

The effect of offensive and defensive actions on taekwondo sparring

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Summary

Introduction. The purpose of this study was to assess the performance of selected male (-71 kg) and female (-63 kg) taekwondo athletes competing under the rules of the International Taekwondo Federation (ITF) in terms of attacks, counter-attacks, fake attacks and fake counter-attacks.

Material and methods. Subjects were participants at the 2007 Polish ITF Taekwondo Championships. A Sony digital video camera (Digital 8) was employed as well as a hand notation system to tabulate the data. The Mann-Whitney U test was used to analyze the data.

Results. The winning male (ES = 0.404) and female (ES = 0.686) taekwondo athletes attacked more. There was no difference in the number of counter-attacks between successful and less successful taekwondo athletes in males (ES = 0.011) and females (ES = 0.097).

Conclusions. Future research should include the specific techniques that were used as well as those that scored most.

Introduction

Performance analysis in sports has been part of the athletes' training program for several decades as far as discrete movements are concerned in soccer [1] or physical demands by position in the same sport [2]. Sanderson [3] focused on (un)successful patterns of play in squash, while notational analysis in other racket sports was also performed [4,5]. More examples of sports where notational analysis has gained inroads include volleyball [6], water polo [7] as well as rowing and swimming [8].

Performance analysis in combat sports has mainly occurred in judo [9,10,11,12] with one of the earliest done by Matsumoto et al. [13]. Calmet et al. [14] sought to investigate the approach and grappling stages in beginning, intermediate and advanced male judo athletes. The authors reported that the frequency of attacks of experienced judo practitioners (67.4%) was lower than those of the beginners (80.0%) and intermediate counterparts (86.7%). Franchini et al. [15] investigated medal winners (super elite) and those who ranked 4th-7th (elite) in at least two judo world championships or Olympic Games between 1995 and 2001. The authors reported that the super elite group recorded more wins, while the men and women in the super elite group as well as the men in the elite group scored more points than the elite women.

Few performance analysis studies were carried out in karate. Koropanovsky et al. [16] revealed that the reverse

straight punch was the most often used technique at three European championships, followed by the roundhouse kick. He reported that the reverse straight punch was most frequently used at European and world championships. Laird and McLeod [17] arrived at the same conclusion when investigating tournaments in Europe. In comparing adults with children (12-13 years), Lapresa et al. [18] revealed that the latter preferred to use their left guards as opposed to the adults, who blocked equally as often with the right and left sides. No differences were found in kicks.

In taekwondo, research on notational analysis is in its beginning stages. Recent analyses were done by Kazemi and colleagues on full-contact taekwondo according to the rules of the World Taekwondo Federation (WTF). The dominant techniques were kicks, with a total absence of punches at the 2000 Olympic Games [19]. More details were provided by Kazemi et al. [20] on kicks and warnings incurred per weight category at the 2008 Olympic Games.

Notational analysis in taekwondo according to the rules of the International Taekwondo Federation (ITF) is likewise scarce. Wąsik and Ślęzak [21] found that in females competing in the over-70 kg weight division, the technique that was often successful in scoring points included the straight punch. The purpose of this study, therefore, was to assess the performance profile of selected male and female taekwondo athletes competing according to ITF rules.

Material and methods

The subjects were participants at the Polish ITF Taekwondo Championships in 2007 in Biała Podlaska. The study covered 12 sparring bouts in the men's weight category up to 71 kg and 7 in the women's weight category of up to 63 kg. These weight divisions comprised the largest number of competitors. Subjects signed an informed consent form after ethical approval was obtained from the Jan Długosz University, Częstochowa, Poland.

To record the frequencies, a Sony digital video camera (Digital 8) was employed as well as a hand notation system to tabulate the direct attacks, fake attacks, direct counter-attacks and fake counter-attacks. Direct attacks and counter-attacks are those that hit the target. Fake attacks and fake counter-attacks are those that are performed to distract the opponent's attention to create a better opportunity to score points.

Since data in performance analysis are typically discrete [22], the Mann-Whitney U test was used to determine the differences in attacks, intended attacks and counter-attacks between winners and non-winners within gender as well as between gender by performance (winning or losing). Logistic regression was employed [23] to assess the contribution of (intended) attacks and (intended) counter-attacks to performance. The level of significance for all analyses was set to an effect size of 0.20.

Results

There was a significant difference in the number of attacks by performance in both males (ES = 0.404) and females (ES = 0.686), i.e., winning male and female taekwondo athletes attacked more. Small differences were found in fake attacks by performance in both males (ES = 0.233) and females (ES = 0.234). Tables 1 (females) and 2 (males) show the totals of the various attacking modes by gender and performance.

There was no difference in the number of counter-attacks between successful and less successful taekwondo athletes in both males (ES = 0.011) and females (ES = 0.097). There was a small difference between successful and non-successful male taekwondo athletes in terms of fake counter-attacks (ES = 0.217). The less successful female taekwondo athletes performed more fake counter-attacks (ES = 1.234).

