

# Effect of ladder drills program on agility of Karate players in Guangxi Polytechnic of Construction Guangxi Province, China

Liang Fengyuan and Singha Tulyakul\*

Faculty of Education, Thaksin University, Thailand.

Accepted 8 November, 2024

---

## ABSTRACT

This research aimed to develop and compare the effects of a ladder drills program on the agility of Karate players. The sample group consisted of Karate players from Guangxi Polytechnic of Construction Guangxi Province, China, obtained from a simple random sampling of 30 people, divided into an experimental group of 15 people trained through a ladder drills program developed by the researcher. At the same time, 15 Karate players of the control group were trained by a traditional training program for eight weeks, three days per week, and 30 to 45 minutes per day. The Illinois agility test was used to measure agility. All data were analyzed by averaging and calculating standard deviation. The Wilcoxon signed ranks test was used to compare the results of agility training within the control and experimental groups' pretest and posttest. The Mann-Whitney U test was used to compare the pretest and posttest between the control and experimental groups. The research found that the ladder drills program developed by the researcher was suitable. It was also found that the experimental group had better agility than the control group at the significant level .05. Both within the experimental and the control group, it was found that the agility posttest was better than the pretest at the significant level .05. The study results will serve as guidelines for enhanced players, coaches, and those who interested the Karate in the future.

**Keywords:** Ladder drills program, agility, Wilcoxon Signed Ranks test, Mann-Whitney U test.

---

\*Corresponding author. E-mail: singha@tsu.ac.th.

---

## INTRODUCTION

Karate originated in the ancient Ryukyu Kingdom, which is now known as the Ryukyu Islands in Japan. It is based on four basic techniques: attacking, punching, kicking, and defending. Karate serves as a sport for exercise, enhances physical fitness, and develops personal qualities through various movement patterns, including basic kata and kumite (Chen, 2006).

Karate is a complex skill that requires a high level of coordination. Competing also involves tricky tactics that must be mastered. Therefore, karate players need good physical fitness, including speed, strength, endurance, flexibility, and agility (Chen et al., 2001). A previous study found that karate players require better agility than athletes

in similar sports, such as Taekwondo, wrestling, and judo (Faraji et al., 2016; Zemkova and Hamar, 2014). Thus, agility is a vital skill for karate.

Agility training with ladder drills offers many benefits, including innovation, uniqueness, and engagement. This approach can enhance athletic performance and development to meet future needs (Chen, 2012).

Ladder drills are an effective training method for increasing agility. This modern technique aligns well with human movement physiology. Coaches and athletes can create training programs suitable for various sports, making the training atmosphere enjoyable and relaxed. This approach also boosts enthusiasm for training.

Ultimately, it enhances agility, enabling athletes to perform more efficiently (Wang, 2011).

The ladder drill program is developed to improve athletes' agility. The research follows the F.I.T.T. principle: frequency (F) indicates that athletes will train three days a week, intensity (I) means the number of drills and their difficulty will increase weekly, time (T) specifies that training sessions will last 30-45 minutes each day, and type (T) refers to the use of ladders as training equipment. According to Naternicola (2015), utilizing the F.I.T.T. principle is essential in creating effective fitness programs for athletes. Furthermore, Powers and Dodd (2020) explain that regardless of the activity, the key components of exercise prescription are Frequency, Intensity, Time (duration), and Type (mode) of exercise, known collectively as the *F.I.T.T. principle*.

Guangxi Polytechnic of Construction, located in Guangxi Province, China, focuses on engineering education while also offering physical education. It trains college karate players to compete in regional and national tournaments. Consequently, preparing athletes is essential for competition, particularly in skill training and physical fitness, which demands intensive training.

However, past statistics show that most college athletes lack physical fitness. When athletes enter the next round, they often become fatigued, and their muscle strength and endurance decrease. This decline affects the agility of karate players, causing them to move more slowly and resulting in competition outcomes that fall short of expectations. Moreover, data from last year's physical fitness test for karate players revealed that many athletes did not pass the evaluation, particularly in agility. Agility is crucial for karate players who need to move, dodge, or use weapons against their opponents. Low physical fitness poses significant problems as it slows the body and hinders the ability to defend against opponents' attacks. Additionally, Guangxi Polytechnic of Construction lacks a training program focused on developing agility and improving performance.

Due to the issues identified in this study, the researcher, who is a karate teacher and coach, aims to develop a ladder drills program. This program is designed to enhance the agility of karate players at Guangxi Polytechnic of Construction in Guangxi Province, China, thereby effectively improving their skills for the future.

