Pencak silat side kick in persinas asad: Biomechanics analysis

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Pencak Silat Side Kick in Persinas ASAD: Biomechanics Analysis

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Abstract The basic technique of kicking in pencak silat was often overlooked due to the consideration of increasing the level of the athlete and not on competence or skill. The purpose of this study was to identify biomechanics analysis of pencak silat side kick of Persinas ASAD. This study used quantitative research to obtain data derived from video recordings of sidekick movements that were analyzed using the Dartfish version 8. The total participants in this test were 30 Persinas ASAD martial arts athletes. This study recorded 30 martial arts athletes from Persinas ASAD with an average age (15.37 ± 1.45 years old), height (160 ± 7.9 cm), weight (50.37 ± 8.61 kg), and leg length (86.37 ± 5.73 cm). The results of side kick motion analysis data are obtained from the video analysis using Dartfish version 8 where the focus of the movement is divided into 3 main phases. These phases include the horse stance, the take-off phase, and the impact phase. The results found that the fighters are in the appropriate category. To get very appropriate category, the participants were expected to improve the ability of the components of speed, accuracy, and reaction speed to be more effective and efficient. Further research was expected to do a motion analysis using video recordings high speed camera on the frontal and sagittal angles.

Keywords Biomechanics Analysis, Side Kick, Pencak Silat

1. Introduction

Pencak silat matches in the category number are divided into 2, which are art category and fight category. The art category is a demonstration of showing moves with both bare hands and weapons, while the fight category is a category that has elements of defense, attack, tactics, and competing techniques [2]. According to Punkastyo, [15], the basic principle of the martial arts fighting category is to get score through attack and defense. The basic technique of fighting category used to obtain scores is to use kicks to target opponents. The kick is around 47% which is dominantly used in the dueling category of martial arts [13]. In the line with an opinion by Sartono et al., [16] that kicking is the dominant technique used during a match, so the technique must be of particular concern during practice. The types of kicking techniques in Pencak silat include: front kicks, sickle kicks, spinning kicks, and sidekicks or T. Sidekicks or T is a kick is often used as the main weapon for attacking. Aside from attacking, this kick also used to defend because the main goal in the match is to get scores. Given the importance of this, the implementation of the sidekick technique in competition must be effective and efficient.

According to Lubis, [14] a side kick technique that is often used by fighters in a match is a kick with a sideways body position and a straight kick next to the target. The items used are the sharp side of the foot, sole, and heel. However, on some events that occur in Persinas Ampuh Sehat Aman Damai (Effective, Healty, Safe, Peace)

ASAD martial athletes, the kicks used are not optimal. It can be seen from the motion even through to the target but the speed still unsatisfied. The movements performed are considered ineffective in obtaining numbers and in terms of biomechanics are less able to maintain movement because they are unstable and indicate an injury [1][5][7][9]. Kick in Pencak silat requires mastery of basic techniques that are mature in a series of movements and the application of kicking also still in the development of capabilities in Pencak silat kicks [21]. A movement technique should have the effectiveness and efficiency [10] of motion when a kick is taken into the target and can get value. Kick into the expected target accompanied by power strived for the impact that occurs from the kick when hit the target on time and the body of the target. Thus, there were a need for an analysis of the side kick movements from Pencak silat in the form of a video display that can be seen repeatedly so it can be seen efficiency and effectiveness [9][10] in achieving motion compatibility from the tide, take off, impact, to the follow-through phase. The analysis of the kick motion used biomechanics analysis on Persinas ASAD's Pencak silat athletes. According to Fajar Awang Irawan, Long-Ren, et al., [9] the biomechanical analysis used was a combination of the sub disciplines of applied mechanics and the sciences of biology and physiology. This field studies about the internal and external forces acting on the human body or all living things and the causal effects of the forces produced [12]. Through research by Irawan et al., [11] and Irawan & Long-Ren, [8] found that biomechanical analysis can help to evaluate performance in monitoring and give recommendations to improve skills and prevent injury. Based on the classification of biomechanics, to achieve maximum achievement there were a need for motion evaluation based on the existing biomechanics science. As explained by Irawan, Permana, Akromawati, & Yang-tian, [11] and Wan & Niu, [20], biomechanical analysis was used to analyze motion through photographing images or videos that are processed to be corrected to improve the athlete's best performance. This research was included in the Occupational Biomechanics category because it refers to the body and leg motion when implement a kick. When doing a sidekick, the angle of the body segment and the speed of a sidekick from the fighter will be measured and calculated using the Dartfish version 8 software. The consideration of performance improvement needed a technological tool such as a video recorder that can simplify the analysis process to measure something that cannot be seen by foresight.

