

Judo Kumi-te Pattern and Technique Effectiveness Shifts after the 2013 International Judo Federation Rule Revision

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- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background & Study Aim: Breaking the opponent's grasp using both hands, failure to engage the opponent promptly at the outset of the match, and delaying the progression of the competition through evading the opponent's attempts at kumi-te all became prohibited under a 2013 rule revision. Violations of these rules result in a shido penalty. This rule revision will affect both the application frequency of kumi-te and competitors' technique selection and attack patterns. Previous studies have not explored the relationship between kumi-te and the effectiveness of throwing techniques in full. The aim of this study is to clarify the effect of kumi-te, with an emphasis on application frequency, on scored techniques through a comparative analysis of matches before and after the 2013 rule revision.

Material & Methods: Three hundred eighty six men's contests from the 2012 Grand Slam Tokyo and 2013 Grand Slam Paris were examined using All Japan Judo Federation DVDs. Data used in the analysis was taken only from techniques that were scored. The attack efficiency index formula introduced by Adam and a t-test were used in combination to conduct a comparative analysis of the contests.

Results: Techniques performed after three applications of kumi-te resulted in significantly higher attack efficiency indexes for 2013 competitions compared to those in 2012 ($p < 0.01$). Specifically, the attack efficiency index results were significantly higher in regards to combination, counter, and yoko-sutemi-waza tactics ($p < 0.05$, $p < 0.05$, $p < 0.01$, respectively).

Conclusions: Based on the results of this study, it is recommended that judo practitioners and their trainers develop new strategies that incorporate three applications of kumi-te. Furthermore, technique selection and tactical planning to counter anticipated changes in opponent's techniques after rule revisions are crucial to scoring in and winning contests.

Key words: combat sports • competition rules • tactical actions • attacking pattern • judo coaching • comparative analysis

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INTRODUCTION

Judo - Literally meaning “the way of gentleness” is a dynamic combat sport that demands both physical prowess and great mental discipline. Furthermore, Judo is commonly described as a fighting art, a spiritual discipline, a system of physical education, and a recreational activity [21].

Kumi-te - A judo standing technique that is performed by gripping the opponent's jacket or body part(s) with one or both hands before initiating an attack.

Shido - In current contest rules, two forms of penalties exist, *hansoku-make* and *shido*. *Hansoku-make* results in immediate disqualification from the match. *Shido* is less severe, with the competitor allowed for *shido* penalties before disqualification.

Kodokan - was founded in 1882 by Jigoro Kano, who was the *kodokan* judo instructor and an educator. *Kodokan* is the mecca for judo. The principles and aims of *kodokan* judo were expressed by two slogans: *Seiryoku Zenyo* (maximum efficient use of energy) and *Jita Kyoei* (Mutual prosperity for self and others) [22].

Kumi-te application frequency - Number of instances of a competitor grasping the opponent's judo jacket or body part(s) with one hand or both hands before initiating a scored attack. The following are examples of a three frequency application: left- right-left /left-right-right / left-left-right / left-left-left

Dan - Rank which indicates skill level. In judo, there are examinations for the ranks from the first-*dan* to the tenth *dan*, with the tenth *dan* being the highest.

Rally attack - an attacking pattern category, traditionally expressed as *go-no-sen* in Japanese. After warding off the opponent's ineffective attack, the opponent is immediately attacked before they can re-establish their defensive posture.

The official rules of **judo** were revised by the International Judo Federation (IJF) four times in the last decade. Specifically, these revisions were conducted in 2006, 2009, 2010, and 2013. According to the IJF, these revisions are aimed at making judo more dynamic and pursuant of traditional judo's goal of achieving *ippon* [1].

Nakamura noted the differences in the frequency of matches decided through a judgment of *ippon* between the 2008 Beijing and the 2012 London Olympic Games [2]. In the 2008 Beijing Olympics, both men and women were awarded *ippon* with a frequency of 51.3%, whereas in the 2012 Olympics, men attained *ippon* 42.9% of the time and women 44.0% of the time. This decrease occurred despite the major 2009 and 2010 rule revisions that limited competitors from directly attacking or blocking attacks using arms and hands below the belt.