## LITERATURE REVIEW

### Agility

Agility is a crucial aspect of physical fitness for athletes. Tulyakul (2020) noted that if athletes lack agility, their chances of success diminish. Agility enables athletes to move efficiently in multiple directions without losing balance. Therefore, it is important for athletes to train for

further development. Corbin et al. (2016) defined agility as the body's ability to move quickly and accurately change direction toward a specific location.

The key factors of agility are "speed" and "change of direction." Agility is the ability to swiftly change the direction of movement in response to stimuli from the limbs within a specific sports environment (Zhao et al., 2015). The main factors impacting agility quality include: 1) movement skills, 2) efficiency and precision of the tools used to analyze movement, 3) flexibility of the central nervous system, 4) baseline quality of various sports characteristics, 5) current mental state, 6) age and gender, and 7) level of fatigue (Wang, 1997).

### Training principles to develop agility

Tulyakul (2020) stated that the principles for enhancing agility should include the following components:

1. Agility training should be repetitive to help the nervous system remember and learn the activity.
2. Good coordination between muscles and every part of the body. Any activity requires different muscles to work together systematically.
3. Agility training is not only about speed and quick movements; it also involves power and muscle strength. To train agility effectively, both components must be developed together for a holistic approach.
4. Reaction time: Developing agility requires training to improve reaction times as an important component.
5. Flexibility: Infrequent movement or lack of opportunities to use joints can prevent muscles and tissues from maintaining their ability to stretch, leading to poor flexibility and decreased agility.

### Principle of agility training using ladder drills

The ladder drills, a training method that involves laying a ladder flat on the ground and practicing steps, are designed to enhance athletes' agility, coordination, speed, and other physical characteristics (Feng, 2019). This modern and comprehensive physical training method is typically conducted after warm-up activities and before the main training session. The training intensity should be maintained at a moderate or higher than moderate level, with the athlete's heart rate ideally staying between 150-180 beats per minute (Zheng, 2020). The research use ladder for training is 7 meters long and has a step width of 25 centimeters, with 13 steps total.

Ladder drills not only improve an athlete's foot speed and the smoothness of various technical movements but also promote proper body coordination, ensuring a holistic improvement in performance (Fei, 2011). According to Krabuanrat (2009) and Tulyakul (2020), training with a

ladder to enhance agility requires a minimum commitment of 8 weeks. During weeks 1 - 2 , the body will adjust, resulting in only slight improvements in agility. In weeks 3 to 4, agility increases slightly to moderately as the body adapts well to the training. By weeks 5 to 6, agility develops

substantially and can improve even more with continued training. In weeks 7 to 8 , agility can be significantly enhanced. However, in weeks 9 to 10, agility levels will be maintained but may show little to no further improvement.



Figure 1. Ladder for training.

### Objectives of the study

1. To develop a ladder drills program on the agility of karate players at Guangxi Polytechnic of Construction in Guangxi Province, China.
2. To compare the differences in agility in the control group and the experimental group between pretest and posttest of karate players at Guangxi Polytechnic of Construction in Guangxi Province, China.
3. To compare the differences in posttest agility between the control group and the experimental karate players at Guangxi Polytechnic of Construction in Guangxi Province, China.

### Research hypothesis

1. The karate players in the experimental and control groups had better agility after training than before training.
2. The karate players in the experimental group had better agility than the control group after training.

## METHODOLOGY

### Population

The population includes 45 karate players aged 18 to 22 from Guangxi Polytechnic of Construction in Guangxi Province, China.

The sample group includes 30 karate players from Guangxi Polytechnic of Construction in Guangxi Province,

China, aged 18 to 22 years. They were selected through simple random sampling and divided into two groups:

- 1) An experimental group of 15 people will participate in a ladder drills program developed by the researcher. This group will train for a total of eight weeks, three days a week (Monday, Wednesday, and Friday) for 40 to 55 minutes each day. The intensity will increase each week by incorporating more training postures and making those postures more difficult.
- 2) A control group of 15 people will undergo a traditional training program. This group will train for eight weeks, three days a week (Monday, Wednesday, and Friday), for 40 to 55 minutes each day. Karate skill training will be the focus for this group, and the intensity of training postures will increase continuously each week.

### Instruments of the study

1. The ladder drills program was developed by the researcher.
2. The traditional training program.
3. Illinois Agility Test (Mackenzie, 2005) for evaluating the agility (pre and post-test).

