Agility Training in Adolescent Pencak Silat Athletes: A Randomized Controlled Experimental Study

Entrenamiento de agilidad en atletas adolescentes de Pencak Silat: un estudio experimental controlado y aleatorizado

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Abstract

Problem Formulation and Objectives. Previous research has discussed various training models to improve agility. However, research that focuses on one form of ladder drills involving one sport in a very limited age category to get better results. This study aims to analyze how big the influence of ladder drills training is on increasing the agility of pencak silat athletes in adolescence.
Method. This research used a quasi-experimental design involving 30 young male pencak silat athletes aged 13-15 years. This research used a two group pre-test – post-test design with a comparison/control group. In the treatment group, ladder drills were given for 16 meeting sessions with a frequency of 4 sessions per week for 4 weeks, the maximum level of training intensity/quality (pulse/minute) given was 180 times/minute, with a loading duration ranging from 15 – 30 seconds, repetition 2 – 4 repetitions, sets done 2 – 3 sets and recovery 2 minutes/repitation by carrying out 10 variations of the movements in the ladder drills exercise. Meanwhile, the control group was not given ladder drills, only taking pre-test and post-test data. Agility data was obtained from the Illinois agility test, both in obtaining pre-test and post-test data, then statistically analyzed using the T-Test.
Results. These findings show that in the treatment group there was a significant influence on the agility of adolescent pencak silat athletes who were given the ladder drills training program with ($p<0.05$), a percentage increase of 2.7%. Meanwhile, in the control group there was no significant effect ($p>0.05$), the percentage increase was 0.2%.
Conclusion. Ladder drills have been proven to be no less effective than other exercises for increasing the agility of trained athletes. Therefore, instructors, coaches, practitioners and athletes can use this ladder drills exercise for those who want to gain optimal agility.

Keywords

Teenagers; Pencak Silat; agility; ladder drills.

Resumen

Formulación del problema y objetivos. Investigaciones anteriores han discutido varios modelos de entrenamiento para mejorar la agilidad. Sin embargo, la investigación que se centra en una forma de ejercicios de escalera que involucra un deporte en una categoría de edad muy limitada para obtener mejores resultados. Este estudio tiene como objetivo analizar qué tan grande es la influencia del entrenamiento de ejercicios de escalera en el aumento de la agilidad de los atletas de pencak silat en la adolescencia.
Método. Esta investigación utilizó un diseño cuasi experimental que involucró a 30 atletas jóvenes de pencak silat de 13 a 15 años. Esta investigación utilizó un diseño de prueba previa y posterior de dos grupos con un grupo de comparación/control. En el grupo de tratamiento, los ejercicios de escalera se administraron durante 16 sesiones de reunión con una frecuencia de 4 sesiones por semana durante 4 semanas, el nivel máximo de intensidad/calidad de entrenamiento (pulso/minuto) administrado fue de 180 veces/minuto, con una duración de carga que oscilaba entre 15 y 30 segundos, repetición 2 – 4 repeticiones, series realizadas 2 – 3 series y recuperación 2 minutos/repetición realizando 10 variaciones de los movimientos en el ejercicio de ejercicios de escalera. Mientras tanto, el grupo de control no recibió ejercicios de escalera, solo tomando datos de pre-prueba y post-prueba. Los datos de agilidad se obtuvieron de la prueba de agilidad de Illinois, tanto en la obtención de datos de pre-prueba como de post-prueba, luego se analizaron estadísticamente usando la Prueba T. Resultados. Estos hallazgos muestran que en el grupo de tratamiento hubo una influencia significativa en la agilidad de los atletas adolescentes de pencak silat a quienes se les dio el programa de entrenamiento de ejercicios de escalera con ($p<0.05$), un aumento porcentual de 2.7%. Mientras tanto, en el grupo de control no hubo un efecto significativo ($p>0.05$), el aumento porcentual fue de 0.2%.
Conclusión. Se ha demostrado que los ejercicios de escalera no son menos efectivos que otros ejercicios para aumentar la agilidad de los atletas entrenados. Por lo tanto, los instructores, entrenadores, practicantes y atletas pueden utilizar este ejercicio de ejercicios de escalera para aquellos que quieran obtener una agilidad óptima.

Palabras clave

Adolescentes; Pencak Silat; agilidad;ejercicios de escalera.

