



Contest coefficients of the elite judo athletes of Russia and Kyrgyzstan (less than 60 kg, 66 kg, 73 kg and 81 kg) from 2010 till 2015

Aleksander Osipov^{1,2,6}, Mikhail Kudryavtsev^{1,3,5,6}, Oleg Koptev⁷, Sergii Iermakov⁴, Valentina Bliznevskaya¹

¹Siberian Federal University, Russia

²Professor V.F. Voino-Yasenetsky Krasnoyarsk State Medical University, Russia

³Reshetnev Siberian State University of Science and Technology, Russia

⁴Gdansk University of Physical Education and Sports, Gdansk, Poland

⁵Krasnoyarsk State Pedagogical University of V.P. Astafyev, Russia

⁶The Siberian Law Institute of the Ministry of Internal Affairs of Russia, Russia

⁷Kirghiz-Russian Slavic University, Kirghizia

Corresponding author: Aleksander Osipov, Siberian Federal University, E-mail: ale44132272@yandex.ru

ABSTRACT:

Study aim. The specialists note that the latest changes in the rules of judo have a negative impact on the quality of competition between the athletes representing the Russian Federation and the CIS countries. In connection with this the goal of the research was to search for the objective and informative criteria for assessing the level of preparedness of the judoists in Russia and Kyrgyzstan for conducting competitive fights. Another purpose of the research was to analyze the readiness level of the elite judo athletes from Russia and Kyrgyzstan to conduct competitive attacking fight in conditions with the significant changes of the rules of judo competitions based on the selected criteria.

Methods. The total number of the judoists – n = 176. The athletes competed in categories less than 60, 66, 73 and up to 81 kg. The time period for the research is 6 years (from 2010 to 2015). The level of the athletes' readiness was determined by comparing the competitive coefficients (CC) of the judoists. The authors attribute to the significant CC of the number of won and lost technical actions, activity in a duel and time intervals between the attacking actions. CC values were determined by the method of analyzing the competitive judo matches. For the analysis, the specialists were involved: the high-level coaches and international judges – n = 16. The number of the studied judo competition – 4032.

Results. Comparative analysis of the CC showed that the athletes of all weight categories reliably (P <0.001) reduced the time interval between attacking actions in the matches. At the same time, the number and quality of Nage-waza technical actions of the athletes of the weight categories less than 60 and 66 kg were revealed. Data CC significantly (P <0.01) increased in judoka categories to 73 kg. Besides, the athletes less than 81 kg did not show significant changes in the Nage-waza quantity and quality factors. It should also be noted that the number of lost Nage-waza receptions of the athletes of categories less than 60 and 66 kg has been reduced. The authors suggested that the judoists of light weight categories formed a defensive style of conducting competitive matches on the whole. Moreover, this style is characterized by a reduction of the risk of attacking Nage-waza actions and an increase in the number of Ne-waza receptions. The most meet the requirements of the modern judo CC athletes



less than 73 kg. Consequently, the judoists less than 81 kg according to the majority of the CC have not significantly improved the quality of the competition during the research.

Conclusions. Furthermore, in view of the new rules of the IJF for conducting an active attack training of the judo wrestlers for competitive activities should be based on the CC athletes. CC wrestlers are determined by the method of the mathematical analysis of the competitive fights of the athletes for certain time periods. Increase and decrease of data CC is an informative indicator of the level of readiness of a judoka in a certain component of the competition. However, the analysis of the CC judoists of the combined teams of Russia and Kyrgyzstan showed that the athletes of weight categories less than 60, 66 and 81 kg formed a generally defensive style of fighting. Besides, this style is aimed at keeping the gained advantage through the false activity and increasing the technique of Ne-waza. The most adapted to the modern requirements of IJF were the athletes weighing up to 73 kg.

KEY WORDS: Judo; analysis of competitive matches; competitive coefficients (CC); weight categories: less than 60, 66, 73 and up to 81 kg; activity; changes in the rules of the IJF (International Judo Federation).

INTRODUCTION

The analysis of the content of the latest scientific publications about judo shows that the system of judo training for the competitive activities has a number of unresolved problems [1]. It is known that a serious system analysis of the whole period of the judoists' preparation is required to eliminate them. Moreover, the purpose of such an analysis is to identify and eliminate learning errors and identify the most effective means and methods of training athletes [2]. It is noted that the modern judo requires the athlete to attack simultaneously and defend against attacks of an opponent with full concentration of the attention [3]. There is a need to solve complex tactical tasks with a lack of time to think about the situation [4]. According to the trainers and scientists opinion Judo wrestling today requires the athletes optimal physical condition [5], a high level of tactical and technical [6] and psychological preparedness for the competitive matches [7, 8]. In the scientific literature various views about the methodology for training judoists for the competitive activities are presented. Below are some of today's methods of selection and training the athletes.

Currently, many coaches trying to increase the level of training of the judokas for the competitive matches saturate the training process with sparring (Randori).

However, the experts note that despite the similarity the physiological requirements for performing Randori are not as high as for real competitive fights [9]. The aim of the authors' research was to reveal a significant difference between the external intensity of the training load, the planned trainers and the internal intensity of the load perceived by judo [10]. Consequently, an increase in training time for Randori's performance can not guarantee that the athletes achieve an optimal level of preparedness for the intense competitive influences.

However, C. Casals argues that the modern curriculum and training programs should aim to increase the muscle mass and reduce fat in the body of the athletes [11]. E. Franchini notes that the elite athletes in judo are characterized by a low percentage of body fat and high anaerobic productivity [12]. According to G. Kuvačić, the success factors in modern judo are the ability to maneuver, coordination, muscular endurance and maximum strength [13]. According to some experts, a high level of coordination and balance together with the ability to maneuver is today, a significant factor in achieving professional success in judo [14]. It should be noted that with the growth of the weight category of the judoists and increase of the indicators of the maximum strength of the athletes with a simultaneous decrease in the ability to maneuver has been revealed [15]. Nowadays, the experts [16] note the dependence of the speed of movement on

body weight in judo. Since the weight of the athlete in judo is limited to a weight limit, an increase in the percentage of muscle mass can not be an effective way to achieve a result for the athletes of lightweight categories. At the same time, the judoists of heavy weight categories are also limited by the limits of categories in increasing muscle mass. Only heavyweight athletes can gain muscle mass without limits. Consequently, the increase in muscle strength is an important, but not the main factor in achieving success in the competitive activities. According to G. Lech, the excessive development of the muscular strength of the judoists will create certain difficulties in the development of the technique and tactical skill of the athletes [17]. It should be noted the weight loss factor before the competition [18]. The rapid weight loss has a negative impact primarily on the muscle strength of the athletes [19].

