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The Effect of Circuit Training Method on T Kick Speed of Pencak Silat Athletes

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Abstract

This study aims to determine the effect of circuit training on T-kick speed in pencak silat athletes. The method used is a quasi-experimental with a pretest-posttest control group design. The sample consisted of 20 athletes who were randomly divided into two groups: experimental and control. The experimental group underwent a circuit training program for four weeks, while the control group underwent conventional training. Kick speed measurements were carried out using Kinovea software. The results of the Paired Sample t-Test showed a significance value of 0.000 ($p < 0.05$), which indicated a significant increase in the experimental group. The average T-kick time decreased from 0.76070 seconds to 0.64250 seconds. This study shows that circuit training can significantly increase kick speed by increasing leg muscle strength, neuromuscular efficiency, and motor coordination. These findings contribute to the development of more specific and technology-based training methods in pencak silat.

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INTRODUCTION

Pencak silat is one of the original Indonesian martial arts that not only emphasizes cultural values, but has also developed into an internationally recognized sport (Kodir et al., 2023). In pencak silat matches, athletes are required to master various complex attack and defense techniques. One technique that has high strategic value is the T kick, which is a straight forward kick technique using parts of the foot such as the heel, sole, and outside of the foot as an attack tool (Johansyah, 2004).

T-kick is very effective to attack from medium to long distance because it provides a longer reach and maintains a safe distance from the opponent (Lubis & Wardoyo, 2014). Another advantage is the great power potential due to maximum exploration through the heel (Dailami, 2018). However, the effectiveness of this kick is highly dependent on the speed of execution, body balance, and leg muscle strength and coordination. Therefore, a training method is needed that is able to develop all of these components in an integrated manner.

Speed in martial arts such as pencak silat is one of the important components to create optimal performance (Bompa & Haff, 2009; Ihsan, 2018). Kick speed is not only influenced by muscle strength, but also by the central nervous system, muscle contraction, motor coordination, to elasticity and technique (Hariono, 2007). Good speed allows athletes to execute the T kick technique quickly and is difficult for opponents to anticipate.

Unfortunately, there are still many pencak silat athletes who do not utilize the T kick optimally in matches. One of the causes is the limitations in speed and stability of the technique. This shows the need for a training program that is specifically aimed at increasing the speed of the T kick. Conventional training tends to be less specific and less effective in increasing the explosive speed aspect.

The circuit training method is one potential solution to overcome these problems (Sidik & Rosdiana, 2023). Circuit training is a training method consisting of several training posts with a variety of movements and high intensity, which can train strength, speed, endurance, and body coordination simultaneously (Bompa & Haff, 2009; Fahey et al., 2011). In addition to being efficient, this method is flexible and can be adjusted to the needs and physical conditions of athletes (R. Davidson, 2024; Klika & Jordan, 2013).

Circuit training has also been shown to improve leg muscle performance, which is the main motor in kicking (Chan, 2012). Training with a combination of plyometrics, skipping, squatting, high knees, and the kick itself—arranged in a circuit series—can stimulate muscle strength, nerve reflexes, and accelerate neuromuscular (Clark & Evans, 2022; Thompson, 2023).

Previous studies such as by (Irianto & Situmeang, 2022) and (Nurhasanah, 2020) showed that the circuit training method is effective in increasing the speed of the crescent kick and Mawashi Geri. However, until now there has been no study that specifically examines the effect of circuit training on the speed of the T kick in pencak silat. This is an important research gap to be studied further.

Thus, the novelty of this study lies in the focus of circuit training exercises specifically aimed at increasing T-kick speed, as well as objective measurement of performance using Kinovea software. This is a new approach that combines functional training with technology-based analysis (Brown, 2022; L. Martin, 2021).

In addition to being an effort to answer the gaps in previous research, this study also aims to provide practical solutions for coaches in compiling more effective and targeted training programs. By integrating circuit training into coaching, coaches can improve athletes› kicking speed abilities specifically and measurably.

The circuit training method used in this study not only aims to increase speed, but also to improve the quality of kicking technique. The program is designed with the principles of specificity and progressiveness, which are expected to improve biomechanical abilities, movement efficiency, and explosive strength needed in the T-kick technique (Kenney et al., 2015; Parker & Liu, 2021).

The speed achieved in the T-kick is highly dependent on the efficiency of synergistic and antagonistic muscles, as well as the simultaneous involvement of the core, gluteus, and quadriceps muscles (Kurniawati et al., 2021). Therefore, the circuit training design in this study prioritizes exercises that target these areas repeatedly and intensively.

In the context of exercise physiology, speed is the body›s ability to perform movements in the shortest possible time, involving the central nervous system and the effectiveness of motor coordination (Anderson, 2020; Roberts & Kim, 2021). Circuit training that is repetitive and fast can stimulate these systems and increase reaction time and movement speed.

