

# EFFECTS OF CHANGES OF BOXING RULES IN PERFORMANCES OF AMATEUR BOXERS BETWEEN TWO STATE CHAMPIONSHIPS OF BOSNIA AND HERZEGOVINA IN COMBATS OF DIFFERENT TIME FORMAT AND NUMBER OF ROUNDS

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## Abstract

Rules in boxing are important because they provide the same conditions to boxers to show their best performances at competitions. World Boxing Federation (AIBA) changed rules in duration of combat. Therefore since 1997, year rules 3x3 minutes altered to 5x2 minutes and in 1999, year 5x2 minutes altered to 4x2 minutes and since 2009, 4x2 minutes returned to 3x3 minutes. The aim of this paper is to determine effects of changes of boxing rules on performances of amateur boxers between two state championships of Bosnia and Herzegovina in boxing in 2007, year and in 2016, years. Notation analysis of performances of amateur boxers was used on sample of 80 combats of State Championship of Bosnia and Herzegovina 2016, year which lasted 4x2 minutes and on sample of 48 combats of State Championship of Bosnia and Herzegovina 2007, year which lasted 3x3 minutes. Results of Chi-square test showed that statistically significant changes occurred in variables of punches, basic defenses, advanced defenses and way of winning, while variables of tactic elements of boxing didn't show statistically significant changes. International Boxing Association (AIBA) decision of returning rules on 3x3 minutes was good decision for boxing because boxers can show their best technical and tactical qualities for bigger efficiency and reduce of injuries and therefore boxing is more interesting to watch. Results of this research can be useful for referee organizations, coaches and competitors in function of more efficient planning and programming training process and especially for boxing scientific community.

Key words: **combat sport, transformation, efficiency, analysis, male competitors**

## Introduction

Organization of boxing competitions under AIBA presents sport duel which is performed based on set of boxing rules of sport in broader sense while in more specific sense referees use these rules to regulate this process. There are two components in boxing and those are: competition and training and that process is regulated by rules which main role is to provide boxers the same conditions for achieving results at competitions with maximal protection of boxers, increase of attractiveness, improvement of understanding of viewers of certain changes in boxing. Because of this, rules are used as fundamental means which help coaches and competitors to achieve their goals during the competition. International Boxing Association (AIBA) in order to bring innovations in boxing, changed rules of duration of rounds. So in period from 1997.-1999, year, duration of

combat and rounds was 5x2 minutes and from 1999.-2009, year, number of rounds and duration of was altered to 4x2 minutes. The last change happened in 2009, year when number of rounds and duration of combat returned to the old format 3x3 minutes. One of the important longitude researches which was conducted was research by Bianco et al. (2013) on amateur boxers in last 59 years in which impact of changes of rules on type of recorded decisions and implications on health of boxer was determined. Based on that research it was concluded that modern amateur boxing is much safer for boxers in formats 3x3 rather than 5x2 and 4x2 minutes formats. Elimination of boxing helmet and throwing out electronic ranking to the old system of referees' decisions also contributes to this. The contest format for elite and 'open' class amateur boxers has

been altered from 4 x 2 minute rounds to 3 x 3 minute rounds (AIBA, 2008), which is likely to have had an impact on the boxers' activity patterns within rounds and the accompanying physiological responses. Indeed, heart rates recorded during competitive situations and blood lactate values recorded post-contest consistently demonstrate differences between the 4 x 2 and 3 x 3 minute formats (Ghosh, 2010; Smith, 2006). Davis, Wittekind and Beneke (2013) in 16 boxers, peak post bout blood [La] was  $11.8 \pm 1.6$  mmol/L irrespective of winning or losing. Post bout blood [La] suggests that boxers must be able to tolerate a lactate production rate of  $1.8 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$  and maintain skillful techniques at a sufficient activity rate. The activity profile of elite male amateur boxing has been discussed previously in the literature; each subsequent paper gives more insight and detail. Over the 4 x 2 minute format it was reported that Bosnian and Herzegovina male boxers used the lead straight punch and the lead hook to the head the most, representing 29% and 23%, respectively, of all attacking actions (Kapo et al., 2008).

