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The Effect of 6 Weeks of Complex Training on the Speed and Agility of Fighting Class Indonesian Pencak Silat Athletes

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Abstract: *Martial art Pencak silat is a traditional martial art form that has evolved into a competitive sport. Speed and agility are critical for successful performance in Pencak silat, as they enable athletes to execute quick strikes, evasive manoeuvres, and defensive techniques effectively. Despite the importance of speed and agility in Pencak silat, there is a lack of consensus on the most effective training methods to enhance these attributes specifically for this martial art. This study investigates the effects of six weeks of complex training on the speed and agility of fighting class Pencak silat athletes. A one-group pretest and posttest design was used to evaluate the effect of complex training on the speed and agility of Pencak silat athletes. The study lasted six weeks, with pre-and posttest assessments to measure agility and speed changes. This research involved 20 male Pencak silat athletes aged between 16 and 19. The primary outcomes measured are agility and speed. The Illinois Agility Test assesses agility. The 40-meter sprint test measures speed. Statistical analysis was carried out using SPSS software. The p-value for the speed test is .000, which is well below the typical significance level threshold of 0.05. The p-value for the agility test is .001, which is also below the 0.05 threshold. The study's findings indicate that complex training significantly improves speed and agility in Pencak silat athletes.*
Keywords: *agility, complex training, Pencak silat, speed*

Introduction

Pencak silat is a traditional martial art from Southeast Asia, especially Indonesia, Malaysia, and Brunei (Mulyana & Lutan, 2021). Pencak silat is divided into art (seni) and sparring or combat (tanding). Art Classes in Pencak Silat, known as Kelas Seni, emphasize the artistic and cultural elements of the martial art. Art classes emphasize the beauty of techniques or moves combined in choreography and are usually accompanied by traditional music. Art classes aim to showcase the beauty and traditional values inherent in *Pencak silat*. In contrast, sparring classes emphasize techniques for self-defense and combat (Soo et al., 2018). This class emphasizes sparring, combat strategies, and effectively executing strikes, grapples, and takedowns in real-life or competitive scenarios.

Pencak silat is characterized by complex techniques that require mastery of the entire body (Karo-Karo et al., 2023). These movements are designed to maximize power, speed, and agility, making *Pencak silat* an effective combat system and a physically demanding discipline. Speed and agility are the essential elements in *Pencak silat* (Damrah et al., 2023). Speed in *Pencak silat* refers to the rapid execution of techniques and the quickness of movement (Dharmadi & Spyanawati, 2023). It encompasses the ability to strike, evade, and reposition oneself with minimal delay, making it a critical component for attack and defence. Agility in *Pencak silat* involves changing direction quickly and maintaining balance during rapid movements (Ihsan et al., 2022). It encompasses nimbleness, coordination, and the capacity to perform complex manoeuvres fluidly. These skills are essential for success in competition and reducing the risk of injury during training and competition.

One of the *Perguruan* or schools of *Pencak Silat* in Indonesia is the *Perguruan Setia Hati Terate*. A preliminary study at the *Perguruan Pencak Silat* Setia Hati Terate in Bengkulu City showed that athletes' attacks were ineffective during matches. Slow attacks, especially when executing kicks, made movements easily readable by opponents. Furthermore, athletes were often slow to change direction and maintain balance during intense movements. These deficiencies resulted in slow reaction times, increased vulnerability to opponent attacks, and difficulty maintaining a dominant position throughout the match.

Based on these issues, an effective training method is needed to improve athletes' explosive speed and agility. One approach is complex training, which combines strength training with plyometric training. Complex training is a training method that combines a set of strength training exercises and a comparable series of plyometric exercises in the same training session and is believed to improve the quality of the plyometric training stimulus (Ali et al., 2017). This training method is a dynamic, high-intensity training method (Lim & Barley, 2016). Using the complex training method can elicit a post-activation potentiation response, allowing individuals to produce more power in subsequent training sessions (Atalag et al., 2021). Complex training is considered superior in improving strength, explosive power, sprinting ability, and agility in various sports compared to strength training or plyometrics performed separately. Previous research has shown that complex training can improve kicking speed, power, reaction time, and punching power in boxing, judo, and *Pencak silat* (Liu et al., 2024).

