

The Leg Length Contributed to the Speed of Sabit Kick in Athletes Pencak Silat

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Abstract Study Purpose: The study aims to investigate the relationship between leg length and the speed of the Sabit kick. The information is essential to develop a target and training program to improve performance during competition in the tanding category in Pencak Silat. Material and Methods: The cross-sectional design was conducted in this study. Eighty-eight male Pencak Silat athletes participated in the study. The inclusion criteria were aged 14-17 years old, the members of Indonesian Pencak Silat (IPSI) at Pekalongan City, Central Java, Indonesia, who were active in the competition tanding category for two years and signed informed consent. The participants were athletes who had experienced competition at the regional level. The leg length was measured using a tape measure, from the umbilicus to the malleolus medial of the ankle. The speed of the sabit kicks is measured using a 10-second test, kicking the sabit towards the target. Rank Spearman analysed the data. Results: The study showed a significant correlation between leg length and the speed of Sabit kick ($p < 0.004$, $r = 0.303$). The statistical information showed a positive correlation between both the leg length and the speed of the sabit kick. Conclusion: The study proved positive moderate relationship between leg length and the speed of the sabit kick. It is helpful to the coach to develop a training program based on the anthropometry of leg length to improve the speed of the sabit kick in the Pencak Silat athletes.

Keywords Martial Art, Anthropometry, Lower Limb, Acceleration

1. Introduction

Pencak Silat, a martial art originating from Indonesia, serves not only as a means to protect oneself from threats and introduce Indonesia's native culture but also stands as one of the sports frequently contested in both national and international level competitions [1]. Traditional martial arts in Indonesia, particularly Pencak Silat, play a crucial role in the cultural heritage and diversity of sports in the country. Pencak Silat, as a martial art, has experienced rapid development in Indonesia [2]. It has been acknowledged by becoming an integral part of the Physical Education curriculum, spanning educational levels from elementary to high school and even higher education institutions [3]. The presence of Pencak Silat in the school environment plays a role in facilitating the development of potential or talented Pencak Silat athletes in Indonesia [4]. Pencak Silat in Indonesia has spread through various channels, forming several axes influenced by enculturation [5]. Experiencing significant growth, Pencak Silat has emerged as one of the competitive sports disciplines, participating in the Asian Games in 2018 [6]. In a Pencak Silat competition, scoring is based on both strikes and kicks [7]. The fundamental principles of Pencak Silat matches include full-body contact, encompassing elements of both offense and defense. Attacks or defenses can be executed through the application of kicking, striking, and throwing techniques [8].

Kicks have become the dominant technique used in competitions, requiring special attention during training [9].

Approximately 47% of kicking techniques are dominantly employed in martial arts categories within Pencak Silat competitions [10]. In the world of Pencak Silat, the speed of sabit kicks becomes a critical aspect that distinguishes between an athlete's expertise and skills. A technical movement needs to possess an optimal level of effectiveness and efficiency [11]. Success in combat often depends on how well an athlete can optimize the speed and accuracy of sabit kicks. Therefore, this research aims to explore the relationship between leg length and sabit kick speed in Pencak Silat athletes.

The importance of a profound understanding of the factors influencing the speed of sabit kicks is not only relevant for improving athlete performance but can also make a significant contribution to coaches, researchers, and sports practitioners in developing more targeted and effective training programs. As the sports world becomes increasingly competitive, the need to comprehend the relationship between anthropometric aspects, such as leg length, and the specific skills of Pencak Silat athletes becomes more pressing. This research is expected to provide a deeper insight into the role of leg length in the context of sabit kick speed, thus laying a strong scientific foundation for the development of more effective and focused training strategies. Understanding and analyzing the correlation between leg length and sabit kick speed can create new opportunities to detail specific aspects that can be optimized in the training of Pencak Silat athletes. Moreover, this research can contribute to a general understanding of speed training principles in the context of martial arts. Therefore, this study has the potential to make a meaningful contribution to the growth and development of Pencak Silat as a martial art that not only preserves cultural values but also helps improve athlete quality and training methods.