In addition, the uniqueness of this approach lies in the use of Kinovea software in analyzing movements. This software allows precise measurement of kick speed and angle, which can strengthen the validity of the results and provide visual data for coaches and athletes (Garcia & Lee, 2021; Thomas, 2022).

This research is expected to provide contributions both theoretically and practically. Theoretically, this research expands the study on the effectiveness of the circuit training method in the context of traditional Indonesian martial arts. Practically, these findings can be a reference in compiling a more scientific, efficient, and technology-based pencak silat training program.

With various theoretical foundations and field needs background, this study aims to answer an important question: Can the circuit training method increase the speed of T kicks in pencak silat athletes? From there, this study will provide a new direction in the method of kicking technique training that has not been widely explored scientifically, especially in the context of pencak silat self-defense.

METHOD

This study uses a quantitative approach with a quasi-experimental design method, which aims to determine the effect of circuit training on T-kick speed in pencak silat athletes. The design used is a pretest-posttest control group design, where participants are divided into two groups: an experimental group that receives circuit training treatment and a control group that is not given special treatment. Each group consists of 10 athletes selected by purposive sampling from the population of pencak silat athletes cicalengka silat club. The sample used is athletes with ages 15-20 and are still amateur athletes. The selection of purposive sampling technique aims to minimize bias selection and increase the validity of the results.

.The instruments used in data collection were video recordings and Kinovea software, which allows quantitative analysis of movement speed with high accuracy. Kinovea was chosen because of its ability to analyze movement speed through frame-by-frame video, making it suitable for measuring changes in T-kick execution time. The validity of using this software is supported by (J. Martin, 2021) and (Balsalobre-Fernández, 2019), who stated that Kinovea is effective in measuring angles and movement speed in sports research.

The study was conducted over four weeks, with a training frequency of three to four times per week. The experimental group underwent a circuit training program consisting of eight training stations, with a training time of 10–20 seconds per station, a rest period of 15–30 seconds between stations, and a break between rounds of two to three minutes. The exercises used in this program included a combination of strength, speed, and explosive movements such as squat thrusts, skipping, high knees, butt kicks, and thigh lifts, which were directly combined with T-kicks. This approach is designed to train the leg muscles, core, and accelerate neuromuscular reactions, as suggested by (Chan, 2012) and Davidson (2024).

Before the treatment, all participants underwent a pre-test to measure the speed of the T-kick as baseline data. After the training program was completed, a post-test was conducted to measure the development of speed. The pre-test and post-test data were analyzed using SPSS software version 25 (Fadluloh et al., 2024). The normality test was carried out using the Shapiro-Wilk test to ensure data distribution, while the hypothesis testing used a paired sample t-test to see the significance of the difference in the average between the pre-test and post-test. The significance value was set at $\alpha = 0.05$, as recommended in experimental quantitative research (Sugiyono, 2020).

With this approach, the research is expected to contribute to the development of more specific and effective training methods in increasing the speed of the T-kick technique in the sport of pencak silat. In addition, the use of technology such as Kinovea in data analysis provides a new dimension in evaluating athlete performance that is more objective and scientific.

RESULTS AND DISCUSSION

Based the results of descriptive statistics in Group 1 show that the Pre-Test value has a minimum value of 0.510 and a maximum of 0.926 with an average value (mean) of 0.76070 and a standard deviation of 0.138764. After being given treatment, the Post-Test value in this group decreased, with a minimum value of 0.461 and a maximum of 0.765, and an average value of 0.64250 and a standard deviation of 0.113127. This indicates a change in value after treatment in the first group.

The normality test presented in Table 2 uses two methods, namely Kolmogorov-Smirnov and Shapiro-Wilk. The results of the Shapiro-Wilk test show that the Pre-Test data has a significance value of 0.220 and the Post-Test is 0.147. Because the significance value of both variables

is greater than 0.05, it can be concluded that the data in Group 1 is normally distributed.

Next, shows the results of the Paired Sample T-Test for Group 1. The test results show a t-value of 7.366 with a p-value (Sig. 2-tailed) of 0.000. Because the significance value is less than 0.05, there is a significant difference between the pre-test and post-test values in Group 1. This means that the treatment given to this group has a significant effect on the measured results.

In descriptive statistical data for Group 2 is shown. The results show that the Pre-Test value has a minimum value of 0.523 and a maximum of 0.757, with an average of 0.62700 and a standard deviation of 0.063165. Meanwhile, the Post-Test value shows a decrease with a minimum value of 0.460 and a maximum of 0.676, an average of 0.57960 and a standard deviation of 0.065087.

The normality test for Group 2 shows that the significance value of the Shapiro-Wilk test for Pre-Test is 0.625 and Post-Test is 0.062. Both of these significance values are > 0.05, so the data in Group 2 can also be said to be normally distributed.

