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The Back Kick Movement In Single Artistic Pencak Silat: A Biomechanical Analysis Review

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Abstract

The back kick is a technique in the seventh move of pencak silat single art that requires body rotation and kicking without looking at the target, so its execution is often inaccurate. The purpose of this study is to analyse the back kick technique in the single art category using a biomechanical approach. The method used was descriptive analysis with purposive sampling, involving six active athletes in the single art category. Data were collected through observation and documentation, and the Kinovea 0.9.5 application was used for motion analysis, focusing on the execution phase, particularly to measure the kicking angle and the distance between the supporting hand and foot. The results of the study showed that the athletes' kicking techniques met the appropriate criteria. The average distance between the supporting hand and foot was 45.81 ± 14.67 cm, with a range of 24.34 cm to 65.10 cm, while the average kicking angle reached 101.17° ± 12.73°, ranging from 86.5° to 118.2°. Out of the six athletes, three achieved the optimal kicking angle, influenced by the balance between the distance between the hands and feet and the body flexion angle. The more ideal the distance between the hands and feet and the body flexion angle, the higher and more stable the kick produced. Further research is expected to examine the analysis of back kicks in greater depth and specificity, including aspects such as speed, distance, angle, body segmentation, strength, and the muscles involved.

Keywords: *Back Kick, Pencak Silat, Solo Art, Movement Analysis*

INTRODUCTION

Pencak Silat is an indigenous Indonesian martial art that has spread to various regions and developed different styles (Ramadhan et al., 2023). According to Pratama, Renda & Trilaksana (2018), the term "Pencak Silat" is derived from two words: "pencak," which refers to structured fundamental martial movements used in training and performances, and "silat," which signifies perfected combat techniques rooted in pure spirituality with the primary goal of ensuring safety, well-being, and avoiding danger.

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According to Amjad & Mega (2016), Pencak Silat, classified as a competitive sport, features four contest categories: sparring, single artistic, double artistic, and team artistic. The sparring category involves two fighters exchanging attacks using punches, kicks, sweeps, or throws. In contrast, the artistic category involves an athlete performing a series of pre-arranged movements within a set time (Rosmawati et al., 2019). Diana et al. (2020) describe single artistic Pencak Silat as a competition where an athlete showcases their skills by performing predetermined movements with precision, stability, and expressive intent, either unarmed or with weapons.

Among various movements in single artistic Pencak Silat, some attract attention due to suboptimal performance, including the side kick/T-kick, horse kick, and back kick. The back kick is executed by turning backward and kicking in the opposite direction. Daryanto (2015) states that the back kick is performed without direct visual contact with the target, as the athlete must rotate 180 degrees before executing the kick with the sole of the foot. Similarly, Kriswanto (2015) describes the back kick as a technique requiring the practitioner to turn around before striking backward using the sole or heel. An effective back kick is accurate and stable upon execution. In the single artistic category, competition rules specify that the target area is the chest, with an ideal kick angle of 110 degrees (IPSI, 2024). In the artistic category, movement accuracy is a crucial judging criterion, and a well-executed kick influences scoring. Conversely, incorrect execution may result in point deductions.

The success of a Pencak Silat athlete depends on their technical proficiency. Pomatahu (2017) states that achieving high performance requires fulfilling several criteria, including physical condition, technique, strategy, and competitive mentality. Practicing fundamental movements is essential for optimal results and injury prevention (Blaszczyszyn et al., 2019). Mastering proper and precise kicking techniques provides a competitive advantage, particularly in the artistic category.

The back kick consists of several phases: the initial stance, execution, and recovery. The movement begins with a front stance, with the right leg forward and bent, shifting body weight onto the right foot. The right hand extends outward with a slight elbow bend, mimicking a backfist strike, while the left hand is positioned in front of the chest. The body then rotates 180 degrees to the left, transitioning into a stance with the left foot forward and slightly bent while the right leg extends. The left leg is then lifted as the body leans forward,

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with both hands placed on the mat for support and balance. The left leg fully extends backward at an angle of 135 degrees relative to the right leg. The supporting right leg is slightly bent to maintain stability. The movement concludes with the left leg retracting as the athlete jumps diagonally to the left, transitioning into a side stance with the right foot behind and bent. The left hand guards the body, and the right hand is positioned in front of the chest, resembling an evasion maneuver.