Recent studies of the judo specialists are aimed at finding the effective methods for quantifying the training and performance of the athletes [20]. It is believed that the availability of qualitative assessments will successfully simulate the process of long-term training of the judoists [21, 22, 23]. The specialists apply the method of forecasting already at the stage of selection of the young athletes in judo schools [24]. Some experts advise applying the method of assessing the anthropometric data of the young athletes [25, 26]. Other scientists argue that the excellence of the physical development can not serve as a guarantee of achieving high sports results in the early stages of selection and sports activities in the future [14]. W. Niedomagala recommends predicting the future achievements using test matches with peers [27]. Various variants of rating estimations of a level of readiness of this or that athlete are offered for use [28]. A number of the scientists propose the use in the training process of an information technology model for training the athletes. This technology makes it possible to reduce

significantly the training time of the athletes to technical techniques of judo [29]. Today, unfortunately, the experts have not come to a common opinion about the advantage of applying a certain rating or information technology in the process of training the elite judoka [30]. Various authors suggest using different technologies and methods for assessing the level of the athletes' preparedness [31, 32]. A large set of different data and criteria indicates the need for further scientific research in this direction.

Today, almost all major judo competitions: world championships, Europe, Asia and the Olympic Games are subjected to close analysis of the specialists. The nature of the struggle of the elite judokas [33], the level of tactical and technical training [34, 35] and the functional readiness of the athletes [36, 37] are studied. In recent years, the studies devoted to the study of the level of activity of the judo movements began to appear at various moments of the competitive matches [38, 39]. Time indicators of the athletes' movements without struggle [40], the struggle for capture, active struggle in the stance and the stalls [41, 42] are studied.

According to E. Franchini such a close study is promoted by quite significant changes in the rules of judo competitions held by the IJF since 2009 [43]. The specialists revealed that a change in the rules of judo competitions had significantly increased the number of judicial warnings (shido) in 2009. The time to fight before the punishment was also reduced by an average of 30 seconds. This led to a lot of shido in every competitive duel. This circumstance allows to the judges to exert a significant influence on the course of the fights [44]. The specialists explain the need for such significant changes in the rules of the competition to take care of the safety of the athletes and increase the level of the spectacle of the judo competitions [45]. To a large extent, the changes in the rules of the competition are negatively affected the sports results of the Russian judo team. If in

2008 and 2009 the Russian national team was one of the leading teams, so in 2010 the results of the Russian judoists decreased noticeably [46]. According to the experts, the Russian athletes were not fully prepared for the changes in the rules of judo [40, 47]. First of all, the athletes could not maintain a high level of motor activity during the entire competition match [48]. Increasing the level of competitiveness of the Russian athletes as well as the athletes of the post-Soviet space the authors of the article are directed. The authors of the article believe that the process of preparing the athletes for competitive activities should include an analysis of certain tactical and technical actions of the judoists. The qualitative and objective evaluation criteria are necessary for a full and detailed analysis of the judo activities in the competitive matches.

Besides, *the goal of the research* is to search for the objective criteria for assessing the level of preparedness of the elite judokas representing the combined teams of the Russian Federation and Kyrgyzstan to an active and attacking fight encouraged by the current IJF rules and analyzing the competitive struggle of the athletes under study on the basis of the proposed criteria.

METHODS

Participants.

The total number of the judoists is $n = 176$. Sports qualification of the wrestlers are 113 masters of sports of the Russian Federation and Kyrgyzstan, 52 masters of sports of the international category and 11 Honored masters of sports. The examined athletes competed in the weight categories less than 60, 66, 73 and 81 kg.

The quality of the fight and the level of preparedness of the athletes were assessed by the invited experts: highly skilled trainers and international judges. These specialists had considerable experience in judging competitions of national and international level and were well versed in the rules of the judo competitions. The number of experts are $n = 16$.

The total number of the competitive fights was 4032 matches. Just over one thousand matches were submitted to evaluate and meet the requirements for the reliability of the research in each weight category. The experts rated 1006 matches in the category of less than 60 kg, in the category up to 66 kg and, the number of experts evaluated by the experts amounted to 1,008 fights. 1011 fights were presented for the evaluation in the category of less than 73 kg. The experts rated 1007 matches in the category of up to 81 kg.

Organization of the study.

The study period was during 6 years from 2010 to 2015. The level of readiness for the competitive activity of a judoka was determined by the method of calculating and comparing the competitive coefficients (CC) of the athletes. Competitive coefficients are the average arithmetic meanings of certain tactical and technical actions of judo wrestlers in the competitive matches. An increase or decrease in the values of certain CCs will indicate an increase or decrease in the level of readiness of a judoka to the achievement-orientated competitive activity.

The basic competitive factors proposed by the authors of the article are presented in Table 1.

Table 1

A list of competitive factors (CC) used in the research

№	Contest ratio	General description
CC -1	The total number of technical actions of the athletes in the stand wrestling (Nage-waza)	The number of all technical actions of the judoists both successful and unsuccessful
CC -2	The total number of successful techniques in the stand wrestling (Nage-waza)	The number of successful (scored judges) technical actions of the judoists
CC -3	The total number of technical actions of the athletes in the groundwork (Ne-waza)	The number of all technical actions of the judoists both successful and unsuccessful
CC -4	The total number of successful techniques in the groundwork (Ne-waza)	The number of successful (scored judges) technical actions of the studied judoists
CC -5	The number of lost technical actions in the stand wrestling (Nage-waza)	The number of admissions by the athletes (scored judges)
CC -6	The number of lost technical actions in the groundwork (Ne-waza)	The number of admissions by the athletes (scored judges)
CC -7	The time interval between the attacking actions of the athletes both in the stand wrestling (Nage-waza) and groundwork (Ne-waza)	The intervals between attempts to conduct technical actions by the judoists

The method of structural analysis of the competitive judo matches was used to determine the values of the competitive coefficient (CC) and the overall assessment of the quality of the competition between the studied athletes. An analysis of competitive wrestling performances was conducted by studying the records of their fights. The quality of the competition was assessed. The time interval of the studies made it possible to evaluate each competitive duel by three experts. The opinion of the majority of the three experts was taken into account in determining the competitive coefficients.

