



The Effect of Quickness and Flexibility Training on Increasing The Reaction Time of The Sickle Kick in The Sport of Pencak Silat

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Article History

Received June 2025

Accepted June 2025

Published Vol.14 No.(2) 2025

Keywords:

Quickness; Flexibility;
Reaction Time

Abstract

This study aims to determine the effect of quickness and flexibility training on increasing the reaction time of sickle kicks in pencak silat athletes. This study uses a quantitative approach with a one-group pretest-posttest quasi-experimental design. The subjects of the study were 16 pencak silat athletes from Banjaran Silat Club, Bandung Regency. Treatment was given through a quickness and flexibility training program for 12 sessions. The measurement instrument used a hit sensor kick shield pad connected to a digital application to measure the reaction time of sickle kicks. The results of statistical analysis showed that the data were normally distributed ($p > 0.05$) based on the Shapiro-Wilk test. The Paired Sample t-Test showed a significant difference between the pre-test and post-test values ($t = 12.591$, $p = 0.000$). The average reaction time value decreased from 0.58669 seconds to 0.49288 seconds after treatment. These findings indicate that the combination of quickness and flexibility training is effective in increasing the reaction time of sickle kicks. This research contributes to the development of a pencak silat training program based on neuromotor and body flexibility.

How to Cite

Putri, A., Mulyana., Firdaus, I. R., & Ajid, O. N. (2025). The Effect of Quickness and Flexibility Training on Increasing The Reaction Time of The Sickle Kick in The Sport of Pencak Silat. *Journal of Physical Education, Sport, Health and Recreation*, 14 (2), 743-747.

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INTRODUCTION

Pencak silat is an original Indonesian martial art that has a wealth of cultural values and is also a rapidly developing sport at the national and international levels. Through various prestigious events such as the SEA Games and Asian Games, pencak silat has shown its competitiveness and become a national identity on the world stage. In pencak silat competitions in the tanding category, kicking techniques are the dominant technical aspect that contributes greatly to the acquisition of points. One of the kicking techniques that is often used is the crescent kick, because it is considered effective for attacking opponents with a wide and unpredictable trajectory (A. S. Dewi et al., 2022; Sucipto, 2018).

The crescent kick requires high speed, coordination, and flexibility of the body, especially in the waist and lower legs. This technique is generally trained early by athletes because in addition to providing high points, it also has biomechanical elements that are easier to modify according to tactical needs in the match. However, the effectiveness of the crescent kick is not only determined by the strength of the leg muscles or basic techniques, but is greatly influenced by the athlete's reaction time in responding to visual or tactile stimuli on the field (Rushall & Pyke, 1990; Williams & Ericsson, 2005).

Reaction time in martial arts is an important indicator of an athlete's readiness and speed of response to a particular stimulus. The faster an athlete reacts, the greater his or her chances of avoiding attacks and launching an efficient retaliation. Therefore, developing reaction time is an aspect that needs to be trained systematically in pencak silat training, especially in the crescent kick technique which demands explosive speed and high accuracy (Mahendra & Mulyana, 2019; Zulfa et al., 2022).

Quickness training is a type of training that aims to increase the speed of reactive movements and the body's ability to respond to stimuli spontaneously. Quickness training involves the central and peripheral nervous systems, and strengthens coordination between the brain and muscles in a short time. This training includes various forms such as ladder drills, cone drills, reaction drills, and shuttle runs which have been proven to be able to develop the speed of perception and motor response (Illah et al., 2024; Shetty, 2020). In the context of pencak silat, this training is relevant to improving reaction ability when facing changes in the opponent's position.

In addition to the quickness aspect, fle-

xibility is also an important component in the success of the crescent kick. Flexibility allows a wider range of joint motion, especially in the hips and waist, so that the kick can be executed faster, higher, and more precisely. Flexibility exercises such as splits, dynamic stretching, and PNF stretching have been widely applied to increase muscle and ligament elasticity, and reduce the risk of injury (A. Bompa T, O & Buzzichie-li, 2019; Aisyah, 2024). Athletes who have good flexibility will find it easier to rotate their bodies maximally when kicking.