Introduction

Pencak silat is a traditional and modern martial art that is performed both solo and in duels with or without musical accompaniment (Kartomi, 2011). Pencak silat provides physical exercise for teenagers that can improve overall physical fitness (Demorest et al., 2016). There are four components that need to be considered to improve performance, namely physical, technical, tactical and mental conditions (Syafruddin, 2011) in addition, the maximum and rapid realization of the body's adaptive potential in combat due to strong technical attacks (Manolachi et al., 2023)one of them is agility. Pencak silat and agility are closely related, agility has a direct influence on basic technical abilities in pencak silat (Ihsan et al., 2022).

Agility is very important for all sports, including pencak silat because agility is characterized by very fast and sharp changes (Thomas et al., 2009) can change direction quickly in response to a stimulus (Theocharis et al., 2023) and maintaining and controlling body position by quickly changing direction with a series of movements (Sekulic et al., 2013). According to (Junpalee et al., 2023) Good agility provides an advantage in avoiding injury. There are many forms of training to improve agility, but researchers prefer Ladder drills.

Ladder drills are a very popular exercise (Brown, L., & Ferrigno, 2014), furthermore (Singchainara et al., 2023) stated that ladder drills are known as a form of training to improve the agility and performance of athletes. There are ten of the best and most fun ladder drills movements, namely side jumps, two forward jumps, and one back jump, squatting/jumping in, one leg forward jump, lateral lunge, side toe touch, and skater with toe taps and plank jacks (Olson, 2021). In line with opinion (Suryadi et al., 2023) that the many combinations of various agility training movements really help skills in each sport.

The development of relevant studies at this time, increasing agility can also be increased through core strength training (CST) and can also provide improvements such as endurance and balance (Ozmen & Aydogmus, 2016). Other studies also suggest that apart from ladder drills, agility can also be improved through sensory motor training (Heleno et al., 2014). In addition, other studies also show that small game exercises and training videos can also provide an effective method for improving agility (Paul et al., 2016). Additionally, according to (de Lima et al., 2020) showed that a training protocol using ladder drills can increase agility and improve the performance of physical functions in older adults easily and practically. However, several studies have found that ladder drills still cannot provide optimal results for agility. Like research (Liskustyawati et al., 2024) stated that the ladder drills agility training affected athletes with a high body mass index, but not with a low or normal body mass index. Therefore, further research is needed to ensure that ladder drills training can increase agility whether with low, high or normal body mass index.

Therefore, researchers were interested in conducting this research with the aim of analyzing how much influence ladder drills exercise had on increasing the agility of young male pencak silat athletes aged 13-15 years. The ladder drills exercise consists of ten variations of movements in the ladder drills exercise. These findings are important for instructors, coaches, practitioners and athletes in improving agility.

Method

Research design

This research is a pre-experiment with a two group pretest-posttest design with a T-Test, the experimental group is the only group given treatment in the research with a control group as a comparison (Montgomery, 2013). In this study, the experimental group was given ladder drills training. Meanwhile, the control group was not given ladder drills, only taking pre-test and post-test data.

Participants

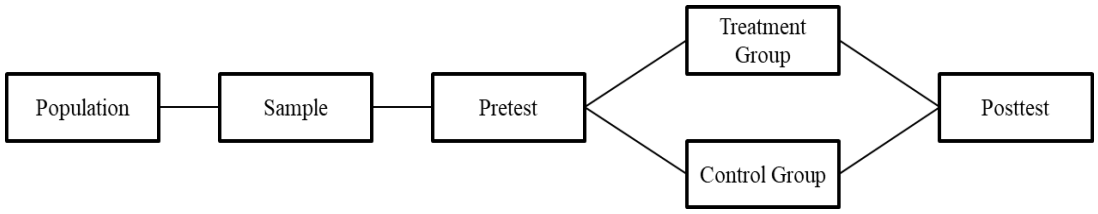
In this study, there were thirty young male pencak silat athletes who participated in this research.

These participants are trained athletes at one of the best pencak silat schools in West Sumatra. They have stated that they are able to comply with the rules during the research and participate voluntarily through a written agreement. Athletes had an average age of 13.8 years, weight 44.47 kg, height 161.13 cm and BMI 17.14.

Procedure

In this study there were three procedural stages, namely pre-test, treatment and post-test. The pre-test carried out initial data collection before the athletes were given the ladder drills training program treatment. After that, it continued with the treatment stage, the treatment was carried out in 16 meeting sessions and then continued with the post-test stage, at this stage the final data collection for agility measurements was carried out again after the sample was given treatment in this study. For the control group, only initial data (pre-test) and final data (post-test) were taken.

