

The Impact of Rules Changes on the Health of Taekwondo Athletes - a Different Approach

Pashalina Hatzopoulou¹, Katerina Papadimitriou¹, Ourania Matsouka¹, Anestis Giannakopoulos¹, Maria Athanasiou¹, Eftychia Evangelidou², Savvas Papadopoulos¹

Η Επίδραση της Αλλαγής των Κανονισμών στην Υγεία των Αθλητριών Taekwondo-μια Διαφορετική Προσέγγιση

Abstract at the end of the article

¹Department of Physical Education and Sport Science, Democritus University of Thrace

²RN, MSc, MHSc, PhD, PostDoc(c), Subdirector of Nursing Management, GHNI "Konstantopouleio-Patission"

Υποβλήθηκε: 4/03/2022
Επανυποβλήθηκε: 25/01/2023
Εγκρίθηκε: 05/04/2023

Corresponding author:

K. Papadimitriou
Department of Physical Education and Sport Science,
Democritus University of Thrace, Campus,
69150 Komotini, Rodopi, Greece
E-mail: kpapadim@phyed.duth.gr

Introduction: For a long time, Taekwondo rules were established with regard to current trends, the competitors' safety, and the organisation of spectacular events with good sportsmanship. The substantial revision of rules in 2009 was expected to bring about changes in the sport as well as the athletes' in-game behaviour. **Purpose:** The purpose of the present study was to analyse the attacking behaviour of female Taekwondo athletes, before and after the implementation of the aforementioned changes. The additional objective was to examine whether or not this change affected the safety of athletes. Thus, our sample comprised female athletes who participated in the 2008 and 2012 Olympics. **Material and Method:** The collection of data was conducted using the SportScout software and the following parameters were analysed: 1. Race (Olympic games 2008, Olympic games 2012), 2. Kick technique, 3. Turning kicks, 4. Point of the kick Techniques, 5. Scoring points, 6. Reaction of the opponent athlete, 7. Avoid the much (waiting time between kicks), 8. Tactic, 9. Objection of the coach. The data were analysed using the crosstabs statistical analysis. **Results:** According to the results, the athletes' in-game behaviour was affected considerably by the rule changes of 2009. Athletes became more competitive, increased dynamic hits ($p=.000$) and kicks to the head ($p=.000$). Also rule changes had a significant effect on number of points ($p=.001$), on opponent's defence ($p=.038$), on interval between kicks ($p=.000$) and on objections of the coach, ($p=.020$). **Conclusions:** None of these changes appeared to have a positive effect as far as the security-health of the athletes is concerned, as extra points were awarded to head kicks. Nevertheless, the sport experts proceeded with further Taekwondo regulation changes in 2015, thus raising more questions as to their ultimate objective.

Key-words: Athlete health, video-analysis, taekwondo competitive behavior

Introduction

Taekwondo is a dynamic sport that requires physical fitness and skill.^{1,2} A competing taekwondo athlete must possess muscular endurance and aerobic capacity, which is required during the entire match.³ As far as technical abilities are concerned, kicks are used by the athletes in both offensive and defensive moves.⁴

In Taekwondo, as in all sports, technical-tactical behaviour during a match is taken into account and points are deducted when athletes do not comply with the rules. The first rules were introduced in 1974 and since then they have been revised several times in accordance with factors such as current trends, the safety of the athletes, the need for hosting spectacular and sportsmanlike events, and in order to ensure fair play and also help taekwondo become an Olympic sport.^{5,6}

A review of taekwondo rules shows that the first major changes were proposed in 2009 and adopted in the Olympic Games of 2012. One of them was the use of electronic protector system vests complying with specific standards approved by the World Taekwondo Federation (WTF). The specific vest measures the force that is exerted by each kick to the opponent's torso.

This way, every successful kick is recorded immediately and the corresponding points are displayed on the scoreboard without any intervention-evaluation by the judges.⁷ Some other changes that were implemented are connected with specific attacks such as the punch to the trunk, which was not awarded any points prior to 2009, the turning kick (+1 point), the turning kick to the head (+1 point), as well as with the coach's right to challenge a decision during a match, etc.

