

Important components of competitive performance in elite male judokas in the heavyweight category

ALEKSANDER OSIPOV¹, MIKHAIL KUDRYAVTSEV², IBRAHIM ALDIABAT³, AWS SWEIDAN⁴,
ALENA GALIMOVA⁵, LARISA ZAKHAROVA⁶, MIKHAIL KOLOKOLTSEV⁷, ELENA KARPENKO⁸,
PAVEL TYUPA⁹

^{1,2,3,6} Siberian Federal University, Krasnoyarsk, RUSSIA

¹ Voino-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, RUSSIA

^{1,2} Siberian Law Institute of the Ministry of Internal Affairs of the Russia, Krasnoyarsk, RUSSIA

² Reshetnev Siberian State University Science and Technology, Krasnoyarsk, RUSSIA

³ Yarmouk University, Irbid, Kingdom of JORDAN

⁴ Greek Orthodox Patriarchate International School - Balqa- Fuheis -JORDAN

⁵ East-Siberian Institute of the Ministry of Internal Affairs of the Russian Federation, RUSSIA

⁷ Irkutsk National Research Technical University, Irkutsk, RUSSIA

⁸ Altai State University, Barnaul, RUSSIA

⁹ Immanuel Kant Baltic Federal University, Kaliningrad, RUSSIA

Published online: April 30, 2023

(Accepted for publication April 15, 2023)

DOI:10.7752/jpes.2023.04105

Abstract:

Current competition judo is characterized by a constant activity increase of athletes and a large number of techniques in competition duels. Evaluation of athletes' competition performance should take into account these indicators. *Research aim.* Analysis and evaluation of important components of the competitive performance of elite male judokas in the heavyweight division and comparison with the components of the competitive performance of elite male judokas in the lightweight division. *Materials and methods.* Calculation of components of competition performance (CCP) of athletes has been done. *Results.* The significant ($p \leq 0.05$) increase of Nage-Waza technique performance in studied athletes has been revealed. Comparative analysis of data has been conducted with indicators of elite judokas, who competing in lightweight categories. The similar indicators with data of elite lightweight judokas (weighing up to 60 kg and 73 kg) have been revealed in technique of Ne-Waza has been revealed. The similar indicators with elite judokas (weighing up to 66 kg and 83 kg) by the number of Shido in competition duels were identified. Elite super heavyweight judokas gradually intensify the Nage-Waza fight dynamics increasing competition performance. *Conclusions.* Super heavyweight judokas are advised to reduce the time pauses between attacking maneuvers in competition duels.

Key Words: combat sports, competition success, dynamics of competition duels, physical training

Introduction

Current competition judo is characterized as a combat sport that involves intermittent efforts, standing, and groundwork actions with different intensities. To reach competition success, a well-developed physical fitness and higher technical-tactical level are needed (Del Vecchio, et al. 2018). The current development dynamics of world judo requires the search for new solutions optimizing athletes' training for successful competition activity. Today, competition training optimization is of great importance for athletes representing. Judo professionals reported that Russian judokas are inferior to their direct competitors, primarily Japanese judokas, in terms of attacking maneuvers effectiveness at significant international competitions (Adam, & Sterkowicz-Przybycień, 2018). Russian scientists & professionals also emphasize the need for elite Russian judokas forming a high level of performance for competition duels (Adolf, et al. 2018). Koptev, (2018) suggest focusing on formation of competition competence of elite judokas – the ability achieving competition results in a biased judging and high-level competition. Judo professionals say that the distinctive feature of judokas of an elite group should be the tactical and technical universality of athlete. The high indicators of the motor activity of judokas in competition duels and high efficiency of tactical and technical actions should be necessary components of competition performance of elite athletes (Miarka, et al. 2016; Torres-Luque, et al. 2016). The analysis results of significant scientific data show that increase of activity and efficiency techniques of Nage-Waza and Ne-Waza is a priority for judo specialists and trainers (Osipov, et al. 2017). It should be noted that there are significant differences in methodics of formation competition performance of judokas depending on the weight category in which the athletes compete. Scientists emphasize the characteristics uniqueness of the competition fight of judokas of certain weight categories in particular heavyweight athletes (Sterkowicz-Przybycień, Miarka, & Fukuda, 2017).