Statistical analysis.

The processing of these studies was carried out using the licensed program SPSS20. The main indices of the descriptive statistics were calculated - the arithmetic middling, mean square deviation and the error of the mean quantity. A parametric t-test was used to assess the reliability of the differences of the mean quantity taking into account the size of the sample.

STATISTICAL RESULTS

The analysis of CC judokas conducted by the experts at the beginning of the research showed the presence of the significant differences in the values of certain CCs depending on the weight category of the athletes. The total number of technical actions of the Nage-waza athletes (CC-1) of the representatives of 3 weight categories up to 60, 66 and 81 kg was recorded by the experts approximately at the same level - 10.34 ± 0.31 attempts to hold moves per match. This coefficient of the judoists up to 73 kg is reliable ($P < 0.01$) less - 9.25 ± 0.41 attempts to conduct the technical actions. The number of the successful actions of the athletes in Nage-waza (CC-2) of the athletes of all weight categories has no significant differences. On average, the successful actions of the experts recognized 3 out of 10 moves in a duel. The number of the technical actions in Ne-waza (CC-3) in judo categories up to 60 and 73 kg is significantly ($P < 0.05$) more than for the athletes up to 66 kg and significantly ($P < 0.01$) more than the wrestlers of the category up to 81 kg. On average for the match, the athletes of the categories: up to 60 and 73 kg carry out one technical action of Ne-waza. The judoists of categories up to 66 and 81 kg according to the expert estimates spend on average only 0.67 ± 0.07 admissions less than one technical action per duel. The number of the

successful technical actions of Ne-waza (SK-4) of the athletes of categories up to 60, 66 and up to 73 kg does not differ significantly and makes an average of 0.51 ± 0.05 admission per match. This coefficient is reliable ($P < 0.01$) for the judoists up to 81 kg and is on the average 0.21 ± 0.07 admissions per duel.

The number of technical actions lost by the athletes in Nage-waza (CC-5) among the athletes of all weight categories was approximately at the same level. On average, for one duel, the athletes lost 2.89 ± 0.06 technical actions per match. The number of technical actions lost in Ne-waza (SK-6) in weight classes up to 60 and 81 kg

significantly ($P < 0.01$) differed from the performance of the athletes in categories up to 66 and 73 kg. In general, the figures of missed moves of the judoists of all categories were low in Ne-waza and less than one move per duel.

The time interval between the attempts to hold moves (CC-7) of the athletes of all weight categories was approximately the same. On average, the time interval between the attempts to conduct technical techniques was 45.53 ± 2.14 seconds. The basic data on the competitive coefficients of the athletes during the beginning of the studies are presented in Table 2.

Table 2

The data of the competitive judo ratios at the beginning of the research (2010)

Contest ratios	2010 year			
	60 kg	66 kg	73 kg	81 kg
CC- 1	10.34±0.31	10.41±0.36	9.25±0.41**	10.26±0.24
CC - 2	3.46±0.36	3.44±0.12	3.27±0.24	3.48±0.21
CC - 3	1.09±0.07	0.82±0.05*	1.08±0.08	0.52±0.09**
CC - 4	0.48±0.04	0.52±0.06	0.53±0.05	0.21±0.07**
CC - 5	2.93±0.08	2.87±0.12	2.94±0.20	2.84±0.16
CC - 6	0.17±0.03**	0.44±0.05	0.42±0.05	0.16±0.03**
CC - 7	44.86±2.45	44.16±1.64	45.28±2.01	45.23±1.96

Note. * - $P < 0.05$; ** - $P < 0.01$.

At the end of the research period, an expert analysis of the competitive coefficients allowed to determine a number of significant differences between the judoists of different weight categories. So CC-1 of the athletes' categories up to 60 and 66 kg was significantly ($P < 0.01$) less than for the athletes of the category up to 81 kg. The highest rates of this coefficient were found for the judoists less than 73 kg. CC-1 of the athletes of this category was significantly ($P < 0.001$) higher than the athletes categories less than 60 and 66 kg and significantly ($P < 0.01$) higher than the athletes category less than 81 kg. CC -2 indicators for weight category athletes up to 60 and 81 kg do not differ significantly. On average, the athletes of these weight categories perform 3.42 ± 0.23 successful

technical actions for the duel. The athletes of the category less than 73 kg revealed the highest rates of CC-2. On average for a match, the athletes of this category perform 4.58 ± 0.17 successful technical actions per match. This value is reliably ($P < 0.01$) higher than the indices of the athletes of other weight categories. CC-2 of the judo categories less than 66 kg was significantly ($P < 0.01$) less than the athletes of other categories. On average, for one fight, the athletes of this weight category perform only 2.29 ± 0.15 successful technical actions. The number of the wrestlers conducted in Ne-waza among the judoists in the weight categories less than 60 and 73 kg did not differ significantly. On average, the wrestlers of weight categories performed 1.40 ± 0.07 admissions during a

competitive match. The value of CC-3 less than 66 and 81 kg had no significant difference at judo categories but was significantly ($P < 0.01$) less than that of other categories of the athletes. On average, the athletes in the categories up to 66 and 81 kg took part in the groundwork only 0.80 ± 0.07 admissions per match. CC-4 indicators are approximately the same for the judoists of three weight categories: less than 60, 73 and 81 kg. Only the athletes less than 66 kg demonstrated significantly less ($P < 0.05$) successful exercises in Ne-waza. The experts noted that the values of CC-4 are low for the judoists of all weight classes under study.