These changes were designed in order to make the sport more spectacular by adding points to the attacks and putting more emphasis on the evaluation of the attack force being recorded through the electronic protector system. However, in 2015 further changes were implemented concerning the points awarded to kicks such as in the cases of turning kicks to the torso and kicks to the head with or without rotation. Moreover, additional electronic equipment that functioned by the same principles as the electronic protector system vest was added to the helmet and the feet.

The questions raised are: why were the rule changes of 2009, implemented in the Olympic Games of 2012, revised again in 2015 by the Federation? The inclusion of additional electronic equipment in order to improve kick assessment was expected. Nonetheless, have the additional kick points the expected impact on the dynamics of the athletes' competitive behaviour and consequently on the dynamics and the engaging aspect of the competitions?

Therefore, the purpose of the current study was to an-

alyse the attacking behaviour of top-level female Taekwondo athletes in competitions held after the 2009 rule changes. The additional objective was to examine whether or not this change affected the safety of athletes. The main research hypothesis was that these changes would have significant impact on the athletes' offensive competitive behaviour.

Methodology

Sample

The sample of the present study consisted of sixteen (16) women's +67 kg matches held in the Olympic Games of 2008 and 2012 (eight matches per competition, 1075 attacks in total). It should be mentioned here that it was not taken into account if the same female athletes participated in both competitions. The only criterion for the selection of the sample was that the matches under study were held both before and after the 2009 rule changes.

Measuring procedure

The matches of the sample were analysed with the use of an observation protocol that contained the following parameters:

1. Race (Olympic games 2008, Olympic games 2012).
2. Kick technique (paltum, Round Kick, counter Kick, back Kick, glaxe kick, side Kick, double paltum, pushing Kick, punch, turning kicks).
3. Turning kicks (yes, no).
4. Point of the kick Techniques (trunk, head).
5. Scoring points (1 point, 1+1 points, 2 points, 2+1 points, 3points, 3+1points, 4points, kick in the air, penalty).
6. Reaction of the opponent athlete (counterattack, combination of successful evasive technique and counterattack, body contact with the opponent athlete, closing, without reaction).
7. Avoid the much (waiting time between kicks).
8. Tactic (offence, defense).
9. Objection of the coach (yes, no).

The above parameters were entered into the Sport Scout software, which was used for the observation of the matches in the sample. To procedure for the collection of data was the following: the recording of data began every time an athlete started an attacking move and ended when the move was completed regardless of whether or not any points were awarded. In the cases when no points were awarded for a kick and the athlete continued her attack, every consequent kick was recorded as a separate attack. This resulted in the recording of 1075 attacks in total.

Statistical analysis

The Crosstabs analysis was used in order to test the

impact of rule changes on the athletes' in-game behaviour. Chi-Square was the criterion used in order to test the homogeneity and independence of variables. Moreover, the Fisher Exact Test was used when the expected value in one or more cells of the relevance tables was lower than 5. The statistical analysis was performed using the SPSS statistical software.

Results

Kicks

According to the results after the rule changes, the total number of kicks (irrespective of the technique used) increased from 41% to 59% (Figure 1).

Kick technique

Rule changes had a significant effect on kick technique (Chi-square₍₈₎=71.04, $p<0.001$). Table 1 shows that after the rule changes the largest increase occurred with kicks that included the "Punch" (from 5% to 95%), the "Roundhouse Kick" (from 12 to 88%), the "Glaxe kick" (from 17% to 83%), the "Side Kick" (from 31% to 69%), and the "Counter Kick" (from 33% to 67%).

Turning kicks

With regard to "turning kicks", it was found that the rule changes did not significantly affect their frequency of use (Chi-Square₍₁₎=.126, $p=0.722$). In particular, 44% of them were performed in matches before and 56% after the rule changes. Moreover, the percentage of kicks without rotational motion was 41% before and 59% accordingly (Table 1).

Point of the kick or punch

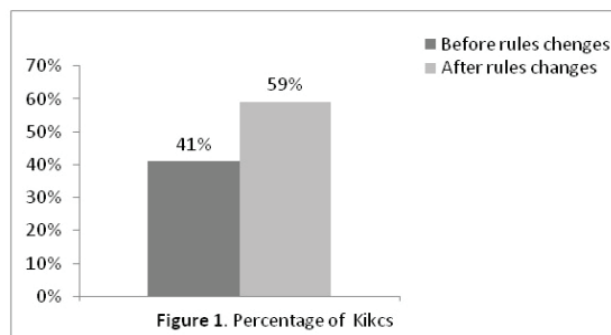
In contrast, rule changes had a significant effect on the point of kick (Chi-square₍₁₎=13.73, $p<0.001$). However, the most important change was found in the case of head kicks, which showed an increase from 27% to 73% (Table 1).