Krumer, (2017) argues that professionals should take into account differences in heterogeneity of the existing weight categories (number of participants, level of sports practice) in studies dedicated to judo. *Franchini, et al.* (2011) emphasized that the need for further research regarding the differences identification between judokas of different weight categories. The significant lack of scientific knowledge about the fitness & performance characteristics of elite judokas of heavyweight categories is highlighted (Drid, et al. 2015). The super heavyweight category judokas (+ 100 kg) have a specific somatotype (Franchini, Sterkowicz-Przybycień, & Takito, 2014) and therefore a unique type of fighting which differs from the fight nature of lightweight categories athletes (Woong, et al. 2018). The analysis of scientific knowledge of judo practice also showed a lack of research in the field of competition training for super heavy and heavyweight judokas in Russian Federation (Osipov, et al. 2017). Due to the lack of objective data, the authors have decided to pay their attention to the level of competition performance of super heavyweight elite judokas (+ 100 kg) in conditions of active fight encouraged by the current rules of the IJF competitions.

In current conditions, scientists & judo professionals have focused on finding effective methods for quantifying judo training for competition activities. The links are explored between level of physical fitness of judokas and their competition results (Lima Kons et al., 2019). Professionals recommend taking into account the total number of attacking actions, fight effectiveness (Lima Kons et al., 2018) and the exact time of fight (without pauses and passive movements) of athletes (Miarka et al., 2018) determining competition performance of elite judokas. Time-motion analysis of judo combats allows both coaches and athletes to optimize the training and competition process (Soriano et al., 2019). Similar criteria are used assessing performance of competition training in other wrestling (Tyupa et al., 2022; Abramnikov, 2022; Korobeynikov, et al., 2016). In recent years, sport professionals have used methods of mathematical analysis of tactical and technical actions in the process of assessing competition performance of judokas (Kozina et al., 2015). We are talking about the calculation of certain quantitative data which is a quantitative ratio between the tactical and technical actions of judokas and referee ratings (Koptev, et al. 2017). The level of high efficiency of such methods of the objective assessment of athletes' training for competition activity served as the basis for using the methods of mathematical analysis in our scientific work.

The aim of this study: analysis and evaluation of important components of the competitive performance of elite male judokas in the heavyweight division and comparison with the components of the competitive performance of elite male judokas in the lightweight division.

Material & methods

Participants

Twenty-three elite male athletes (mean age – 25.18 ± 7.35 years-old; mean height – 192.14 ± 11.24 cm; mean body mass – 126.54 ± 25.17 kg) participated in this investigation. To participate in the scientific work, all athletes had to meet the following inclusion criteria: **a)** six years or more of judo competition experience; **b)** taken part in official regional and national/international judo competitions tournaments in super heavyweight category during the last two years; **c)** membership in the National Russian Judo Federation. All participants were previously informed of the research purposes, associated benefits, experimental procedures, and potential by informed consent. All ethical principles of scientific work with humans are observed, according to the Helsinki Declaration of 2008. This scientific work was implemented after approval by the university ethics committee Siberian Federal University (Institute of Physical Culture, Sport and Tourism, SibFU, Protocol no. 12/2020).

The study design

The overall duration of this investigation conducted about two years (March, 2020 – June, 2022). The first stage of this scientific work (March, 2020 – March, 2022) included the collection of data on the competition performance of participants (official video recordings of the judo competition). The second stage of the investigation (April, 2022 – May, 2022) included the analysis of the collected data and evaluation of the data. A comparative analysis of obtained data with information about components of competition performance (CCP) of lightweight judokas was carried out on the final stage of the investigation (May, 2022 – June, 2022). Scientific information about the CCP of elite lightweight judokas was taken from earlier scientific works of scientists from the CIS countries (Koptev, et al. 2019; Osipov, et al. 2018; Koptev, 2018; Koptev, et al. 2017).

