ORIGINAL ARTICLE

Offensive activity as an element of the evaluation of struggle dynamics of judo contestants

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Source of support: Departmental sources

Received: 27 September 2013; **Accepted:** 16 February 2014; **Published online:** 17 April 2014

ICID: 1098837

Abstract

Background & Study Aim: Analyses of the actions taken at start by the contestants of combat sports deliver a considerable amount of valuable information for the training staff. Evaluation of technical and tactical preparation of judokas has recently been performed on the basis of various criteria. The purpose of this study was to propose a new element of measuring the combat dynamics of judokas – offensive activity (OA), and comparing it with currently functioning indexes.

Material & Methods: The research has been executed on the basis of DVD records from 41 final combats from the most important worldwide judo championships, which took place between 2007 and 2010. 69 leading judokas of the world, representing 27 countries, took part in the championships. The analyses were performed on the basis of the Kalina's method of combat dynamics measurement. The combat dynamics phenomenon is defined by the following indexes: activeness, effectiveness of attack, effectiveness of counterattacks and defensive effectiveness. A new element was proposed as an addition – offensive activeness, as a counterpart of the combat dynamics evaluation.

Result: The activeness of contestants did not exceed 0.5, which means that, for over a half of their combats, judokas did not take any actions (neither offensive nor defensive). The winners of final combats were characterized by much higher offensive activeness, effectiveness of attack and defensive activeness. The analysis of events in the time function indicated that the highest combat effectiveness was recorded in the fourth minute of the combat, and the lowest – in the first minute.

Conclusion: The offensive activeness index may be very helpful in analyzing both the actions of contestants and the referees (particularly in the case of equalizers or draws).

Key words: combat sports · judo rules · method of combat dynamics measurement · top level judokas

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Introduction

In judo, similarly to other combat sports, the contestant's actions are primarily determined by the opponent's counteractions. The medal winners of the most important worldwide championships are generally similar when it comes to their figures and body compositions, physical and mental preparation [1-5]. The factor which differs them most is their technical and tactical preparation, which is considered by the coaches to be the most important element of prestart preparation of judokas [6]. It has been proven that advantage over the opponent in terms of physical fitness is not a factor which determines a win in direct combat [7].

Analyses of actions taken by contestants at start are often performed and published. The level of detail of these analyses varies: with respect to the criteria

Hansoku-make – penalty which has effected a disqualification from the fight, given to any contestant who has committed a Grave Infringement (or who having been given three Shidos, commits a further Slight Infringement).

Hantei – referees decide of winner by voting, will take effect only if there is a draw in scoring at the end of the time allotted for the Golden Score contest.

Ippon – Score that finish the contest. The Referee shall announce Ippon when in his opinion the applied technique corresponds to the following criteria: When a contestant with control throws the other contestant largely on his back with considerable force and speed. When a contestant holds with Osaekomi-waza the other contestant, who is unable to get away for 25 seconds after the announcement of Osaekomi. When a contestant gives up by tapping twice or more with his hand or foot or says Maitta (I give up!) generally as a result of Osaekomi-waza, Shime-waza or Kansetsu-waza. When a contestant is incapacitated by the effect of a Shime-waza or Kansetsu-waza.

Judogi – judo uniform. The contestant shall wear either a blue or white Judogi. (The first contestant called shall wear the white Judogi, the second shall wear the blue).

Kinsa – strong techniques without any score for example 14 seconds Osaekomi or throw on the hips.

Shido – penalty given for slight infringements (prohibited act). The first Shido does not change the result of contest. Second Shido has effected a Yuko for the opponent, third – Waza-ari, fourth (Hansoku-make) – Ippon.

of effectiveness evaluation, and the actions to be recorded [8-16]. Undoubtedly, they are a precious source of information about the methods of fights of judokas at varying levels of sports competition. The planning of technical training takes into account the current tendencies in judo. The recent changes in the regulations have been changing this tendency considerably [17-21].