Several previous studies have shown that flexibility training significantly contributes to increasing the speed and accuracy of kicks in martial arts, including taekwondo and pencak silat (Kharisma, 2017; Pratama, 2016). The novelty of this study lies in its integrative approach, combining quickness and flexibility training within a single intervention to enhance reaction time in the crescent kick technique. Unlike most previous studies that examine these components in isolation, this research explores their synergistic effect, addressing a critical gap in the current body of literature.

Unfortunately, in real matches, reaction time is a key element that determines the effectiveness of a kick. Athletes with slow reaction times will lose momentum and be more easily blocked or counterattacked. Therefore, it is important for coaches to design a training program that integrates stimulus, neuromotor strengthening, and flexibility enhancement as a single training unit (J. C. S. Dewi & Aguss, 2023; Sayfullah et al., 2023). This study attempts to fill this gap by evaluating the effect of a combination of quickness and flexibility training on the reaction time of the crescent kick.

With a quasi-experimental approach, this study was conducted on pencak silat athletes in the competing category who followed a structured training program for 12 meetings. Reaction time measurements were carried out using a kick shield pad sensor that provides light stimuli to assess the speed of athlete response to stimuli. This design aims to objectively test the effectiveness of training interventions on reaction time with an inferential statistical approach based on paired sample t-test, in order to obtain data validity that can be scientifically accounted for.

The results of the study can enrich the literature on the effect of physical condition training on the reaction time aspect in martial arts. Practically, these findings can be used as a reference by coaches and sports practitioners in compiling a pencak silat training program based on neuromotor and body flexibility. By integrating these

two aspects of training, athletes are not only able to kick quickly and accurately, but are also able to maintain consistent performance without experiencing injuries that endanger the sustainability of their careers in the arena.

METHODS

This study used a quantitative approach with a quasi-experimental design to test the effect of quickness and flexibility training on increasing the reaction time of sickle kicks in pencak silat athletes. The design used was a one-group pretest-posttest, where measurements were taken before and after treatment in the form of a specific training program. This design was chosen because it allows researchers to assess the changes that occur due to the intervention, even without a comparison control group (Sugiyono, 2020).

The subjects in this study were 16 pencak silat athletes from Banjaran Silat Club, Bandung Regency, who were selected using purposive sampling technique based on the following criteria: actively training for at least 1 year, in the competing category, and willing to follow the entire series of training and measurement programs. The location of the study was at the GOR Desa Banjaran, Bandung, which has adequate training facilities. All participants were given information and consent before participating in the intervention as part of ethical research procedures.

The treatment in this study was a 4-week quickness and flexibility training program with a training frequency of 3 times per week (total 12 sessions), and each session lasted ± 60 minutes. Quickness training included cone drills, ladder drills, shuttle runs, and reaction drills designed to increase motor reaction speed. While flexibility training included dynamic stretching, static stretching, and the Proprioceptive Neuromuscular Facilitation (PNF) method which focused on the flexibility of the waist, pelvis, and lower legs.

The measurement instrument used is a hit sensor kick shield pad connected to a digital time measuring application via a smartphone. This tool provides a stimulus in the form of light, and records the time between the stimulus appearing until the athlete successfully performs a crescent kick that hits the target. Each athlete performs two attempts using the right and left feet alternately, and the fastest time is taken as the final score. Measurements are taken twice: before the training program (pretest) and after completing all training sessions (posttest).

Data were analyzed using SPSS software version 21 (Fadluloh et al., 2024). The analysis

began with a normality test using Shapiro-Wilk to ensure normal data distribution. After that, a Paired Sample t-Test was conducted to determine significant differences between pretest and posttest values. The significance level was set at $p < 0.05$. The results of this statistical test were used to test the hypothesis that quickness and flexibility training have an effect on increasing the reaction time of the sickle kick.

RESULTS AND DISCUSSION

Shows descriptive statistics of the Pre-Test and Post-Test values given to 16 respondents. The minimum Pre-Test value is 0.523 and the maximum is 0.645 with an average (mean) of 0.58669 and a standard deviation of 0.039587. While for the Post-Test, the minimum value is 0.426 and the maximum is 0.590 with an average of 0.49288 and a standard deviation of 0.048220. These data indicate a decrease in the average value from the Pre-Test to the Post-Test.

The results of normality tests using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For both types of data (Pre-Test and Post-Test), the significance value of the Shapiro-Wilk test is greater than 0.05 (Pre-Test: 0.536, Post-Test: 0.160), which indicates that the data is normally distributed and meets the assumptions for further parametric tests.