Coaches and Pencak Silat athletes from IPSI (Indonesian Pencak Silat Association) in the city of Pekalongan, during their training and competition preparations, face a crucial question regarding the relationship between leg length and sabit kick speed. As an integral part of the Pencak Silat technique identity, the sabit kick plays a significant role in determining victory in the competition arena. Pencak Silat athletes with diverse leg lengths encounter challenges in optimizing the speed of their sabit kicks. The fundamental questions arise as follows: does leg length significantly affect sabit kick speed, and how can athletes manage this factor to enhance their performance in the competition arena? To answer these two questions, Pencak Silat athletes need to reflect and acknowledge that physical factors, such as leg length, are not only a genetic inheritance but also aspects that can be managed through specific training and techniques. The extent to which athletes can leverage their leg length advantage in executing powerful sabit kicks becomes a primary factor in the development of individual

strategies.

Awareness of the importance of the relationship between leg length and sabit kick speed can serve as a catalyst for Pencak Silat athletes to tailor their training programs more specifically. Therefore, research and personal experiments become proactive steps in detailing and refining techniques that align with each athlete's uniqueness. A deeper exploration of this correlation through research is highly necessary for Pencak Silat athletes to open up opportunities in creating more effective and detailed training methods, thereby enhancing their competitiveness at the local, national, and even international levels. As such, this discussion is not merely a theoretical concept but serves as a concrete foundation for the technical and tactical improvement of Pencak Silat athletes in the city of Pekalongan, specifically, and worldwide in general, aiming for outstanding achievements.

2. Material and Methods

2.1. Study Participants

The study was a cross-sectional design, which correlated the leg length and the speed of kicking Sabit style in Pencak Silat athletes. The population in this study consisted of 164 athletes from the Indonesian Pencak Silat Association (IPSI) in Pekalongan City. Based on inclusion and exclusion criteria, 88 athletes aged 14 -17 were voluntary to be subject to the study. The inclusion criteria were: 1) active in pencak silat training, 2) active in competitions for two years, 3) 3) had experience in pencak silat competition in tanding category at regional level 4) aged 14-17.

2.2. Research Instrument

The leg length was measured using a tape measure unit in centimetres. A tape measure is typically used to measure the length of each lower extremity by measuring the distance between the anterior superior iliac spine (ASIS) and the medial malleolus and is referred to as the "direct" clinical method for measuring leg-length discrepancy (LLD) [12].

The speed of the sabit kicks was measured by performing of sabit kicks to the target for 10 seconds [13]. The speed of the sabit kicks becomes a key indicator of the technical skill of athletes in executing these kicks. This variable reflects how quickly athletes can deliver the sabit kicks with precision and optimal strength. A study on the evaluation of the speed of the sabit kick in pencak silat was conducted among the national pencak silat athletes from 1999 to 2005. This assessment included the measurement of validity and reliability coefficients, with a reliability value of 0.87 and both content validity and face validity:

Table 1. Classification of sabit kick speed among national pencak silat athletes

Category	Woman	Man
Very Good	>20	>25
Good	19-23	20-20
Enough	16-18	17-19
Not Enough	13-15	15-16
Very Less	<12	<14

2.3. Analyzed Data

The data was analyzed using normality and homogeneity. The hypothesis analysis is tested using Spearman rank correlation.

3. Results and Discussion

3.1. Results

The data for this research yielded results from the measurement of leg length using a calibrated measuring tool and the sabit kick speed test, which refers to the assessment norms of Pencak Silat parameter tests according to [13]. The test and measurement results for this study can be observed in the following table:

Table 2. Characteristics data subject of the study

Variables	n	Mean \pm SD	95% Confidence interval
Aged (years)	88	13.70 \pm 1.07	13.47 - 13.93
Leg Length (cm)	88	91.45 \pm 5.65	90.28 - 92.66
The Sabit Kicks Speed in 10 seconds (count)	88	19.18 \pm 2.60	18.65 - 19.76
The Criteria of speed	88	3.31 \pm .793	3.14 - 3.47

Based on the data of the Speed Sabit Kick performing

for 10 second the criteria is showed in table 3.