Based on the author observations through understanding and knowledge of the effectiveness of human movements, it is necessary to have a series of movements that are not only brief but also appropriate. Many athletes still ignore the correct movement techniques through the aspects of mechanics. The basic technique of kicking was often overlooked due to the consideration of increasing the level of the athlete and not on competence or skill. Sidekicks who felt to be less effective and needs to be clearly repeatedly. The series of motion analysis was needed when kicking can be integrated by combining technology with science in training material [12][15][19]. The purpose of this study was to identify biomechanics analysis of pencak silat side kick of Persinas ASAD. Recommendations will be given later to improve the movement in order to improve performance and prevent injury.

2. Materials and Methods

2.1. Participants

Participants in the study were 30 Persinas ASAD martial arts athletes (average age: 15.37 ± 1.45 years, height: 160 ± 7.9 cm, weight: 50.37 ± 8.61 kg, and right leg length: 86.37 ± 5.73 cm). Their informed consent was provided before testing. The study was approved by the Health Research Ethics Commission of Universitas Negeri Semarang, Indonesia based on Standards and Operational Guidance for Human Participants in accordance with WHO 2011.

2.2. Data Collection

A video camcorder was used to record athletes' sidekick movements in a National Sports Week event. A Pencak Silat Side Kick Movement Test Stage form that was issued by Ikatan Pencak Silat Indonesia (Pencak Silat Association of Indonesia) was used to obtain data consisting of movement indicators at each kick phase to determine a suitability level of the side kick movement [2][18]. It was refers to theoretical bases of the skills of the side kick Pencak silat and had been validated [18]. Assessing items in the form were set in a Dartfish software version 8, GEAR Software B.V., Helmond by just putting checkmarks in assessing columns in the software.

2.3. Data Analyses

The Dartfish software was used to analyze the videos to find errors of athletes' movements matched to the assessing items in the form [18] and to measure angles of body segments and joints, and time of each phase to quantify the movement.

In the form, the side kick movement was divided into three main phases (Figure 1): 1) the horse-standing phase, 2) the take-off phase, and 3) the impact phase. The movement in each phase was assessed according to the suitability indicator of the side kick movement in Pencak silat [18]. Qualitative information included 20, 30 and 25 assessing items in the horse-standing, take-off and impact phases, respectively. 20 assessing items were separated into 5 categories regarding the focus of vision, direction of

kicking, elbow flexion, knee flexion, and the horse stance position. 30 assessing items were separated into 7 categories regarding the focus of vision, knee extension, upper leg support, hip rotation, shoulder adduction, abduction, and shoulder internal rotation. 25 assessing items were separated into 5 categories regarding the focus of vision, shoulder internal rotation, knee flexion, body posture, and the application of the instep to the target. The assessment was scored using Likert scale set as 1 to 5 (Very Less Appropriate, Less Appropriate, Almost Appropriate, Appropriate, Very Appropriate) for the phase I, phase II, and phase III of all sidekick movement and the scores were averaged for each phase [18].

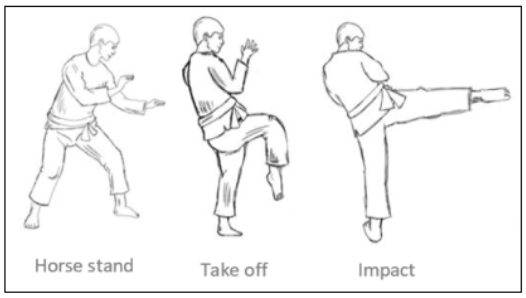

Figure 1. Basic Side kick phase by Subekti et al., [18]

3. Results and Discussion

3.1. Results

In the horse-standing phase, the Pencak silat athletes performed 100% Very Appropriate in the focus of vision category. In the direction of kicking, 90% was found in the Very Appropriate category but the Elbow flexion category was 86% performed Appropriate. Knee flexion of the kicking was 97% as Very Appropriate and the Horse Standing Position 96% in the Very Appropriate category. Overall, participants performed Very Appropriate during the horse-standing phase.

In the take-off phase, the Pencak silat athletes also performed 100% Very Appropriate in the focus of vision category. They were required to lift the leg and extend the knee around 100° (66%) in the Upper leg support for the Appropriate category during the take-off phase performance. Nevertheless, 57% of the participants performed Almost appropriate in the knee extension category. Hip rotation contributed the movement 92% Very appropriate category for the kicking performance. Shoulder adduction performed 87%, while shoulder abduction 88%, and shoulder internal rotation performed 80%. All the participants performed 81% in the Appropriate categories.