The 2013 IJF rule revision completely prohibits competitors from attacking or defending below the belt using arms or hands. Furthermore, breaking the opponent's grip using both hands, failure to immediately engage the opponent, and delaying match progression through evasive techniques became prohibited, resulting in a *shido* for the offender.

Shishida states that Jigoro Kano, the founder of **Kodokan Judo**, envisioned a combination of close and distant proximity techniques resulting in an ideal sport [3]. Distant proximity techniques that have been performed often in recent contests, but will disappear completely due to the rule revisions, are as follows: *morote-gari*, *kibisu-gaeshi*, *tani-otoshi*, *kuchiki-taoshi*, and *sukui-nage*. The pursuit of a more dynamic sport through new competition regulations forces competitors to implement fundamental technical changes in order to score in contests.

Analysis of rule revision effects on match outcomes has been conducted numerous times in recent years, providing valuable information for judo managers and competitors [4-11]. Tamura et al. documented a significant increase in the frequency of attacks involving grasping the opponent's jacket sleeves and collar using both hands after the IJF 2009 rule revision by analysing and comparing data from 2008 and 2009 contests ($P < 0.001$) [4].

However, the relationship between *kumi-te application frequency* and attack efficacy has not been studied in full. Previous studies analyzing the single

variable of *kumi-te* application frequency to identify its influence on attack efficacy have been carried out [12-14]. However, it is possible that the design of these studies overestimated *kumi-te* application frequency's effect on attack efficacy, without taking into account significant related factors. Several variables related to *kumi-te* application frequency and attack efficacy were identified and analyzed in this study: *kumi-te* frequency itself, technique classes, specific techniques, and attacking patterns. A comparative analysis was done using competitions from before and after the 2013 rule revision.

Maekawa et al. created a rating scale enabling coaches and managers to determine skill level regardless of competition outcomes by querying top level Japanese university judo coaches on factors they use in participation selection for competitions [15]. This rating scale met specified standards of validity and reliability. Two of the factors identified in this study were the athlete's assertiveness in applying *kumi-te* and respective *kumi-te* style. Sanchez et al. clarify that handgrip strength of the different podium placement winners was statistically different in females ($p = 0.001$) but not in males ($p = 0.198$) among the 102 judokas (71 male and 31 female) in the 15 to 19 age class competing in the Junior Championship of Galicia 2008 in Spain [16].

Hirose et al. state that tactical manoeuvres aimed at gaining an advantage in *kumi-te* are important for increasing technique effectiveness and significantly influence competition outcomes [12]. Nakamura et al. analysed the relationship between locations on the opponent's wear where *kumi-te* were applied and winners' technical tactics in the World Judo Championship 2001 to assist in strategy-making for future international contests [13].

Our research's focus on *kumi-te* as a significant factor determining competition outcomes, specifically following IJF rule revisions, is widely supported by prior research performed on the topic. The aim of this study is to clarify the effects of *kumi-te*, with an emphasis on application frequency, on scored techniques through a comparative analysis of matches before and after the 2013 rule revision.

MATERIAL AND METHODS

Subjects

Three hundred eighty six men's contests from the 2012 Grand Slam Tokyo (154 valid) and the 2013 Grand Slam Paris (232 contests valid) were analysed using All Japan

Judo Federation DVDs. Because preliminary matches were not used in matches where bronze medals were awarded in the 2012 competition, the 2013 preliminary matches were eliminated from the analysis. Furthermore, one match from the 2013 competition was not recorded perfectly, and so was eliminated from the analysis.

Contests occurring two months apart were chosen in order to eliminate any extraneous variables. The 2013 competition was one month after the 2013 rule revision. Contest information is shown in Table 1.