Research on physical conditioning in *Pencak silat* largely emphasizes general physical abilities and skills (Salsaputri et al., 2025). However, investigations into complex training to improve speed and agility, key determinants of success in combat sports, have yet to be explored. Most evidence regarding the effectiveness of complex training comes from other combat sports, which do not fully reflect the unique movement patterns, explosive demands, and tactical requirements of *Pencak silat*. This lack of focused research creates a gap in understanding how a six-week complex training program can affect the speed and agility of *Pencak silat* athletes in combat sports. This study aims to address this gap and is expected to serve as a reference for improving the speed and agility of *Pencak silat* athletes.

Based on the background outlined, the purpose of this study was to investigate the effect of six weeks of complex training on the speed and agility of *Pencak silat* fighting class athletes. Based on a review of relevant literature, we hypothesize that six weeks of complex training can improve the speed and agility of *Pencak silat* athletes.

Material and Methods

Experimental design

This research is pre-experimental research (Farooq et al., 2016). A one-group pretest and posttest design was employed to assess the effect of complex training on the speed and agility of *Pencak silat* athletes. The training was conducted over six weeks, with each week comprising three training sessions.

Table 1. *Complex Training*

Week 1-2	Day 1 (2 sets, three repetitions, recovery 30 seconds, intensity 55%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	Day 2 (3 sets, five repetitions, recovery 30 seconds, intensity 55%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	Day 3 (3 sets, four repetitions, recovery 30 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills
Week 3-4	Day 1 (3 sets, six repetitions, recovery 30 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	Day 2 (3 sets, eight repetitions, recovery 30 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	Day 3 (3 sets, eight repetitions, recovery 30 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills
Week 5-6	D1 (6 sets, three repetitions, recovery 80 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	D2 (6 sets, three repetitions, recovery 80 seconds, intensity 70%) one leg squat side hop triple hop jump single leg hurdle hop luging drills	D3 (6 sets, three repetitions, recovery 30 seconds, intensity 80%) one leg squat side hop triple hop jump single leg hurdle hop luging drills

Participant

This research involved 20 male *Pencak silat* athletes aged between 16 and 19. Sampling technique using purposive sampling (Campbell et al., 2020). This research utilizes the most relevant respondents and has the potential to provide valuable insights into the variables under study. The participants were recruited from *Pencak silat Setia Hati Terate Bengkulu, Indonesia*. All participants had at least two years of *Pencak silat* experience and were free from any injuries that could affect their performance during the research period.

Measurement

The primary outcomes measured are agility and speed. The following tests were performed before and after the intervention. The instruments used in this study were the 40-meter sprint test and the Illinois agility test. The 40-meter sprint test measures speed (Manullang et al., 2025). The implementation begins from the starting position and then continues with running as fast as possible to the finish line, which is 40 meters away. Athletes are timed from a standing start, and the best of three attempts is recorded. Sprint performance over 40 meters was measured using a manual stopwatch, with times converted to meters per second (m/s). For example, a 40-meter sprint completed in 7 seconds corresponds to approximately 5.71 m/s.

The Illinois agility test assesses agility. This test is 10 m long and 5 m wide with three cones 3.3 m apart and placed in a straight line in the middle of the area (Çetinkaya et al., 2018). Participants start from a prone position at the starting line, then run straight, back, zig-zag between the centre cones, zig-zag again, and run straight to the finish line. Time is recorded from start to finish to measure agility. The time to complete the course was recorded manually using a stopwatch. These times were then converted to speed in meters per second (m/s) by dividing the total distance by the recorded time. All measurements were conducted by the same tester to ensure consistency, providing a reliable and practical estimate of each participant's agility performance.

Data analysis

Statistical analysis was carried out using SPSS software. Descriptive statistics were calculated for all variables. Data normality was analyzed using the Shapiro-Wilk. Data homogeneity was assessed using the Levene statistic. If the data is not homogeneous, the non-parametric Wilcoxon test was used. If the data are declared normal and homogeneous, the independent sample t-test is used to compare results before and after the intervention. The level of significance was set at $p < 0.05$.

Ethical Considerations

After explaining the purpose, procedures, potential risks, and benefits of the study, informed consent was obtained from all participants. Participants were free to withdraw from the study without any consequences.

Results

The research results are shown in the tables below.