The expert assessments of CC-5 were different for the athletes of all weight categories. The highest judgments were judoka categories up to 66 kg. On average, these athletes lose 1.57 ± 0.12 admissions in Nage-waza for the duel. The wrestlers of the weight category up to 60 kg on average lose 1.92 ± 0.14 moves which is significant ($P < 0.05$) more. The athletes of the weight category less than 73 kg lose in the stand wrestling 2.50 ± 0.12 technical actions per match. This indicator is reliably ($P < 0.01$) higher than that of the wrestlers of light weight categories. The worst result of CC-5 was found for the athletes less than 81 kg.

These athletes lose during the match 2.82 ± 0.30 admissions. This value is reliably ($P < 0.05$) more than the wrestlers of the category up to 73 kg. The values of CC-6 of the athletes of all categories did not show significant differences. On average, the judoists lose 0.23 ± 0.04 technical actions in Ne-waza for a duel.

The time intervals between the attacking actions of the athletes were approximately the same in judo categories less than 60 and 73 kg in a duel. On average, the time between attacking actions for the athletes of these categories is 29.31 ± 1.04 seconds. The wrestlers of the weight category up to 81 kg has the CC-7 index which is 32.55 ± 0.83 seconds which is significantly ($P < 0.01$) higher than the interval between the athletes attacks of the categories less than 60 and 73 kg. The greatest value of CC-7 was found for the wrestlers of the category less than 66 kg. The interval between attacking actions for the athletes of this category is an average of 34.48 ± 1.14 seconds. This value is reliable ($P < 0.01$) higher than the similar values of CC-7 of the judoists of other categories. The basic data of the athletes' competitive rates during the completion period are presented in Table 3.

Table 3

The data on competitive judo ratios at the end of the studies

Contest ratios	2015 year			
	60 kg	66 kg	73 kg	81 kg
CC - 1	9.65±0.28	9.43±0.34	12.17±0.29***	10.36±0.33**
CC - 2	3.38±0.25	2.29±0.15**	4.58±0.17**	3.45±0.20
CC - 3	1.38±0.08	0.83±0.07**	1.41±0.09	0.76±0.06**
CC - 4	0.62±0.06	0.21±0.05*	0.67±0.07	0.58±0.06
CC - 5	1.92±0.14*	1.57±0.12	2.50±0.12**	2.82±0.30**
CC - 6	0.23±0.04	0.22±0.05	0.24±0.03	0.22±0.04
CC - 7	29.19±0.89	34.48±1.14**	29.43±0.66	32.55±0.83**

Note. * - $P < 0.05$; ** - $P < 0.01$; *** - $P < 0.001$.

Comparison of the competitive coefficients of the athletes under study shows that the significant changes have taken place in the competitive struggle of

the judoists. In the weight category less than 60 kg the total number of the technical methods used by the athletes has decreased significantly ($P < 0.01$) during the

competitive match. The number of successful Nage-waza moves also decreased but insignificantly from 3.46 ± 0.36 to 3.38 ± 0.25 moves. Significantly ($P < 0.01$) the total number of technical actions in the stand wrestling (Ne-waza) increased from 1.09 ± 0.07 to 1.38 ± 0.08 moves. CC-4 athletes weight category less than 60 kg significantly ($P < 0.05$) increased from 0.48 ± 0.04 to 0.62 ± 0.06 moves. Reliably ($P < 0.01$) the number of lost technical actions of Nage-waza was reduced. The number of Ne-waza technical actions lost by the wrestlers increased slightly. A significant ($P < 0.001$) decrease in the time interval between the attempts to conduct attacking judo actions in the competitive matches was revealed. The athletes in the weight category less than 60 kg began to conduct the attacking actions on average 15 seconds faster than at the beginning of the research period.

Besides, in the weight category less than 66 kg the experts revealed a significant ($P < 0.01$) decrease in the total number of technical actions performed by the athletes in a competitive duel. Reliably ($P < 0.01$) the number of successful technical actions of wrestlers of this weight category in stand wrestling decreased from 3.44 ± 0.12 to 2.29 ± 0.15 moves. The total number of moves performed by the wrestlers in the stand wrestling of Ne-waza for the period of research has not undergone significant changes. The number of successful Ne-waza receptions during the study period is significantly ($P < 0.01$) decreased. CC-5 of the wrestlers less than 66 kg has changed significantly. On average, for the match, the athletes began to lose technical actions Nage-waza much less from 2.87 ± 0.12 to 1.57 ± 0.12 moves. Indicators of CC-6 of the wrestlers also significantly ($P < 0.01$) decreased. The loss of Ne-waza fell from 0.44 ± 0.05 to 0.22 ± 0.05 on average per duel. The time interval between the attacking actions significantly ($P < 0.001$) decreased from 44.16 ± 1.64 to 34.48 ± 1.14 seconds.

However, the analysis of the competitive judo ratios in the category less than 73 kg showed that the athletes significantly ($P < 0.01$) increased the number of technical actions performed in each match. On average, the number of moves increased from 9.25 ± 0.41 to 12.17 ± 0.29 actions. CC-2 of the athletes also significantly ($P < 0.01$) increased from 3.27 ± 0.24 to 4.58 ± 0.17 administration. The number of technical actions Ne-waza of the athletes significantly ($P < 0.05$) increased. The success of Ne-waza's actions increased slightly but the differences of the coefficients were not recognized as significant. CC-5 of the athletes of this category significantly ($P < 0.01$) decreased. CC-6 at the end of the study also proved to be reliably ($P < 0.01$) lower than at the beginning of the study. The time between the attacking actions of the athletes significantly ($P < 0.001$) decreased on average from 45.28 ± 2.01 to 29.43 ± 0.66 seconds.

Consequently, in the weight category less than 81 kg a slight increase in the total number of the technical actions of the judoists was revealed, however, insignificant. CC-2 in athletes of this category slightly decreased. The total number of Ne-waza competitive technique of the athletes was significantly increased ($P < 0.05$). The success of the actions of Ne-waza of the wrestlers of this category is significant ($P < 0.01$) increased. CC-5 of the judoists less than 81 kg did not undergo significant changes. The loss of Ne-waza of these athletes increased, however, the experts did not find the difference of the coefficients significant. The time interval between the attacking actions of the athletes significantly ($P < 0.001$) decreased. The average time between the attacks was 32 seconds compared with 45 seconds at the beginning of the study period.