Table 1. Contest information

	2012 Tokyo	2013 Paris
Dates	30.11-02.12.2012	04-05.02.2013
Cities	Tokyo (Japan)	Paris (France)
Countries	28	48
Contests	154	261
Participants	161	240

Reference: www.jjf.org

Analysts

Three analysts participated in this analysis. One of the analysts is “6th *dan*”, and the other two analysts are “7th *dan*”. All analysts are Certified Grade A referees by the Japan Judo Federation. Each analyst has at least 40 years of experience in Judo practice, and they are all currently active in judo instruction.

Procedure

Three hundred ninety six throwing techniques preceded by applications of *kumi-te* were analysed: 144 scored techniques from the 2012 contest and 252 scored techniques from the 2013 contest.

The three analysts categorized the data as follows: technical means and classification and attacking patterns (single, combination, counter, and **rally attack**). These were categorized based on to the regulations as defined by the *Kodokan* manual [17].

Scored throwing techniques preceded by instances of *kumi-te* were counted and the scores awarded, *ippon*, *waza-ari*, or *yuko*, were confirmed and recorded. Competitors' tactical manoeuvres were also confirmed unanimously by the analysts conducting the study.

Technique effectiveness, average scores awarded in each contest, and factors detailed in the following paragraph were analysed using an MS Excel software in relation to the Formula of Attack Efficiency Index (FAEI) developed by Adam:

$$FAEI = (5p \times YN + 7p \times WN + 10p \times IN) / CN$$

(YN=the number of *yuko*, WN=the number of *waza-ari*, IN=the number of *ippon*, CN=contest number) [18].

Comparisons in technique effectiveness were made between the two contests using the data from the resulting figures.

The following items from the 2012 and 2013 contests were analysed and compared.

The attack efficiency index was calculated.

The contest's *kumi-te* frequency was reported in terms of the attack efficiency index.

The *kumi-te* application frequency amongst the different attacking patterns was reported in terms of the attack efficiency index.

The specific techniques in which *kumi-te* were applied were divided into two broad categories (2≥Grips, 3≤Grips) and were analysed in terms of the attack efficiency index.

The five technical classes of throwing techniques in which *kumi-te* were applied were divided into two broad categories (2≥Grips, 3≤Grips) and were analysed in terms of the attack efficiency index.

Statistical Analysis

Welch's *t*-test was used to determine variations in the attack efficiency index of the five analysed items between the 2012 and 2013 contests. The statistical significance level was set at $p < 0.05$ for all analyses. Statistical Package for Social Science (SPSS) base 21.0 for Windows (IBM, San Jose, CA, USA) was used to compute the statistics [19].

RESULTS

The attack efficiency index increased from 7.03 to 7.81 between the 2012 and 2013 contests. However, this change was not statistically significant. The attack efficiency index significantly increased from 1.28 to 2.33 between the 2012 and 2013 contests in instances where *kumi-te* was applied three times ($p < 0.01$) (Figure 1).

Scored techniques preceded by three instances of *kumi-te* resulted in a significant increase in the attack efficiency index of combination and counter attacks: 0.10 to 0.38 between the 2012 and 2013 contests