In this scientific work used data from certain important CCP determining the indicators of competition performance of elite judokas. Those CCP represent the quantitative indicators of certain tactical and technical maneuvers of judokas in competition duels and judging scores of athletes' maneuvers in matches. The changes of dynamics of CCP data are a fairly objective criterion for determining the level of competition performance of elite judokas for competition success.

The authors used the following CCP determining the performance of athletes for competition duels: CCP-1 – the ratio between the number of total and successful actions of judokas in Nage-Waza in competition duels; CCP-2 – the ratio between the number of total and successful actions of judokas in Ne-Waza in competition duels; CCP-3 – the ratio between the time intervals in competition duel (the time of passive fight and time of the attack); CCP-4 – the number of Shido received by athletes from the judges on average for a competition match (Koptev, 2018).

Procedures

The evaluation of athletes' CCP data was carried out by the method of video analysis of competition duels. 466 competition matches with studied participants for two years (2020-2022) were presented for the analysis. All competition duels of studied participants were divided into two equal time periods (March, 2020 – March, 2021 and April, 2021 – March, 2022) for the possibility of qualitative data comparison. The CCP of each athlete have been studied in at least 20 national and international competition duels. The judo professionals (n = 16) – judges and highly qualified coaches (Honored coaches of Russian Federation in judo) who have significant experience in judging at judo competitions were involved improving the quality of the assessment. The indicators of CCP of participants were evaluated by 3 experts in each competition match. The opinion of the most of 3 experts was taken into account deriving the average estimate of CCP of participants in competition duels.

Statistical analysis

Overall data analysis was performed with IBM SPSS Statistics for Windows 20.0 (Armonk, NY: IBM Corp.). All data presented as means and standard deviations (Mean±SD). The distribution of each variable was examined using the Kolmogorov-Smirnov normality test. Homogeneity of variance was verified with the Levene's test. All variables presented normal distribution. To test the differences between variables in different intervention periods, an analysis of variance (one-way ANOVA), including Tukey's HSD test was performed. The level of significance was set at $p \leq 0.05$.

Results

Evaluation of CCP of participants showed the presence of significant dynamics ($p \leq 0.05$) of a gradual increase of successful tactical and technical actions of athletes in Nage-Waza technique. In the first stage of research (March, 2020 – March, 2021) $CCP-1 = 5.69 \pm 0.16$ and in the final stage of research (April, 2021 – March, 2022) $CCP-1 = 4.88 \pm 0.67$. The decrease of $CCP-1$ indices indicates an increase of total number of successful tactical and technical actions (assessed by judges) in relation to the total number of tactical and technical maneuvers of judokas. The significant increase ($p \leq 0.05$) of total actions number of participants (Nage-Waza) performed in each competition match was also revealed: from 6.83 ± 0.26 maneuvers (2020–2021) to 7.51 ± 0.34 (2021–2022).

The ratio assessment of tactical and technical actions of participants in Ne-Waza technique has not revealed significant changes of $CCP-2$ indicators of judokas during the period of investigation. In period (2021–2022) indicators of $CCP-2$ turned out to be slightly higher – 2.81 ± 0.14 than the indicators of $CCP-2$ in period (2020–2021) – 2.49 ± 0.23 . Such data allow us to conclude about the low number of athletes' actions (Ne-Waza) and an average of about 2 attempts to conduct maneuvers for a competition duel.

No significant differences were reported in ratio between passive match time and attack time ($CCP-3$) during the period of the investigation. Was showed a slight decrease of estimated component indicators over the period of the investigation: from 2.05 ± 0.08 (March, 2020 – March, 2021) to 1.89 ± 0.04 (April, 2021 – March, 2022). Such statistic testifies about a slight increase of amount of attack time in competition duels, not significant enough.

Evaluation of the $CCP-4$ (total number of Shido) had not allowed revealing significant differences between different periods of this investigation. In period (2020–2021), $CCP-4 = 2.17 \pm 0.12$ and in period (2021–2022) – 2.12 ± 0.17 Shido from the judges for a competition match. On average, each of studied judokas had received from the judges at least 2 Shido in a competition duel.