Elements of judo fights comprise not only throws and grapples, but also various maneuvers and preparatory actions [9, 10]. A win in a fight is therefore not only the result of a successful action, but also the penalties inflicted on the opponent [22]. Actions conducted skillfully will allow for gaining advantage without taking risky attempts at throws.

The aim of this study was to propose a new index for measuring the dynamics of judokas' contests – offensive activeness, and comparing it to the already functioning indexes.

Material and methods

The analyses covered final combats from world level male judo tournaments, which took place between 2007 and 2010. The research material comprised DVD records of gold medal combats from the Beijing Olympic Games, the world championships in Tokyo (2010) and in Rotterdam (2009), the Grand Slam in Paris (2010), the World Cups in Warsaw (2007 and 2009). 41 fights were analyzed in 10-second sequences. The total time of fights was 2 hours 52 minutes, which made 1,042 sequences.

The contests were attended by 69 leading judokas from 27 countries. The most of the contestants represented Japan (n=8), Russia (n=8), Korea (n=7), Belarus (n=4), France (n=4), the Netherlands (n=4) and Germany (n=4).

According to the Kalina's method of combat dynamics measurement [23], all actions were recorded (on observation sheets) in 10-second fight sequences: attacks and counterattacks (throws, holds, chokes, levers), defense without counterattack – defining their effectiveness, as well as preparatory actions, breaks, decisions of referees. In each category, events are recorded in the form of proportions of relations: the number of successful actions vs. the number of observed actions belonging to this group, which may be expressed in a 0 to 1 index of arbitrary units. Events (in 10-second combat sequences) are recorded in the form of arbitrary symbols or in the form of brief description. The basic criteria for evaluating the dynamics of combats assume variables expressed in proper indexes:

- Offensive and defensive activeness index, which forms the *activeness index* (AI). It is a proportion of 10-second combat sequences, during which the contestant attempted at least at one attack, counterattack or defense without counterattack vs. the number of 10-second combat sequences.
- Offensive activeness index, which is the *effectiveness of attacks* (EA) – a proportion of the number of attacks, for which points were granted, to the number of attacks made.
- *Counterattack effectiveness index* (EC), which is a proportion of the number of counterattacks, for which points were granted, to the number of counterattacks made.
- *Defensive effectiveness index* (ED), which is a proportion of the number of successful defensive actions (without counterattack) to the number offensive actions taken by the opponent, with the exception of attacks, which were followed by a counterattack of the contestant.

Additionally, a new index was proposed – the *offensive activeness index* (OA) – which was a proportion of the number of 10-second combat sequences, during which the contestant attempted at one offensive action (attack), aiming at gaining advantage, to the number of all sequences in a fight.

The average value of particular components used in the description of events taking place in a fight is the *general fight dynamics index* (SDI).

Standard statistical means were applied: arithmetic mean and standard deviation. Differences between particular data were calculated by means of chi-square and t-Student tests. The minimal level of actuality was established at the level of $p<0.05$.

Results

The activeness of contestants (expressed with the activeness index: AI) did not exceed 0.5, which means that for over a half of their fights judokas did not take any actions (neither offensive nor defensive), executing only preparatory actions. The winners of final fights were characterized by considerably higher offensive activeness (OA), effectiveness of attack and defensive effectiveness. The values of the offensive index (0.3 and 0.17) indicate that even the gold medal winners of the analyzed tournaments did not

take any actions aiming at gaining advantage for over 2/3 of their fights. The defensive effectiveness (ED) of the winners of fights was nearly one hundred percent (0.99). Points gained after own actions were thus gained only by one party (Figure 1).

When analyzing the dynamics of fights in particular weight categories, the biggest differences were recorded in the activeness of the contestants. The highest activeness (expressed by AI) (0.52) was recorded for contestants in the below 73 kg category, and the lowest activeness (0.36) – 81 kg and +100 kg. Analogously, the highest offensive effectiveness was recorded for judokas up to 73 kg (0.29), as well as 66 kg (0.28) and 100 kg (0.27). The number of actions undertaken did not always translate into their effectiveness. The lowest offensive activity (OA) was recorded for the 66 kg category (0.05, the difference between the attack effectiveness and defensive effectiveness was p=0.001). The most effective attacks (EA) (0.19) were recorded for the 73 kg contestants (Figure 2).