Scoring points

It was also found that the number of points was partially affected by the changes (Chi-square₍₁₎=22.77, $p<0.001$). As shown in Table 1, there was an increase in the cases of +1 point (from 42% to 58%) and +3 points (from 0% to 100%). However, there was also an increase in the percentage of non-scoring attacks from 40% to 61%.

Reaction of the opponent athlete

As far as the opponent's defence is concerned (Table 1), it was found that the percentage of "counterattacks" increased from 40% to 60%, of "Closing" from 35% to 65%, of "Combination of successful evasive technique and



counterattack" from 46% to 54%, while there was also an increase even in the "Without reaction" parameter from 37% to 63%. The only drop, as far as the type of defence was concerned, appeared in the case of "evasive technique and counterattack" (from 59% to 41%). As the value of Chi-Square₍₄₎ (=10.1, $p=0.038$) was statistically significant, the opponent's defence was affected by the rule changes.

Avoid the match

The interval between kicks was significantly affected by the rule changes (Chi-Square₍₄₎=147.11, $p=0.001$). More precisely, it dropped from 66% to 34% (Table 1).

Tactic

According to the results, there was no significant effect of the rule changes on the number of occurring attacks and defences in the observed matches (Chi-Square₍₁₎=6.43, $p=0.970$). More specifically, both attacking and defensive actions showed small upward trends (41% and 59% accordingly) after the introduction of rule changes (Table 1).

Objection of the coach

As far as objections of the coach are concerned, it was found that there was a rise between 10% and 90% following the implementation of rule changes (Figure 2). This significant increase was confirmed by the value of Chi-Square₍₂₎=7.83, $p=0.020$.

Discussion

As already mentioned, the purpose of the present study was to analyse the attacking behaviour of top-level female Taekwondo athletes through the analysis of matches played during the Olympic Games held in 2008 and 2012.

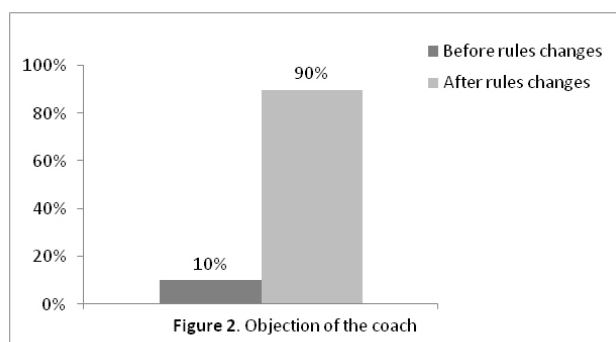
As expected, rule changes had a significant effect on the way the athletes in the sample competed. In general, there was an increase in attacking movements. However, when the technique of every single kick was

Table1. Categories of analysis and their parameters

Category	Parameters	Before rules changes	After rules changes
Body parts	Trunk	43%	57%
	Head	27%	73%
KickTechniques	Pal coup	47%	53%
	Roundhouse Kick	12%	88%
	Counter Kick	33%	67%
	Back Kick	44%	56%
	Glaxe kick	17%	83%
	Side Kick	31%	69%
	Double pal coup	49%	52%
Turning kicks	Pushing Kick	43%	57%
	Punch	5%	95%
	Yes	44%	56%
Point of the kick or punch	No	41%	59%
	Air kick	0%	0%
	1 point	42%	58%
	1+1 points	0%	100%
	2 points	71%	29%
Reaction of the opponent athlete	3 points	0%	100%
	Without point	46%	54%
	Penalty	52%	48%
	Counterattack	40%	60%
	Successful evasive technique	46%	54%
	Combination of successful evasive technique and counterattack	59%	41%
Avoid the much	Closing	35%	65%
	Without reaction	37%	63%
Tactic	Yes	66%	34%
	No	15%	85%
Tactic	Offence	41%	59%
	Defense	43%	59%

examined, it was found that in the period between the two Olympic Games of 2008 and 2012, the most significant increase occurred in the case of kicks to the head, namely the "Roundhouse Kick", the "Counter Kick" and the "Glaxe kick". In general, there was an increase in at-

tacking movements. However, when the technique of every single kick was examined, it was found that in the period between the two Olympic Games of 2008 and 2012, the most significant increase occurred in the case of kicks to the head, namely the "Roundhouse Kick", the