Egyptian national level 3 x 3 minute male boxers threw 15 punches/min; winners had more lead- and rear-hand punches in round 3 and more straight, hook, and uppercut punches to the head in round 1 than the losers (unfortunately they do not specify lead or rear hand here) (Asker, 2011). It is suggested that for novice amateur male boxers to land punches in 3 x 3 minute bouts they must maintain a high frequency of lead-hand straight punches to the head, together with punching combinations (Davis, Wittekind, Beneke, 2013). However, that study found that regardless of landing punches, triple-punch combinations, even if they did not hit their target, had the highest probability of being scored by judges (Davis et al., 2015). The most recent study in this area reported that 3 x 3-minute male Olympic bouts consisted of  $\sim 1.3$  actions/s, comprising  $\sim 20$  punches,  $\sim 2.5$  defensive movements, and  $\sim 47$  vertical hip movements, all per minute, over 3 subsequent rounds lasting up to 252 seconds (Davis et al., 2015). At this level, unlike the novice boxers, rear-hand punches and the ability to increase punching accuracy over subsequent rounds were important for success. However, the study concluded that "technical discrimination between winners and losers at [the Olympic] level was difficult; outcome may be more dependent on which punch is 'lucky' enough to be scored by the judges or who 'appears' to be dominant on the day." (Davis et al., 2015, pg.56). The aim of this paper is to determine effects of changes of boxing rules on performances of amateur boxers between two state championships of Bosnia and Herzegovina in boxing in 2007.year where combat was performed in format 4x2 minutes and in 2016. year in format 3x3 minutes.

## Methods

### Sample subjects

Sample subjects of this research were n=80 combats from State Championship of Bosnia and Herzegovina in

2007.year and n=48 combats from State Championship of Bosnia and Herzegovina in 2016.year.

### Sample variables

Variables which were monitored as performances of amateur boxers at state championships of Bosnia and Herzegovina in boxing were:

Punches with hand: *Straight punch in head, straight punch to stomach, uppercut to head, uppercut to stomach, cross to head and cross to stomach.*

Basic defenses: *Blocking straight punch with hand, blocking uppercut, blocking cross with arm.*

Advanced defenses: *Avoidance, evasion and deflection*

Tactical elements of boxing: *offensive, defensive and combined*

Way of winning: *knock-out, referee's decision and injury*

### Procedures

All combats at National Championships of Bosnia and Herzegovina in 2007. & 2016.year, were recorded by video camera SONY HANDYCAM DCR- SR75. Two observers analyzed video records and they inserted all data into specially designed tables for registration performances of amateur boxers.

### Reliability

In order to determine the accuracy of the measurements, repeated measures (re-test) of intra-observers and inter-observers were used, who analysed all final fights from National Championships of Bosnia and Herzegovina in 2007. and 2016.year, under the same conditions and with the same equipment. After two weeks the same matches were reanalysed. Percentage error in measuring was calculated by comparing the data from the first measurement (V1) with the data from the second measurement taking into account all the three stages of analysed variables (V2) and using the equation (1) (Hughes, Cooper, & Nevill, 2004).  
Percentage error =  $(V1-V2) / (V\text{mean}) \times 100\%$  (1)  
Intra-observer percentage errors of reliability for National Championships of Bosnia and Herzegovina in 2007. and 2016.year ranged from 0.00% to 1.25%, and the inter-observers reliability for National Championships of Bosnia and Herzegovina in 2007. and 2016.year ranged from 0.00% to 3.18%, which is acceptable to 5%, which is the level of limiting error.

### Data analysis

Analyzed variables are shown in frequencies and percentage means. Chi-square test in the level of statistical significance of 0.01% and 0.05% was analyzed using SPSS 22.0 IBM Corporation, USA, is used for determination effects between two levels of competition with combats of different time format (Field, 2005). In order to determine the significance in the differences between the cells, standard residuals were calculated (*Std. Residual*).