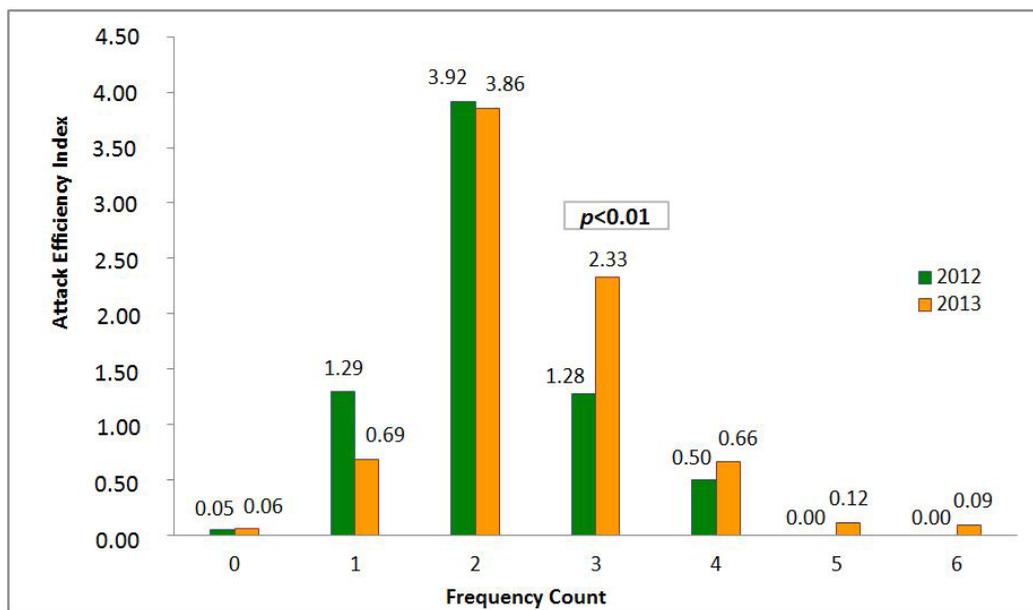


Figure 1. Kumi-te Application Frequency measured by AEI

($p < 0.05$), and from 0.21 to 0.63 between the 2012 and 2013 contests ($p < 0.05$), respectively (Table 2).

No significant difference existed in either the categories ($2 \geq \text{Grips}$, $3 \leq \text{Grips}$) based on the attack efficiency index of all scored techniques between the 2012 and 2013 contests (Tables 3 and 4). Data from table 3 illustrates that the four techniques, *kuchiki-taoshi*, *sasae-tsurikomi-ashi*, *tani-otoshi*, and *osoto-makikomi*, were awarded points in the 2012 competition but not in the 2013 competition in cases where *kumi-te* were applied zero to two times, whereas 14 techniques not awarded points in the 2012 contest, *seoi-otoshi*, *kouchi-gaeshi*, *uki-otoshi*, *osoto-gaeshi*, *osoto-otoshi*, *ashi-guruma*, *uchimata-gaeshi*, *utsuri-goshi*, *soto-makikomi*,

kouchi-makikomi, *uchi-mata-makikomi*, *yoko-otoshi*, *uchi-makikomi*, and *yoko-guruma* were confirmed as being awarded points in the 2013 contest.

The five scored techniques that were preceded by three to six applications of *kumi-te* in the 2012 contest, *sukui-nage*, *osoto-gaeshi*, *okuri-ashi-barai*, *harai-goshi*, and *yoko-guruma* did not garner points in the 2013 contest, whereas 16 non-scoring techniques from the 2012 contest, *tai-otoshi*, *hiza-guruma*, *barai-tsurikomi-ashi*, *harai-goshi-gaeshi*, *ashi-guruma*, *osoto-guruma*, *utsuri-goshi*, *o-goshi*, *koshi-guruma*, *ushiro-goshi*, *ura-nage*, *soto-makikomi*, *uchi-mata-makikomi*, *uchi-makikomi*, *osoto-makikomi*, and *harai-makikomi* were verified as being awarded points in the 2013 contest (Table 4).

Table 2. Comparison of Attacking Efficiency Index of Attacking Patterns based on Kumi-te Application Frequency

Gripping Frequency	Single		Combination		Counter		Rally	
	2012	2013	2012	2013	2012	2013	2012	2013
Total	4.48	4.23	0.95	1.53	1.14	1.55	0.46	0.50
0	0.05	0.04	0.00	0.02	0.00	0.00	0.00	0.00
1	0.70	0.33	0.18	0.19	0.38	0.17	0.03	0.00
2	2.55	2.29	0.68	0.76	0.41	0.64	0.29	0.17
3	0.83	1.04	0.10	0.38*	0.21	0.63*	0.14	0.28
4	0.36	0.41	0.00	0.13	0.14	0.06	0.00	0.06
5		0.07		0.00		0.04		0.00
6		0.04		0.05		0.00		0.00

