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The Effectiveness of Speed Training on the Physiological Characteristics of Athletes in Youth Pencak Silat in the Competing and Art Categories

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Abstract

Performance of cardiovascular endurance, explosive power, and agility are the most crucial types of physical conditions in the sport of Pencak silat. Research on the effects of specific exercises on performance in the sport of Pencak silat is still limited. Therefore, this study aimed to assess the impact of speed training for six weeks on the performance of cardiovascular endurance, explosive power, and agility of adolescent Pencak silat athletes in the fighting and art categories. The experimental method with pretest and post-test approaches without a control group design is used in this study. The total subjects were 30 male Pencak silat athletes who were divided into two groups (15 fighter athletes and 15 arts athletes) with an average age of 18.53 ± 2.13 years, body weight 62.74 ± 4.18 kg, height 168.78 ± 3.82, BMI 22.04 ± 1.82, and FAT 10.55 ± 1.29%. Subjects were recruited based on inclusion criteria, including not smoking, not consuming alcohol, not being on drug intervention and having a minimum of 3 years of practice. The results showed that speed training (sprint) for six weeks significantly affected VO2max, agility and leg muscle strength in Pencak silat athletes. Thus, the findings in this study can be used as a reference for Pencak silat coaches and athletes in improving the aerobic and anaerobic performance of athletes.

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INTRODUCTION

Pencak silat is a type of martial arts sport that became popular in the decade of the 80s and became increasingly popular at the end of this decade and is growing in European countries and the United States and has received international recognition (Apriantono et al., 2020; Aziz et al., 2002a; Hadiana et al., 2021; Soo et al., 2018). Pencak silat which was originally a type of activity for self-defence turned into a cultural activity and tended to be used for ceremonial and recreational purposes, but from this traditional art form, it was later modified in such a way

that it became a competitive sport in the regulations of the silat itself under the auspices of the Pencak Federation. International Silat (Aziz et al., 2002a; Soo et al., 2018).

The martial arts sport of Pencak silat is divided into two categories, namely the arts category and the fighting category. The International Pencak Silat Federation (IPSF) explained that the arts category of Pencak silat has a focus on the movements and choreography patterns of the silat fighters, while the sparring category focuses on the fight and there is direct physical touch (full body contact) between one fighter and the opposing fighter (Bayu Thomi). Rizal et al., 2021; Soo et al., 2018).

Previous research has shown that Pencak silat in the sparring category is a type of sport that has high aerobic and anaerobic characteristics and there is a lot of physical touch between one fighter and his opponent (Aziz et al., 2002a; Soo et al., 2018; Wijaya et al. ., 2021) thus making high demands in the physical, technical and mental aspects of each match. While research on Pencak silat athletes in the arts category has not been done much the demands for physical needs for the art category are still difficult to understand.

Excellent physical condition is needed to produce maximum performance when training or competing. Several previous studies have stated that certain types of exercise have been shown to increase aerobic and anaerobic capacity endurance, agility performance and lower body muscle strength in adolescent athletes and professional elite athletes in several sports (Hidayat, 2018; Mathisen, 2016; Mathisen & Pettersen). , 2018; Perez-gomez & Calbet, 2013; Sloth et al., 2013; Wen et al., 2019).

Considering that Pencak silat is a self-defence sport with aerobic and anaerobic characteristics, it requires Pencak silat athletes to have excellent physical conditions. Therefore, the prime physical condition must start from adolescence because several previous studies have stated that greater performance improvement occurs when doing exercise programs in adolescents compared to adults (Mathisen, 2016; Mathisen & Pettersen, 2018).

Programmed speed training has been shown in several previous studies to improve performance in athletes in sports such as volleyball and futsal (Eryılmaz & Kaynak, 2019; Majid, 2021; Mathisen, 2016; Sloth et al., 2013; Wen et al., 2019) but research is still limited to Pencak silat athletes.

Therefore, based on the explanation presented in the previous paragraph, this study aims to determine the effect of speed training on aerobic capacity, agility performance, and leg muscle strength of adolescent Pencak silat athletes in the fighting and art categories from Karawang Regency.

METHODS

The experimental method with a pretest-posttest approach without a control group design is used in this study. where all subjects will be given the same treatment and period.

The total subjects in this study were 30 male Pencak Silat athletes consisting of 15 male Pencak silat athletes in the Fighter category and 15 male Pencak silat athletes in the arts category from Jambi City. Subjects were selected based on inclusion criteria including, not smoking, having at least 3 years of practice experience, being male, not currently on drug intervention, and not currently consuming alcohol. All subjects were explained to participate in the study and subjects were asked to sign an informed consent if they agreed and were willing to be subjects in this study.