### Data collection method

Data collection of the study is in the following order:

1. Request a letter from the Graduate School at Thaksin

University to the Chancellor of Guangxi Polytechnic of Construction in Guangxi Province, China. This letter should ask for permission to collect data from the sample group of karate players for research purposes.

2. Schedule the training sessions for the ladder drills program. Training occurs from 4:30 PM to 5:15 PM, three days a week: Monday, Wednesday, and Friday. The experiment takes place between March and April 2024.

3. Explain the details of the agility test by Illinois Agility Test to the researcher assistant for data collection in detail.

4. Explain the sample groups to provide each group with details about the ladder drills program and the traditional training program.

5. Prepare the workplace and equipment used for the training. Inspect and check the readiness and quality of the tools and equipment.

6. Conduct the Illinois Agility Test with the sample group before training. The researcher explained the details and demonstrated the testing method thoroughly to ensure accurate results.

7. The group was divided into two groups: the experimental group, consisting of 15 people, will train using the ladder drills program developed by the researcher, and the control group, consisting of 15 people, will train using the traditional training program and proceed according to the

specified program.

8. After the 8-week training period, the agility test was performed with the Illinois Agility Test.

9. The researcher recorded the agility test results.

10. The data obtained from the test were analyzed statistically.

## RESULTS

1. The ladder drills program developed by the researcher has validity, as the IOC consistency index was found to be between 0.60 and 1.00. It has been adjusted based on suggestions from five experts. Additionally, it has been modified to address obstacles and problems encountered, including adjusting the time for training postures, finding additional ladder drills, and learning the training postures. This includes emphasizing warm-up and cool-down exercises every session.

2. The results of agility training showed that after the 8th week, both the ladder drills group and the traditional training program group demonstrated improved agility compared to before the training.

**Table 1.** The Wilcoxon Signed-Rank Test was compared to the differences in agility training between pretest and posttest after 8 weeks of training (Experimental group).

Period of training	N	Experimental group			
		$\bar{X}$	SD.	Z	P
Pretest	15	20.75	.8045	-3.408	0.01*
Posttest	15	17.72	.95		

\* $P < .05$

Table 1 shows the results of the agility test of karate athletes. Considering the time taken within the experimental group before training, the mean time was 20.75. After 8 weeks of training, the agility test had a mean time

of 17.72. The groups' differences ( $P$  value) had a statistical value of 0.01. Therefore, the agility of karate athletes before and after eight weeks of training was significantly different at the .01 level, and it was better after training than before.

**Table 2.** The Wilcoxon Signed-Rank Test was compared to the differences in agility training between pretest and posttest after 8 weeks of training (Control group).

Period of training	N	Control group			
		$\bar{X}$	SD.	Z	P
Pretest	15	20.84	.8043	-3.408	0.01*
Posttest	15	19.57	.94		

\* $P < .05$

Table 2 shows the results of the agility test of karate athletes. Considering the time taken within the control group before training, the mean time was 20.84. After eight weeks of training, the agility test had a mean time of 19.57. The groups' differences (*P* value) had a statistical value of 0.01. Therefore, the agility of karate athletes before and after eight weeks of training was significantly different at

the .01 level, and it was better after training than before.

3. After eight weeks of training, the experimental group, which participated in the ladder drills program, demonstrated better agility than the control group, which trained in the traditional program.

**Table 3.** Comparison of the differences in agility between the control and experimental groups after 8 weeks of training using the Mann-Whitney U-test.

Groups	N	$\bar{X}$	SD.	Z	P
Control group (Posttest)	15	19.58	.94	-4.169	.001*
Experimental group (Posttest)	15	17.72	.95		

\**P* < .05

Table 3 shows the agility results of karate athletes after eight weeks of training. The control group had a mean score of 19.58, while the experimental group had a mean score of 17.72. The *P*-value, which indicates the difference between the two groups, was .001. This means that the agility of karate athletes in the experimental group was significantly better than that of the control group after 8 weeks of training, with a statistical significance at the .05 level.