* $p < 0.05$

Table 3. Comparison of Attack Efficiency Index (AEI) derived from Throwing Techniques and Gripping Frequency ($2 \geq$ Grips) Descending order of 2012 contest

Technical Classification	2012		2013	
	Techniques	AEI	Techniques	AEI
Te-waza (Hand techniques)	Seoi-nage	0.69	Seoi-nage	0.44
	Sukui-nage	0.22	Sukui-nage	0.04
	Kata-guruma	0.20	Kata-guruma	0.13
	Ippon-seoi-nage	0.19	ippon-seoi-nage	0.16
	Sumi-otoshi	0.14	Sumi-otoshi	0.06
	Tai-otoshi	0.14	Tai-otoshi	0.09
	Uchimata-sukashi	0.11	Uchimata-sukashi	0.03
	Kuchiki-taoshi	0.11	Kuchiki-taoshi	0.00
	Obi-tori-gaeshi	0.05	Obi-tori-gaeshi	0.04
	Seoi-otoshi	0.00	Seoi-otoshi	0.05
	Kouchi-gaeshi	0.00	Kouchi-gaeshi	0.04
	Uki-otoshi	0.00	Uki-otoshi	0.02
	Ashi-waza (Foot techniques)	Ouchi-gari	0.55	Ouchi-gari
Uchi-mata		0.49	Uchi-mata	0.76
Kosoto-gake		0.46	Kosoto-gake	0.32
Osoto-gari		0.25	Osoto-gari	0.19
Kosoto-gari		0.22	Kosoto-gari	0.11
Kouchi-gari		0.21	Kouchi-gari	0.18
Hiza-guruma		0.06	Hiza-guruma	0.06
Sasae-tsurikomi-ashi		0.05	Sasae-tsurikomi-ashi	0.00
Deashi-harai		0.03	Deashi-harai	0.04
Osoto-gaeshi		0.00	Osoto-gaeshi	0.12
Osoto-otoshi		0.00	Osoto-otoshi	0.10
Ashi-guruma		0.00	Ashi-guruma	0.03
Uchimata-gaeshi		0.00	Uchimata-gaeshi	0.02
Koshi-waza (Hip techniques)	Sode-tsurikomi-goshi	0.36	Sode-tsurikomi-goshi	0.30
	O-goshi	0.18	O-goshi	0.04
	Harai-goshi	0.11	Harai-goshi	0.03
	Utsri-goshi	0.00	Utsri-goshi	0.03
Ma-sutemi-waza (Rear-sacrifice techniques)	Ura-nage	0.11	Ura-nage	0.11
	Sumi-gaeshi	0.10	Sumi-gaeshi	0.06
	Tomoe-nage	0.03	Tomoe-nage	0.12
Yoko-sutemi-waza (side-sacrifice techniques)	Tani-otoshi	0.08	Tani-otoshi	0.00
	Osoto-makikomi	0.06	Osoto-makikomi	0.00
	Harai-makikomi	0.03	Harai-makikomi	0.12
	Soto-makikomi	0.00	Soto-makikomi	0.15
	Kouchi-makikomi	0.00	Kouchi-makikomi	0.09
	Uchi-mata-makikomi	0.00	Uchi-mata-makikomi	0.07
	Yoko-otoshi	0.00	Yoko-otoshi	0.05
	Uchi-makikomi	0.00	Uchi-makikomi	0.03
Yoko-guruma	0.00	Yoko-guruma	0.03	

Light grey shading indicates decrease in effectiveness between 2012 and 2013.

Dark grey shading indicates an increase in effectiveness between 2012 and 2013.