Understanding an athlete's biomechanics is crucial for correcting movement errors and enhancing precision and efficiency. Daharis et al. (2022) state that biomechanics optimize movement sequences to improve effectiveness and performance. Lobietti (2017) defines biomechanics as the study of internal and external forces acting on the human body. Meanwhile, Mailapalli et al. (2015) emphasize that biomechanics provide insights into human movement mechanics in various activities. To ensure consistency and accuracy in an athlete's technique, standardized criteria are necessary, particularly in the back kick, to enhance movement analysis and efficiency (Billah & Irawan, 2022). This study aims to analyze the back kick technique of single artistic Pencak Silat athletes from Padepokan Silat Gunung Talang, assessing its accuracy and biomechanical aspects requiring improvement.

METHOD

This study employs a qualitative descriptive method. According to Marisi et al. (2022), qualitative research aims to understand phenomena experienced by research subjects through interviews, observations, and documentation. Descriptive research seeks to provide a factual and systematic depiction of a phenomenon. This study focuses on describing the back kick movement at Padepokan Silat Gunung Talang. The observation method was used, involving direct data collection through on-site observations. The study was conducted at Padepokan Silat Gunung Talang, Semarang, with a population of athletes in the artistic category. The sample was selected using purposive sampling, consisting of six active single artistic category athletes. Data were collected through observations and video recordings, then analyzed using the Kinovea 0.9.5 application. This application facilitates measurements of rotation angles, movement speed, and body stability to assess the back kick execution of single artistic athletes at Padepokan Silat Gunung Talang. The research procedure comprised three stages: (1) Preparation: coordinating with athletes, checking equipment, and ensuring the athletes'

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physical and mental conditions; (2) Data Collection: recording movements from various angles using a smartphone; (3) Analysis: processing video data with Kinovea and recording results in a movement indicator table. The data analysis procedure included: (1) Creating a distribution table of values; (2) Recording observation scores based on set criteria; (3) Summing the scores obtained for each phase; (4) Applying the scores to a formula; (5) Adapting the formula as needed for data requirements; (6) Entering the final overall score into a criteria table.

RESULT

The sample data includes height, weight, and BMI, as shown in Table 1. The value of n represents the total number of research samples. Descriptive analysis results indicate that the average sample height is 159.75 cm, with the tallest height recorded at 174 cm and the shortest at 150 cm, with a standard deviation of ± 8.26 cm. The average sample weight is 55.72 kg, with the heaviest weight recorded at 64 kg and the lightest at 50 kg, with a standard deviation of ± 5.52 kg. The average BMI of the sample is 20.8, with the highest BMI recorded at 22.2 and the lowest at 18.6, with a standard deviation of 1.20. This study generated indicators such as height, weight, hand-to-leg distance, body flexion angle, kick angle, and kick height. The analysis in this study is divided into three phases: initial phase, execution phase, and final phase..

Table 1. Anthopometric Data

Variable	*N*	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Height	6	150	174	159,75	8,26
Weight	6	50	64	55,72	5,52
BMI	6	18,6	22,2	20,8	1,20

Based on Table 2, the overall average score of the back kick movement in single artistic Pencak Silat was 3.7029, classified as "appropriate." The initial phase obtained an average score of 3.6875, categorized as "appropriate," the execution phase achieved an average score of 3.8171, also classified as "appropriate," and the final phase recorded an average score of 3.6042, classified as "appropriate." Ideal movement conformity includes movement accuracy, rhythm, expression, and adherence to IPSI's standard movements (2024). This study focuses on the execution phase. The analysis results indicate that the execution phase across stages one to three achieved an overall average score of 3.8171,

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placing the athletes in the "appropriate" category.

Table 2. Back Kick Movement Suitability Assessment Result

n=6	Score	Criteria
Initial Phase	3,6875	Appropriate
Execution Phase	3,8171	Appropriate
Final Phase	3,6042	Appropriate
Average	3,7029	Appropriate

Based on Table 3, six athletes from Padepokan Silat Gunung Talang, during the execution phase at maximal extension, achieved an average hand-to-leg distance of 45.81 ± 14.67 cm, an average kick height of 130.71 ± 35.12 cm, a kick angle of 101.17 ± 12.73 degrees, and a body flexion angle of 56.98 ± 8.33 degrees. The average time required to perform the movement was 1.43 ± 0.31 seconds.