The overall information about participants' CCP results in studied period (March, 2020 – March, 2022) outlined in Table 1.

Table 1. The overall findings of dynamics of participants' CCP in full period of the investigation.

Studied indicators	Participants (n = 23)		p ≤
	March, 2020 – March, 2021	April, 2021 – March, 2022	
CCP-1 (Nage-Waza)	5.69 ± 0.16	4.88 ± 0.67	0.036*
CCP-2 (Ne-Waza)	2.49 ± 0.23	2.81 ± 0.14	0.628
CCP-3 (attack time)	2.05 ± 0.08	1.89 ± 0.04	0.847
CCP-4 (Shido)	2.17 ± 0.12	2.12 ± 0.17	0.958

Note: * – $p \leq 0.05$ – (significance level).

A comparative analysis of obtained results by the studied participants with the CCP indicators of judo athletes, who competing in lightweight categories showed that super heavyweight male judokas demonstrated a higher indicator in Nage-Waza technique ($CCP-1$) compared to athletes of other weight categories (excluding elite male judokas, who competing in category up to 66 kg). There were similar indicators in $CCP-2$ (Ne-Waza technique) between studied athletes and elite judokas, who competing in weight categories: up to 60 kg and 73 kg. No significant differences in $CCP-3$ (passive match time and attack time) between studied judokas and other

athletes were identified. At the same time, this indicator was slightly worse for the studied athletes. CCP-4 (total number of Shido) in studied athletes were at the same level as the athletes, who competing in weight categories: up to 66 kg and 81 kg. The overall analysis of CCP of studied athletes and elite male judokas, who competing in lightweight categories, outlined in Fig.1

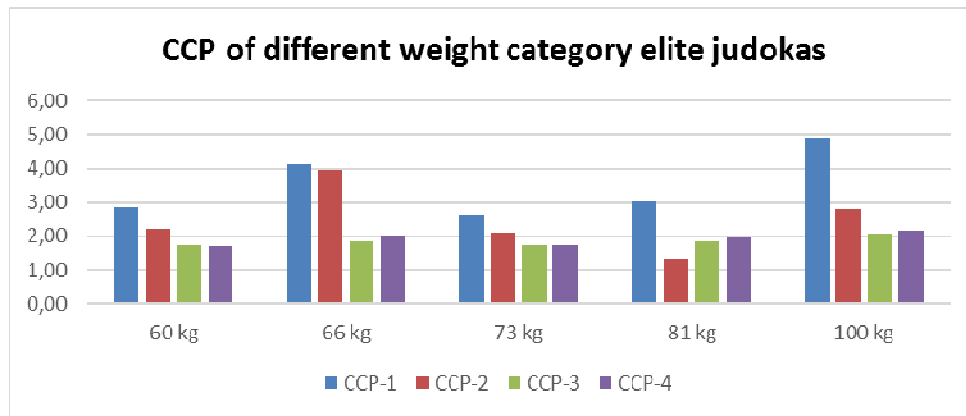


Fig. 1 Comparative analysis of CCP of elite male judokas, who competing in various weight categories (up to 60 kg; 66 kg; 73 kg; 81 kg; + 100 kg).

Dicussion

This investigation showed that elite male super heavyweight judokas significant increased individual CCP (CCP-1 – successful tactical and technical actions in Nage-Waza technique) and not significant increased other CCP (CCP-2 – successful tactical and technical actions in Ne-Waza technique; CCP-3 – passive match time and attack time in the duel; CCP-4 – total number of Shido) during the period of investigation. Comparative analysis of the CCP of participants with CCP of judo athletes, who competing in other weight categories showed that the studied judokas have approximately equal CCP-3 and CCP-4 indicators with judo athletes, who competing in lightweight categories. Large differences between heavyweight judokas and athletes, who competing in lightweight categories were revealed only in the CCP-1 (Nage-Waza technique) and CCP-2 (Ne-Waza technique).

