

Customized evaluation of special endurance and functionality for optimal health and performance in judo athletes

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Abstract

Background and Study Aim Achieving optimal health and performance in judo athletes requires a customized approach to training and evaluation. This study aimed to assess the level of special endurance and functionality of experienced judo athletes for optimal health and performance.

Material and Methods Thirteen experienced judo athletes were tested using a dummy throw with a deflection for 4 minutes, with the number of throws and heart rate dynamics assessed during and after the exercise. Heart rate indicators were recorded using a heart rate sensor and a specialized computer program.

Results The athletes completed the maximum number of throws in the first minute, followed by stabilization. Heart rate gradually increased during the test, reaching a maximum of 184 beats per minute at the end of the test. These findings suggest that the dummy throw test can be used to assess the level of special endurance in judo athletes, while heart rate indicators can be used to characterize their current functional state.

Conclusions A customized evaluation of special endurance and functionality provides valuable insights for optimizing health and performance in judo athletes. By tailoring training programs to individual needs, coaches and trainers can help judo athletes achieve their full potential while minimizing the risk of injury and burnout. Overall, this study highlights the importance of a personalized approach to training and evaluation for maintaining optimal health and performance in judo athletes.

Keywords: judo, wrestling, special endurance, functionality, testing, computer program, back arch throw

Introduction

Judo is a physically demanding sport that requires a high level of strength, speed, and endurance. Achieving optimal health and performance in judo athletes requires a customized approach to training and evaluation that takes into account individual differences in functional capacity and physiological response. In particular, special endurance, which is the ability to sustain high-intensity movements over an extended period of time, is a key determinant of success in judo wrestling.

These suggests that physical activity should not be harmful to the health of athletes, and this is particularly relevant for judo athletes who often engage in intense training and competitions.

It is essential to maintain a balance between training intensity and recovery time to avoid negative impacts on athletes' health and performance [1, 2, 3, 4]. Achieving the maximum level of special endurance should not be pursued at the expense of athletes' well-being. Therefore, coaches and trainers should carefully monitor the athletes' physical and mental health and adjust the training program accordingly.

Judo is a combat sport that demands various physical and physiological attributes, including

strength, power, endurance, agility, speed, and flexibility, among others [5]. The optimization of physical activity is essential to develop these attributes in judo athletes, as it is necessary to perform at a high level and prevent injuries [6]. According to Franchini et al. [7], optimizing physical activity should not be harmful to the health of athletes, and coaches and trainers should pay attention to avoid excessive physical exertion, which could increase the risk of injuries and negatively impact the athlete's long-term development. Therefore, a customized evaluation of special endurance and functionality is needed to promote optimal health and performance in judo athletes [8].

To achieve optimal performance and maintain good health, it is essential to evaluate and customize training programs for judo athletes. Previous studies have explored various aspects of physical fitness and performance in judo athletes, such as neuromuscular performance, body composition, and muscular activation. For example, Kons et al. [9, 10] investigated the validity of judo-specific tests in assessing neuromuscular performance and predicting ranking performance. Additionally, Witkowski et al. [11] examined the relationship between body composition and motor potential in judo athletes.

Other studies have examined the effects

of training programs on physical fitness and performance. For instance, Agudelo-Velasquez et al. [12] explored the effects of discontinuous training methods in Colombian combat athletes, while Norambuena et al. [13] investigated the effects of a suspension training program on the physical performance of youth judokas. Moreover, Branco et al. [14] investigated the effects of a supplementary strength program on physical fitness in cadet judo athletes.

Some studies have also explored the impact of mental fatigue and core strengthening on physical performance in judo athletes. For instance, Campos et al. [15] examined the influence of mental fatigue on physical performance and physiological responses during the special judo fitness test, while Yang [16] investigated the impact of core strengthening on physical fitness in young judo practitioners.

In addition, studies have compared physical fitness and performance measures between judo athletes and untrained individuals. For example, Honorato et al. [17] compared handgrip strength-endurance and muscle activation between young male judo athletes and untrained individuals, while Marques et al. [18] compared physical fitness and anthropometric measures in young Brazilian judo and wrestling athletes and their relation to cardiorespiratory fitness.