## DISCUSSION

The impact of the ladder drills program on the agility of karate players at Guangxi Polytechnic of Construction in Guangxi Province, China, has been analyzed according to the following research objectives:

1. The first objective is to develop a ladder drills program that enhances the agility of karate players. The researcher had the program reviewed by five experts to assess its quality and validity, focusing on the IOC index. The IOC value for agility should be 0.5 or higher, aligning with the findings of Phusi-on (2015), which state that an acceptable IOC value must not fall below 0.5. Furthermore, adjustments to the ladder drills program were made based on experts' recommendations, including the order of training postures to increase complexity and ensure the timing matched the training postures. Subsequently, the developed ladder drills program was pilot-tested with students enrolled in the karate course at Guangxi Polytechnic of Construction to identify shortcomings, problems, and obstacles prior to actual training, enhancing its appropriateness and effectiveness. This aligns with the assertion of Pipitkul (2018) that validity refers to statements or questions that accurately measure what they are intended to assess based on the research content. The

program was designed to improve the agility of karate players, illustrating that an effective ladder drills program will aid in developing better agility. Additionally, the assessment of tool quality in this method corresponds with the study by Thammathe and Tulyakul (2024), which developed a combined training program to enhance agility in football players. Their research indicated that the combination training program demonstrated acceptable validity and successfully improved the agility of football players.

2. The second research objective was to compare the agility differences between the control and experimental groups in pretest and posttest assessments. The research found that after 8 weeks of training, the posttest values indicated that the average agility of both karate players significantly improved compared to their pretest values at the .05 level. In the experimental group using the ladder drills program, the research shows that players training with this method effectively enhanced their skills. This program helps players change the direction of their feet quickly and maintain a balanced body posture. Consequently, training with ladder drills increases karate players' agility. This finding aligns with Hikmah et al. (2023), who used a ladder to improve agility in karate athletes. After six weeks of training, the karate athletes showed increased agility. According to Kamutsri (2017), improving agility requires athletes to focus on developing essential physical fitness components. Agility is interconnected with improvements in muscle strength, power, and speed. Additionally, training can enhance the nervous system's quick response, facilitating efficient directional changes. Furthermore, players must develop their anaerobic energy system, which is crucial for quick muscle contractions and movement efficiency during sudden direction changes. Agility training can be applied in various forms, each requiring athletes to utilize speed

and rhythm in their movements. The training goals and targets must be clearly defined based on the specific needs and current fitness levels of the athletes. Moreover, it is essential to align agility training with the established training program since quick muscle contractions during this training can lead to injuries. Therefore, it is vital for athletes to be well-rested and warmed up before engaging in agility training. Emphasizing the ability to change movement direction rapidly—particularly footwork—is crucial in all sports. Coaches should tailor the training duration and intensity to suit different sports. Focusing on 5 to 10 meters distances and changing direction at 3 to 5 predetermined points can be beneficial. In each training session, athletes should maintain a balanced body posture while executing forward, sideways, and backward movements that align with their specific sports. Therefore, the ladder drills program is a valid method for enhancing agility.

However, despite not following the correct and appropriate principles, the research results in the control group trained with the traditional program showed improvement. After 8 weeks of traditional training, the average agility test results of the karate players were better than before training. This indicates that eight-week traditional agility training can develop agility when the body moves quickly. This is consistent with Thani (2020), who found that body movement can enhance physical fitness and sports skills. Thupbuchha (2015) also stated that the program must involve training at least three days per week to increase agility. The training regimen should alternate between difficulty levels and gradually increase in intensity.

3. The final research objective was to compare the agility differences between the control and experimental groups in the post-test after eight weeks of karate training. The research found that karate players who trained with the ladder drills program developed by the researcher had better average agility than those who followed the traditional program. This improvement is attributed to the implementation of the ladder drills program according to the appropriate principles for enhancing players' agility. Specifically, it utilized the F.I.T.T. principle: frequency (F), where players trained three days a week; intensity (I), which involved progressively increasing the complexity and number of training postures each week; and time (T), focusing on effective methods for developing agility. This aligns with the findings of Muhmut (2019), Heyward (1991), and Naternicola (2015), who emphasized that training for physical fitness should follow the F.I.T.T. principle when designing training programs for athletes. Likewise, Robin and Louis (2019) studied the impacts of ladder drills on athletes' agility and discovered that those who trained with ladder drills improved their agility more than those who did not. This is supported by Krabuanrat (2009), who noted that ladder drills are specialized

training equipment for enhancing foot movement. Such training can stimulate the nervous system to promote faster muscle contractions, improving foot movement efficiency and overall agility. Moreover, it requires precision and accuracy, and should ideally not involve additional equipment, as this may hinder the ability to move effectively. Additionally, the ladder drills training format fosters the development of movement skills, with the space size being adaptable to the athlete's shape and abilities.

