Activity profile during action time in national silat competition

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Summary

Introduction. The purpose of the current case study was to describe the detailed activity that occurs during the fight time of a silat bout.

Material and methods. A DVD recording of a single international bout was entered into the Focus X2 system and the system used to identify 14 different types of event performed by the 2 contestants as well as the start and end of action periods. An intra-operator reliability study revealed that the strength of agreement for action was moderate (k = 0.44), the athlete performing the action was moderate (k = 0.47) and the outcome of an action was fair (k = 0.25).

Results. A chi square test of independence revealed that the two contests performed a different profile of actions during the bout ($\chi^2 = 39.8, p < 0.001$) with the red contestant performing more kicks and less blocks proportionately than the blue contestant. A chi square test of independence also revealed no significant association between an action performed by a contestant and the previous action that he performed ($\chi^2 = 7.6, p = 0.108$).

Conclusions. The data about the nature of the activity performed within fight periods can be combined with the analysis done by previous study to provide a detailed description of the demands of the sport and assist in the development of specific training programmes. The approach used here would be useful to apply to other sports whose work and rest periods have been investigated to give a greater understanding of the type and frequency of action within the work periods.

Introduction

The requirement and prescription of training programmes for sport requires an understanding of the physiological requirements of the match. Various forms of time motion analyses have been used widely to estimate the nature of specific intermittent high intensity and low intensity activities as they relate to the energy requirements of team sports [1,2,3]. Previous research notated the technique used in defensive and offensive movements such as in mixed-martial arts [4], boxing [5] and Muay Thai [6]. However, there is no research that specifically describes the activity involved in silat that specifically describes the activity that contributes to the physiological demands of this combat sport.

The nature of work periods within any combat sports depends on the frequency, volume and type of the activity being performed. The distribution of fight time and break time has been determined in international silat competition in the previous research [7], which indicated that 62.6% of the match is spent in fight time. In addition, a single match contains 30.0 mean action periods with on average 15.3 s being performed with break periods averaging 8.4 s. The work to rest ratio of 2:1 in silat might be misinterpreted if people count the action periods performed in silat in the same way as work periods in field games and racket sports are interpreted. The nature of “purposeful movement” in team games [8], rallies in racket sports [9] and action periods in martial arts are very different. Therefore, the objectives of this study are to describe the detail activity that occurs during the fight time of a silat match, especially the profile of technical events.

Material and methods

Match analysis

A publicly available video recording of one female silat match from the national silat competition in Malaysia (National Sports Council, Malaysia) was used for the analysis. This was a female final match of class E of the 65-70 kg weight category. Subsequent player motion analysis was carried out using a commercial sports performance analysis software package called Focus X2 (Elite Sport Analysis, Delgaty...
Bay, Scotland). The system was used to identify 14 different types of event performed by the two female contestants as well as the start and end of action periods.

Video sequences were repeated where necessary and the playback rate was reduced to 50% to allow accurate measurement of each offensive and defensive movement category. The video could be paused and played back frame-by-frame for ease of use. Silat exponent motion was subjectively categorised by an experienced observational analyst for silat competition. Information could be entered into the computer system using a 'Mouse', via representation on the screen of the silat match, and specially designed screen functions for each exponent (red or blue), action and outcome for each activity. The timed list recorded in Focus X2 was exported for processing in excel (Microsoft Excel 2002, Microsoft Corporation, USA). The commencement and completion of each individual action period was recorded and the duration was calculated by spreadsheet programming allowing durations (differences between action period end and start times) to be calculated. An intra-operator reliability study of fights was undertaken to establish the reliability of the method.

Motion categories
Silat exponent's motions were coded into 14 different types of categories and were defined as follows:

**Punch**

The punch 'tumbuk' attack is done by a hand with a closed fist hitting the target. In silat punching is often used to fight the opponent. It can be a straight punch 'tumbuk lurus' or uppercut 'sauk' to the exponent body's [10].