The impact phase found the Pencak silat athletes also performed Very Appropriate in the focus of vision category 100%. They were required to perform shoulder internal rotation during the impact phase 53% Almost Appropriate. Nevertheless, knee flexion showed 84% 53% performed "Inappropriate" in the shoulder internal rotation category. Assessment for the body posture showed 88% performed in the Appropriate category. Instep to the target of the athletes also showed 87% performed Appropriate category. Overall, the impact phase showed 82.9% in the Appropriate category. Based on the assessment of each phase above, the average of the series pencak silat kicking phase showed 85.7% performed in the Appropriate category.

Table 1. The performance in categories of side kick phase

Category	Percentage	Performance
Horse-standing phase		
Focus of vision	100%	Very appropriate
Direction of kicking	90%	Very Appropriate
Elbow flexion	86%	Appropriate
Knee Flexion	97%	Very Appropriate
Horse stand position	96%	Very Appropriate
Take-off phase		
Focus of vision	100%	Very appropriate
Knee extension	57%	Almost appropriate
Upper leg support	66%	Appropriate
Hip rotation	92%	Very Appropriate
Shoulder adduction	87%	Appropriate
Shoulder abduction	88%	Appropriate
Shoulder internal rotation	80%	Appropriate
Impact phase		
Focus of vision	100%	Very appropriate
Shoulder internal rotation	53%	Almost appropriate
Knee flexion	84%	Appropriate
Body posture	88%	Appropriate
Instep to the target	87%	Appropriate

The appropriate indicator of the movement was the knee lifted and whipped towards the target in the impact phase with a trajectory from the side. 30 participants showed the kick movement using insteps to the target in the impact phase performed Appropriate category based on the standard of assessment from Subekti et al., [18] which have been described in the research method. The average performance of all Pencak silat athletes' side kick moves from phase I (3.9 ± 0.738 second), phase II (3.5 ± 0.527 second), and phase III (3.6 ± 0.516 second) was 3.7 ± 0.208 which meant that they performed Almost Appropriate based on the analysis using Dartfish. Moreover, the average time of horse-standing and take-off phases was 0.492 ± 0.090 second.

3.2. Discussion

The suitability of the movement during the ideal impact phase in accordance with the reference from Subekti et al., [17[18] which starts with the initial stages in the direction of the view always focus on seeing the target, so that the kick was right on target. At this stage, athletes do it in the Very Appropriate category. The focus of the kick was intended to maintain concentration when the kick was carried out and anticipate counterattacks from the opponent.

In phase I the data obtained on a score of 13-16 is the appropriate category where 25 athletes dominate in providing comments in the Very Appropriate category. The other 4 athletes are in the Appropriate category and only 1 athlete is in the Almost Appropriate category. Figure 2 also explains about phase II. It is found that 20 athletes declared Appropriate category with the score number 13-18. 8 athletes list themselves in the Very Appropriate category and 2 athletes were in the Almost Appropriate Category. The last phase regarding the impact phase found that 25 athletes declared Appropriate and 5 others in the Very Appropriate category. Some parameters do not explain the information because according to Subekti et al., [18] there is no use of kinematic parameters as a reference or comparison.