Table 3. Kinematic Data of Back Kick in Single Artistic

Kinematic Data of Back Kick			
Indicator	**Mean ± SD**	**Min**	**Max**
Initial Phase			
Stage 1: Turning Around			
Kick Time (s)	0,49 ± 0,05	0,40	0,56
Left Leg Flexion Angle (°)	123,53 ± 26,74	83,3	148,2
Foot Rotation (°)	105,25 ± 57,01	19,7	180
Torso Angle (°)	152,23 ± 11,86	132,1	163,7
Stage 2: Lift the Left Leg			
Kick Time (s)	0,74 ± 0,21	0,48	1,00
Left Leg Height (cm)	71,12 ± 14,85	48,93	86,07
Stage 3: Maximum Extension			
Hand Placement Time (s)	1,06 ± 0,28	0,72	1,48
Hand and Leg Reach Length (cm)	45,81 ± 14,67	24,34	65,10
Distance Between Hands (cm)	27,29 ± 6,31	19,51	34,45
Body Flexion Angle (°)	56,98 ± 8,33	45,7	66,5
Kick Time (s)	1,43 ± 0,31	1,08	1,76

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Right Leg Flexion Angle (°)	150,35 ± 13,79	107,5	161,6
Kick Height (cm)	130,71 ± 35,12	86,55	176,80
Kick Angle (°)	101,17 ± 12,73	86,5	118,2
Torso Angle (°)	158,3 ± 12,34	141,5	177,1

DISCUSSION

Based on the results of the motion analysis of the single artistic back kick, kinematic data such as hand-to-leg distance, kick height, kick angle, and body flexion angle were obtained from video documentation analyzed using the Kinovea 0.9.5 application, as illustrated in Figure 1.

Figure 1. Analysis of Back Kick Movement in Single Artistic

The back kick movement in single artistic Pencak Silat consists of three phases: the initial phase, the execution phase, and the final phase, as illustrated in Figure 2. Based on the movement conformity analysis in Table 2, all athletes were categorized as "appropriate" in the initial, execution, and final phases. The back kick requires good balance and explosive leg power to be performed optimally. Maintaining good balance results in a higher and more accurate kick, meeting the evaluation criteria set by judges.

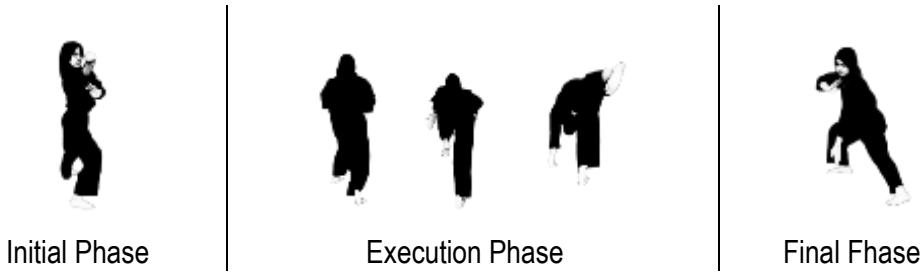

Figure 2. Phases of Back Kick Movement

The motion analysis in this study focuses on the execution phase at maximal extension, as shown in Figure 2. Kinematic data were collected during this phase,

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including kick angle, body flexion angle, hand-to-leg distance, and kick height. The data displayed in Figure 3 highlight the relationship between kick angle and body flexion angle. The results indicate that greater body flexion angles correspond to lower kick angles. For instance, sample 3 and sample 6, with body flexion angles of 66.5° and 66.2°, produced suboptimal kick angles of 95.1° and 86.5°, respectively. Conversely, samples 1, 4, and 5, with shorter body flexion angles of 54.2°, 58.2°, and 45.7°, achieved higher kick angles of 110°, 118°, and 108°.