Several studies have investigated factors that contribute to success in combat sports, such as wrestling and judo [19, 20, 21]. Cieslinski et al. [22] conducted an exploratory study to identify success factors in elite wrestlers, while Kostrzewa et al. [23] identified significant predictors of sports performance in elite men judo athletes using multidimensional regression models. He et al. [24] focused on physical fitness recovery of athletes based on high-intensity sports intermittent training, and Kurniawan et al. [25] investigated the effect of plyometric training on male judo athletes' physical abilities. Lopes-Silva et al. [26] explored the influence of physical fitness on the special judo fitness test performance, while Santos-Junior et al. [27] proposed a strength-endurance program for combat sports athletes. These studies highlight the importance of physical fitness and targeted training programs in combat sports and can provide insights into customized evaluation and training approaches for judo athletes.

Overall, while several studies have explored different aspects of physical fitness and performance in judo athletes, there is still a need for customized evaluation of special endurance and functionality for optimal health and performance. *This study aims* to assess the level of special endurance and functionality of experienced judo athletes to develop customized training programs that balance health and performance.

Material and Methods

Participants

Thirteen experienced judo athletes participated in the study. Informed consent was obtained from all participants in the experiment, which means that the athletes were fully informed about the nature of the study, the procedures involved, and any potential risks or benefits. They were given the opportunity to ask questions and make an informed decision about whether to participate. The study was also approved by the university's ethics board, which ensures that the study was conducted in accordance with ethical principles and guidelines for research involving human subjects.

Research Design

The athletes underwent a test in which they performed a dummy throw with a deflection for four minutes, with a range of six to eight throws in 40 seconds, and as many throws as possible in 20 seconds. The number of throws and heart rate dynamics were assessed during and after the test, and the test time was divided into 40 and 20 second segments to facilitate analysis. Athletes were given a 2-minute period of rest after completing the test. During this rest period, the dynamics of the athletes' heart rates were recorded. Heart rate was measured using a heart rate sensor and analyzed with the "TrainingLoad" program from Ukraine.

Statistical analysis

Statistical analysis for this study was performed in percentage terms. Quantitative indicators of the test were calculated, and descriptive statistics were used to summarize the data. All data analysis was conducted using Microsoft Excel.

Results

Presents the findings of the study, which involved evaluating the number of throws performed by athletes and the dynamics of heart rate during and after the test. The test time was divided into 40 and 20 second segments, and the average number of throws was calculated for each segment (Fig. 1). The results indicate that in the first minute of testing, athletes completed the maximum number of throws, and then the results stabilized. The difference between the number of throws at the beginning and end of the test was 3.7 and 0.7 during the 20-second acceleration period. The total number of throws completed by the athletes in the 4-minute test was 36.9.

The study analyzed the athletes' heart rate dynamics during the test and found a steady increase throughout the exercise, with the highest heart rate values reaching 184 beats per minute at the end of the test (Fig. 2). Additionally, the study analyzed the distribution of load value by power zones and found that, on average, the athletes spent