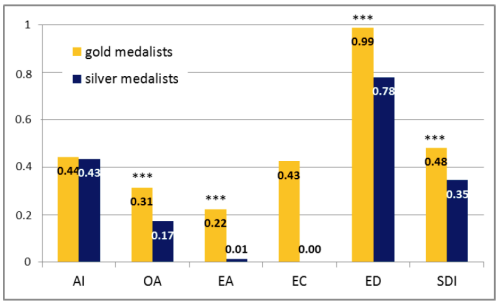

Figure 1. Gold and silver medalists struggle dynamics elements (***: p<0.001).

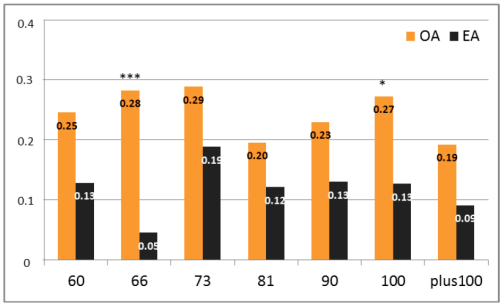

Figure 2. Offensive activity (OA) and effectiveness of attacks (EA) contestants from every weight categories (*: p<0.05; ***: p<0.001).

The analysis of combat dynamics elements in the time function allows us to determine the frequency of particular events (with 10-second accuracy). The highest offensive activity (OA) was recorded in the fourth minute of the fight (in the 210 second 0.35; in average in the fourth minute: 0.27). The lowest offensive activeness was recorded in the first minute (in the first 10 second: 0.07; in average in the first minute: 0.17). In average per one minute, the effectiveness of attacks was highest (0.12) in the fifth minute of the fight, and the lowest – in the first (0.03). In the 260th second, the offensive effectiveness was 0.28 (the most), and in 10, 60, 100, 160 and 230th second: 0.00 (Figure 3).

The offensive activeness (OA) of gold medal winners of the analyzed tournaments was highest in the fourth minute (0.46 in the 210th second; in average in the fourth minute 0.34). The biggest differences in the offensive activeness of gold and silver medal winners, in favor of the winners, was recorded in the beginning of the fifth minute, however, in the end of the fifth minute higher offensive activeness of silver medal winners was recorded (Figure 4).

According to the regulations, the lack of offensive activeness results in the *shido* caution. In the analyzed fights, the referees penalized the contestants 66 times (in average 1.61 per fight, once per 156.1 second. To compare, only 44 actions rewarded with points were recorded (in average 1.07 per fight, once per 235seconds, with the average fight length of 251.8 seconds).

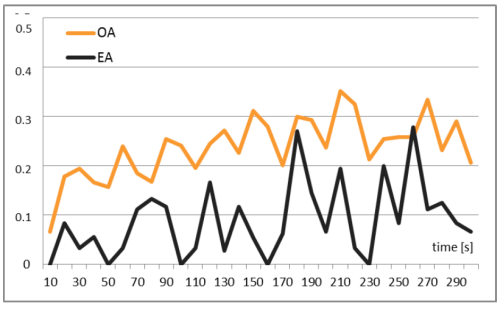

Figure 3. Offensive activity (OA) and effectiveness of attacks (EA) contestants, a function of time.

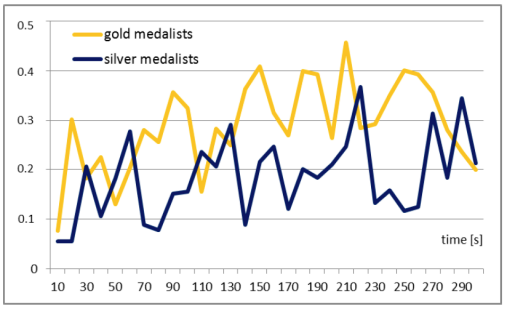

Figure 4. Gold and silver medalists offensive activity (OA), a function of time.