Furthermore, the parameters to be taken in this study include aerobic capacity, aspects of agility, and leg muscle strength before and after giving (treatment) speed training (sprint training). In this study, height measurement using a stadiometer and weight measurement using an OMRON Carada digital scale. Measurement of capacity using the bleep test field method, the agility aspect using the shuttle run test, and leg muscle strength using the vertical jump test.

The procedure in this study, in the initial stage all research subjects who are martial arts athletes in the competition and art categories will do treatment in the form of sprint training for 18 training sessions (30 minutes in each session) and carried out three times a week (Monday, Wednesday and Friday) for 6 consecutive weeks. The sprint training program was conducted at Gor Panatayuda in Karawang Regency. The training session started with a 5-minute static warm-up and was followed by a 5-minute warm-up. And then the core session is held.

The core training session consisted of 8 straight 20-meter sprints, 8 direction change sprints with 600 and 900 laps, and ended with a relay run with 900 laps. The cool-down session was done to stretch the muscles and joints after a core training session for 10 minutes.

Analysis of the data presented in this study in the form of mean and standard deviation. Furthermore, normality and homogeneity testing in this study used the Shapiro Wilk test and continued with significance analysis. Parameters of aerobic capacity, agility aspects, and leg muscle strength before and after treatment using one-way ANOVA analysis. All analyzes were performed using SPSS (version 22, IBM Corp, Somers, NY). Statistical significance was accepted at the alpha level of $p < 0.05$.

FINDINGS AND DISCUSSION

Findings

The results showed that anthropometric data such as age, weight, height, BMI and FAT between the two groups did not show any significant difference. So the two groups are said to be homogeneous. See table 1.

Table 1. Anthropometric Data

Variable	Total sampling	Group	P-value

	(N=30)	Fighter (*n*=15)	Art (*n*=15)	
Age (Years)	18.53 ± 2.13	18.37 ± 2.72	18.70 ± 1.98	0.331
Weight (kg)	62.74 ± 4.18	64.18 ± 3.65	61.31 ± 5.85	0.262
Height (cm)	168.78 ± 3.82	169.28 ± 3.23	168.28 ± 3.46	0.057
BMI (kg/m^{-2})	22.04 ± 1.82	22.46 ± 3.13	21.63 ± 2.63	0.065
FAT (%)	10.55 ± 1.29	10.55 ± 1.21	11.55 ± 1.21	0.052

BMI = body mass index

Table 2 shows the results of the comparison between pre and post-after being given speed training treatment for 6 weeks, where the results of this study indicate that in the fighter group there are significant differences in the variables of VO2max, agility and vertical jump. Furthermore, for the art group, there was also a significant difference in VO2max and Vertical Jump but for the agility variable, there was no significant increase.

Table 2. Comparison of VO2max, agility and leg muscle strength

Variable	Fighter		Art		Time x group
	pre	post	pre	post	*P*-Value
VO_{2max} (mL/kg/min)	48,82 ± 2.76	50,21±3,76	46,18 ± 3,31	47,79 ± 4,34	0,021*
Kelincahan (sec)	10,71 ± 0,89	9,76± 0,37*	11,37 ± 0,86	11,22 ± 1,01	0,527
Vertical Jump (cm)	50,65 ± 3,82	54,31±2,92	46,82 ± 2,74	48,92 ± 3,12	0,018*

Discussion

This study presents for the first time the effects of implemented 6-week sprint training on Pencak silat athletes in Indonesia. The findings in this study indicate that the average age, weight, height, BMI and FAT in the two groups did not show a significant difference so it can be categorized that all samples are homogeneous which can then be given intervention between the two groups. Furthermore, the effect of speed training for 6 weeks had a significant effect on aerobic ability in both groups which was marked by an increase in VO2max (p=0.021), while for the Agility parameter there was an increase in both groups, but for the art group, there was no significant difference. , while the control group showed a significant difference (p<0.005), then the variable leg muscle strength marked by the vertical jump test in the two groups showed a significant difference after doing speed training for 6 weeks (p=0.018).

From these findings, it can be concluded that the sprint training protocol carried out 3 times a week for 6 weeks was able to produce a significant increase in the value of aerobic capacity, agility aspects, and leg muscle

strength, especially in adolescent Pencak silat athletes in the competition and art categories. This increase is due to the adaptation of red and white muscles that are continuously trained so that they can increase a person's aerobic speed and endurance (Sloth et al., 2013). The results of this study are in line with previous studies which stated that there was an increase in the aerobic capacity of adolescent soccer and volleyball athletes after they were intervened in sprint training for 6-12 weeks (Eryılmaz & Kaynak, 2019; Sloth et al., 2013; Syamsudin et al., 2021; Wen et al., 2019).