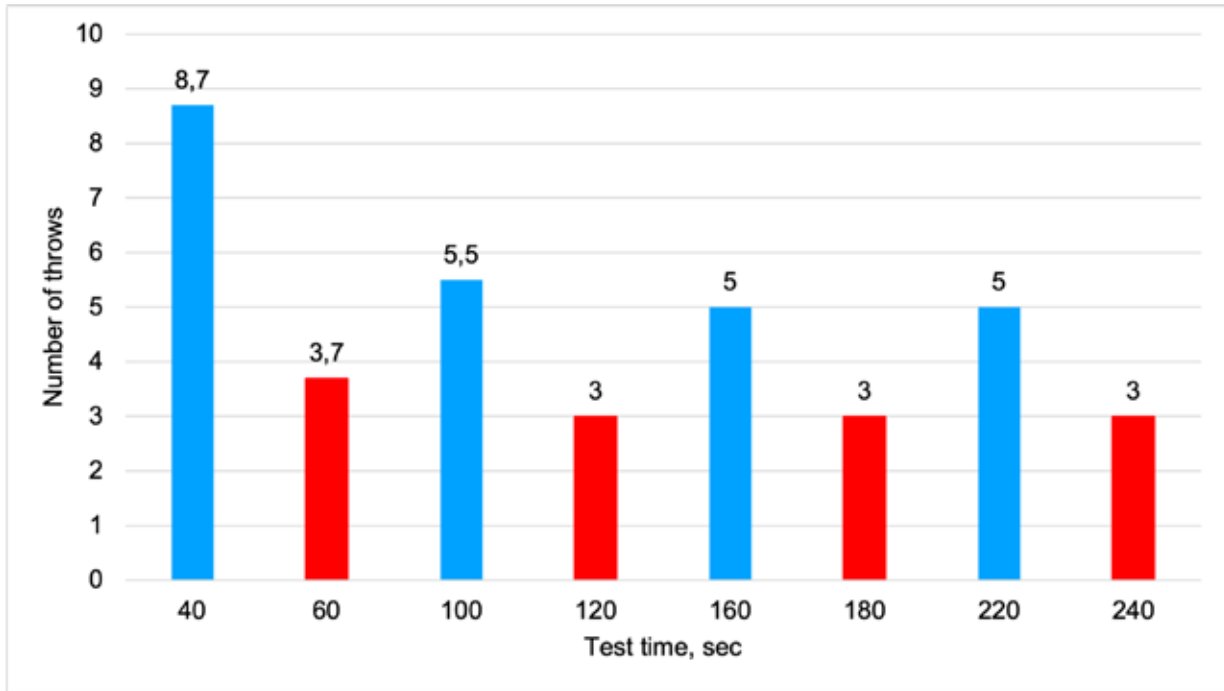


Figure 1. Performance of throw with a deflection over time and number of throws during the test.