**Kick**

The kick 'tendang / terajang' is an attacking movement which is performed with one leg or two legs simultaneously. A kick can be aimed at any target. It can be front kick 'tendang depan', side-kick 'depak' or semi-circular side kick 'tendang lengkar' [10].

**Block**

The blocking movements begin with the posture position 'sikap pasang': the exponent stands straight with his hands around his body or close to his chest. Blocking or parrying 'tangkisan' can be done using arms, elbows and legs with the purpose to block off or striking back at any attack [10].

**Catch**

The catch 'tangkapan' is done by using the hand to obstruct the opponent from carrying out an attack. The silat exponent is able to prevent himself from being attacked by pointing the attack which he has caught to another direction. A catch which twists or drags the opponent is forbidden. Also, a catch which could break the part which is being held such as the leg and waist is also forbidden. These regulations exist to protect the silat exponent's [10].

**Topple**

There are various ways of toppling down one's opponent. For example, a silat exponent 'pesilat' can either push, shove the opponent's back leg from the bag or from the side, shove, hit, kick, strike or punch to make the opponent lose his balance. Every fall is considered valid as long as the silat exponent topples his opponent down without wrestling or he is able to overpower the opponent whom he has brought down [10].

Swiping 'sapuan' involves attacking an opponent's leg which are on the ground to unbalance him and bring down to the ground. A silat exponent can perform this attacking movement either with his right or left leg. Hence, front sweep 'sapuan depan' is done by swinging the leg to the front to push an opponent's front leg, while back sweep 'sapuan belakang' is carried out by swaying the leg backward to hit the back leg[10].

**Evade/Dodge**

The evade 'elakan' technique is carried out by silat exponent when he tries to evade an attack. This technique does not require the silat exponent to touch the opponent in fending off the attack. They are many ways of carrying out his defensive movement such as dodging 'gelek', retreat 'mundur', evasion to the side 'elak sisi', bending 'elak serung', jumping 'lonjak', ducking 'susup' and etc. [10].

**Self-Release**

Self-release 'lepas tangkapan' technique is a technique to unlock any clinch or catch from an opponent [11].

**Block and Punch**

The blocking technique is used to block any hand or leg attack from the opponent and followed by counter attack using the hand to punch the opponent.

**Block and Kick**

The blocking technique is used to block any hand or leg attack from the opponent and followed by counter attack using the leg to kick the opponent.

**Block and Sweep**

The blocking technique is used to block any hand or leg attack from the opponent and followed by counter attack using sweeping technique to the opponent.

**Fake Punch**

An action which a silat exponent intends to confuse the opponent using a fake punch to break his opponent's defensive posture.

**Fake Kick**

An action which a silat exponent intends to confuse the opponent using a fake kick to break his opponent defensive posture.

**Others**

Both silat exponents are either in posture position 'sikap pasang' or coming close to each other using silat step pattern 'pola langkah'.

All the activities are considered high intensity except for others which at that time both silat exponents are in low intensity periods.

**Reliability of Observation**

The author analysed all the activities and simultaneously classified each change of motion in a single match. Two ob-
servations were done separated by 48 hours. It requires experienced silat practitioners to analyse the data as the movement of both exponents is fast, needing close inspection. The classification of movement was subjective with work being classified according to the instruction given by the referee.

Statistical analysis

The observation generated data will be frequency counted, a method of recording in observational research in which the researcher records each occurrence clearly defined behaviour within a certain time frame [12]. All the raw data generated by the FOCUS System was exported into Microsoft Excel Spreadsheet and then transferred into SPSS for more detailed analysis. Statistical analysis was conducted using Statistical Package for Social Scientists, version 14.0 (SPSS, Chicago, IL). A chi square test of independence was used to determine if there was a similar profile of actions performed by the red and blue contestant in the match. An alpha level of \( p < 0.05 \) was taken to show statistical significant.