The explanation of the mechanism that occurs for aerobic adaptation to sprint training is still unclear and several previous studies have not been able to explain with certainty this phenomenon. However, in some of these studies, it was agreed that the speed with which the body adapts to speed training is associated with the number of muscle fibres involved during speed training (Sloth et al., 2013).

In general, speed training will involve more type I muscle fibres, causing specific adaptations in that type of muscle fibre and speed training has been shown to induce greater adaptation of oxidative enzymes in type II muscle fibres (Almeida et al., 2021; Bailey et al., 2009; Dudley et al., 1982; Sloth et al., 2013). Consequently, specific oxidative adaptations in type II muscle fibres contribute to an increase in aerobic capacity (Almeida et al., 2021; Dudley et al., 1982; Sloth et al., 2013).

The research that we have done shows that the aerobic capacity of adolescent Pencak silat athletes in the competition category from Karawang Regency is at a value of 50 ml/kg/min. The value of aerobic capacity generated in this study is different from previous studies involving elite or professional athletes. The data in this study show that elite or professional athletes have aerobic capacity values in the range of 54-59 ml/kg/min (Apriantono et al., 2020; Aziz et al., 2002b, 2002a; Soo et al., 2018). Meanwhile, in the youth martial arts athletes in the art category, in the research that has been done, we found that the aerobic capacity was at a value of 47 ml/kg/min.

Research on the value of aerobic capacity in Pencak silat athletes in the art category is still little done, especially at the elite level, making it difficult for us to discuss further the value of aerobic capacity in Pencak silat athletes in the arts category. The high value of aerobic capacity possessed by elite level Pencak silat athletes due to differences in training load, competitive experience, and level of competition carried out by elite level Pencak silat athletes causes them to tend to have higher aerobic capacity.

In this study, we found that the sprint training protocol used in this study had a positive effect on increasing the agility of adolescent Pencak silat athletes from Karawang Regency in both the sparring category and the arts category. Our research reinforces previous research which states that speed training within a span of 6-10 weeks has

a positive effect on the agility of adolescent athletes in several sports such as taekwondo, Pencak silat and football (Habibie et al., 2020; Mathisen, 2016; Mathisen & Pettersen, 2018; Singh & Sathe, 2017).

Increased agility abilities are caused by the sprint training program there are several movements such as explosive changes in direction, acceleration, and deceleration causing neuromuscular adaptation, increased motor units, and muscle coordination which have been shown to improve agility aspects (Mathisen, 2016; Mathisen & Pettersen, 2016). 2018; Singh & Sathe, 2017).

Another result that we found in this study was an increase in the ability of the leg muscles in adolescent Pencak silat athletes in the fighting category and the arts category of Karawang Regency after doing a speed training program for 6 weeks. Our study is not different from previous studies which concluded that there was a positive effect on the leg muscle strength of volleyball and soccer athletes after performing programmed speed training (Haugen, 2011; Majid, 2021; Perez-gomez & Calbet, 2013).

The increased ability of leg muscle strength is due to adaptation in most of the leg muscles, especially in the tendon muscles after doing speed training to increase the strength of the leg extensors and the explosive power of the legs (Ampillo & Ristian, 2014; Suryadi et al., 2021).

Limitations in this study were the small number of participants who participated in this study and there was no assessment to determine the effect when participants competed. However, systematic and programmed training is a process to develop the ability of adolescent athletes to achieve maximum performance when competing and become more mature when they enter the adult athlete phase.

A regular, disciplined, directed and continuous exercise program can improve physical and mental performance so that movements performed during repeated exercises result in better reflex formation, more control over movement patterns, and movement automation (Ampillo & Ristian, 2014; Majid, 2014). 2021). Therefore, through repeated sprint training in this study, there was an increase in aerobic capacity, agility and leg strength aspects in the youth Pencak silat athletes of Karawang Regency in the arts and sparring categories.

CONCLUSION

The findings in this study provide evidence that speed training for 6 weeks can have a positive effect on Vo2max, agility and leg muscle strength of Pencak silat athletes. Thus the results of this study can be a reference for Pencak silat coaches and athletes so that the 6-week Sprint Training Program can become a Good Choice Training Program. Furthermore, further research is needed using research samples including athletes in various sports and the use of heart rate monitors so that the characteristics of athletes when doing

sprint training programs can be known objectively.

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