The results of the Paired Sample t-Test to compare the Pre-Test and Post-Test values. The results show a significant difference with a t value = 12.591, $df = 15$, and a significance value (2-tailed) of 0.000 ($p < 0.05$). This shows that there is a significant difference between the Pre-Test and Post-Test values.

This study aims to examine the effect of quickness and flexibility training on increasing the reaction time of sickle kicks in pencak silat athletes. The results of statistical analysis showed that there was a significant increase between the pre-test and post-test values after the treatment was given. The average reaction time in the pre-test was 0.58669 seconds, while in the post-test it became 0.49288 seconds. This average decrease indicates an increase in the athlete's reaction ability after undergoing the training program. The results of the paired sample t-test also showed a significance value of 0.000 ($p < 0.05$), which indicates that the difference is statistically very significant.

This increase is inseparable from the effectiveness of quickness training, which focuses on improving motor reactions and speed in re-

sponding to stimuli. Quickness training such as cone drills, ladder drills, reaction drills, and agility drills have been shown to increase the speed of signals from the central nervous system to the muscles so that reaction times become faster (Shetty, 2020). This is in line with the findings of (Illah et al., 2024) which stated that SAQ training (speed, agility, quickness) was able to significantly increase kicking speed in high school pencak silat athletes.

Flexibility training also plays an important role in supporting the effectiveness of the crescent kick. Good waist flexibility allows athletes to rotate their bodies more widely and smoothly, resulting in faster and more accurate kicks. (Aisyah, 2024) in her research stated that split training has a significant effect on the accuracy of the crescent kick because flexibility makes it easier for athletes to regulate timing and coordinate movements.

Furthermore, good flexibility also plays a role in preventing injuries. The explosive and fast crescent kick movement relies heavily on the flexibility of the pelvic, waist, and thigh muscles. If the muscles are not flexible, the possibility of injuries such as muscle strains or tears will be greater (Sabila et al., 2022). Thus, a training program that integrates flexibility aspects functions not only to improve performance, but also to support the sustainability of athlete performance safely and sustainably.

The results of this study are also consistent with the theory of motor training which states that rapid reaction ability is the result of a combination of perceptual speed, decision-making process, and muscle response speed (Rushall & Pyke, 1990; Williams & Ericsson, 2005). Therefore, providing stimulus stimulation in reaction training is an important component in accelerating the athlete's neuromuscular adaptation process.

In the context of pencak silat, the crescent kick is a technique that relies heavily on precise timing. When reaction time increases, athletes will find it easier to adjust their movements to their opponent's attacks or openings. This strengthens the effectiveness of the match strategy. (A. S. Dewi et al., 2022) added that improving kicking techniques can be done through modified training that emphasizes speed of movement and flexibility, which are the main focuses of this study.

This study also addresses a gap in previous literature. Most previous studies have only focused on kicking speed or leg muscle strength (Mahendra & Mulyana, 2019; Malinda et al., 2021), while the aspect of reaction time as a performance indicator has not been studied in depth,

especially in the context of the influence of quickness and flexibility training. Therefore, the results of this study make an important contribution to the development of training methodology for pencak silat, especially in the fighting category.

Practically, these results can be used as a basis for coaches in designing more comprehensive training programs and focusing on improving reaction time through quickness and flexibility training. The combination of the two types of training has been proven effective in improving the performance of the crescent kick, which is a dominant technique and score determinant in pencak silat matches (Anugrah, 2022; Pratama, 2016).

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that quickness and flexibility training have a significant effect on increasing the reaction time of sickle kicks in pencak silat athletes. The results of the analysis showed a significant decrease in reaction time from pre-test to post-test, which indicates an increase in athlete performance after undergoing the training program. Quickness training has been proven effective in increasing the speed of response to stimuli through improving neuromuscular coordination, while flexibility training helps expand the range of motion and increase the efficiency of kicking movements. The combination of these two types of training not only increases the speed and accuracy of sickle kicks, but also contributes to preventing injuries and increasing athlete readiness during the match. Therefore, quickness and flexibility training can be used as an effective training strategy in an effort to improve the performance of sickle kick techniques in pencak silat, especially in the aspect of reaction time which is very important in the match.

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