Table 3. The Percentage of the Sabit Kick Speed Test

Criteria	n	Percentage (%)
Very well	-	-
Well	43	48, 86 %
Enough	31	35, 23 %
Not Enough	12	13, 64 %
Less Once	2	2, 27 %

The results of the normality test for the research data can be seen in the table below:

Table 4. Tests of Normality

Variables	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Leg Length	.058	88	.200 [*]
Sabit kick speed	.133	88	.001

Based on the normality test with Kolmogorov-Smirnov on the leg length variable, the significance value is 0.200 > greater than 0.05, indicating that the leg length variable data is normally distributed. Meanwhile, for the sabit kick speed variable, the significance value is 0.001 < less than 0.05, meaning that the sabit kick speed variable data is not normal. Since one of the variable's significance values indicates non-normal distribution, it can be concluded that the normality test results show non-normal distribution, and therefore, the data analysis will use non-parametric analysis with Spearman's rank.

The Spearman rank test in this study is necessary to determine the significant relationship between the leg length variable and sabit kick speed, understand the strength of the relationship between the leg length variable and sabit kick speed, and observe the direction of the relationship between the leg length variable and sabit kick speed. The results of the correlation test using Spearman's rank can be seen in the following table:

Table 5. Correlations

Correlation test	Rank Leg Length	Rank Sabit Kick Speed	
Spearman's rho	Rank Leg Length	Correlation Coefficient	1.000
		Sig. (2-tailed)	.303**
		N	88
	Rank Sabit Kick Speed	Correlation Coefficient	.303**
		Sig. (2-tailed)	.004
		N	88

** . Correlation is significant at the 0.01 level (2-tailed).

Table 5 showed a significant correlation between leg length and the speed of the sabit kick ($p = 0.004$, $r = 0.303$). The coefficient of correlation is 0.303, meaning that the relation is moderately strong. The positive relationship indicates that when the leg length is longer, the speed is faster.

3.2. Discussion

In pencak silat matches, kicking becomes the main technique used by the fighters to launch attacks and score points [14]. Based on anthropometric reference data of Indonesians, leg length can be classified as follows: 1) Short-legged: Leg length less than 45% of body height. 2) Normal: Leg length between 45-52.5% of body height. 3) Long-legged: Leg length more than 52.5% of body height [15]. The leg length is proved contributed in the speed of Sabit kick. It's considered that the longer of the leg the speed of kicking is greater or faster.

The study was in line with the previous study proved that the longer legs a better score of speed kicking than shorter legs does, and the difference of mean speed kicking was 1.90 [16]. The study interpreted that the leg length contributed to the speed of the sabit kick in positive support.

In fact, most children, involved in a sport without going through talent identification processes, including anthropometric leg length. Whereas talent in the context of sports is shaped by factors such as social, physiological, psychological, and physical indicators [17]. Based on the results of research through validity and reliability testing, leg length measurement is one of the 15 valid and reliable test instruments for identifying talented athletes in Pencak Silat [18]. Therefore, it can be concluded that leg length plays a crucial role in measuring specific physical abilities in pencak silat, including aspects such as pencak silat skill performance, pencak silat kick speed, pencak silat kick agility, pencak Silat kick coordination, and pencak silat kick strength. The research findings indicate that the sickle kick is influenced by several factors including (1) Leg muscle explosive strength contributes 21.59% to sickle kick performance; (2) Flexibility has an impact of 6.94% on sickle kick performance; (3) Achievement motivation influences sickle kick performance by 9.74%; (4) Leg muscle explosive strength through achievement motivation affects sickle kick performance by 38.14%; (5) Flexibility through achievement motivation affects sickle kick performance by 13.51%; and (6) There is a combined influence of these variables amounting to 51.41% [3].

However the study showed the relation of leg length and the speed of the sabit kick in moderate, it can be the indicator of the leg length contributed in the speed of sabit kick. The information can help coaches, sports scientists, trainers to design the training program based on anthropometry to improve the speed of sabit kick in pencak silat.