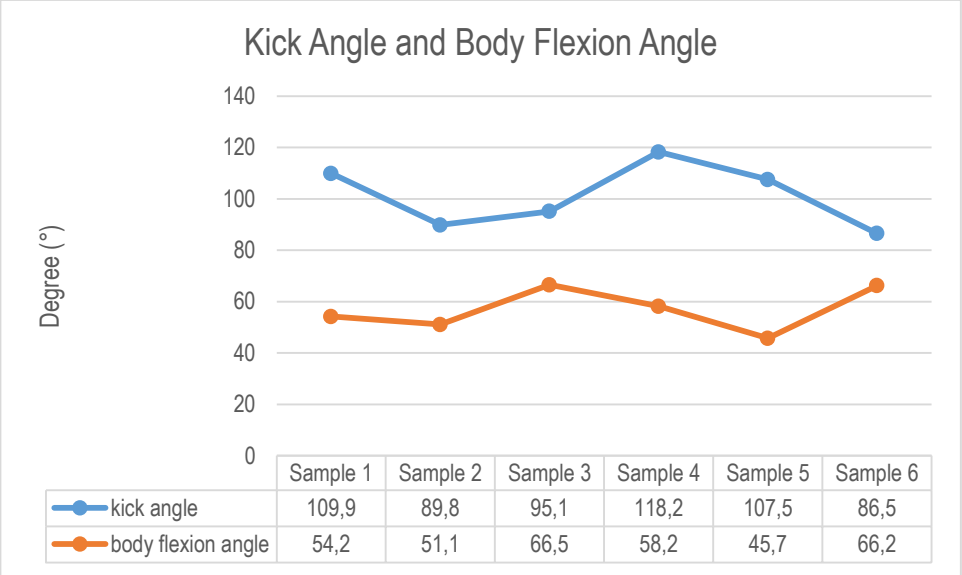

Figure 3. Graph of kick angle and body flexion angle

The results of the back kick movement analysis indicate that body flexion angle influences the height and effectiveness of the kick angle. Lowering the body's center of gravity and maintaining it between support areas enhances stability compared to an upright position (Marzuki, 2009). An optimal and accurate back kick is also influenced by explosive leg power. Zulham (2017) found that explosive leg power significantly affects back kick quality. Strong explosive leg power generates maximum speed and strength, leading to a more accurate and powerful back kick (Gomang, 2016).

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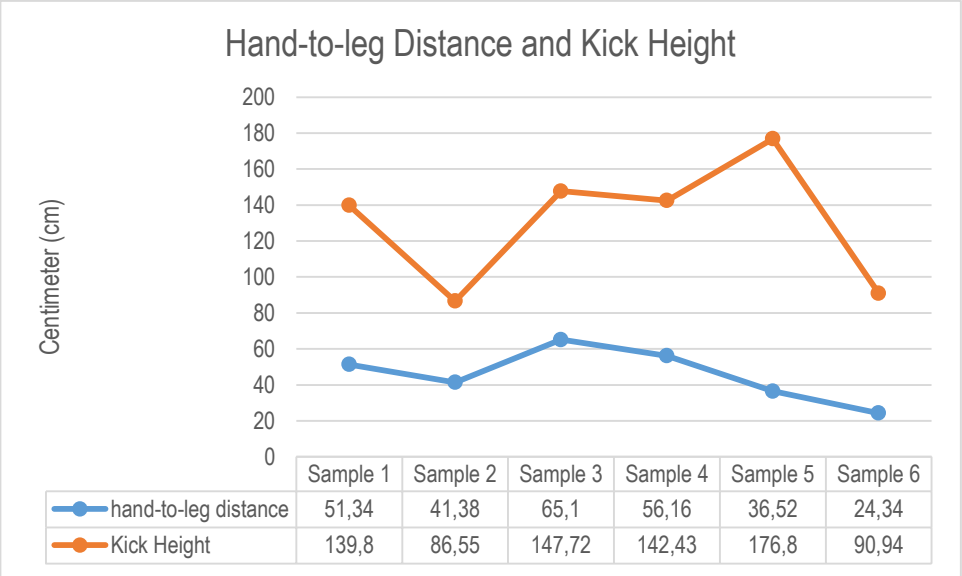

Figure 4. Graph of kick height and hand-to-foot distance

Based on the graph shown in Figure 4, the kick height and hand-to-leg distance are analyzed. The data indicate that sample 2 had the lowest kick height at 86.6 cm, while sample 5 demonstrated the highest back kick at 177 cm. Regarding the hand-to-leg distance, sample 6 had the shortest distance at 24.3 cm, whereas sample 3 had the longest at 65.1 cm.

From the overall samples analyzed, the hand-to-leg distance significantly influences kick height. A shorter distance results in a lower kick height, whereas a longer distance leads to a higher kick. This occurs because the closer the hand is as a body support to the base, the more unstable the balance becomes, affecting the kick's effectiveness. Marzuki (2009) states that as the center of gravity moves closer to the base, stability increases, enhancing overall balance and execution.

CONCLUSION

This study found that the back kick technique of Padepokan Silat Gunung Talang athletes falls within the "appropriate" category. The distance between the hands and the supporting foot significantly affects kick height, while body flexion angle influences the kick angle. This research focused on analyzing the back kick angle, hand-foot distance, and body flexion angle in single artistic Pencak Silat. Future studies should explore additional variables such as speed, distance, angle, body segmentation, strength, and muscle involvement for a more comprehensive biomechanical analysis.

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