Figure 1. Research Design



Information:
Population : Research population
Sample : Sample
Pre-test : Initial test
Treatment Group : Treatment Group
Control Group : Control Group
Post test : Final test

This research used ladder drills which lasted for 4 weeks 4 times a week. This exercise begins with a static and dynamic warm-up for 15 minutes, followed by core exercises (ladder drills) where there are 8 variations of movement, namely, forward forward with a flat water, forward forward with a medium of water but in each column, forward forward at in each column of the left side of the body, move forward in each column of the right side of the body, zig zag forward, close and open the legs and move forward, close and open the legs and move backwards, move the left side, right and straight forward. After that, static and dynamic cooling continued for 15 minutes. Meetings 1 – 4 in the first week, moderate intensity (quality) level with pulse frequency/minute (150 - 165 times/minute), 4 repetitions, 3 sets, and recovery 2 minutes/repitition. At meetings 5 – 8 in the second week, the intensity level (quality) is increased to submaximal with a pulse frequency/minute (165 – 180 times/minute), 4 repetitions, 3 sets, and recovery of 2 minutes/repitition. Then continue with meetings 9 – 12 in the third week and 13 – 16 in the fourth week, the intensity level (quality) is increased to maximum with pulse frequency/minute (180 and above times/minute).

Instrument

To get agility results, researchers used the Illinois Agility Test (Widiastuti., 2015), because the Illinois Agility Test provides or shows valid agility results (Raya et al., 2013) and is in accordance with the characteristics of the sport of pencak silat.

Statistical analysis

In this study, researchers used descriptive statistics to explain each variable, while the normality test was analyzed using Kolmogorov Smirnov, homogeneity was analyzed using Levene's test. Then, test the researcher's hypothesis using the Paired Samples Test (T-Test). Paired Samples Test (T-Test) is a method for determining the effectiveness of treatment which is characterized by the average difference before and after treatment (Frey, 2023). All data in this study were analyzed using the IBM SPSS version 24 statistical program.

Results

This research obtained an average agility result for the treatment group, namely 20.50± 1.4(pre-test) and 17.80± 1.0(post-test). Meanwhile, for the control group, namely 21.0 ± 2.0 (pre-test) and 21.2 ± 1.9 (post-test). This shows that there was a significant increase in the group that was given ladder drills training treatment compared to the control group that was not given ladder drills training treatment, which can be seen in table 1.

Table 1. Agility results in each treatment group

Treatment	Group	N	Minimal	Maximum	M±SD
Experiment	Pre-Test	15	18	22.5	20.5 ± 1.4
	Post-Test	15	16	19.6	17.8 ± 1.0
Control	Pre-Test	15	18	25.1	21.0 ± 2.0
	Post-Test	15	18.5	24.9	21.2 ± 1.9

Note: The dependent variable is agility, with units of "seconds"

Furthermore, Table 2, Figure 2 and Figure 3 also show that the normality and homogeneity test data for the experimental group and control group were normally and homogeneously distributed (p>0.05).

Table 2. Test requirements for normality and homogeneity analysis

Treatment Group	Normality test						Homogeneity Test		
	Kolmogorv-Smirnov			Shapiro-Wilk			Levene's		
	Statistics	df	Sig	Statistics	df	Sig	df 1	df 2	Sig
Pre-Test Experiment	0.128	15	0.200	0.948	15	0.496	3	56	0.070
Post-Test Experiment	0.142	15	0.200	0.944	15	0.435			
Pre-Test Control	0.147	15	0.200	0.957	15	0.642			
Control Post-Test	0.171	15	0.200	0.932	15	0.296			

Note: Data is normally distributed and homogeneous (p>0.05)

Figure 2. Experimental Group
a) Normality Plot Graph, b). Normality Plot Graph Decreased