Table 4. Comparison of Attack Efficiency Index (AEI) derived from Throwing Techniques and Gripping Frequency (3≤Gripps) Descending order of 2012 contest

Technical Classification	2012		2013	
	Techniques	AEI	Techniques	AEI
Te-waza (Hand techniques)	Sukui-nage	0.08	Sukui-nage	0.00
	Sumi-otoshi	0.08	Sumi-otoshi	0.22
	Ippon-seoi-nage	0.06	Ippon-seoi-nage	0.20
	Kata-guruma	0.06	Kata-guruma	0.06
	Obi-tori-gaeshi	0.05	Obi-tori-gaeshi	0.02
	Seoi-nage	0.05	Seoi-nage	0.21
	Seoi-otoshi	0.05	Seoi-otoshi	0.02
	Tai-otoshi	0.00	Tai-otoshi	0.09
Ashi-waza (Foot techniques)	Uchi-mata	0.26	Uchi-mata	0.51
	Kouchi-gari	0.19	Kouchi-gari	0.03
	Osoto-gari	0.13	Osoto-gari	0.15
	Osoto-gaeshi	0.06	Osoto-gaeshi	0.00
	Okuri-ashi-harai	0.06	Okuri-ashi-harai	0.00
	Kosoto-gari	0.06	Kosoto-gari	0.04
	Deashi-harai	0.06	Deashi-harai	0.02
	Ouchi-gari	0.03	Ouchi-gari	0.21
	Ouchi-gaeshi	0.03	Ouchi-gaeshi	0.02
	Kosoto-gake	0.03	Kosoto-gake	0.12
	Hiza-guruma	0.00	Hiza-guruma	0.09
	Harai-tsurikomi-ashi	0.00	Harai-tsurikomi-ashi	0.05
	Harai-goshi-gaeshi	0.00	Harai-goshi-gaeshi	0.04
	Ashi-guruma	0.00	Ashi-guruma	0.03
	Osoto-guruma	0.00	Osoto-guruma	0.03
Koshi-waza (Hip techniques)	Sode-tsurikomi-goshi	0.13	Sode-tsurikomi-goshi	0.15
	Harai-goshi	0.06	Harai-goshi	0.00
	Utsuri-goshi	0.00	Utsuri-goshi	0.06
	O-goshi	0.00	O-goshi	0.05
	Koshi-guruma	0.00	Koshi-guruma	0.03
	Ushiro-goshi	0.00	Ushiro-goshi	0.02
Ma-sutemi-waza (Rear-sacrifice techniques)	Sumi-gaeshi	0.08	Sumi-gaeshi	0.21
	Tomoe-nage	0.05	Tomoe-nage	0.09
	Ura-nage	0.00	Ura-nage	0.04
Yoko-sutemi-waza (side-sacrifice techniques)	Yoko-guruma	0.06	Yoko-guruma	0.00
	Kouchi-makikomi	0.03	Kouchi-makikomi	0.09
	Soto-makikomi	0.00	Soto-makikomi	0.09
	Uchi-mata-makikomi	0.00	Uchi-mata-makikomi	0.07
	Uchi-makikomi	0.00	Uchi-makikomi	0.05
	Osoto-makikomi	0.00	Osoto-makikomi	0.03
	Harai-makikomi	0.00	Harai-makikomi	0.03

Light grey shading indicates decrease in effectiveness between 2012 and 2013.

Dark grey shading indicates an increase in effectiveness between 2012 and 2013.

DISCUSSION

When *kumi-te* were applied in the range of zero to two times in combination with a scored technique there was no significant difference in the attack efficiency index amongst the five technical classes between the 2012 and 2013 contests. However, *kumi-te* application ranging from three to six times resulted in a significant increase in the attack efficiency index of *yoko-sutemi-waza* between the 2012 and 2013 contests ($p < 0.01$) (Figures 2 and 3).