Table 2. *Result of speed test*

Pretest		Posttest	
Min	3.08	Min	3.08
Max	4.44	Max	5.71
Mean	3.62	Mean	4.18
Median	3.64	Median	4.00
Std. Dev	0.42	Std. Dev	0.74

Table 2 presents the results of the speed test. The data show an increase in mean speed from the pretest to the posttest, as indicated by a rise in mean speed from 3.62 m/s to 4.18 m/s. An increase in the standard deviation from 0.42 m/s to 0.74 m/s suggests that variation in speed among participants increased after the intervention. The minimum speed remained unchanged, and the median increased from 3.64 m/s to 4.00 m/s, indicating an overall improve-

ment in speed performance in the posttest. The maximum speed increased from 4.44 m/s to 5.71 m/s, suggesting that overall group performance improved.

Table 3. *The Results of the Normality Test*

	Shapiro Wilk		
	Statistic	**df**	**Sig.**
Pretest	.908	20	.059
Postest	.921	20	.106

Based on the data normality test using the Shapiro-Wilk test at a significance level of 0.05, the significance value is > 0.05. Therefore, the pretest and posttest data on the speed variable are normally distributed.

Table 4. *The Results of the Homogeneity Test*

Levene Statistic	**df1**	**df2**	**Sig.**
4.576	1	38	.039

Based on the data homogeneity test using the Levene Statistic at a significance level of 0.05, the significance value is <0.05. So, the pretest and posttest data on the speed variable are stated to be inhomogeneous. Therefore, the next step is to carry out a non-parametric analysis using the Wilcoxon test.

Table 5. *The Results of the Wilcoxon Test*

	Post-Pre
Z	-3.418
Asymp. Sig. (2-tailed)	.001

The results of the Wilcoxon test show the significance. Value < 0.05. Therefore, there is a significant difference between the pre-intervention and post-intervention periods.

Table 6. *The Result of the agility test*

Pretest		**Posttest**	
Min	1.30	Min	1.40
Max	2.10	Max	2.10
Mean	1.69	Mean	1.78
Median	1.70	Median	1.75
Std. Dev	0.23	Std. Dev	0.21

Table 6 shows the results of the pretest and posttest. The data show an increase in mean agility from pretest to posttest, as indicated by a rise in mean agility from 1.69 m/s to 1.78 m/s. An increase in the standard deviation from 0.42 m/s to 0.74 m/s suggests that variation in speed among participants increased after the intervention. The minimum agility increased from 1.30 m/s to 1.40 m/s, and the median agility increased from 1.70 m/s to 1.75 m/s, supporting the overall improvement in agility performance in the posttest. The constant maximum agility indicates that the fastest individual's performance remained unchanged, but the overall group performance improved.

Table 7. *Results of the Normality Test*

	Shapiro Wilk		
	Statistic	**df**	**Sig.**
Pretest	.956	20	.472
Postest	.931	20	.162

Based on the data normality test using the Shapiro-Wilk test at a significance level of 0.05, the significance value is > 0.05. Therefore, the pretest and posttest data on the agility variable are normally distributed.

Table 8. *The Results of the Homogeneity Test*

Levene Statistic	df1	df2	Sig.
.081	1	38	.778

Based on the data homogeneity test using the Levene Statistic at a significance level of 0.05, the significance value is greater than 0.05. So, the pretest and posttest data on the agility variable are declared homogeneous. Therefore, the next step is to carry out a parametric analysis using the Paired Sample test.

Table 9. *Paired Sample Test Results*

t	df	Sig. (2-tailed)
-3.943	19	.001

The results of the paired sample test show the significance. Value < 0.05. There is a significant difference between before and after the intervention.

Discussion

The study results showed that *Pencak silat* athletes experienced increased speed and agility. Sprint performance over 40 meters was measured using a manual stopwatch, with times converted to meters per second (m/s). For example, a 40-meter sprint completed in 7 seconds corresponds to approximately 5.71 m/s. Despite minor timing variability inherent in manual measurement, the results show clear improvement: mean speed increased from 3.62 m/s to 4.18 m/s, and maximum speed rose from 4.44 m/s to 5.71 m/s. The increase in standard deviation (0.42 m/s to 0.74 m/s) reflects expected variability among participants. These findings are consistent with previous research (Ønnessen et al., 2011), confirming that the intervention effectively enhanced sprint performance.