## Results

Results of Chi-square test showed differences between performances of amateur boxers between two state championships in boxing in combats of different time formats. Differences in the level of statistical significance ( $p < .01$ ) occurred in variables of applied punches ( $\chi^2 = 343.7$ ,  $df = 5$ ,  $p < 0.00001$ ), basic defenses ( $\chi^2 = 291.9$ ,  $df = 2$ ,  $p < .00001$ ), advanced defenses ( $\chi^2 = 88.9$ ,  $df = 2$ ,  $p < .00001$ ). The way of winning is significant in level ( $p < .05$ ) of statistical significance ( $\chi^2 = 7.8$ ,  $df = 2$ ,  $p = .019$ ). Performances of amateur boxers in tactical elements didn't show existence of statistically significant differences ( $\chi^2 = 5.4$ ,  $df = 2$ ,  $p = .066$ ) between two state championships with different time format of combats.

Table 1. Performed punches at National championships of Bosnia and Herzegovina (NC B&H) in boxing

		NC B&H 2007. 4x2	NC B&H 2016. 3x3	Totals
Straight punch to the head	Frequency	2901	2629	5530
	%	44,4	53,5	48,3
	Std. Residual	-4.67	+5.41	
Straight punch to the stomach	Frequency	252	242	494
	%	3,9	4,9	4,3
	Std. Residual	-1.8	+2.08	
Uppercut to the head	Frequency	134	209	343
	%	2,0	4,3	3,0
	Std. Residual	-4.45	+5.14	
Uppercut to the stomach	Frequency	105	195	300
	%	1,6	4,0	2,6
	Std. Residual	-5.09	+5.89	
Cross to the head	Frequency	2791	1347	4138
	%	42,7	27,4	36,2
	Std. Residual	+8.69	-10.06	
Cross to the stomach	Frequency	354	292	646
	%	5,4	5,9	5,6
	Std. Residual	+4.6	+0.89	
Totals	Frequency	6537	4914	11451
	%	57,1	42,9	100,0

Table 2. Basic defenses

		NC B&H 2007. 4x2	NC B&H 2016. 3x3	Totals
Blocking straight punch with the arm	Frequency	169	1170	1339
	%	27,1	65,1	55,3
	Std. Residual	-9.45	+5.57	
Blocking uppercut with arm	Frequency	24	80	104
	%	3,8	4,4	4,3
	Std. Residual	-0.44	+0.26	
Blocking cross with arm	Frequency	431	548	979
	%	69,1	30,5	40,4
	Std. Residual	+11.26	-6.63	
Totals	Frequency	624	1798	2422
	%	25,8	74,2	100,0

Table 3. Advanced defenses

		NC B&H 2007 4x2	NC B&H 2016 3x3	Totals
Avoidance	Frequency	412	176	588
	%	25,5	45,2	29,3
	Std. Residual	-2.82	+5.75	
Escapes	Frequency	909	118	1027
	%	56,2	30,3	51,2
	Std. Residual	+2.81	-5.72	
Deflection	Frequency	295	95	390
	%	18,3	24,5	19,5
	Std. Residual	-1.09	+2.22	
Totals	Frequency	1616	389	2005
	%	80,6	19,4	100,0

Table 4. Tactical elements of boxing

		NC B&H 2007 4x2	NC B&H 2016 3x3	Totals
Offensive	Frequency	10	12	22
	%	12,5	25,0	17,2
	Std. Residual	-0.88	+1.13	
Defensive	Frequency	15	12	27
	%	18,8	25,0	21,1
	Std. Residual	-0.33	+0.43	
Combined	Frequency	55	24	79
	%	68,7	50,0	61,7
	Std. Residual	+0.8	-1.03	
Totals	Frequency	80	48	128
	%	62,5	37,5	100,0

Table 5. Way of winning

		NC B&H 2007 4x2	NC B&H 2016 3x3	Totals
Knock-out	Frequency	3	8	11
	%	7,5	33,3	17,2
	Std. Residual	-1.29	+1.66	
Referee's decision	Frequency	35	16	51
	%	87,5	66,7	79,7
	Std. Residual	+0.46	-0.6	
Injury	Frequency	2	0	2
	%	5,0	0,0	3,1
	Std. Residual	+0.67	-0.87	
Totals	Frequency	40	24	64
	%	62,5	37,5	100,0