Results

Table 1 shows the summary of the intra-operator reliability study revealed that the strength of agreement for the actions was moderate \((k=0.44)\), the exponent performing the action was moderate \((k=0.47)\) and the outcome of an action was fair \((k=0.25)\). The action factors used were description of the action, the exponent performing the action and outcome of actions. Each of these reliability results was recorded in Table 1. Table 2 shows the actions performed during the contest and their outcomes in the match. Table 3 shows the frequency profile of actions for the 2 contestants.

A chi square test of independence revealed that the two contest acts performed a different profile of actions during the bout \(\chi^2 = 74.0, p < 0.001\) with the red contestant performing

<table>
<thead>
<tr>
<th>Table 1. Reliability of silat data (kappa)</th>
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<tr>
<td><strong>Variable</strong></td>
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<td>Action</td>
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<td>Exponent performing the action</td>
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<td>Outcome of actions</td>
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<table>
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<tr>
<th>Table 2. Frequency of actions and outcomes recorded during a silat match</th>
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<tbody>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td>Block</td>
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<td>Block and Kick</td>
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<tr>
<td>Block and Punch</td>
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<tr>
<td>Block and Sweep</td>
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<tr>
<td>Kick</td>
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<tr>
<td>Fake Kick</td>
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<tr>
<td>Punch</td>
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<td>Fake Punch</td>
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<tr>
<td>Self-Release</td>
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<tr>
<td>Topple</td>
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<tr>
<td>Sweep</td>
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<tr>
<td>Catch</td>
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<tr>
<td>Dodge</td>
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<tr>
<td>Others</td>
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<tr>
<td><strong>Total</strong></td>
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\*Note: Not available - means action that did not count as outcome by observer. Others – means low intensity activities.

<table>
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<tr>
<th>Table 3. Frequency profile of the 2 contestants</th>
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<td><strong>Exponent</strong></td>
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<tr>
<td>Blue</td>
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<tr>
<td>Red</td>
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<tr>
<td><strong>Total</strong></td>
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\*Note: ‘Other\*’ here refers to other activities than block and kick.
more kicks and less blocks proportionately than the blue contestant. A chi square test of independence also revealed no significant association between an action performed by a contestant and the previous action that was performed ($\chi^2 = 7.6$, $p = 0.108$). The red contestant performed 0.34 events per s of fight time while the blue contestant performed 0.33.

**Discussion**

Table 2 shows that the 57% of the fight was comprised of kick and punch actions. However, the percentage of punches (82.6%) that hit the target was greater than percentage of kicks (12.9%). The data indicated that national silat exponent needs to be good both at punching and kicking. Even though the frequency of punching is lower than kicking, the high percentage of hitting the target showed that punching is the most successful action for a silat exponent to get a point in competition. Therefore, training should aim to develop punching ability and accuracy. However, it is important to know that any local muscular fatigue experienced during a match maybe more likely to occur in the lower limbs due to the large number of kicks performed in a short period of time. Aziz et al. [13] also suggested that silat exponents possess high levels of anaerobic power capability of the lower body, which is supported by the high frequency of kicks reported in this study.

There were 20.3% of the 237 actions performed by the exponents were classified as **others** actions and would be classified as low-intensity activity. The remaining attacking and defensive actions were classified as high intensity activity. Shapie et al. [7] indicated that average work to rest ratio during a silat match is approximately 2:1. In the present study 79.7% of the actions or activities recorded were considered high intensity but in the real time the duration of low intensity periods maybe greater than high intensity periods that involved in the silat match. It can be assumed that anaerobic sources contribute to the metabolic demands during the work spent performing high intensity activity such as punching, kicking, blocking, dodging, catching, swiping and toppling. During the low intensity activity both of the silat exponents were deemed to be performing low activity actions such as “sikap pasang” posture or coming close to each other using silat step pattern “pola langkah”. Anaerobic sources contribute a major amount of the total energy required during high-intensity burst, thus aerobic metabolic is vital during the low-intensity activity to allow recovery. The aerobic sources contribute to the metabolic demand during the **others** action (low-intensity action) in a round of silat (Table 2). Even though the break periods are the best time for recovery, the low intensity periods contribute to aid both exponents to recover from high intensity actions. Therefore, the aerobic system needs to be specifically developed to help aid recovery during the intermittent activity (e.g. replenish creatine phosphate).