Under the new regulations, competitors are encouraged to grip the opponent's judo jacket above the belt quickly and aggressively while concurrently carrying out defensive techniques over a smaller area due to the ruling that prohibits grasping below the belt. This has resulted in offensive measures being thwarted due to the reduced area needing protection when defence is required, as evidenced by the insignificant increase

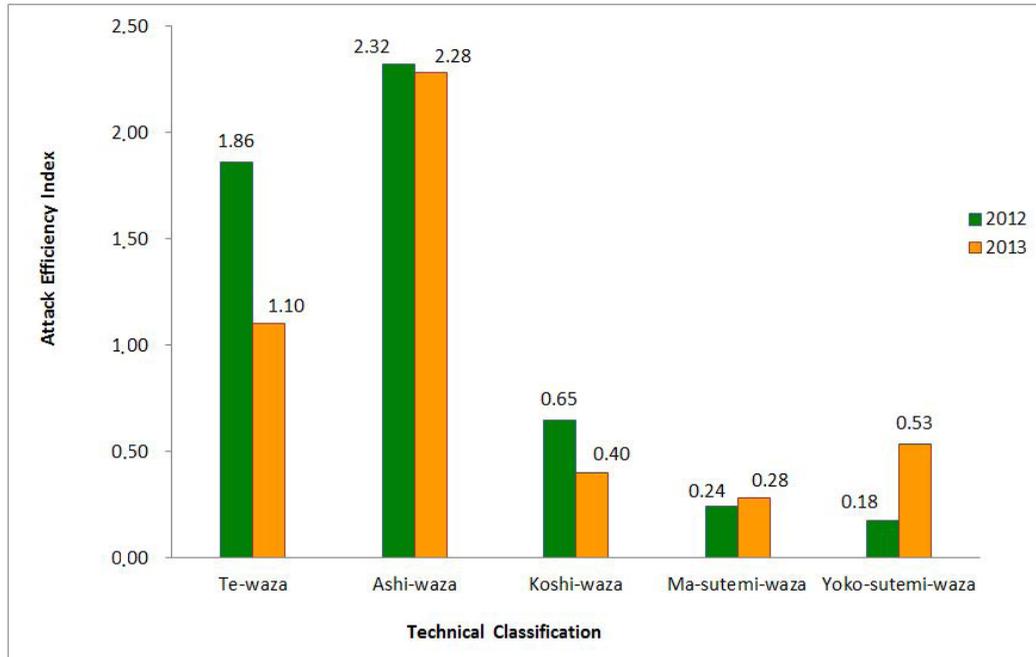


Figure2. Attack Efficiency Index by Technical Classification (2 ≥ G)

