

The Effect of Modified Tabata Training and Leg Muscle Strength on Sickle Kick Speed

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Abstract

The background is the speed of sickle kick pencak silat in PPLP South Sulawesi is minimum. It's make during match easily to catch the opponents. The purpose is to determine the effect of modified tabata training and leg muscle strength on the sickle kick speed of PPLP South Sulawesi Pencak Silat athletes. Research method using experimental 2x2 factorial design and the sample is PPLP and SMANKO South Sulawesi pencak silat athletes totaling 12 people conducted in the training hall of PPLP South Sulawesi pencak silat athletes on April 30, 2023 to June 04, 2023. The exercises given were modified tabata training interval 1:½ and 1:1 for 5 weeks. Data collection techniques using leg dynamometer tests and sickle kick speed test for 10 seconds. The results of first hypothesis test show difference in the increase mean is 2.83, standar deviation is 1.095 and p value is 0.001 <0.05. Second hypothesis test show difference in the increase mean is 0.5, standar deviation is 0.928 and p value is 0.001 <0.05. Third hypothesis test show interaction between modified tabata training and leg muscle strength with p value 0.032 <0.05. The conclusion is athletes who are trained in modified tabata training 1:½ intervals and have good leg muscle strength have a better increase in sickle kick speed than athletes who are trained in modified tabata training 1:1 intervals and have moderate leg muscle strength, and there is an interaction between modified tabata training and leg muscle strength on sickle kick speed.

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INTRODUCTION

The achievements of South Sulawesi pencak silat athletes are quite proud and are one of the leading branches of South Sulawesi province in national and international championship events. The South Sulawesi Provincial Government has shown seriousness in fostering athletes in the sport of pencak silat. Pencak silat itself is included in the sports that are fostered starting from student level coaching. However, the achievements of South Sulawesi pencak silat athletes have decreased from year to year. Based on South Sulawesi Dispora data in 2019 South Sulawesi PPLP pencak silat athletes who won medals at the national championship had a presentation of 75% while in 2022 it decreased to 12.5%, this means that there was a decrease in presentation of 62.5%.

Pencak silat is a cultural product of Indonesia that functions to defend itself from its environment to maintain and increase faith and devotion (Gristyutawati et al., 2012). Pencak silat functions as a martial art to face various threats from other people, animals and nature (Ediyono & Teguh, 2019). The movements in pencak silat are the development of everyday movements which are a spontaneity of natural phenomena (Indrahti et al., 2021). Besides self-defense, Pencak Silat is also an achievement sport. Pencak silat has several techniques, namely: attacks (fists, kicks, falls, and locks), defenses (fists, kicks, falls, and locks), ground techniques (sweeping, circling, and scissors) (Nugroho, 2004). These general techniques are not fully allowed to be used in matches because there are some techniques that can paralyze the opponent. The basic techniques commonly used by pencak silat athletes during matches are kicks, punches, falls, and defenses (Nugroho, 2020). The kick technique is the technique most often used by fighters during matches compared to punches and slams with a presentation of 47% (Nugroho, 2005). Even in pencak silat matches 100% of fighters use kicking techniques with various variations in achieving victory (Riadi, 2003).

The results of the researcher's observations through interviews with the PPLP South Sulawesi pencak silat coach in 2023 stated that the factor causing the decline in the achievements of PPLP South Sulawesi pencak silat athletes was the athlete's kicking speed when competing decreased in the last round of the match so that opponents could easily perform catch and slam techniques to score points while the kicking technique most often used by PPLP South Sulawesi pencak silat athletes is a sickle kick.

The sickle kick is a kick that has a crescent shape and the target tool used is the instep, the sickle kick is the easiest kick to do but also easy to anticipate by the opponent (Kriswanto, 2015). The sickle kick is a semicircular kick to the inside by targeting all parts of the body using the back and toes (Lubis, 2004). The advantage of the sickle kick technique is that it can be seen and heard clearly by the referee and judges so that during the match the judges are easy to record the incoming kick points. Meanwhile, the weakness of this kicking technique is that it is easy to catch so good speed is needed when using this kicking technique.

