fall and that is



what martial arts athletes want in order to win the match quickly and avoid the risk of excessive impact. So it will be very difficult to train to increase agility without first training speed and strengthening muscles, joints and bones through strength training. From the description of this discussion, it is clear that ladder drill training with variations can increase agility for karate athletes aged 14-16 years. Training with this model also has an impact on the athlete's physical condition simultaneously and does not require a long time. Indirectly, training with many variations using ladder drills is useful for athletes to be able to think about how to develop tactical patterns and strategies for athletes to attack or avoid during kumite.

### Conclusion

The ladder drill training program has proven to be effective and efficient in increasing the agility of Kumite karate athletes aged 14 - 16 years. With a variety of training models, it had an effect on increasing agility from 17.48 to 16.47 seconds, with an average increase of 1.1 seconds and an effect of 72%. Meanwhile, training with the same ladder drill without intensity and different sets had no effect on agility from 17.50 to 17.23 seconds, with an average increase of 0.27 seconds and an effect of 37.8%. The importance of this training model can provide variations for coaches to train athletes so that athletes' agility can develop and athletes can develop strategies and tactics during kumite. It is hoped that in the future, agility training for karate athletes can continue to be developed by adding variables, samples or comparing training models that can increase the agility of karate athletes.

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