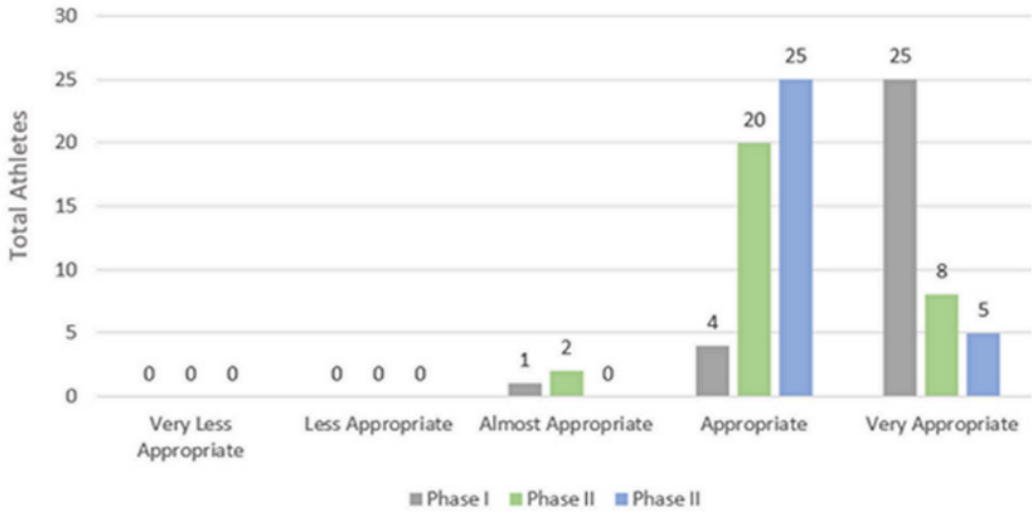

Figure 2. The suitability of the side kick diagram

The movement of the right pose in the arm when the impact phase did not lay back too much and the movement of the left hand in the front of the chest, so that the shoulder internal rotation of the arm can help the movement of the limbs when kicking was more effective. At this stage, the athlete had Almost Appropriate category because 10 of 30 athletes have hyperextensions motion and the arms were not effective in supporting the legs when kicking. The athlete's right arm was in the lower right side and the athlete's left arm was in the abduction position away from the body. As a result, the kicking motion was interrupted by the swinging of the arm and the result of the kick being less than the maximum because the movement was split concentration. Range of Motion (ROM) in this kick pose would be more effective if the movement in the body parts can be as close as possible to the center of body parts, as in Irawan et al., [10] and Irawan & Long-ren, [7] review in the effectiveness of motion for improving performance. In the horse standing phase, the average of the view of kicking is in the Very Appropriate category, this explains that the horse standing was done very well because the strength of the leg muscles supports the upper extremity during preparation for the kicking process. The elbow flexion angle has an average in the Appropriate category (86%), which explains that the elbow flexion between athletes is not the same, the possibility happens was the typical of athletes with defense and offence. Athletes with offence characteristics, the elbow angle they have will be greater due to the counter attack. Meanwhile, the knee flexion in the category very appropriate with the value of 97% and supported by the horse standing position (96%) was Very Appropriate before doing take off. The take-off phase describes the focus of vision on a Very Appropriate category. For knee extension in the Almost Appropriate category, the value was 57% because some of the movements performed by the participants had different leg muscle speed and strength, but in this study the data was not presented. Upper leg support showed Appropriate category (66%) to stabilize the upper extremity while kicking. The shoulder internal rotation performed was not optimal, it can be seen from the data 80% Appropriate category to counter knee flexion for the impact phase. Hip rotation has contribution in the take-off phase 92% (Very Appropriate) for the leg to moving faster and accurate to the target.

Correct kick trajectory for those with the right dominant leg starts from the lower right side towards the upper left side. The position of the gravity in the center of mass was balanced and there was hip rotation. At this stage, the athlete does it very well. The athletes perform well when the knee was raised, whipped toward the front of target with the trajectory from the side with the body position upright sideways. This can be influenced by the data on a leg length (86.37 ± 5.73) from the results. The research data found the fighter has an average leg length of 86.37 cm so that the range reach to the target was very easily to achieved. At this stage, the athlete's body posture when doing sideways movements in the Appropriate category. The side kick was done using the entire instep of the foot so that the leg power can be used optimally on the target. At this phase, athletes showed Appropriate category. Study by Liskustyawati et al., [13] revealed that kicks taken while competing have a predominance especially for attacking.

It was strived for the fighter to remain focused to maintain movement [3][4] and prepare themselves in the event of a counterattack from the opponent [17]. The position of the right foot was pulled in reflexes to form flexion movements on the knees, hands form a tide, horses as wide as shoulders and leg movements when following through after the impact and placed forward or stepped foot forward [5] to close the motion of the opponent's attack and to maintain balance in order to facilitate the athlete when continue the next attack motion.

Three phases presented by Subekti et al., [18] which consists of the horse stand, take off, and impact phases were the main references in Pencak silat movements, especially on the side kick. While the follow-through phase was the additional information used through biomechanical analysis to supplement existing references through current study. Right now, the side kick phase there was a series of enhanced movements using 4 phases consisting of the stand horse, take off, impact, and follow-through. Understanding the four phases was to facilitate the fighter or trainer in evaluating the movement during an attack, defense movements from opposing inverse attacks, and preparation for the next motion.

Overall, the series of side-kicks of the Persinas ASAD athletes belong to the Appropriate category. But there were needs to be an increase in the justification of side kick movements in Persinas ASAD in order to get movements that can be included in the Very Appropriate category, so it is more effective and efficient to be used in a match.

4. Conclusion

This study concludes that the fighter has the suitability of motion on the side kick in the Appropriate category. To get a Very Appropriate category, the participants are expected to improve the ability of the components of speed, accuracy, and reaction speed to be more effective and efficient. Further research was expected to do a motion analysis using video recordings high speed camera on the frontal and sagittal angles to see the clear angle and more detailed movements for the improvement of side kick performance.

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