Kick speed is a technique that uses the leg to attack an opponent in a short time (Nurhasanah et al., 2020). Kick speed in pencak silat is the ability of fighters to kick quickly, strongly, and right on target (Nasution & Heri, 2017). Speed is influenced by several factors, namely: heredity, reaction, environment, facilities and infrastructure, opponent, technique, concentration, and muscle elasticity (Harsono, 1988). While the factors that greatly affect the speed of kicks in pencak silat, namely: endurance, nerve mobility process, contraction and relaxation, muscle stretching, muscle coordination, muscle elasticity, strength, mastery of techniques, and explosive power (Hariono, 2007). Kick speed can be improved through an effective and efficient training program and special technique training in pencak silat that can increase speed (Riski et al., 2023).

The speed of the sickle kick in pencak silat athletes can be increased by providing exercise. Exercise is a process that athletes must do to win. Exercise is a process to improve and develop the potential and abilities of athletes to the highest degree (Yudiana et al., 2012). Exercise is a process that is carried out repeatedly, systematically, and there is an increase in the frequency of training from day to day (Harsono, 1988). Exercise is physical activity in sports that is carried out for a long time and systematically so that there is an increase in individuals both in terms of physiological and psychological to achieve predetermined goals (Bompa, 1994). One effective and efficient exercise is tabata training.

Tabata training is high interval training useful for improving performance in sports that require aerobic and anaerobic energy systems to re-synthesize ATP used during exercise (Tabata, 2019). Interval training can increase lung capacity so that athletes do not easily feel fatigue (Christanto et al., 2022). Tabata training can also increase VO₂max and is a very suitable interval training method for athletes (Olson, 2013). Proper tabata training can start to reduce body fat, increase body metabolism during exercise, exercise more effectively and efficiently, increase aerobic and anaerobic endurance, increase physical and mental strength, and can be done during leisure time (Imanudin & Sultoni, 2017). Tabata training also provides benefits for increasing muscle mass, ankle strength (dorsiflexion), hip strength (abduction, flexion, extension, external rotation), knee strength (extension, flexion), and balance (Lee et al., 2021).

Apart from providing benefits for improving physical components, tabata training can also lose weight, reduce waist to hip size, and reduce body fat percentage in someone who is overweight (Domaradzki et al., 2020). Tabata training can lose weight by burning lots of calories because each movement involves various body systems such as the heart, lungs and muscles (Arisman & Noviarini, 2021). Tabata training can be applied to various groups ranging from children to adults. Tabata training

in children can have a positive impact on the child's body, therefore tabata training and stability training are needed in school learning programs to increase physical activity in children (Ekström et al., 2019).

Previous research explains that tabata training has an effect on increasing the speed of sickle kicks in pencak silat athletes by 2.82% (Kusuma & Wibowo, 2022). In the implementation of tabata training there is a ratio of recovery or rest time compared to work time. The ratio is expressed in a ratio of 1:½, 1:1, 1:2, and 1:3. With a shorter training duration, the commonly used ratio is 1:½ and 1:1. Based on the above background, researchers are interested in conducting research with the title "The Effect of Tabata Exercise Modification and Leg Muscle Strength on Sickle Kick Speed of South Sulawesi PPLP Pencak Silat Athletes".

METHODS

This research is experimental research with a 2x2 factorial research design. The population in this study amounted to 20 people then the sample was selected as many as 12 people using purposive sampling technique in sampling with the following criteria: (1) PPLP and SMANKO South Sulawesi pencak silat athletes, (2) Athletes who compete in the sparring category, and (3) Male gender. This research was conducted in the training hall of PPLP South Sulawesi pencak silat athletes on April 30, 2023 to June 04, 2023.

The sample was divided into two groups based on good and moderate leg muscle strength using a leg dynamometer to measure the leg muscle strength of each sample. The group that has good leg muscle strength is then divided into two groups to be given modified tabata interval training 1:½ and 1:1 as well as the group of athletes who have moderate leg muscle strength so that in this study there are four groups. Group A₁B₁ is a group that has good leg muscle strength and is given modified tabata interval training 1:½. Group A₁B₂ is a group that has moderate leg muscle strength and is given a modification of tabata interval training 1:½.

Group A_2B_1 has good leg muscle strength and is given modified tabata interval training 1:1. Group A_2B_2 has moderate leg muscle strength and is given modified tabata interval training 1:1.