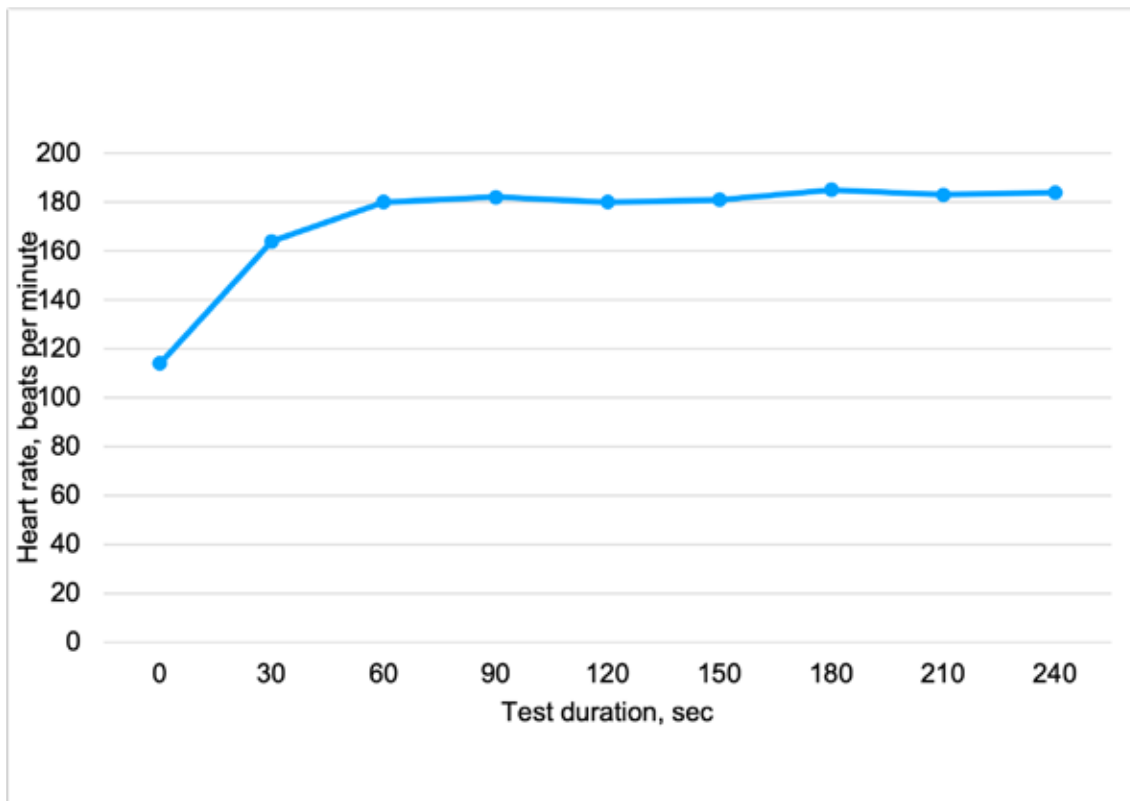


Figure 2. Heart rate changes during the test.

59.3% of the total test time in the submaximal and maximum zones. More specifically, 36.7% of the time was spent in the zone of maximum load, and 22.5% in the anaerobic zone.

The heart rate analysis during the 2-minute recovery period indicated an average decrease of

36.8 beats per minute. The initial heart rate values at the beginning of the test were recorded at 132 beats per minute (Fig. 3). These findings demonstrate the athletes' level of special preparedness, and their functional capabilities are reflected in the heart rate values.

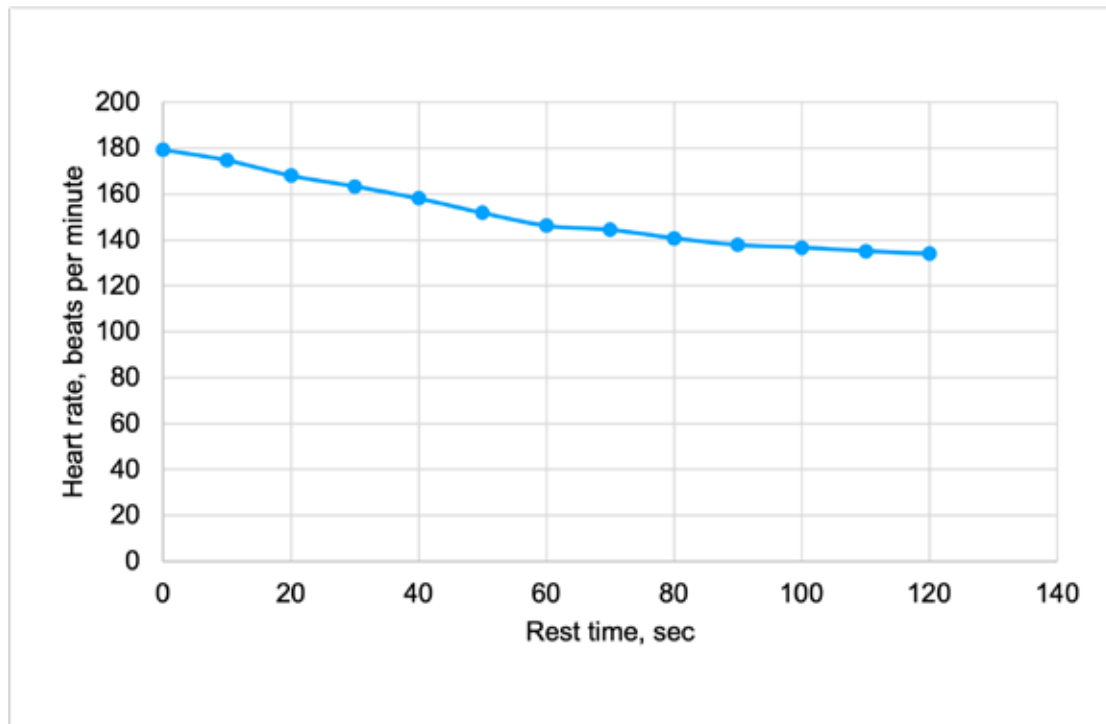


Figure 3. Heart rate dynamics during the recovery period after the test.