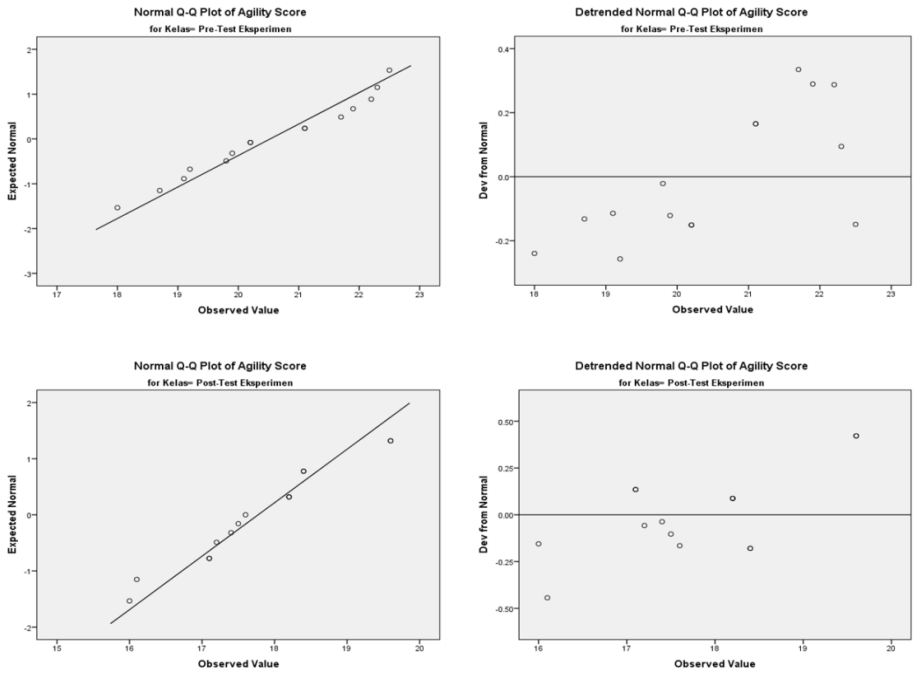
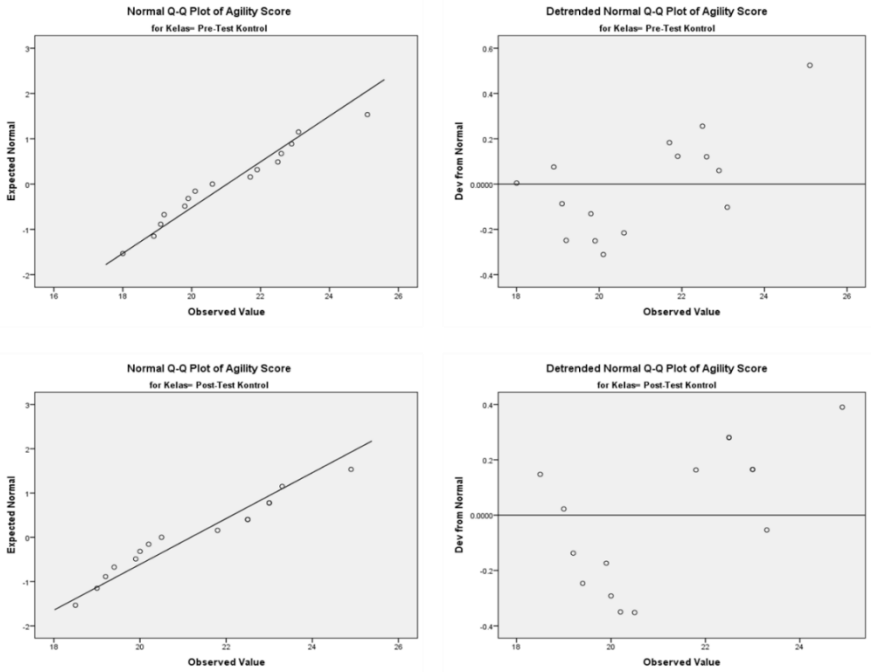


Figure 3. Control Group
a) Normality Plot Graph, b). Normality Plot Graph Decreased



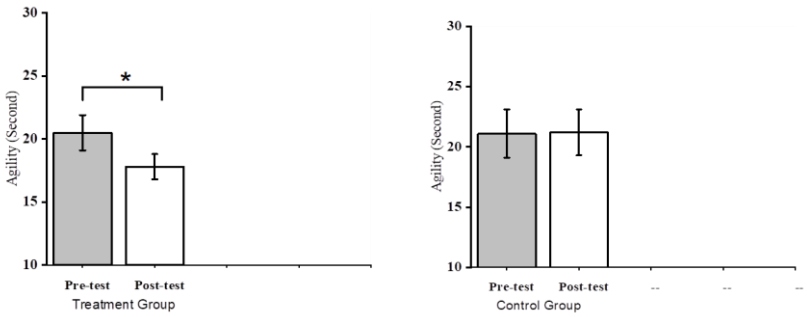
After the analysis requirements are met, then continue with Table 3 below which presents the results of the Paired Samples Test (T-Test), this table shows that there is a significant increase in agility after being given the ladder drills training treatment with ($p < 0.05$).