When collapsed over gender, those who won attacked more (ES = 0.372) and also performed fewer fake counter-attacks (ES = 0.554). Table 3 displays the totals collapsed over gender.

Logistic regression showed that for men, there was no association between (intended) attack, (intended) counter-attack and performance [$\chi^2 = 4.928$]. The odds ratio for the total regression analysis was 2.364 (60.42% correctly predicted).

In the women, however, there was a relationship: $\chi^2 = 38.727$. The odds ratios are shown in Table 4. There was a perfect classification of 100%.

Tab. 1. Total numbers, medians and inter-quartile ranges of (fake) attacks and (fake) counter-attacks by performance in female taekwondo athletes (-63 kg)

	Winners		Non-winners	
	Total	Median ± IR	Total	Median ± IR
Direct attack	57	4.0 ± 2.0	43	3.0 ± 2.0
Fake attack	34	3.0 ± 1.0	40	3.0 ± 2.0
Direct counter-attack	47	3.0 ± 1.0	44	3.0 ± 1.0
Fake counter-attack	6	0.0 ± 1.0	40	3.0 ± 1.0

Tab. 2. Total numbers, medians and inter-quartile ranges of (intended) attacks and (intended) counterattacks by performance in male taekwondo athletes (-71 kg)

	Winners		Non-winners	
	Total	Median ± IR	Total	Median ± IR
Direct attack	48	2.0 ± 1.5	36	1.5 ± 1.0
Fake attack	33	1.5 ± 1.0	39	2.0 ± 1.0
Direct counter-attack	35	1.0 ± 1.0	35	1.0 ± 1.0
Fake counter-attack	9	0.0 ± 1.0	14	0.5 ± 1.0

Tab. 3. Total numbers, medians and inter-quartile ranges of (intended) attacks and (intended) counterattacks by performance in male and female taekwondo athletes combined

	Winners		Non-winners	
	Total	Median ± IR	Total	Median ± IR
Direct attack	184	3.0 ± 2.0	79	2.0 ± 2.0
Fake attack	146	2.0 ± 1.0	79	2.0 ± 0.0
Direct counter-attack	161	2.0 ± 2.0	79	2.0 ± 2.0
Fake counter-attack	69	0.0 ± 1.0	54	1.0 ± 2.0

Tab. 4 Odds ratios of the logistic regression analysis of the women's matches

	Constant	Direct attack	Fake attack	Direct counter-attack	Fake counter-attack
Estimate	-6.44730	-5.03194	2.088	0.85967	10.56
OR (unit change)	0.00158	0.00653	8.072	2.36239	38672.46
OR (range)		0.00000	4246.206	31.14624	

Discussion

Based on the effect sizes, the attack played a larger role in the performance of the successful women compared to their male counterparts, while the number of fake counter-attacks was much more decisive in the less successful female taekwondo athletes. The importance of attacking was also reported in karate [16,24] and judo [12,25]. Those who won matches at the 2008 Olympic Games attacked more (55%) compared to those who did not win.

Koropanovski et al. [16] showed that male karate athletes attacked more, especially with punches, although recent rule changes may have led to more kicks being used than a decade ago. Among the arm techniques, the straight punch is favored, which the authors contributed to its shortest performance time. This line of reasoning, however, does not seem to hold for full-contact taekwondo, where kicks are mostly used [19]. Blažević et al. [26] also mentioned that Croatian karate athletes recorded faster punches than kicks, which was found in taekwondo as well [27].

In the only known study available on taekwondo according to ITF rules, Wąsik and Ślęzak [21] observed that the most commonly used technique was the punch followed by the roundhouse kick with the side kick coming in third. Those techniques that resulted in points included straight punches followed by the roundhouse and side kicks.

Matsushigue et al. [28] found the winners to perform fewer techniques, which were also lower in intensity in terms of heart

rate and lactate accumulation. Both males and females in full-contact taekwondo tend to use single leg attacks with women winning more points by counter-attacks [29]. The defensive fighting style in full-contact taekwondo was also characteristic of the 2008 Olympic Games [19].

The competitor's technical and tactical training management belongs to the coach's basic professional responsibilities [30]. It is suggested that combat sports tactics translates into sequences of particular movements, which are imposed on the opponent to facilitate a successful attack [31]. The current analysis shows that increasing the number of attacks and putting the opponent on the defensive reduces his or her efficiency. A thorough analysis of the sparring structure in taekwondo is suggested to facilitate improvements and individual approaches of training methods.

Conclusions

1. Competitors showing greater activity appear to become winners more frequently.
2. Taking into consideration different types of actions, the attack played a significant role in the performance of the successful women compared to their male counterparts,
3. The number of fake counter-attacks was much more decisive in the less successful female taekwondo athletes.
4. Research results point to the most essential elements that ought to be included in ITF taekwondo training.

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