## Discussion

Application of rules changes demands of general, basic and specific abilities and features which are necessary for successful training and competitive activities and therefore changes in planning and programming complete training process of an athlete, which gets more demanding every day. Correct application of rules and competitor's knowledge of them contribute to efficiency of training process and saves precious time on disputable situations which

became normal phenomenon in sport. Analyzing results of performed punches from two state championships in boxing (Table 1.) and based on results of standard residuals it is evident that there were positive changes in performed punches (straight punches and uppercuts) during the application of rule 3x3 minute format as oppose to 4x2 time format rule. However, application of cross to the head didn't lead to positive transformations and they stayed dominant in combats of 4x2 minute format. This points to the fact that competitors who fought by rules of 4x2 time format had bigger frequency of cross punches because of its technical features which were emphasized with bigger dynamics during the combat and shortening the distance which at the end resulted with this score of applied punches. Competitors who fought by 3x3 time format rules had dominant, fast, easy and précised straight punches with low energy consumption of a boxer. It is interesting that uppercuts had significant application in 3x3 time format rule than in 4x2 time format rule. This is most probably because they had enough room for adequate preparation of performance and the fact that uppercut is technically and tactically most demanding punch in boxing and based on these indicators it can be concluded that analyzed boxers of state championships of Bosnia and Herzegovina were technically very well prepared. There were no significant changes in application of cross to the stomach and the reason for this is that these punches are performed as feinting punches to the head and as punch in series of attacks on semi-distance. Apart from this, cross to the body is applied when boxer is certain that he will hit the aim and that he will finish the action to the opponent's body without consequences. Obtained results in this research are confirmed by research of El-Ashker (2011) which analyzed technical and tactical aspects of boxing matches which differentiate winners and losers and came to the conclusion that winners have better offensive technique of straight punch to the head or body, punches with lead or rear hand, combination of punches and defensive way of fighting in 3x3 time format. Effects of change of rules reflected positively on basic defense in boxing in two segments NC BI&H when applying 3x3 rule (NC B&H, 2016) in relation to 4x2 rule (NC B&H, 2007) (Table 2). The biggest application had defense, blocking straight punch with hand (Std.Rezidual. +5.57) which is part of basic defense.

Also, positive effects reflected on application of blocking uppercut with hand (Std.Rezidual. +0.26). However, change by rules 3x3 didn't occur in blocking cross with hand. They stayed dominant at competition in 2007. where combat lasted 4x2 minutes (Std.Rezidual. +11.26). These data concur with data form Table 1. which tells us that defenses were applied situationally and depending on punches which were dominant and which was caused by change of 3x3 minute rule. It contributed to the fact that dominant defenses were: blocking straight punch with the hand and blocking uppercut with the hand, and number of straight punches and uppercuts was bigger in 3x3 rule than in 4x2 rule (Std. Rezidual). In 4x2 rule there was big-

ger number of (Std. Rezidual) of performed cross punches which was caused by rule of decreasing time limit from 4x2 minutes where intensity of combat in semi-distance and close fight and punch and defense had better application of performance.

Results of change of rules in boxing reflected positively to the advanced defense in boxing in two segments of NC BI&H when applying 3x3 minute rule (NC B&H 2016) in relation to 4x2 minute rule (NC B&H 2007, Table 3.). Avoidance (Std.Rezidual. +5.75) and deflection (Std.Rezidual. +2.22) had more significant application in combats of 3x3 minutes format while escapes (Std.Rezidual. +2.81) stayed dominant in combats of 4x2 minute format. Application of avoidance in 3x3 minute format, from tactical aspect, were directed to forcing attack at semi-distance in terms of more active attack in contact with the opponent, by using technical segments of avoidance, which are useful for blocking cross punches, where boxers put themselves in good position and perform contra attack with their free arm.