To optimize the speed of sabit kicking and the correct technique is important to develop training program. Based

on research on the relationship between eye-foot coordination (both single and double), speed, and the ratio of limb length to body height with the ability to perform (sickle) kicks in pencak silat, athletes are advised to utilize eye-foot coordination, enhance speed, and pay attention to a balanced ratio between limb length and body height according to the demands of pencak silat to improve kicking ability [8].

Relevant research emphasizes the importance of integrating functional training with an emphasis on core and traditional strength preparation as a strategy to enhance overall kicking performance [19]. The findings from previous study concluded that plyometric exercises have a positive impact on increasing jump height, 20-meter sprint speed, and endurance in soccer players [20]. Performing plyometric exercises leads to a significant improvement in sprint acceleration performance, highlighting the importance of movement contraction patterns and speed [21]. Plyometric box jump reaction training has a significant impact on increasing kick speed frequency [22]. Plyometric training achieves a success rate of 96.7% and receives positive feedback regarding perceived benefits by athletes [23]. Based on the research results, it is revealed that the traditional Balinese game of "meogoak-goakan" has a positive impact on the running speed of junior Pencak Silat athletes [24].

Additionally, ladder exercises can serve as an alternative training method to improve movement speed. Ladder drills are commonly used equipment to train speed, coordination, balance, and agility across various age groups, sports types, and genders [25]. Factors influencing athlete speed include movement technique, muscle strength, body balance, and psychological factors [26]. Strength, particularly in the lower body muscles like the legs and hips, plays a crucial role in generating the energy thrust needed for quick movement. Muscle strength also enables the body to overcome obstacles or resistance that may slow down movement.

Training should be provided in a structured, systematic manner with the right dosage and without being excessively prolonged to avoid oxidative damage. An observational study indicated an increase in cardiac troponin levels after prolonged activity, associated with oxidative stress and exercise intensity [27]. If the intensity of speed training is deemed too high, based on research results, it is recommended to consume red beetroot powder after intense workouts to maintain blood pressure balance and blood glucose levels [28].

The relevant research findings mentioned above can serve as references for coaches aiming to improve kick speed while considering the length of the legs. The importance of leg muscle strength and endurance is crucial in supporting movement speed, highlighting the significance of having good strength and power in the lower body. This contributes to the ability to change direction quickly during rapid changes in speed [29]. Furthermore, providing encouragement and special

attention to athletes is crucial in managing stress among them. As concluded in a study, advocating special attention to athletes is recommended so that they can positively control their habits, address low and manageable physical and psychological stress, engage in flexible imaginative exercises involving sticks, and monitor the continuity of athletes' mental training [30].

4. Conclusions

This study reveals a significant correlation between leg length and Sabit kick speed among 88 Pencak Silat athletes in the city of Pekalongan. There is a positively moderate correlation, indicating that longer legs tend to result in faster Sabit kicks. These findings lay an important foundation for further research and development in the field of athlete anthropometry. This provides insight into further understanding about other factors that may play a role in improving athlete performance in the martial art of Pencak Silat.

This information is invaluable for coaches, instructors, and sports scientists in designing training programs tailored to athletes' anthropometric characteristics. By understanding the relationship between leg length and kick speed, they can optimize athletes' potential in Pencak Silat. This will help improve the effectiveness of training and training strategies that can enhance overall athlete performance, as well as provide a strong basis for developing more efficient and effective training methodologies in the future.

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Conflict of Interest

The authors declare that there are no potential conflicts of interest reported in the context of this research. This indicates that the authors have no involvement or interests that could affect the objectivity of the research results or the interpretation of findings. Transparency regarding the absence of conflicts of interest is crucial to maintain the integrity and trust in the presented research results, allowing readers to interpret the findings with confidence that the study was conducted honestly without biases influencing the results. By stating the absence of conflicts of interest, the authors provide assurance of the quality and

objectivity of the conducted research.

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