“Counter Kick” and the “Glaxe kick”. Moreover, there was also an increase in the case of the “Side Kick” to the torso, which had been mainly used to repel the opponent. Such an increase was expected due to the introduction of the electronic protector system that measured the force that is exerted by kicks in order to score points. Furthermore, as expected, the frequency of punches to the chest was also increased, as, due to the rule changes, it now scored points.⁷

With regard to turning kicks, it was found that they did not increase as expected in the 2012 Olympic Games, as even the “Back Kick” a turning kick to the torso, is awarded only +1 point according to the new regulations. It appears that the female athletes in the present study tended to use less complex attacks in order to preserve strength, since turning kicks are considered as high-intensity techniques requiring considerable ergophysiological response. High-intensity techniques, such as the “Back Kick”, may not be the best option in order to win a match.¹ In their study,⁷ analysed the technique and tactics employed in official Taekwondo competitions by young male and female athletes and found a higher frequency of back-leg kicks. This is considered reasonable as the specific technique requires a shift of the body weight in the direction of the kick, resulting in a more natural movement. By contrast, front-leg kicks required a backward shift of the body weight, opposite to the direction of the kick, which required greater effort by the athletes in order to perform the kick properly.

With regard to the area of kicks, it was found that there was an increase in no-turning kicks to the head. It appears that the athletes went for the +1 point awarded to this type of kick by the rule changes. Although this kick may be more spectacular, it increases the risk of head injuries, according to the according to researchers,⁹ suggested that the athletes and their trainers should be informed of the corresponding risk factors, so as to be aware of the short and long-term consequences of concussion on the athletes’ health. Moreover, they pointed out the need for improvement of the corresponding

rule, although, as established later, the specific issue had long been identified in studies such as the one performed during the 14th Taekwondo World Championship of 1999 by other researchers^{9,10,11} but there had been no attempt to alleviate the problem. Therefore, it could be argued that the new Taekwondo regulations were not adopted with the athlete’s safety in mind. On the contrary, awarding +1 point to head kicks increased their use by the female athletes. It could be argued that Taekwondo experts are not particularly concerned about the consequences caused by the rule changes, as according to the according to research studies¹³ there has been no significant increase in concussions since their implementation in 2009...!

The fact that, after the change in rules, the number of kicks as well as the final score increased does not necessarily mean that the behaviour demonstrated by the athletes was more offensive and less defensive. The female athletes’ behaviour in the 2000 Olympics is characterised as defensive as they used more defensive kicks.¹⁴ However, after the introduction of the rules in the 2012 Olympics, the interval between kicks decreased and the number of both offensive and defensive kicks increased accordingly. This could be attributed to the extra points awarded to certain kicks, thus motivating the athletes to be more competitive and aggressive.

This in-game behaviour, combined with the changes in points, contributed to higher final scores in matches. As a result, Taekwondo became more engaging as a sport, as both current and final score could change momentarily. It appears that the female athletes in the sample tried to perform quick kicks, knowing that even if they were far behind in score, they could now equalise, outscore or even defeat their opponent. This also affected their defensive behaviour in that they avoided more complex moves, such as ‘defence and counterattack’. Also, they reacted to the opponent’s attacks either assuming a “closed stance”, with “direct counterattack” or even by simply evading the attack. A possible reason that the athletes used the specific tactic was in order to maintain higher stamina levels.¹

Finally, as far as the objection parameter is concerned, it was one of the biggest rule changes. More specifically, prior to the implementation of the new rules, coaches could make objections only after the match was over with the outcome being uncertain. Objections made by the coach during a match can be now promptly reviewed by the referee. This encouraged the coaches to make more objections, as in the case of the 2012 Olympics, compared to the number of objections in the past which was exceptionally small, sometimes as low as zero, as in the 2008 Olympics. As a result, scoring would become more reliable and objective, without any

doubts raised on the part of athletes and coaches during or after the match.