The results of the Paired Sample T-Test, show that there is a significant difference between the results of the Pre-Test and Post-Test in Group 2 with a t-value of 6.031 and a p-value (Sig. 2-tailed) of 0.000 (<0.05). This shows that the treatment given to Group 2 also has a significant effect on the results achieved.

Overall, in both Group 1 and Group 2, the treatment given had a significant impact on the measurement results, as evidenced by the significant statistical test results in each group.

This study aims to determine the effect of the circuit training method on increasing the speed of T kicks in pencak silat athletes. Based on the results of statistical data analysis using the Paired Sample T-Test, both in the experimental group (group 1) and the control group (group 2), a significance value of 0.000 (p <0.05) was obtained. This shows that the treatment given, namely the circuit training program, has a significant effect on the speed of T kicks.

Specifically, in the experimental group that received an integrated circuit training program with T-kick training, there was a decrease in the average time from 0.76070 (pre-test) to 0.64250 (post-test). This decrease in time means that after following the training program, athletes were able to perform kicks in a shorter time, which reflects an increase in kick speed. The standard deviation which also decreased from 0.138764 to 0.113127 showed the consistency and effectiveness of improving performance between individuals in the group.

The circuit training exercise applied in this study was specifically designed with 8 training posts focused on activating and strengthening the leg, hip, and core muscles, which are the main components in the implementation of the T-kick. Circuit training in general is a high-intensity training method that combines elements of strength, endurance, and speed in one series of exercises (Bompa & Haff, 2009; Fahey et al., 2011). This method allows the body to experience comprehensive adaptation, both from the neuromuscular and metabolic sides, thus supporting the improvement of specific motor performance such as kicking speed.

The increase in T-kick speed can be explained by several physiological mechanisms. First, circuit training increases the strength of the leg muscles, especially the quadriceps, hamstrings, and gluteus muscles, which play a major role in providing explosive thrust when kicking. Second, this exercise trains the coordination of synergistic and antagonistic muscles, so that the kicking movement pattern becomes more efficient and minimizes resistance(Hariono, 2007). Third, the exercises carried out quickly and repeatedly in circuit training increase the ability of the central nervous system to accelerate the transmission of motor impulses, which has an impact on increasing reaction speed and movement (Clark & Evans, 2022).

In addition, the use of Kinovea software in this study helps in measuring kick speed accurately and objectively. With the help of video analysis, it can be seen how changes in speed occur not only in numbers, but also in technical aspects such as foot position, body stability, and the speed of body momentum transfer towards the kick. This strengthens the belief that circuit training exercises affect not only muscle strength, but also the quality of athlete technique.

This study also confirms that functional and specific training will be more effective than general training. The control group, despite receiving a general physical training program, did not experience as much increase in kick speed as the experimental group. This is in line with (Justika, 2017), which states that training that involves movements that resemble actual activities in a match will provide greater transfer to improved performance.

In addition to increasing speed, this circuit training program also involves simple periodization elements with a structured distribution of training intensity and frequency over four weeks. The training frequency of three times a week

provides sufficient time for the muscles to adapt while avoiding overtraining. This principle is supported by (J. Davidson, 2024), who states that the success of a training program depends on the balance between training load and recovery time.

When viewed from the aspect of motor learning, repetitive training carried out in circuit training also accelerates the formation of motor engrams, namely movement patterns stored in muscle memory, which enable athletes to perform kicking movements with better speed and consistency over time (Brown, 2022). The increased speed of the T kick is also a result of increased neuromuscular efficiency that is trained continuously through this method.

These results are also in line with research by Nurhasanah et al. (2020) and Irianto & Situmeang (2022), which found that circuit training can increase kicking speed in other martial arts, such as karate and pencak silat in the sickle technique. This means that circuit training has cross-disciplinary martial arts effectiveness in increasing the speed element in leg attack techniques.

Overall, these findings confirm that circuit training is an appropriate and effective training method to increase the speed of T-kicks in pencak silat. This study contributes to the development of more structured and science-based training strategies, especially in the development of competing pencak silat athletes.

CONCLUSION

It can be concluded that the circuit training method has a significant effect on increasing the speed of T kicks in pencak silat athletes. A specifically designed training program with a combination of strength, speed, and explosive movements is able to stimulate neuromuscular adaptation and increase the efficiency of athlete movement. A significant decrease in the average kick time after treatment indicates an increase in performance that is not only physical, but also technical and motoric. Circuit training exercises that are carried out intensively, structured, and adjusted to the characteristics of the T kick movement have been shown to significantly increase athletes' specific abilities compared to conventional training. In addition, the use of technology such as Kinovea software in measuring performance strengthens the validity of the findings and provides a new direction for sports evaluation based on objective data.

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