Seven fights (17% of all fights) were separated from all of the analyzed ones. In the se fights, none of the contestants made a successful attack and none of

them gained any points after their own actions. In the majority of fights, the result was determined by the *shido* cautions for the lack of action. The winners of fights, although they did not state their advantage with effective attacks, were usually dominating, which is indicated by the difference in offensive effectiveness. The analysis of struggle dynamics in this case does not reveal any differences between competitors. Although there were the differences which shows the penalties (Table 1).

In one of the fights (the final of the 2010 Grand Slam, 66 kg category), the gold medal winner displayed lower offensive effectiveness, but his opponent made mistakes from the very beginning, in the form of forbidden grapples, one-sided grapples, for which he was consistently penalized by the referees. After the fourth summon, according to the regulations, he was disqualified (*hansoku-make*). Lower offensive activeness of the winner was also recorded in the world champion finale fight in the +100 kg category, which took place in 2009, however, the differences were minimal there. The referee penalized both contestants, but the winner received one caution less. One of the fights (the final of the 2009 World Cup, cat. 66 kg) resulted in a draw and the winner was selected by the referees through *hantei*. The winner displayed higher offensive effectiveness, which, with an equal number of actions nearly gaining a point – the *kinsa*, is a factor determining the evaluation in *hantei* (Table 2).

Discussion

In a judo contest, referees are equally (or maybe more willing – as in the fights analyzed for the purpose of this work) willing to grant points after offensive actions as to inflict cautions to contestants (for instance for the lack of activeness) [11,22]. Particularly when well technically and physically prepared contestants are competing, finishing the advantage with a successful throw is very difficult. The result of numerous fights is determined by cautions only, and when the fight and the play-off finish in a draw, the winner is selected by the referees through *hantei* [24]. Evaluating the contestants, the referees take into account the number of actions threatening the opponent and the so-called *kinsa*, and the offensive activeness of judokas, which consists in the number and the frequency of their attacks. Sometimes it turns out that, in a fight ending in a draw, one of the contestants is clearly dominating, although he does not conduct any successful action. Offensive activeness may therefore be a helping hand in evaluating fights ending in a draw. Thanks to it, it will be possible to determine the level of the opponent's actual engagement in the fight. The activeness index takes into account offensive and defensive actions. In a judo fight, one can acquire advantage only after offensive actions. A referee has the right to penalize a contestant with the *shido* for too offensive a stand and the lack of attempts at attacking – the co-called passivity [24]. Cautioning

Table 1. Struggle dynamics elements of judokas without new indicator (OA) from contests which none of contestants did not perform even one effective attack.

Tournament	Place	Weight	AI	EA	EC	EO	SDI	Penalties
GS 2010	1	66	0.27	0.00	0.00	1.00	0.32	1
	2	66	0.27	0.00	0.00	1.00	0.32	4
GS 2010	1	+100	0.43	0.00	–	1.00	0.48	0
	2	+100	0.43	0.00	–	1.00	0.48	3
WC 2009	1	66	0.57	0.00	–	1.00	0.52	2
	2	66	0.57	0.00	–	1.00	0.52	3
WC 2009	1	+100	0.17	0.00	–	1.00	0.39	1
	2	+100	0.17	0.00	–	1.00	0.39	2
WCup 2009	1	60	0.52	0.00	–	1.00	0.51	1
	2	60	0.52	0.00	–	1.00	0.51	1
OG 2008	1	90	0.53	0.00	–	1.00	0.51	0
	2	90	0.53	0.00	–	1.00	0.51	1
OG 2008	1	+100	0.30	0.00	–	1.00	0.43	0
	2	+100	0.30	0.00	–	1.00	0.43	2
AVERAGE	1	–	0.40	0.00	0.00	1.00	0.35	0.71
	2	–	0.40	0.00	0.00	1.00	0.35	2.29

Table 2. Struggle dynamics elements of judokas with new indicator (OA) from contests which none of contestants did not perform even one effective attack.