The sample will then carry out a pretest to measure the initial speed of the athlete's sickle kick before being given treatment using the sickle kick speed test for 10 seconds with the correct procedure. Then the sample was given a modification of tabata training interval 1:½ which is rest time proportional to half the training time and interval 1:1 which is training time proportional to rest time. The exercises were given three times a week for five weeks with a total of 16 meetings and the duration of one meeting was 38-53 minutes. The duration of the exercise is 20 minutes of warm-up, core activities include 3-4 sets with each set consisting of 8 repetitions and each repetition consists of 10-20 seconds. The intensity of the exercise given in the first week is 70% of the maximum heart rate and continues to rise until the fourth and fifth weeks of 85%-max of the maximum heart rate. As well as 10 minutes of time for cooling down. After undergoing training for 5 weeks each sample then carried out a posttest to determine the athlete's sickle kick speed after being given treatment using a sickle kick speed test for 10 seconds with the correct procedure.

The data analysis technique in this study used the IBM SPSS 26 application as a calculation tool, namely the normality test, homogeneity test and hypothesis testing using the two-way Anova test to determine the effect of modified tabata training and leg muscle strength on sickle kick speed. Statistical significance was accepted at the level of $p < 0.05$.

RESULTS AND DISCUSSION

This study divided a sample of 12 people into four groups, namely a group that had good leg muscle strength and trained with modified tabata interval training 1:½, a group that had moderate leg muscle strength and trained with modified tabata interval training 1:½, a group

that had good leg muscle strength and trained with modified tabata interval training 1:1, and a group that had moderate leg muscle strength and trained with modified tabata interval training 1:1. Data from each sample was obtained through tests and measurements and analyzed using IBM SPSS 26.

Table 1 describes the data description of the difference in the mean value of the pretest of groups A_1 and A_2 is 2.17 and a standard deviation is 1.67 while the difference in the mean value of the posttest of groups A_1 and A_2 is 5 and a standard deviation is 2.765. Table 2 describes the data description of the difference in the mean value of the pretest of groups B_1 and B_2 is 2.5 and a standard deviation is 1.11 while the difference in the mean value of the posttest of groups B_1 and B_2 is 2 and a standard deviation is 2.038. Table 3 describes the data description of the increase in the mean value of the pretest and posttest of group A_1B_1 is 4 and a standard deviation is 0. Group A_1B_2 has an increase in the mean value of the pretest and posttest is 0.33 and the standard deviation has decreased is 1.14. The A_2B_1 group had a decrease in the mean pretest and posttest value is 1 and a decrease in standard deviation is 1.25. The A_2B_2 group had a decrease in pretest and posttest mean value is 0.34 and a decrease in standard deviation is 0.55.

Table 4 explains the normality test p value $0.181 > 0.05$ so it can be concluded that the data is normally distributed and the homogeneity test p value $0.257 > 0.05$ so it can be concluded that the data is homogen. Table 5 explains the hypothesis test of the difference in the effect of tabata training modification on sickle kick speed with the value of F count $> F$ table ($23.684 > 4.256$) and p value $0.001 < 0.05$ which means there is a significant difference in the effect of tabata training modification interval 1:½ and 1:1 on sickle kick speed. Table 6 explains the hypothesis test for differences in leg muscle strength on sickle kick speed with the value of F count $> F$ table ($15.158 > 4.256$) and p value $0.005 < 0.05$, which means there is a significant difference in the effect of good and moderate leg muscle strength on sickle kick speed. Table 7

explains the hypothesis test of the interaction between modification of tabata training and leg muscle strength on sickle kick speed with the value of F count > F table ($6.737 > 4.256$) and p value $0.032 < 0.05$ which means there is a significant interaction between modification of tabata training and leg muscle strength on sickle kick speed.

Table 1. Data Description of the Groups with Modified Tabata Interval Training 1:½ And 1:1

Group	N	Pretest	Posttest	Improvement
		Mean ± SD	Mean ± SD	Mean ± SD
A1 Tabata Training 1:½	6	24.50 ± 2,881	27.33 ± 4.131	2.83 ± 1.25
A2 Tabata Training 1:1	6	22.33 ± 1.211	22,33 ± 1.366	0 ± 0.155
Difference	6	2.17 ± 1.67	5 ± 2.765	2.83 ± 1.095

Table 2. Data Description of the Groups that Have Good and Moderate Leg Muscle Strength