Subsequently, the experts noted that during the time of the research the athletes made an attempt to adapt to the requirement of the judges for conducting an active attack during the whole match. A significant

decrease in the time intervals between the attempts to attack the athletes of all the studied categories has been revealed. The data on the change of the CC-7 - the main

indicator of the determination of the athlete's activity in modern judo for the period of research are presented in Figure 1.

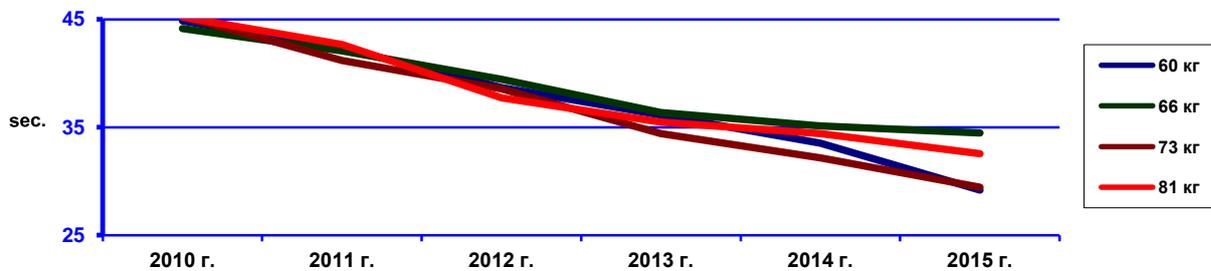


Figure 1. Dynamics of changes in the CC-7 for the study period

DISCUSSION

At the same time the experts are the specialists and judo trainers who recommend paying attention to the problem of the qualitative assessment and detailed analysis of the competitive judo matches with mandatory use of various technical and tactical indicators of the athletes [20]. A number of the experts advise the use of the results of physical [31] and special tests [49, 50] in conjunction with the level of the activity in competitive matches for the expert evaluation of the level of technical and tactical preparedness of the athletes [39, 51]. In our opinion, the results of various physical and special tests may not provide completely objective data on the level of readiness of a judoka to a competitive struggle. This especially applies to the judoists of light and heavy weight categories limited by the limits of the body weight in the development of certain physical qualities and abilities [16]. Moreover, in the period of close proximity to the important competitions many athletes reduce their weight which negatively affects the physical profile of the judoists [52, 53]. We can note a significant degree of influence on the competitive results of recent changes in the rules of the IJF [43] allowing the judges to exert a significant influence on the course and outcome of the

duels. Under these conditions, one of the main criteria for achieving success at the competitions will be the level of the activity of the judoists [54]. The authors of the article draw their attention to the possibility of using certain competitive coefficients (CC) in the process of training the elite judoists which allows evaluating objectively the degree of readiness of the athletes to conduct competitive and active struggle in high-level competitions [40].

Moreover, the majority of the specialists pay their attention to the need to increase the total number of the attacks in competitive matches and to increase the effectiveness of the performed methods like Nage-waza and Ne-waza in most judokas [37]. According to the experts, in modern judo, the success of an athlete in competitive activities can bring only a significant number of attacking technical actions more than the opponents [3, 48]. It was revealed that high rates of motor abilities that determine the level of motor activity of the athletes during the fights are significantly correlated with the level of the athletic skill and sporting achievements of the judoists [55]. Unfortunately, the scientific research of the Russian scientists has revealed a significant shortage of works devoted to the study of the level of motor activity of the Russian judokas in the competitive matches. The components of

training the athletes are insufficiently studied for conducting the competitive fights taking into account the requirements of the judges for the activity of the struggle [56]. The activity of the athletes during the match is today the main criterion for determining the winner for the judges. D. Boguszewski suggests the introduction of a new element for assessing the quality of competitiveness of the judoists for assessing the measurement of the dynamics of the actions of the athletes during the duel - an offensive activity and using it along with other evaluation criteria. In the opinion of this expert, the overall assessment of the dynamics of combat operations in judo matches is determined by the indicators of offensive activity, the effectiveness of attacking and defensive actions and counterattacks [51]. The authors of the article generally agree with these criteria for assessing the dynamics of the competitive fights but they propose to supplement their data with analysis of the relationship between all the technical actions of the athletes' successful and lost techniques. Also, according to the authors of the article, the specialists - trainers and athletes should always take into account the ratio of time intervals between the actual attacking actions of the athletes in competitive matches. D. Boguszewski also notes that in matches of the elite judoists the greatest combat effectiveness - the optimal combination of effective attacking and counterattacking actions was revealed in the fourth minute of the match and the lowest level of combat effectiveness was revealed in the first minute. The research of the authors of the article shows that the level of activity of the judo players except for the first minute of the match is quite high throughout the match. The combat effectiveness of the athletes increases in the second minute of the match and is at a high level for three minutes. Only in the last minute of the match the level of activity of the judoists is reduced due to the fatigue of the wrestlers and the action of tactical

schemes aimed at retaining the advantage of the winning athlete.

According to the latest scientific studies of M. Adam and K. Sterkowicz-Przybycień devoted to the competitive activity of the elite judoists allow to the specialists to declare the advantage of the Japanese judoists over the Russian athletes in the indicators of attacking the actions in high-level competitions [57]. The authors of the article tend to only partially agree with this statement. Indeed, the studies indicate a certain lack of Nage-waza activity in the weighted athletes under study less than 60 and 66 kg. However, the data of the athletes from the weight categories less than 73 and 81 kg indicate an increase in the number of attacks by Nage-waza and Ne-waza of the athletes weighing less than 73 kg and the attacking actions of Ne-waza of the athletes weighing less than 81 kg for the period of research. It was also revealed a significant decrease in the time intervals between the attacking actions in competitive judo games of the weight categories. Consequently, in certain weight categories, the judoists from the CIS countries make up the real competition to the foreign athletes including the Japanese wrestlers.