Table 3. T-Test

Paired Samples Test (T-Test)						
Treatment	Group	m	elementary school	df	p	Conclusion
Experiment	Pre-Test vs Post-Test	2.75	1.24	14	0,000	Significant
Control	Pre-Test vs Post-Test	-0.15	0.44	14	0.201	Not significant

Note: The dependent variable is agility. Significant difference ($p<0.05$).

Figure 4. Test of differences in agility between the experimental group and the control group, the group given the ladder drills training treatment could increase agility significantly (*$p<0.05$) compared to the control group. Data is presented with Mean and Std Error, p-value obtained using paired t-test to compare pre-test to post-test for each group



Discussion

These findings show that there has been a significant improvement in athletes through providing a form of agility training (ladder drills). These results confirm previous research which revealed that ladder drills training can increase agility (de Lima et al., 2020) and ladder drills can also improve dynamic balance (Ng et al., 2017). According to (Agus et al., 2021) Agility is a person's ability to change direction quickly and precisely when moving without losing balance. Apart from that, agility is one of

the components of motor fitness which is really needed for all activities that require the speed of changing the position of the body and its parts (Sepriadi, 2020).

Agility training of a competitive nature can result in significant agility gains (Kovacikova & Zemková, 2021). Previous research also reported that agility training can be manipulated to change physical and physiological changes, as it applies optimal training principles such as overload, progression, and periodization (Atkinson et al., 2016). The principles of an exercise program can be said to be effective if it has the right intensity, frequency and duration (Josse et al., 2010). In this study, it was given for 16 meeting sessions with a frequency of 4 sessions per week for 4 weeks, the maximum level of training intensity/quality (pulse/minute) given was 180 times/minute, with a loading duration ranging from 15 – 30 seconds, repetitions 2 – 4 repetitions, 2 – 3 sets and recovery 2 minutes/rep by carrying out 10 variations of the movements in the ladder drills exercise. This research is in line with research (Kosova et al., 2022) that plyometric training given for 8 weeks can also increase agility, besides that giving CoBAg training for 9 weeks can also increase athletes' agility (Mohamad Puzi & Choo, 2021). In addition, the Proprioceptive Neuromuscular Facilitation (PNF) – Contract Relax Antagonist Contract (CRAC) method can increase agility by 4% (Millner et al., 2022).

Agility training not only provides an optimal influence on martial arts or pencak silat sports, but agility training can also provide an optimal influence on other sports, as in the opinion (Gusliandi et al., 2020) Agility training can also have an optimal impact on badminton by providing footwork training. Besides that, (Antara et al., 2023) suggests that agility training can improve dribbling technical skills in female athletes in the sport of hockey. Furthermore, agility training also greatly contributes to a person's physical health, as explained by previous research. Agility training can also increase agility for people with Down syndrome (Lin & Wuang, 2012). In line with research (Reed-Jones et al., 2012) that agility training can also improve reflexes and the ability of older adults to carry out rapid body movements to control effective balance.

This research was carried out as closely as possible to avoid errors when treatment was given to athletes. Although these findings are promising, this research still has weaknesses. First, this study only implemented one form of agility training (ladder drills). After that, the sample in this study was relatively small, namely 15 athletes with trained athletes at one of the best pencak silat colleges in West Sumatra. Apart from that, this study did not use a control group or comparison group in order to compare the results between the treatment group and the comparison group. This research was only carried out for 4 weeks with a frequency of 4 times per week, longer research is recommended to get better and optimal results.

Conclusions

This research concludes that agility needs to be considered through forms of training to increase agility, one of which is ladder drills because it can provide optimal results. In accordance with these findings, the results of increasing the agility of adolescent pencak silat athletes in the experimental group were better than the control group with an average of 22.5 pre-test and 19.6 post-test with a significant percentage of 2.7%. These findings are important because they provide information about increasing agility that is supported by a given training program, which may be useful for instructors, coaches, practitioners and athletes in improving agility. Further research is needed involving other forms of agility training and related factors in agility training, the number of samples in the trained category, and longer treatment times and athletes in improving agility.

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