Conclusion

It can be concluded from the present study that the 2009 rule changes appear to have resulted in more engaging matches (higher number of kicks, frequent changes in score, more offensive as well as defensive kicks) due to the introduction of electronic equipment, the recording of scoring kicks, but also the extra points awarded to certain kicks. Moreover, the athletes became more competitive and aggressive.

However, there were further changes in the regulations (awarding extra points to certain kicks and introducing additional electronic equipment) in the 2018 Olympic Games. It appears that changes were once again targeted towards more spectacular games and it remains to be seen which ones will affect the athletes' in-game behaviour compared to the Olympics of 2012. This is the next research question that could be answered by studying the matches held in the 2018 Olympic Games using the same observation protocol that appeared quite effective in the assessment of the matches in the present study.

ΠΕΡΙΛΗΨΗ

Η Επίδραση της Αλλαγής των Κανονισμών στην Υγεία των Αθλητριών Taekwondo-μία Διαφορετική Προσέγγιση

Πασχαλίνα Χατζοπούλου¹, Κατερίνα Παπαδημητρίου¹, Ουρανία Ματσούκα¹, Ανέστης Γιαννακόπουλος¹,
Μαρία Αθανασίου¹, Ευτυχία Ευαγγελίδου², Σάββας Παπαδόπουλος¹

¹Τμήμα Επιστήμης Φυσικής Αγωγής και Αθλητισμού, Δημοκρίτειο Πανεπιστήμιο Θράκης, Κομοτηνή, Ελλάδα
²RN, MSc, MHS, PhD, PostDoc(c), Υποδιευθύντρια Νοσηλευτικής Υπηρεσίας, ΓΝΝΙ «Κωνσταντοπούλειο-Πατησίων

Εισαγωγή: Από πολύ παλιά οι κανονισμοί στο Taekwondo θεσπίζονταν με γνώμονα τις τάσεις των εποχών, την ασφάλεια των αγωνιζομένων και τη διεξαγωγή θεαματικών αγώνων χωρίς αντιαθλητικές ενέργειες. Από την μεγαλύτερη τροποποίηση των κανονισμών, που έγινε το 2009, αναμενόταν αλλαγές στο άθλημα αλλά και στην αγωνιστική συμπεριφορά των αθλητών. **Σκοπός:** Να αναλύσει την επιθετική συμπεριφορά, αθλητριών του Taekwondo, πριν και μετά την τροποποίηση των κανονισμών του 2009. Επιμέρους στόχος ήταν να εξετάσει κατά πόσο αυτή η αλλαγή επηρέασε ή όχι την ασφάλεια των αθλητών. **Υλικό και Μέθοδος:** Μελετήθηκαν οι αθλήτριες που συμμετείχαν στους Ολυμπιακούς αγώνες του 2008 και 2012. Η συλλογή των δεδομένων έγινε με το λογισμικό SportsScout και αναλύθηκαν οι παράμετροι: 1. Αγώνες, 2. Τεχνική των λακτισμάτων, 3. Περιστροφικά λακτίσματα, 4. Σημείο λακτισμάτων ή της γροθιάς, 5. Αποτέλεσμα χτυπημάτων, 6. Αντίδραση της αντίπαλης αθλήτριας, 7. Αναμονή μεταξύ των χτυπημάτων, 8. Τακτική, 9. Ένσταση από τον προπονητή. Η στατιστική επεξεργασία των δεδομένων έγινε μέσω της ανάλυσης Cross-tabs. **Αποτελέσματα:** Διαπιστώθηκε ότι η αλλαγή των κανονισμών το 2009 επηρέασε στο μεγαλύτερο μέρος της την αγωνιστική συμπεριφορά των αθλητριών. Οι αθλήτριες έγιναν περισσότερο ανταγωνιστικές, αυξήθηκαν τα δυναμικά χτυπήματα ($p < 0,001$) και τα χτυπήματα στο κεφάλι ($p < 0,001$). Επίσης, η αλλαγή των κανονισμών επηρέασε σημαντικά τον αριθμό των πόντων ($p < 0,001$), την άμυνα του αντιπάλου ($p = 0,038$), τον χρόνο αναμονής μεταξύ των χτυπημάτων ($p < 0,001$) και τις ενστάσεις των διαιτητών, ($p = 0,020$). **Συμπεράσματα:** Δεν φάνηκε ότι κάποια τροποποίηση ενίσχυσε την ασφάλεια-υγεία των αθλητών μιας και δόθηκαν extra πόντοι στο χτύπημα στο κεφάλι. Παρ' όλα αυτά οι ειδικοί του αθλήματος προχώρησαν σε εκ νέου τροποποίηση των κανονισμών το 2015 γεγονός που θέτει επιπλέον ερωτήματα για το απώτερο στόχο των τροποποιήσεων στους κανονισμούς στο Taekwondo.