Current study shows that there were significantly different fighting styles between the two exponents. The blue exponent was taller than then red exponent; and she used more kicks and was responsible for 71.0% of the kicks (Table 3) made during the fight (match won by the blue exponent). The red exponent produced more blocks and less kicks proportionately than blue contestant. The red exponent produced 80.8% for the blocks performed by the two exponents suggests the blue exponent was superior on this technique. The action profiling of both exponents showed that block is a common action in silat for defensive actions and kicking was the common action for striking. It was observed that during the match both of the exponents were good at the catching technique but failed to topple down the opponent. This is because both of the exponents were good in the self-release technique. Furthermore, the blue exponent was using the blocking technique more while receiving an attack from the red exponent which in this study was categorised as a kick technique. Thus, beside from silat techniques the results suggested successful silat exponents tended to demonstrate high upper body isometric strength (catch) and power (punch and block) and superior lower body strength and power (kicks), endurance (repetition of kicks) and speed (kick velocity). Aziz et al. [13] reported that in comparison to judo and taekwondo athletes, the silat exponents have better explosive leg power and comparable ability to perform short duration high-intensity exercise in the lower body, which is similar with the current finding. Moreover, it is advised that exponents should be well trained in understanding the concept of distance in silat while receiving an attack. This is because failure to understand the concept may result in injuries (e.g. using blocking when the exponent should use dodge/evading technique) during the silat match. Thus, the need for limb speed [14] for kicking and punching, better co-ordination to evade strikes and also other factors as aforementioned that influences movement patterns common to silat competition need to be taken into consideration. Therefore, it is important to develop skills that contribute to scoring points besides developing the metabolic systems that involved in silat competition.

**Conclusions**

Post-event analysis of hand notation indicates that the prototype system developed for this study can be used to record and evaluate a silat match. This study complemented with those of the broad work and rest study undertaken by Shapie et al. [7]. The current study has provided a great understanding of information for the silat by looking at the activity involved in competition. Both of the exponents performed more high intensity actions than low intensity actions (i.e. the frequency count). However it is important to understand that high intensity actions will contribute more in the score points (i.e. outcome that count) rather than low intensity actions. There is also a range of frequency in attacking and defensive activities used by both of the exponents. The winner (blue exponent) used more kicks than the loser which may reflect greater skill or fitness or both. However, it is still doubtful that these are the only factors that influence the match. It is recommended that future studies determine the full range of activities performed with movement classifications and the variation of strikes that contribute to losing and winning the match.
It is recommended that those developing conditioning elements of training programmes for silat athletes are aware of the frequency and spread of durations of action and rest periods within action periods. The implication from a coaching perspective of the types and frequencies of strikes used would suggest that in training, a large proportion of time needs to be utilised in development of kicking and blocking as well as the conditioning of lower limbs in order to absorb strikes and resist fatigue during a match to being able to defend and counter attack effectively.

There is a limitation of this case study as the findings here only represent one silat match, so the findings cannot be generalised to all silat competition. However, the purpose of this study was to develop a system for monitoring actions during a silat match (and not establishing normative data). Furthermore, the system developed is useful in future study in silat. This was the first study to provide descriptive detailed information of a silat match, increasing the knowledge base and providing a methodology that can be used in future research and by coaches. Furthermore, the other sports where the frequency and duration of high intensity activity periods fail to provide sufficient information to fully characterise the demands of the sport.

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