In general it should be recognized that the studied athletes became more active in the competitive matches. The time between attacking actions was reliably ($P < 0.001$) decreased for the athletes of all categories. However, the weight-class athletes achieved this indicator by increasing the activity of Ne-waza often only denoting the attacks and trying to retain the previously gained advantage. The experts also identified some patterned actions of the athletes. After every 25-28 seconds of the match, the athlete strove to perform technical action, often without a good grip or creating a situation favorable to the holding of the throw. Thus, the impression was created by the judoist to actively fight for the spectators and judges. The quality of technical actions was not high.

In the weight category less than 73 kg the increase in activity was significant ($P < 0.01$) and was achieved by increasing the number of technical actions both Nage-waza and Ne-waza. The quality of the struggle between Nage-waza and Ne-waza also increased. It can be concluded that the athletes of this category have most adapted to the current conditions of conducting competitive fights from the standpoint of IJF requirements to increase the activity and spectacularity of the competitive matches. The smallest differences of the CC values were found for the athletes in the weight category less than 81 kg. With the exception of reducing the time intervals between attacking actions a significant increase in CC was revealed only in the Ne-waza technique. Therefore, it can be concluded that the judoists of this weight category have adapted to the new judo requirements due to some increase in Ne-waza activity. The quality of Nage-waza of the athletes of this category has slightly decreased.

The effectiveness of using various methods of the mathematical modeling for the training of the elite judoists is noted by the specialists [58]. According to the authors of the article, the definition of CC values is an accessible, reliable and informative way of monitoring and evaluating the level of the athletes' competitive readiness to achieve significant sporting results in modern judo. The analysis of the athletes' CC allows us to conclude that the athletes of different weight categories adapt to the new changes of the judo rules in different ways. The athletes of light weight categories have chosen basically closed defensive style of conducting matches. This style is characterized by the retention of the advantage gained at the beginning of the match due to the false activity and the increase in Ne-waza time. The judoists less than 81 kg preferred to increase the amount of Ne-waza equipment in the total number of technical actions performed in each duel. The most consistent with the

recommendations of the IJF style of conducting the fights of the athletes of the category less than 73 kg. The athletes of this category, a significant increase of the general technique of Nage-waza and Ne-waza was revealed. The quality of the struggle between Nage-waza and Ne-waza has also increased. The number of lost technical techniques has decreased noticeably. These athletes demonstrated an active and entertaining style of conducting competitive fights taking into account the recommendations of the IJF and the new rules of judo competitions.

The changes regularly introduced by the IJF into the rules of judo competition dictate the need to find the new and effective methods for training the athletes to achieve success in competitive activities. The authors of the article believe that the training of the athletes should be built taking into account the CC wrestlers determined by the mathematical analysis of the judo actions in competitive matches. The increase or decrease of the values of a particular CC will indicate the level of the immediate readiness of the athlete in a particular component of the competition. The dynamics of changes of CC values will signal a coach for making changes to the training process. The CC values of the athletes under study show that in judo categories less than 60 and up to 66 kg, a defensive style of fighting was formed with an insufficient number of the active attacking actions. The athletes less than 81 kg in general did not improve the quality level of the most of the CC indicators for the period of the research. Such data suggest that the process of preparation of these athletes has not undergone significant changes from 2010 to 2015. The positive dynamics of changes in the majority of CC was revealed only by the judoists less than 73 kg.

The authors of the article believe that the comprehensive scientific research devoted to the assessment of the quality of the judo competition between the Russian Federation and the CIS countries and the

search for the new scientifically grounded methods of training athletes for the successful competitive activities will be in demand by the scientific community, coaches and athletes. The relevance of such studies is dictated by a large number of significant changes of the rules of the competitions in judo and the growth of sportsmanship of the athletes.

ACKNOWLEDGEMENT

The authors would like to thank the subjects who participated in this study.

Conflicts of interest

If the authors have any conflicts of interest to declare.

REFERENCES

- Osipov, A., Kudryavtsev, M., Fedorova, P., et al. *Comparative analysis of the scientific views of Russian and foreign scientists on the problem of training skilled judo wrestlers*. Journal of Physical Education and Sport, 2017. **1**: p. 288-293. DOI:10.7752/jpes.2017.01043
- Polevaia-Secareanu, A. *Training of judoists using the means of rhythmic education and music*. Sport Science, 2016. **4**(86): p. 41-49. DOI: <http://dx.doi.org/10.15823/sm.2016.41>
- Segedi, I., Sertic, H., Franjic, D., et al. *Analysis of judo match for seniors*. Journal of Combat Sports and Martial Arts, 2014. **2**(5): p. 57-61.
- Ziv, G., and Lidor, R. *Psychological preparation of competitive judokas – a review*. Journal of Sports Science and Medicine, 2013. **12**(3): p. 371-380.
- Koptev, O. *Physical activity of judokas at competitions*. Uchenye zapiski universiteta imeni P.F. Lesgafta, 2015. **9**(127): p. 116-120. [In Russian]
- Bocioaca, L. *Technical and tactical optimization factors in judo*. Procedia – Social and Behavioral Sciences, 2014. **117**: p. 389-394. DOI:10.1016/j.sbspro.2014.02.233
- Zaggelidis, G., Mavrovouniotis, F., Argyriadou, E., et al. *Opinions about judo athletes' image*. Journal of Human Sport and Exercise, 2013. **8**(2): p. 322-333. DOI:10.4100/jhse.2012.82.01
- Korobeynikov, G., Korobeynikova, L., Romanyuk, L., et al. *Relationship of psychophysiological characteristics with different levels of motivation in judo athletes of high qualification*. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017. **21**(6): p. 272-278. DOI:10.15561/18189172.2017.0603
- Franchini, E., Brito, C., Fukuda, D., et al. *The physiology of judo-specific training modalities*. Journal of Strength and Conditioning Research, 2014. **28**(5): p. 1474-1481. DOI:10.1519/JSC.0000000000000281
- Viveiros, L., Caldas Costa, E., Moreira, A., et al. *Training load monitoring in judo: comparison between the training load intensity experienced by the athlete*. Revista Brasileira de Medicina do Esporte, **17**(4): p. 266-269. <http://dx.doi.org/10.1590/S1517-86922011000400011>
- Casals, C., Huertas, J., Franchini, E., et al. *Special judo fitness test level and anthropometric profile of elite Spanish judo athletes*. Journal of Strength and Conditioning Research, 2017. **31**(5): p. 1229-1235. DOI:10.1519/JSC.0000000000001261
- Franchini, E., Del Vecchio, F., Matsushique, K., et al. *Physiological profiles of elite judo athletes*. Sports Medicine (Auckland, N.Z.), 2011. **41**(2): p. 147-166. DOI:10.2165/11538580-000000000-00000
- Kuvačić, G., Krstulović, S., and Caput, P. *Factors determining success in youth judokas*. Journal of Human Kinetics, 2017. **56**: p. 207-217. DOI:10.1515/hukin-2017-0038
- Osipov, A., Kudryavtsev, M., Iermakov, S., et al. *Criteria for effective sports selection in judo schools – on example of sportsmanship's progress of young judo athletes in Russian Federation*. Archives of Budo, 2017. **13**(1): p. 179-187.
- Detanico, D., Budal Arins, F., Dal Pupo, J., et al. *Strength parameters in judo athletes: An approach using hand dominance and weight*. Human Movement, 2012. **13**(4): p. 330-336. DOI:10.2478/v10038-012-0038-x
- Dudeniene, L., Skarbalius, A., Pukenas, K., et al. *Time-motion performance in semi-professional Lithuanian women's judo athletes*. Archives of Budo, 2017. **13**(1): P. 309-314.
- Lech, G., Chwala, W., Ambrozy, T., et al. *Muscle torque and its relation to technique, tactics, sports level and age group in judo contestants*. Journal of Human Kinetics, 2015. **45**: p. 167-175. DOI:10.1515/hukin-2015-0017
- Çelik, N., Beyleroğlu, M., Soyal, M., et al. *The effect of liquid losses in trainings during competition period on some biochemical values of u18 male judokas (age 15-17)*. Physical education of students, 2017. **21**(5): p. 249-254. DOI:10.15561/20755279.2017.0508