Λέξεις κλειδιά: Υγεία αθλητών, βίντεο-ανάλυση, αγωνιστική συμπεριφορά στο Taekwondo

✉ **Υπεύθυνος αλληλογραφίας:** Κατερίνα Παπαδημητρίου, Τμήμα Επιστήμης Φυσικής Αγωγής και Αθλητισμού, Δημοκρίτειο Πανεπιστήμιο Θράκης, Κομοτηνή, Ροδόπη, Ελλάδα, E-mail: krapadim@phyed.duth.gr

References

1. Matsushigue K, Hartmann K, Franchini E. Taekwondo: Physiological responses and match analysis. *Journal of Strength and Conditioning Research* 2009, 23, 4:1112-1117
2. Wheeler K, Nolan E, Ball, N. Can Anthropometric and Physiological Performance Measures Differentiate between Olympic Selected and Non-Selected Taekwondo Athletes? *International Journal of Sports Science and Engineering* 2012, 6, 3: 175-183
3. Mota GR., Magalhães, CG., De Azevedo, Lopes, CR., Castardeli, E., Barbosa, Marocolo, J.M., & Baldissera, V., (2011). Lactate Threshold in Taekwondo through Specific Tests. *Journal of Exercise Physiology, (online journal)*, 14, 60-66
4. Beis K, Pieter W, Abatzides G. Taekwondo techniques and competition characteristics involved in time-loss injuries. *Journal of Sports Science* 2007, 6, 2: 45-51
5. Bujak, Z, Miler J, Litwiniuk S. The level of technical training as a factor differentiating professional activities taekwondo coach. *Journal of Combat Sports and Martial Arts* 2012, 2 2:109-113
6. <https://etane.gr/taekwondo-regulations>
7. Fysentzidis M. Olympic Taekwondo, sport and art. Athens: Kyklos Publications 2009
8. Casolino E, Cortis C, Lupo C, Chiodo S, Minganti C, Capranica L. Physiological versus Psychological Evaluation in Taekwondo Elite Athletes. *International Journal of Sports Physiology and Performance* 2012, 7:322-331
9. Jae-Ok K, Voaklander D. Effects of Competition Rule Changes on the Incidence of Head Kicks and Possible Concussions in Taekwondo. *Clinical Journal of Sport Medicine* 2016, 26,3:239-44
10. Koh JO, Cassidy JD. Incidence study of head blows and concussions in competition taekwondo. *Clin J Sport Med.* 2004 Mar;14(2):72-9. doi: 10.1097/00042752-200403000-00004. PMID: 15014340
11. Pieter W, Fife GP, O'Sullivan DM. Competition injuries in taekwondo: a literature review and suggestions for prevention and surveillance. *Br J Sports Med.* 2012 Jun;46(7):485-91. doi: 10.1136/bjsports-2012-091011. PMID: 22661697
12. Thomas RE, Thomas BC, Vaska MM. Injuries in taekwondo: systematic review. *Phys Sportsmed.* 2017 Nov;45(4):372-390. doi: 10.1080/00913847.2017.1369193. Epub 2017 Sep 8. PMID: 28829198
13. Koh JO, Watkinson EJ. Video analysis of blows to the head and face at the 1999 World Taekwondo championships. *Journal of Sports Medicine and Physical Fitness* 2002, 42, 3:348-53
14. Kazemi M, Perri G, Soave D. A profile of 2008 Olympic Taekwondo competitors. *Journal of the Canadian Chiropractic Association* 2010, 54, 4:243-249