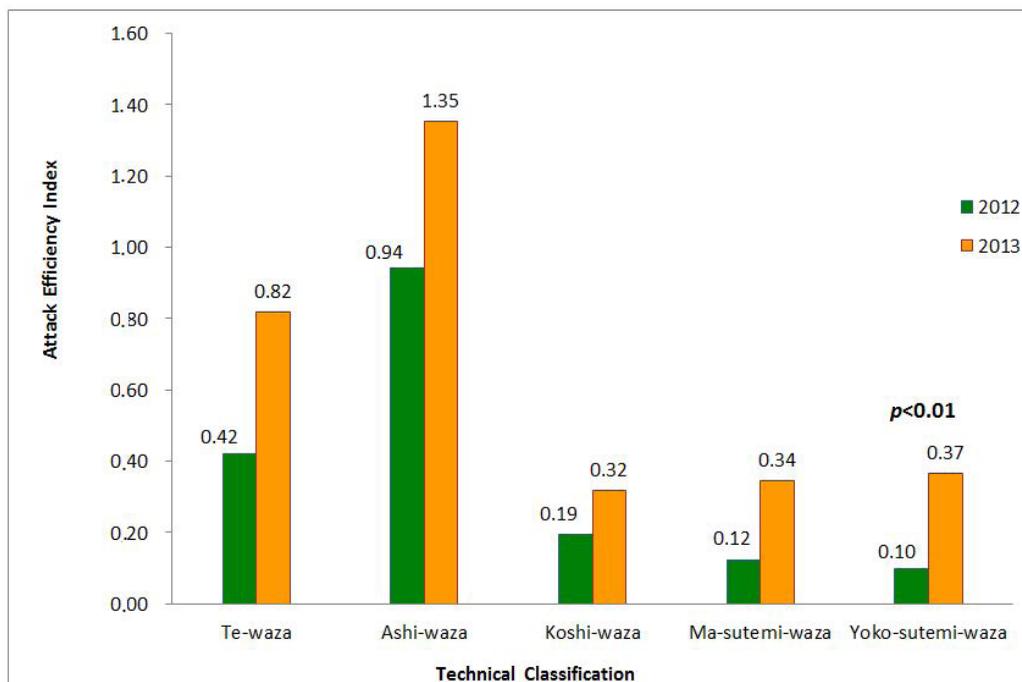


Figure3. Attack Efficiency Index by Technical Classification (3 ≤ G)

in the attack efficiency index. It was concluded that competitors developed effective defence techniques to compensate for the rule revision.

Our previous research on the effect of 2010 rule revision clarified that players continued to use hand techniques below the belt, even after the 2010 rule revision that prohibited direct attacks and defences with the use of hand techniques below the belt was introduced [20]. The current analysis affirms the theory that players promptly made strategies against the rule revision(s), and supports the assertion that players promptly responded to the rule revision(s).

The current study's results support the conclusion that competitors apply *kumi-te* a third time, surprising their opponents. This resulted in the significant increase in the attack efficiency index among techniques following three applications of *kumi-te* between the 2012 and the 2013 contests. Hirotsuki et al. state that rarely used combinations of *kumi-te* are most effective when combined with *ouchi-gari*, *osoto-gari*, *deashi-barai*, *kouchi-gari*, *uchi-mata*, and *kosoto-gari* [14]. Application of *kumi-te* in combination with *ashi-waza* is effective because it surprises the opponent. This supports the conclusion that the application of *kumi-te* three times before scored techniques produced a significant increase in the attack efficiency index.

Significant increases in the attack efficiency index of combination and counter attacks preceded by three applications of *kumi-te* were recorded between the 2012 and 2013 contests. The research suggests that competitors could maintain physical balance through applying *kumi-te* three times when engaging in counter or combination techniques, as these require rapid or automatic movement to earn points.

In terms of technical manoeuvres, the study confirmed the disappearance of nine techniques which were awarded points in the 2012 contests and not the 2013 contests, but noted the appearance of 30 scored techniques in the 2013 competition which went unscored in the 2012 competition, particularly in the frequency category ($2 \geq \text{Grip}$, $3 \leq \text{Grip}$). In summary, the rule revision did not result in a decreased number of technical manoeuvres. It was inferred that competitors shifted their strategies to incorporate technical manoeuvres to accommodate the rule revisions. In this instance, techniques that went unscored in the 2012 competition were effective in

the 2013 competition and vice versa. Specifically, the increase in the use of various techniques is a result of the prohibition of the use of counter attacks that utilize *kuchiki-taoshi* and *sukiu-nage*, which were effectively used before the 2013 rule revisions, as noted in previous research [20].

In terms of techniques, the attack efficiency index of the *yoko-sutemi-waza* category used with three to six applications of *kumi-te* significantly increased in the 2013 contests ($p < 0.01$). We concluded that the unconfirmed scored techniques in the 2012 contest, such as *uchi-makikomi*, *soto-makikomi*, *uchi-mata-makikomi*, *osoto-makikomi*, and *barai-makikomi* that were used as scored techniques in the 2013 contest, were a factor that caused a significant increase in the attack efficiency index.

CONCLUSION

This research suggests that it is necessary to develop new strategies that incorporate three applications of *kumi-te* into the competitors' manoeuvres. Furthermore, it is suggested that managers and competitors be aware of the rule revision's effects and prepare for them by addressing the likely disappearance of some techniques due to these revisions.

Limitations of the study include the inability to compare across the seven weight categories due to the lack of applicable samples. Future studies should include an increased research sample size to accommodate for this limitation. Furthermore, similar research accounting for differences between males and females, the effects of the rule revision on the attack efficiency index, and their respective insights into training and strategy adjustments is advisable.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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