Bocioaca, (2014) indicate that the optimization of the technical training of judokas provides the basis for the necessary level of tactical performance allowing achieving success in competition duels. It's known that elite judokas, who competing in heavyweight categories demonstrate less technical activity in competition duels than judokas, who competing in lightweight categories (Díaz-de-Durana et al. 2018). Judo professionals point out that time for performing movements in a fight depends on physical strength of upper limbs and strength of grips of heavyweight categories athletes. Elite male judokas, who competing in lightweight categories actively use movements on legs and muscular strength of lower limbs due to which they increase the speed of movements in competition duels (Lima Kons et al. 2019). This investigation found a positive increase in both the total number of technical actions of Nage-Waza and number of successful Nage-Waza and Ne-Waza techniques of elite male judokas, who competing in super heavyweight (+ 100 kg) category. The indicators of weight category judokas (+ 100 kg) were better than those of weight category athletes up to 66 kg in the indicators of CCP-2 component. Such data indicate the need to attract the attention of specialists and coaches to training practice and competition training of judokas weighing up to 66 kg. The presence of positive dynamics increase of the number and effectiveness of Nage-Waza technique of heavyweight category judokas (+ 100 kg) indicates an increase of competitive readiness level of judokas to active fight in the face of fierce competition. In current competition judo, high rates of motor activity in competitive fights and high efficiency of fighting techniques are the necessary conditions that characterize the judo's performance achieving a high result in competition (Miarka et al. 2016).

According to *K. Sterkowicz-Przybycień et al.* (2017) the mean time interval between the attacking actions of elite athletes is on average 23.5–28.5 sec in competition duels. The upper interval indicators are characteristic of heavyweight category judokas. In this investigation, participants showed somewhat worse indicators of this interval – 29.4 sec. A positive trend was observed in reducing this range weight category judokas (+ 100 kg). If in March, 2020 – March, 2021 the mean time interval between attacks for the athletes under study was 34.12 ± 0.49 sec, in April, 2021 – March, 2022 – 29.41 ± 0.34 sec. Even with a decrease of the attack interval by almost 4 sec, the super heavyweight male judokas are significantly inferior of this indicator to the judo athletes, who competing in lightweight categories. It should be noted that attack phase of heavyweight category judokas has a longer time interval than lightweight category judokas. The indicators of attack interval of lightweight categories judokas due to the advantage in speed and active movements will be higher than

heavyweight category judokas. Today the only exception in super heavyweight category is only *Teddy Riner*, his total number and effectiveness of attacks significantly exceeds the attacking actions of other elite super heavyweight judokas (Adam, & Wolska, 2016).

The scientific works show that super heavyweight category male judokas are characterized by a significantly lower frequency of technical actions in all phases of duel compared with athletes of lightweight categories (Díaz-de-Durana et al. 2018). This investigation demonstrated that studied participants are really inferior to judokas of other categories in terms of the total number of Nage-Waza techniques. However, it was revealed that number of successful techniques of Nage-Waza in super heavyweight judokas surpass athletes weighing up to 60 kg; 73 kg and 81 kg.

Nagai et al. (2019) reported that athletes should actively use the transitions from Nage-Waza to Ne-Waza achieving success in competition duels. Judo professionals recommend super heavyweight judokas to increase the level of Ne-Waza fighting performance in improving competition results significantly (Díaz-de-Durana et al. 2018). In terms of the ratio of Ne-Waza techniques, the studied judokas demonstrate similar values with athletes weighing up to 60 kg and 73 kg, and superiority over judokas weighing up to 81 kg. The total amount of Ne-Waza techniques for super heavyweight category judokas is small, on mean slightly more than 2 technical actions per match.

Any conclusions presented in this investigation have some limitations. These limitations associated with the total low number of participants and the lack of opportunity to study the training routine and pre-competition training cycles of judokas.

Conclusions

This scientific work investigated that competition performance of Nage-Waza technique of super heavyweight elite male judokas in competition duels a significant increase during the last two years (2020–2022). The attack time also gradually increases in total match time. However, in this component, super heavyweight judokas so far are inferior to athletes, who competing in lightweight categories. Super heavyweight judokas are recommended increasing time interval for attacking maneuvers, what should have a positive impact on the level of their competition performance in international judo competitions.