Although the maximum agility score did not change from pretest to posttest, this reflects the performance of the fastest individual athlete, who maintained the same level of performance. However, meaningful improvements were observed at the group level, as shown by mean, median, and minimum values increases. These findings suggest that the intervention effectively improved the agility of most participants, even if the top performer did not show further gains. This outcome can be explained by the ceiling effect, in which individuals who already perform at a high level may show limited or no further improvement compared to those with lower baseline performance. Such variability in training adaptations is well-documented in sports science, where athletes respond differently to the same training stimulus depending on their initial performance capacity and physiological profile (Hecksteden et al., 2015). Therefore, the unchanged maximum value does not indicate a lack of training effect but highlights differential responsiveness among athletes.

Complex training is a very effective method for increasing speed and agility (Bauer et al., 2019), especially for *Pencak silat* athletes who require fast and dynamic movements. Increased speed and agility occur because in the training complex, athletes perform strength and plyometric training as one unit (Miller et al., 2014). Complex training utilizes the principle of post-activation potentiation, where muscle performance is temporarily enhanced after heavy resistance training (Yang et al., 2024). Post-activation potentiation is a phenomenon in which muscle power output is temporarily increased after high-intensity resistance training. This occurs because weightlifting activates the central nervous system and increases motor neuron stimulation. When followed by plyometric training, this higher condition allows for more robust and explosive movements, increasing the mat's speed and agility (Mashud et al., 2024)

Strength training in complex training builds muscle strength capacity, while subsequent plyometric training improves the ability to produce force quickly (Lagrange, 2022). This dual approach increases overall muscle strength, allowing the athlete to perform faster and more powerful movements essential for effective offensive and defensive techniques in *Pencak silat*. Strength is significant for *Pencak silat* athletes because it increases their ability to perform techniques with force, maintain balance and stability, survive long bouts, prevent injury, defend effectively, and perform competitive manoeuvres (Ahmad et al., 2024).

Complex training improves neuromuscular coordination by challenging the body to perform high-intensity compound movements followed by explosive actions (Fort-Vanmeerhaeghe et al., 2016). This increases the athlete's ability to synchronize muscle groups efficiently, resulting in more fluid and precise movements during competition. Complex training can also increase the rate of force development, which is essential for agility and speed (Bogdanis et al., 2019). It improves the rate of force development by training muscles to activate more quickly and powerfully. This allows the athlete to change direction quickly and accelerate rapidly, essential components of effective performance in *Pencak silat*.

High-intensity strength training followed by plyometrics optimizes the recruitment of fast-twitch muscle fibers essential for explosive movements (Khotimah et al., 2023). Increased recruitment of these fibres results in better performance in activities that require sudden speed and rapid changes in direction. Regular exposure to complex training demands the body to handle high-intensity efforts more effectively. This conditioning improves overall athletic endurance, allowing *Pencak silat* athletes to maintain high levels of speed and agility throughout their bouts (Sulfa et al., 2024). Endurance is critical for *Pencak silat* athletes because it allows them to maintain high-performance levels, recover quickly, execute techniques consistently, handle psychological stress, defend effectively, remain agile, and train intensively (Mardinus et al., 2025).

Complex training exercises can be tailored to mimic the specific movements and demands of *Pencak silat*. This training method improves speed, agility, and overall athleticism, providing a competitive edge in this dynamic martial art. Although complex training can provide significant benefits, it also has the potential to cause disadvantages such as increased risk of injury, overtraining, technical disorders, high physical and mental demands, time consumption, recovery needs, and potential training imbalance. *Pencak silat* athletes should carefully consider these factors and ensure a well-structured and balanced training program to maximize benefits and minimize disadvantages.

Despite these encouraging results, the researchers acknowledge several limitations. The limited sample size, lack of randomization, and lack of a control group limit the ability to draw strong causal inferences. These limitations do not diminish its value to *Pencak silat* coaches and athletes. *Pencak silat* coaches can integrate complex training to improve athletes' speed and agility. Further research could use a control group to broaden understanding of its effectiveness and generalizability.

Conclusion

Complex training is an effective method for improving speed and agility in *Pencak silat* athletes. This training method improves muscle performance through improved neuromuscular coordination and fast-twitch muscle fibre recruitment. By increasing overall muscle strength, athletes can perform movements more quickly and powerfully. However, complex training carries potential drawbacks, such as increased risk of injury, overtraining, high physical and mental demands, and the need for extensive recovery. Athletes should incorporate complex training into a well-balanced program to maximize its benefits while minimizing potential drawbacks.

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