19. Yang, W., Heine, O., Mester, J., et al. *Impact of rapid weight reduction on health and performance related indicators of athletes representing the Olympic combat sports*. Archives of Budo, 2017. **13**(1): p. 147-160.
20. Agostinho, M., Philippe, A., Marcolino, G., et al. *Perceived training intensity and performance changes quantification in judo*. Journal of Strength and Conditioning Research, 2015. **29**(6): p. 1570-1577. DOI:10.1519/JSC.0000000000000777
21. Podrigalo, L., Volodchenko, A., Rovnaya, O., et al. *Analysis of martial arts athletes' goniometric indicators*. Physical education of students, 2017. **21**(4): p. 182-188. DOI:10.15561/20755279.2017.0406
22. Ivaskiene, V., Skyriene, V., Markevičius, V. *Self-assessment and aggression's manifestation of Judo wrestlers in age and qualification aspects*. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017. **21**(4): p. 163-168. DOI:10.15561/18189172.2017.0403
23. Tayebi, S., Mahdian, H., Mahmoudi, S. *Short-term adaptation of some iron indices of young elite wrestlers to three types of aerobic, anaerobic, and wrestling training*. International Journal of Applied Exercise Physiology, 2016. **5**(1): p. 11-16.
24. Norjali Wazir, M., Torfs, M., Mostaert, M., et al. *Predicting judo champions and medallists using statistical modeling*. Archives of Budo, 2017. **13**(1): p. 161-168.
25. Krstulović, S., Zuvela, F., Katić, R. *Biomotor systems in elite junior judoists*. Collegium Antropologicum, 2006. **30**(4): p. 845-851.
26. Podrigalo, L., Iermakov, S., Alekseev, A., et al. *Studying of interconnectios of morphological functional indicators of students, who practice martial arts*. Physical education of students, 2016. **20**(1): p. 64-70. DOI:10.15561/20755279.2016.0109
27. Niedomagala, W. *The result of "testing fights in a vertical posture" as a selection criterion for professional training of judo sport – prognostic value TFVP*. Archives of Budo. Science of Martial Arts and Extreme Sports, 2016. **12**: p. 181-190.
28. Lascau Florin, D., and Rosu, D. *Study regarding the prediction of medal winning in Olympic Games judo competitions*. Journal of Physical Education and Sport, 2013. **3**: p. 386-390. DOI:10.7752/jpes.2013.03062
29. Arziutov, G., Iermakov, S., Bartik, P., et al. *The use of didactic laws in the teaching of the physical elements involved in judo techniques*. Ido Movement for Culture. Journal of Martial Arts Anthropology, 2016. **4**: p. 21-30. DOI:[10.14589/ido.16.4.4](https://doi.org/10.14589/ido.16.4.4)
30. Sterkowicz, S., Heinisch, H., and Sterkowicz-Przybycień, K. *Effect of body length, body weight, and sport achievement on points scored by male judo athletes in the Olympic tournament 2012*. Archives of Budo. Science of Martial Arts and Extreme Sports, 2016. **12**: p. 1-9.
31. Saraiva, A., Borba-Pinheiro, C., Reis, V., et al. *Order of strength exercises on the performance of judo athletes*. Revista Internacional de Medicina y Ciencias de la Actividad Fisica y el Deporte, 2017. **68**: p. 605-617. <https://doi.org/10.15366/rimcafd2017.68.002>
32. Agostinho, M., Junior J., Stankovic, N., et al. *Comparison of special judo fitness test and dynamic and isometric judo chin-up tests' performance and classificatory tables' development for cadet and junior athletes*. Journal of Exercise Rehabilitation, 2018. **14**(2): p. 244-252. DOI:10.12965/jer.1836020.010
33. Krumer, A. *On winning probabilities, weight categories, and home advantage in professional judo*. Journal of Sports Economics, 2017. **18**(1): p. 77-96. <https://doi.org/10.1177/1527002514560576>
34. Miller, G., Collins, N., Stewart, M., et al. *Throwing technique and efficiency in the 2013 British judo championships*. International Journal of Performance Analysis in Sport, 2015. **15**(1): p. 53-68. <https://doi.org/10.1080/24748668.2015.11868776>
35. Adam, M., Smaruj, M. *The indices of technical-tactical preparation of the World's Judo Champions in Tokyo 2010 as an assessment criterion for individual training*. Archives of Budo. Science of Martial Arts and Extreme Sports, 2013. **9**: p. 33-39.
36. Bonato, M., Rampichini, S., Ferrara M., et al. *Aerobic training program for the enhancements of HR and VO2 off-kinetics in elite judo athletes*. Journal of Sports Medicine and Physical Fitness, 2015. **55**(11): p. 1277-1284.
37. Osipov, A., Kudryavtsev, M., Iermakov, S., et al. *Increase in level of special physical fitness of the athletes specialising in different combat sports (judo, sambo, combat sambo) through of crossfit training*. Archives of Budo, 2018. **14**(1).
38. Jagiello, W., Dornowsky, M., and Wolska, B. *Basic technical skills (throws) in 17-19-year-old judokas*. Physical education of students, 2014. **6**: p. 77-80. DOI: 10.15561/20755279.2014.0615
39. Pujszo, R., Adam, M., Wolska, B. *The course of judo competition created by gold medalists of the World Championships 2015 in Astana*. Archives of Budo. Science of Martial Arts and Extreme Sports, 2017. **13**: p. 119-125.
40. Koptev, O., Osipov, A., Kudryavtsev, M., et al. *Estimation degree of changes influence in competition rules on the contests ratios of judo wrestlers of lightweight categories in Russia and Kyrgyzstan*. Journal of Physical Education and Sport, 2017. **4**(Supplement Issue): p. 2067-2072. DOI:10.7752/jpes.2017.s4209
41. Adam, M., Klimowicz, P., Pujszo, R. *Judoists' tactical and technical efficiency during the World Championships in 2014 and 2015*. Baltic Journal of Health and Physical Activity, 2016. **8**(2): p. 19-28.