Acknowledgements

We would like to thank the all elite male judo athletes, coaches, referees and judo professionals, who participated in the scientific work.

Conflicts of interest

The authors declare that this scientific work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References:

- Abramenkov, P. (2022). Crossfit as a means of physical fitness Young taekwondo athletes During the training phase (stage of sports specialization). *Health, Physical Culture and Sports*, 25(1), 121-130. Retrieved from <http://hpcas.ru/article/view/11277>, DOI:10.14258/zosh(2022)1.13
- Adam, M., & Sterkowicz-Przybycień, K. (2018). The efficiency of tactical and technical actions of the national teams of Japan and Russia at the World Championships in Judo (2013, 2014 & 2015). *Biomedical Human Kinetics*, 10, 45-52, DOI:10.1515/bhk-2018-0008
- Adam, M., & Wolska, B. (2016). The general individual technical-tactical profile of the multi-medallist judo athlete Teddy Riner's. *Archives of Budo. Science of Martial Arts and Extreme Sports*, 12, 37-44.
- Adolf, V., Sidorov, L., Kudryavtsev, M., Osipov, A., & Bliznevsky, A. (2018). Precompetitive fitness methods applied by Russian judo teams prior to international events. *Teoriya i Praktika Fizicheskoy Kultury*, 9, 66-68.
- Bocioaca, L. (2014). Technical and tactical optimization factors in judo. *Procedia – Social and Behavioral Sciences*, 117, 389-394, DOI:10.1016/j.sbspro.2014.02.233
- Del Vecchio, F., Coswig, V., Farias, C., Dimare, M., & Miarka, B. (2018). Technical-tactical, physiological and neuromuscular effects of opponent number in simulated judo combats: a pilot study. *Journal of Physical Education and Sport*, 18(3), 1583-1591, DOI:10.7752/jpes.2018.03233
- Díaz-de-Durana, A., dal Bello, F., Brito, C., & Miarka, B. (2018). High level performance in world judo circuit: Notational analyzes of combat phase by weight categories. *Journal of Human Sport and Exercise*, 13(2proc), S329-S338, DOI:10.14198/jhse.2018.13.Proc2.17
- Drid, P., Casals, C., Mekic, A., Radjo, I., Stojanovic, M., & Ostojic, S. (2015). [Fitness and anthropometric profiles of international vs. national judo medalists in half-heavyweight category](#). *Journal of Strength and Conditioning Research*, 29(8), 2115-2121, DOI:10.1519/JSC.0000000000000861
- Franchini, E., Del Vecchio, F., Matsushigue, K., & Artioli, G. (2011). Physiological profiles of elite judo athletes. *Sports Medicine*, 41(2), 147-166, DOI:10.2165/11538580-000000000-00000