Group	N	Pretest	Posttest	Improvement
		Mean ± SD	Mean ± SD	Mean ± SD
B1 Good Leg Muscle Strength	6	24.67 ± 2.582	24.83 ± 4.355	0.16 ± 1.773
B2 Moderate Leg Muscle Strength	6	22.17 ± 1.472	22.83 ± 2.317	0.66 ± 0.845
Difference	6	2.5 ± 1.11	2 ± 2.038	0.5 ± 0.928

Table 3. Data Description of the Interaction Between Modified Tabata Training and Leg Muscle Strength

Group	N	Pretest	Posttest	Improvement
		Mean ± SD	Mean ± SD	Mean ± SD
A1B1	3	26.67 ± 1.53	30.67 ± 1.53	4 ± 0
A1B2	3	23.67 ± 3.79	24.00 ± 2.65	0.33 ± -1.14
A2B1	3	24.00 ± 3.05	23.00 ± 1.00	-1 ± -1.25
A2B2	3	23.33 ± 2.08	21.67 ± 1.53	-0.34 ± -0.55

Table 4. Prerequisite Test

Prerequisite Test	Sig. Value
Normality	0.181 > 0.05
Homogeneity	0.257 > 0.05

Table 5. Hypothesis Test of the Difference in the Effect of Tabata Training Modifications on Sickle Kick Speed

Source	F Count	F Table	Sig
Tabata Training	23.684	4.256	0.001

Table 6. Hypothesis Test of the Differences in Leg Muscle Strength on Sickle Kick Speed

Source	F Count	F Table	Sig
Leg Muscle Strength	15.158	4.256	0.005

Table 7. Hypothesis Test of the Interaction Between Modified Tabata Training and Leg Muscle Strength on Sickle Kick Speed

Source	F Count	F Table	Sig
Modified Tabata Training Leg Muscle Strength	6.737	4.256	0.032

The results of testing the first hypothesis state that there is a significant difference in effect between modification of tabata interval training 1:½ and modification of tabata interval training 1:1 on sickle kick speed. Testing the second hypothesis states that there is a significant difference in effect between good leg muscle strength and moderate leg muscle strength on sickle kick speed. Testing the third hypothesis states that there is a significant interaction between modification of tabata training and leg muscle strength on the sickle kick speed of PPLP South Sulawesi pencak silat athletes.

Exercise is needed by athletes to improve their physical and technical abilities. One effective and efficient exercise that can be given to pencak silat athletes is tabata training. Tabata training is a high-intensity interval training where there is a comparison between the ratio of training activity and training rest (Romdani & Prianto, 2018). Tabata training combined with the right training frequency can improve a person's physical fitness because the frequency of training has a direct effect on the accuracy of the training method used (Ambardi et al., 2023). Tabata training with the right interval can increase the speed of sickle kicks for pencak silat athletes, this is in line with previous research which states that tabata training has an effect on increasing the speed of sickle kicks in pencak athletes, which is 2.82% (Kusuma & Wibowo, 2022).

Leg muscle strength also affects the speed of sickle kicks for pencak silat athletes. Muscle strength is the maximum power produced by the muscles to overcome the load from inside and outside received by the body (Afrizal, 2017). Leg muscle strength has a big role in pencak silat kick speed because when athletes kick, leg muscle strength is needed to produce a strong and fast kick (Suripto et al., 2022). The success of a fighter in kicking a sickle during a match is

influenced by several factors, namely leg muscle strength, leg muscle explosiveness, foot coordination speed, and flexibility (Nasufi, 2015).

Tabata training and leg muscle strength have an influence on increasing the speed of the sickle kick of PPLP South Sulawesi pencak silat athletes so that it can be said that there is a significant interaction between modified tabata training and leg muscle strength on sickle kick speed. This is in line with previous research which states that there is a relationship between tabata training and leg muscle strength where giving tabata training to athletes can increase leg muscle strength which is one of the factors in increasing sickle kick speed (Munandar & Fauqi, 2022).

CONCLUSION

The conclusion of this study is that martial arts athletes who are given modified tabata training interval 1: ½ for five weeks with a duration of 38-53 minutes three times a week and have good leg muscle strength have a better increase in sickle kick speed than athletes who are given modified tabata training interval 1: 1 and have moderate leg muscle strength. And there is also an interaction between modification of tabata training and leg muscle strength on the speed of sickle kicks of PPLP South Sulawesi martial arts athletes.

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