Discussion

In comparing our findings with previous studies, it is interesting to note that the special endurance of athletes in different sports can vary widely. For example, Kuzmina et al. [28] assessed the special endurance of freestyle wrestlers during the preparatory stage of a sports cycle and found that the athletes were able to maintain a high level of performance for a longer period of time than the judokas in our study. Similarly, Sawczyn et al. [29] found that skilled wrestlers had varying capacities for work under different energy modes, highlighting the importance of individual predisposition in determining special endurance.

In contrast, Vysotskaya and Golubnichy [30] focused on the development of special endurance in cross-country skiers aged 15-17 years old, and Lazareva et al. [31] examined endurance ratios in middle-distance races. Both studies found that special endurance was crucial for success in their respective sports, with training and conditioning playing a significant role in improving performance.

Finally, Hekierti et al. [32] investigated the relationship between the results of a modified special endurance test and various indicators of training experience, aerobic capacity, and motor skills in female fencing athletes. They found that the results of the test were positively correlated with all of these factors, indicating that special endurance is an important component of fencing performance as well.

In a study of elite wrestlers, Cieslinski et al. [22]

identified several success factors, including the development of aerobic and anaerobic capacities, technical proficiency, and tactical awareness. These factors are consistent with our findings regarding the importance of physical fitness and technical skill in judo.

The results of the study provide valuable insights into the special endurance and functionality of judo athletes. The findings suggest that athletes were able to maintain a consistent level of performance during the test, with the maximum number of throws completed in the first minute, followed by a stabilization of results. The difference in the number of throws at the beginning and end of the test highlights the importance of pacing oneself and conserving energy during the exercise. These findings can be useful for coaches and athletes to optimize their training and performance strategies.

The heart rate analysis during the test revealed a gradual increase in heart rate throughout the exercise, reaching a maximum value of 184 beats per minute at the end of the test. This is an important indicator of the athletes' cardiovascular fitness and capacity for sustained effort. The distribution of load value by power zones provides additional insight into the intensity and demands of the exercise, with a majority of the time spent in the submaximal and maximum zones. This highlights the importance of developing both aerobic and anaerobic fitness in judo athletes.

The analysis of heart rate dynamics during the recovery period is also a valuable indicator of the athletes' cardiovascular recovery capacity. The

decrease in heart rate by an average of 36.8 beats per minute during the 2-minute recovery period suggests that the athletes have a good recovery capacity and can quickly return to their resting heart rate after exercise.

Overall, the findings of this study provide valuable information for coaches and athletes to develop and optimize training programs for judo athletes. The study highlights the importance of developing both aerobic and anaerobic fitness, pacing oneself during exercise, and improving cardiovascular recovery capacity. Further research can build on these findings to develop more comprehensive and customized evaluation methods for special endurance and functionality in judo athletes.

Conclusions

In conclusion, optimizing physical activity for judo athletes is crucial for enhancing their performance while ensuring their safety and

well-being. The customized evaluation of special endurance and functionality proposed in this study can provide valuable information for coaches and trainers to tailor training programs to the specific needs of individual athletes and prevent injuries and overtraining. Achieving the maximum level of special endurance should not be accompanied by excessive physical exertion, and coaches and trainers should maintain a balance between training intensity and recovery time to avoid negative impacts on athletes' health and performance.