Dominance of application of defense by deflection in 3x3 minute format was used by boxers in combats against straight punches to the head because defense is performed timely and correctly by deflection which enables boxers to put themselves in advantageous exit position to perform contra attack with return punch which occurred with application of 3x3 minute rule and forcing combats with straight punches. Dominance of defense by reflection (bending to the back) by the rule of 4x2 minute format, is shown because of the fact that return punches can be performed during the short-distance and semi-distance combats. All indicators from different segments of boxing combats, according to different rules, reflected on the final result and that is the way of winning (Table 5). In 3x3 minute combats there is bigger number of winnings by knock-out (Std.Rezidual. +1.66). Quality of boxing technique is emphasized through application of 3x3 minute rule because boxers can have quality preparation for attack from a distance by using straight punches and punches in series by using other technique elements which resulted with ending before regular end of combat. This also creates opportunity for efficient combat. Type of winning in which referees made final decisions in combats dominated in competitions of 4x2 format (Std.Rezidual. +0.46). Because of high intensity of exchange of punches in semi-distance and in short-distance where boxers couldn't use their most efficient technical-tactical advantages because of shortness of time, referees had dominant role in deciding the winner. Rules are important because they protect health of boxers. By applying the 3x3 rule there were no injuries of boxers in combats (Std.Rezidual - 0.87). This happened probably because fighters had better control during the combat which caused less injuries and better efficiency. Abandoning the combat because of injury happened in two cases, by application of the rule 4x2 minute format (Std. Rezidual. +0.67) because of bigger frequency of punches at semi-distance and clinching where fighters have con-

stant activity of higher intensity which resulted with uncontrolled punches and weaker defense due to tiredness. Obtained results of two state championships of Bosnia and Herzegovina with different time duration of combats point to justification of AIBA decision to change rules of duration and number of rounds in boxing. Results of this research are similar to the results of research of Kruszewski et al. (2016) who analyzed final combats of Olympic games in 2012. in London. Straight punches are most commonly used punches in relation to uppercuts and crosses while the most common way of defense is application of contra punches, which points to the conclusion that avoidance and deflection give opportunity of efficient contra attack. El-Ashker (2011) analyzed technical and tactical aspects of boxing matches which differentiate winners and losers and found out that winners have more developed offensive technique of straight punch to the head or body, punches with front and rear hand, combination of punches and defensive way of fighting in 3x3 minute matches in 33 rounds and that winning in boxing demands great effort of boxer to apply more efficient punches of than the opponent. Obtained results of this research are the same as the results of research of Hickey (2006); Blower, (2007) who determined that straight punch is the most efficient punch in boxing.

Davis, Wittekind and Beneke (2013) winners landed  $18 \pm 11$  more punches than losers by applying more lead-hand punches in round 1, total punches to the head ( $121.3 \pm 10.2$  vs  $96.0 \pm 9.8$ ), and block and counterpunch combinations ( $2.8 \pm 1.1$  vs.  $0.1 \pm 0.2$ ) over all 3 rounds and punching combinations ( $44.3 \pm 6.4$  vs  $28.8 \pm 6.7$ ) in rounds 1 and 3 (all  $P < .05$ ). The results suggest that landing punches requires the ability to maintain a high frequency of attacking movements, in particular the lead-hand straight punch to the head together with punching combinations. Defensive movements must initiate a counterattack.

All these indicators from state championships of B&H and from researchers which researched boxing by applying different rules, point to the fact that it is necessary to, according to 3x3 minute rule, develop straight punches and crosses of advanced defense, avoidance and deflection and improve application of uppercuts, basic defenses and advanced defenses of avoidance at training. Significance of this research is reflected in opportunity that coaches can apply obtained results in their work with younger boxers and to create quality assumptions for creation of complete boxers of senior rank.

## Conclusion

Obtained results of two National championships of Bosnia and Herzegovina in 2007.year and in 2016.year with different time duration of combats point to the justification of the decision of International Boxing Association (AIBA) to change rules of duration of combat and number

of rounds in boxing. Matches that lasted 4x2 minutes at National Championship of Bosnia and Herzegovina caused increase of intensity of combat through increased frequency of punches and reduce of quality of performances of technical-tactical elements with potential injuries and less attractive boxing for viewers. International Boxing Association (AIBA) returned to the old rule of 3x3 minute format, making good decision for boxing because boxers can show their best technical-tactical qualities with bigger efficiency and reduce of injuries and therefore boxing is more interesting to watch. Results of this research can be useful for referees' organizations, coaches and competitors at all levels of competition in function of more efficient planning and programming training process and especially for boxing scientific community, which has an obligation to help in creation of quality boxers.

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