42. Miarka, B., Gonçalves Panissa, V., Ferreira Julio, U., et al. *A comparison of time-motion performance between age groups in judo matches*. Journal of Sports Sciences, 2012. **30**(9): p. 899-905. <https://doi.org/10.1080/02640414.2012.679675>
43. Franchini, E., Takito, M., Calmet, M. *European judo championships: impact of the new rule changes on points and penalties*. International Journal of Performance Analysis in Sport, 2013. **13**(2): p. 474-479. <https://doi.org/10.1080/24748668.2013.11868663>
44. Balafoutas, L., Lindner, F., and Sutter, M. *Sabotage in tournaments: Evidence from a natural experiment*. IZA Discussion Paper, 2012. No. **6316**: 25 p.
45. Adam, M., Tomita, H., Szymanski, M., et al. *Ways of performing the judo throws and their efficiency during All-Japan Judo Championships at open weight category*. Ido Movement for Culture. Journal of Martial Arts Anthropology, 2015. **1**: p. 39-45. DOI:10.14589/ido.15.6
46. Adam, M., Smaruj, M., and Tyzkowsky, S. *The diagnosis of the technical-tactical preparation of judo competitors during the World Championships (2009 and 2010) in the light of the new judo sport rules*. Archives of Budo, 2011. **7**(1): p. 5-9.
47. Tel'uk, S. *Comparative analysis of competitive activity of Russian men judo team on 2012 Olympic games and 2013 World championships*. Vestnik sportivnoy nauki, 2014. **3**. p. 13-17. [In Russian]
48. Osipov, A., Kudryavtsev, M., Struchkov, V., et al. *Expert analysis of the competitive level of young Russian judo athletes who train for active attack fighting*. Journal of Physical Education and Sport, 2016. **4**: p. 1153-1158. DOI:10.7752/jpes.2016.04185
49. Kons, R., Ache-Dias, J., Detanico, D. *Can physical tests predict the technical-tactical performance during official judo competitions?* Archives of Budo. Science of Martial Arts and Extreme Sports, 2017. **13**: p. 143-151.
50. Marques, L., Franchini, E., Draço, J., et al. *Physiological and performance changes in national and international judo athletes during block periodization training*. Biology of Sport, 2017, **34**(4): p. 371-378. DOI:10.5114/biolSport.2017.69825
51. Boguszewski, D. *Offensive activity as an element of the evaluation of struggle dynamics of judo contestants*. Archives of Budo, 2014. **10**: p. 101-106
52. Torres-Luque, G., Hernandez-Garcia, R., Escobar-Molina, R., et al. *Physical and physiological characteristics of judo athletes: an update*. Sports, 2016. **4**(1): 20. DOI:10.3390/sports4010020
53. Coufalová, K., Cochrane, D., Malý, T., et al. *Changes in body composition, anthropometric indicators and maximal strength due to weight reduction in judo*. Archives of Budo, 2014. **10**: p. 161-168.
54. Korobeynikov, G., Latyshev, S., Latyshev, N., et al. *General laws of competition duel and universal requirements to technical-tactic fitness of elite wrestlers*. Physical education of students, 2016. **20**(1): p. 37-42. DOI:10.15561/20755279.2016.0105
55. Lech, G., Pałka, T., Tyka, A., et al. *Effect of motor abilities on the course of fight and achievement level in judokas at different age*. Archives of Budo. Science of Martial Arts and Extreme Sports, 2015. **11**: p. 169-179.
56. Osipov, A., Kudryavtsev, M., Iermakov, S., and Jagiello, W. *Topics of doctoral and postdoctoral dissertations devoted to judo in period 2000-2016 – the overall analysis of works of Russian experts*. Archives of Budo, 2017. **13**: p. 1-10.
57. Adam, M., Sterkowicz-Przybycień, K. *The efficiency of tactical and technical actions of the national teams of Japan and Russia at the World Championships in Judo (2013, 2014 and 2015)*. Biomedical Human Kinetics, 2018. **10**: p. 45-52. DOI:10.1515/bhk-2018-0008
58. Kozina, Z., Jagiello, W., and Jagiello, M. *Determination of sportsmen's individual characteristics with the help of mathematical simulation and methods of multi-dimensional analysis*. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015. **12**: p. 41-50. <http://dx.doi.org/10.15561/18189172.2015.1207>