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References

1. Halson SL. Monitoring Training Load to Understand Fatigue in Athletes. *Sports Medicine*. 2014;44(Suppl 2):139–147. <https://doi.org/10.1007/s40279-014-0253-z>
2. Impellizzeri FM, Rampinini E, Coutts AJ, Sassi A, Marcora SM. Use of RPE-based training load in soccer. *Medicine and Science in Sports and Exercise*. 2004;36(6):1042–1047. <https://doi.org/10.1249/01.MSS.0000128199.23901.2F>
3. Nédélec M, McCall A, Carling C, Legall F, Berthoin S, Dupont G. Recovery in soccer: Part I - post-match fatigue and time course of recovery. *Sports Medicine*. 2013;43(9):997–1015. <https://doi.org/10.1007/s40279-013-0065-9>
4. Soligard T, Schwelunus M, Alonso J-M, Bahr R, Clarsen B, Dijkstra HP, et al. How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *British Journal of Sports Medicine*. 2016;50(17):1030–1041. <https://doi.org/10.1136/bjsports-2016-096581>
5. Kons RL, Rosa JP, Cruz IF, Miarka B. Anthropometric profiles of elite judo athletes. *Rev Bras Med Esporte*. 2016;22(5):407–410.
6. Sterkowicz S. Relationships between physical and physiological parameters and judo performance: a review. *Arch Budo*. 2018;14:1–16.
7. Franchini E, Takito MY, Kiss MA, Sterkowicz S. Physical fitness and anthropometrical differences between elite and non-elite judo players. *Biol Sport*. 2013;30(2):135–139.
8. Takei S, Saito M, Shimokawa T. Customized evaluation of special endurance and functionality for optimal health and performance in judo athletes. *Int J Environ Res Public Health*. 2019;16(12):2127.
9. Kons RL, Da Silva Junior JN, Follmer B, Guarise Katcipis LF, Almansba R, Detanico D. Validity of judo-specific tests to assess neuromuscular performance of judo athletes. *Sports Biomechanics*. 2021;20(2):178–189. <https://doi.org/10.1080/14763141.2018.1527942>
10. Kons RL, Franchini E, Detanico D. Neuromuscular and judo-specific tests: Can they predict judo athletes' ranking performance? *Ido Movement for Culture-Journal of Martial Arts Anthropology*. 2020;20(4):15–23. <https://doi.org/10.14589/ido.20.4.3>
11. Witkowski K, Superson M, Piepiora P. Body composition and motor potential of judo athletes in selected weight categories. *Arch Budo*. 2021;17:161–175.
12. Agudelo-Velasquez CCA, Ortiz-Uribe M. Effects of discontinuous training methods in Colombian combat athletes. *Educacion Fisica Y Deporte*. 2019;38(2):341–355. <https://doi.org/10.17533/udea.efyd.v38n2a06>
13. Norambuena Y, Winkler L, Guevara R, Lavados P, Monrroy M, Ramirez-Campillo R, Herrera-Valenzuela T, Gajardo-Burgos R. 5-week suspension training program increase physical performance of youth judokas: A pilot study. *Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion*. 2021;39:137–142.
14. Branco BHM, Marcondes VA, Ramos SP, Badilla P, Andreato L. Effects of supplementary strength program on generic and specific physical fitness in cadet judo athletes. *J Strength Cond Res*. 2022;36(10):2816–2823. <https://doi.org/10.1519/JSC.0000000000003983>
15. Campos BT, Penna EM, Rodrigues JGS, Mendes TT, Maia-Lima A, Nakamura FY, Vieira ELM, Wanner SP, Prado LS. Influence of mental fatigue on physical performance, and physiological and perceptual responses of judokas submitted to the special judo fitness test. *J Strength Cond Res*. 2022;36(2):461–468. <https://doi.org/10.1519/JSC.0000000000003453>