## Conclusion

According to the research results, the ladder drills program greatly affects the agility of karate players. This program, developed by the researcher, was designed based on training principles and appropriate training periods. As a result, the agility of the karate players in the experimental group improved, allowing them to move and change direction more quickly. Agility is achieved by practicing movement, changing direction, controlling muscular and sensory systems, and responding quickly and efficiently. Effective balance control is essential because most sports require movement, and some require quick direction changes. If the body is agile and has good physical fitness in other components, it will contribute to success in the sport.

## REFERENCES

- Chen, J., and Nguyen, D. B. (2001). *Karate course*. Hanoi: Vietnam Hanoi Sports Publishing House.
- Chen, K. (2012). Experimental research on "soft ladder training" in college aerobics preparation activities. *Chinese School Physical Education*, 2, 53-55.
- Chen, X. (2006). Research on the development of karate in Shanghai. *Fighting*, 3(11), 33-34.
- Corbin, C. B., Welk, G. J., Corbin, W. R., and Welk, K. A. (2016). *Concepts of fitness and wellness: A comprehensive lifestyle approach*. Boston: McGraw-Hill.
- Faraji, H., Nikookheslat, S. D., and Fatollahi, S. (2016). Physical and physiological profile of elite Iranian karate players. *International Journal of Applied Exercise Physiology*, 5(4), 35-44.
- Fei, M. (2011). *Research on the influence of soft ladder training on the footwork speed of high school male basketball players*. Northeast China: Normal University.
- Feng, D. (2019). *The influence of weighted soft ladder training on the agility of junior high school male basketball players* [Doctoral dissertation, Beijing Sport University].
- Hikmah, N., Tomoliyus, T., Wedi, S., Wijayanti, N. P. N., Prayoga, H. D., and Prabowo, T. A. (2023). Is ladder drill training effective for increasing agility for karate athletes in the 'Kumite' category (14-16 years). *International Journal of Physical Education, Sports and Health*, 10(5), 15-20.
- Kamutsri, T. (2017). *Physical Fitness Development*. College of Sports Science and Technology, Mahidol University; Nakhonpatom.
- Krabuanrat, C. (2009). *9-Square and brain development*. (2nd ed). Bangkok: Sinthana Copy Center.
- Mackenzie, B. (2005). *101 Performance Evaluation Tests*. London. Electric Word plc.

- Muhmut, A. (2019). The effects of quick strength training on agility performance in soccer. *Universal Journal of Educational Research*, 7(4), 1001-1006.
- Naternicola, N. L. (2015). *Fitness steps to success*. South Australia: Human Kinetics.
- Phusi-on, S. (2015). *Application of SPSS to analyze research data*. (7th ed). Mahasarakham: Taksila Printing.
- Pipitkul, K. (2018). Quality of questionnaire instruments. Validity and reliability in public administration research. *Northeastern University Academic and Research Journal*, 8(2), 104 – 106.
- Robin, K., and Louis, R. (2019). Impact of ladder training on the agility performance of footballers. *International Journal of Yogic, Human Movement and Sports Sciences*, 4(1), 779-781.
- Powers, S. K., and Dodd, S. L. (2020). *Total Fitness & Wellness*. Pearson.
- Thammathes, S., and Tulyakul, S. (2024). The effects of the combined training program on agility in football players. *Education Quarterly Reviews*, 7(1).
- Thupbucha, A. (2015). The effect of supplementary training with agility training program on the soccer dribbling ability of male soccer players aged 16-18 years. *Journal of Graduate Studies Network of Northern Rajabhat Universities*, 5(8), 131-142.
- Tulyakul, S. (2020). *Physical fitness training*. Thaksin University. Songkhla.
- Wang, B. (1997). Training methods for coordination and agility. *Chinese School Sports*, 6, 40-43.
- Wang, Z. (2011). Study on the mechanism of soft ladder training method in improving athletes' agility. *Sports World Academic Edition*, 4, 99-100.
- Zemkova, E., and Hamar, D. (2014). Agility performance in athletes of different sport specializations. *Acta Gymnica*, 44(3), 133-140.
- Zhao, X., Zhang, Y., and Ge, C. (2015). Research progress on the theory and methods of sports agility quality. *Journal of Capital Institute of Physical Education*, 27(3), 249-256.
- Zheng, K. (2020). Experimental study on the effect of soft ladder training on lower limb mobility of American football players. [Doctoral dissertation, Shandong Institute of Physical Education].

---

**Citation:** Fengyuan, L., and Tulyakul, S. (2024). Effect of ladder drills program on agility of Karate players in Guangxi Polytechnic of Construction Guangxi Province, China. *African Educational Research Journal*, 12(4): 269-275.

---