Tournament	Place	Weight	AI	OA	EA	EC	EO	SDI	Penalties
GS 2010	1	66	0.27	0.10	0.00	0.00	1.00	0.24	1
	2	66	0.27	0.20	0.00	0.00	1.00	0.28	4
GS 2010	1	+100	0.43	0.33	0.00	–	1.00	0.42	0
	2	+100	0.43	0.10	0.00	–	1.00	0.33	3
WC 2009	1	66	0.57	0.50	0.00	–	1.00	0.51	2
	2	66	0.57	0.10	0.00	–	1.00	0.35	3
WC 2009	1	+100	0.17	0.07	0.00	–	1.00	0.26	1
	2	+100	0.17	0.10	0.00	–	1.00	0.27	2
WCup 2009	1	60	0.52	0.31	0.00	–	1.00	0.43	1
	2	60	0.52	0.21	0.00	–	1.00	0.39	1
OG 2008	1	90	0.53	0.47	0.00	–	1.00	0.41	0
	2	90	0.53	0.13	0.00	–	1.00	0.36	1
OG 2008	1	+100	0.30	0.30	0.00	–	1.00	0.38	0
	2	+100	0.30	0.03	0.00	–	1.00	0.27	2
AVERAGE	1	–	0.40	0.30	0.00	0.00	1.00	0.38	0.71
	2	–	0.40	0.13	0.00	0.00	1.00	0.32	2.29

GS – Grand Slam, WC – World Championship, WCup – World Cup, OG – Olympic Games

is one of the most controversial and questionable issues in the combat regulations. The majority of errors are committed in this element of the art of judgment. Some situations may be interpreted in many ways. The evaluation of offensive activeness with the offensive activeness index would allow us to look at a great deal of actions taken by the judokas objectively. Even a secondary analysis could bring advantages in the form of improved judgment. Disputable situations are analyzed on referee courses on all training levels: regional to worldwide level.

Addiction to assess the struggle dynamics of a new indicator allows for a more detailed characterization of activity of judokas. Nowadays effective offensive actions are less and less, many fights ended by penalty or by *hantei*. Therefore difficult is the search for the distinguishing characteristics of winners. For example in Grand Slam and World Championship in 2010 were no significant differences between gold and silver medalists in any of the elements of the struggle dynamics (according to the current formula) [14]. It was only offensive activity (OA) analysis revealed significant differences between them (p= 0.006). After joining the AO index also Struggle Dynamics Index (SDI) has changed and the recalculation significantly differentiated champions and vice-champions (p=0.041).

The IJF authorities have been trying to make judo a mode media-oriented and popular discipline. Hence, they introduced multicolor *judogi*, the colors of the tatami, on which the fights are held, were changed, and the regulations for the fights are constantly changed [24]. Not all of the changes bring desired results [18-21]. Analyzing the media attractiveness, the most popular argument is the number of fights ending with *ippon*. This is, however, a very risky thesis, since a fight may end with *ippon* also one second before the end of the play-off, after nearly eight minutes. A longer fight is generally less dynamic [18,19,25]. There is therefore a need to search for new ways of evaluating the attractiveness of judo fights. One of them may be their dynamics, and offensive effectiveness of contestants.

Conclusions

The offensive activeness index may be a useful tool in evaluating the actions of contestants – particularly in the case of equalizers or draws (where is was the only element differing the contestants).

The winners of fights were generally characterized by higher offensive activeness, although in 17% of the fights neither of the parties received a point after own action. The ability to undertake offensive action

is one of the main distinguishing features of the winners of fights.

The contestants, who displayed higher offensive activeness, were not always successful attackers, and contestants characterized by lower offensive activeness were always penalized, which translated into points for their opponents.

The offensive activeness index may be used to evaluate the referees, in the context of cautions for passivity inflicted on contestants and possible *hantei* statements ending draws.

Competing interests

Author declares that does not have any financial or personal relationships with other people or organisations that could inappropriately influence paper.

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Cite this article as: Boguszewski D. Offensive activity as an element of the evaluation of struggle dynamics of judo contestants. Arch Budo 2014; 10: 101-106