- Franchini, E., Sterkowicz-Przybycień, K., & Takito, M. (2014). Anthropometrical profile of judo athletes: Comparative analysis between weight categories. *International Journal of Morphology*, 32(1), 36-42, DOI:10.4067/S0717-95022014000100007
- Koptev, O. (2018). Competitive competence structure in judo. *Human. Sport. Medicine*, 18(2), 35-44.
- Koptev, O., Osipov, A., Kudryavtsev, M., Zhavner, T., Klimuk, Y., Vapaeva, A., Kuzmin, V., & Mokrova, T. (2019). Level increase of competitive readiness of elite judokas in the weight category of up to 60 kg (as an example is the national team of Kyrgyzstan). *Journal of Physical Education and Sport*, 19(1), 716-721, DOI:10.7752/jpes.2019.01103
- Koptev, O., Osipov, A., Kudryavtsev, M., Zhavner, T., Vonog, V., Fedorova, P., et al. (2017). 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*, 17(Supplement issue 4), 2067-2072, DOI:10.7752/jpes.2017.s4209
- Korobeynikov, G., Latyshev, S., Latyshev, N., Goraschenko, A., & Korobeynikova, L. (2016). General laws of competition duel and universal requirements to technical-tactic fitness of elite wrestlers. *Physical Education of Students*, 20(1), 37-42, DOI:10.15561/20755279.2016.0105
- Kozina, Z., Jagiello, W., & Jagiello, M. (2015). 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*, 12, 41-50, DOI:10.15561/18189172.2015.1207
- Krumer, A. (2017). On winning probabilities, weight categories, and home advantage in professional judo. *Journal of Sports Economics*, 18(1), 77-96, DOI:10.1177/1527002514560576
- Lima Kons, R., Detanico, D., Ache-Dias, J., & Dal Pupo, J. (2019). Relationship between physical fitness and match-derived performance in judo athletes according to weight category. *Sport Science for Health*, DOI:10.1007/s11332-018-00524-y
- Lima Kons, R., Franchini, E., & Detanico, D. (2018). Relationship between physical fitness, attacks and effectiveness in short- and long-duration judo matches. *International Journal of Performance Analysis in Sport*, 18(6), 1024-1036, DOI:[10.1080/24748668.2018.1545198](https://doi.org/10.1080/24748668.2018.1545198)
- Miarka, B., Brito, C., Amtmann, J., Cordova, C., Bello, F., & Camey, S. (2018). Suggestions for judo training with pacing strategy and decision making by judo championship phases. *Journal of Human Kinetics*, 64(1), 219-232, DOI:10.1515/hukin-2017-0196
- Miarka, B., Del Vecchio, F., Julianetti, R., Cury, R., Camey, S., & Franchini, E. (2016). Time-motion and tactical analysis of Olympic judo fighters. *International Journal of Performance Analysis in Sport*, 16(1), 133-142, DOI:10.1080/24748668.2016.11868876
- Nagai, S., Takito, M., Calmet, M., Pierantozzi, E., & Franchini, E. (2019). Successful transition to groundwork combat during junior and senior Judo World Championships. *International Journal of Performance Analysis in Sport*, DOI:10.1080/24748668.2019.1585739
- Osipov, A., Kudryavtsev, M., Fedorova, P., Serzhanova, Z., Struchkov, V., et al. (2017). 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*, 17(1), 288-293, DOI:10.7752/jpes.2017.01043
- Osipov, A., Kudryavtsev, M., Koptev, O., Iermakov, S., & Bliznevskaya, V. (2018). 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. *International Journal of Applied Exercise Physiology*, 7(2), 32-45, DOI:10.22631/ijaep.v7i2.267
- Soriano, D., Iruñtia, A., Tarragó, R., Tayot, P., Milà-Villaroel, R., & Iglesias, X. (2019). Time-motion analysis during elite judo combats (defragmenting the gripping time). *Archives of Budo*, 15, 33-43.
- Sterkowicz-Przybycień, K., Miarka, B., & Fukuda, D. (2017). Sex and weight category differences in time-motion analysis of elite judo athletes: Implications for assessment and training. *Journal of Strength and Conditioning Research*, 31(3), 817-825, DOI:10.1519/JSC.0000000000001597
- Torres-Luque, G., Hernandez-Garcia, R., Escobar-Molina, R., Garatachea, N., & Nikolaidis, P. (2016). Physical and physiological characteristics of judo athletes: An update. *Sports (Basel)*, 4(1), 20, DOI:[10.3390/sports4010020](https://doi.org/10.3390/sports4010020)
- Tyupa, P., Litasov, P., & Zelenin, A. (2022). On the issue of the need to develop standard models for conducting competitive fights in hand-to-hand combat against opponents of various style. *Health, Physical Culture and Sports*, 25(1), 95-103. Retrieved from <http://hpcas.ru/article/view/11155>. DOI:10.14258/zosh(2022)1.11
- Woong, N., Min, Y., Hyun, K., Uk, L., Young, K., et al. (2018). Somatotype analysis of Korean combat sport athletes based on weight divisions. *Archives of Budo*, 14, 169-178.