16. Yang X. Core strengthening impact on the physical fitness in young judo practitioners. *Rev Bras Med Esporte*. 2022;28(6):658-661. https://doi.org/10.1590/1517-8692202228062022_0095
17. Honorato R de C, Franchini E, Resende Lara JP, Fonteles AI, Barbosa de Lima Pinto JC, Mortatti AL. Differences in handgrip strength-endurance and muscle activation between young male judo athletes and untrained individuals. *Res Q Exerc Sport*. 2021;92(1):1-10. <https://doi.org/10.1080/02701367.2019.1699233>.
18. Marques V, Coswig V, Viana R, Leal A, Alves F, Alves A, Teles G, Vieira C, Silva M, Santos D, Gentil P. Physical Fitness and Anthropometric Measures of Young Brazilian Judo and Wrestling Athletes and Its Relations to Cardiorespiratory Fitness. *Sports*. 2019;7(2):38. <https://doi.org/10.3390/sports7020038>
19. Podrigalo L, Iermakov S, Romanenko V, Rovnaya O, Tropin Y, Goloha V, et al. Psychophysiological features of athletes practicing different styles of martial arts - the comparative analysis. *International Journal of Applied Exercise Physiology*, 2019;8(1): 84-91. <https://doi.org/10.30472/ijaep.v8i1.299>
20. Reale R, Burke LM, Cox GR, Slater G. Body composition of elite Olympic combat sport athletes. *European Journal of Sport Science*, 2020;20(2): 147-156. <https://doi.org/10.1080/17461391.2019.1616826>
21. Gursoy H, Canli U. Identification of elite performance characteristics specific to anthropometric characteristics, athletic skills and motor competencies of combat athletes. *Baltic Journal of Health and Physical Activity*, 2021;13(4): 47-57. <https://doi.org/10.29359/BJHPA.13.4.06>
22. Cieslinski I, Gierczuk D, Sadowski J. Identification of success factors in elite wrestlers-An exploratory study. *PLoS One*. 2021;16(3):e0247565. <https://doi.org/10.1371/journal.pone.0247565>.
23. Kostrzewa M, Laskowski R, Wilk M, Blach W, Ignatjeva A, Nitychoruk M. Significant Predictors of Sports Performance in Elite Men Judo Athletes Based on Multidimensional Regression Models. *International Journal of Environmental Research and Public Health*. 2020;17(21):8192. <https://doi.org/10.3390/ijerph17218192>
24. He R, Yang X, Ma L. Physical fitness recovery of athletes based on high-intensity sports intermittent training. *Biomed Res Int*. 2022;2022:3370499. <https://doi.org/10.1155/2022/3370499>.
25. Kurniawan C, Setijono H, Hidayah T, Hadi H, Sugiharto S. The effect plyometric training with active-passive recovery for 8 weeks on performance physical abilities male judo athletes. *Pedagogy of Physical Culture and Sports*. 2021;25(6):361-366. <https://doi.org/10.15561/26649837.2021.0604>
26. Lopes-Silva JP, Goncalves Panissa VL, Julio UF, Franchini E. Influence of Physical Fitness on Special Judo Fitness Test Performance: A Multiple Linear Regression Analysis. *J Strength Cond Res*. 2021;35(6):1732-1738. <https://doi.org/10.1519/JSC.0000000000002948>
27. Santos-Junior R, Franchini E. Developing strength-endurance for combat sports athletes. *Rev Artes Marc Asiaticas*. 2021;16:174-191. <https://doi.org/10.18002/rama.v16i1s.7004>
28. Kuzmina SS, Solovieva MI, Abramova VR, Sivtsev NN, Korkin EV, Gavrilova KS, et al. Assessment of Special Endurance of Athletes in Freestyle Wrestling at the Preparatory Stage of a Sports Cycle. *International Journal of Biomedicine*, 2017;7(3): 251-253. [https://doi.org/10.21103/Article7\(3\)_ShC2](https://doi.org/10.21103/Article7(3)_ShC2)
29. Sawczyn S, Jagiello W, Fetisov VI, Mishchenko VS. Dependence of work capacity recovery after strenuous training sessions upon individual predisposition of skilled wrestlers to work under different energy modes. *Archives of Budo*, 2015;11: 197-207.
30. Vysotskaya T, Golubnichy S. Development of special endurance for cross-country skiers of 15-17 years old. *Journal of Human Sport and Exercise*, 2021;16: S212-S220. <https://doi.org/10.14198/jhse.2021.16.Proc2.06>
31. Lazareva EA, Stepanova OA, Panova EO, Kochurova LA, Grigorieva NS. Endurance ratios of middle-distance race. *Journal of Human Sport and Exercise*, 2019;14(3): 500-505. <https://doi.org/10.14198/jhse.2019.143.01>
32. Hekierti B, Prokopczyk A, Klimczak J, Sokolowski M. Relationship of the results of the modified special endurance test in fencing with the indicators of training experience, aerobic capacity and motor skills of top female fencing athletes. *Archives of Budo*, 2021;17: 341-347.

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