


Editorial

# Special Issue Athletes' Performance and Analysis in Combat Sports and Martial Arts

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## 1. Introduction

Combat sports and martial arts have gained popularity in mainstream culture and are recognized in various realms of physical culture [1,2]. They have captured the interest of researchers in both elite and recreational sports [3–6]. Their advantages lie in their spectacle, multidirectional impact on physical functioning, motor skill development, as well as utilitarian values for self-defense or training for law enforcement [7–10].

Research on athletes allows for the assessment of training progress, identifying an improvement or decline in performance, and appropriately adjusting training loads. Scientific investigations also enable the visualization of detailed physiological responses during combat sports (exercise physiology), the biomechanical analysis of specific actions, and the effectiveness of technical–tactical solutions [11–15]. The goal of the research conducted for this edition of “Athletes Performance and Analysis in Combat Sports and Martial Arts” is to comprehensively present the complex structure of combat in combat sports (in terms of temporal and substantive aspects) and to seek ways to refine the optimal preparation system for tournament fighters. The solutions to this problem are presented through a series of original empirical studies.

These studies form the basis for a comprehensive thematic monograph related to various aspects of fighting arts. The term “fighting arts” is a collective term encompassing different martial arts, combat sports, and self-defense systems, as adopted in the general theory of fighting arts (GTFA) [16]. GTFA, alongside sports sciences (sports theory, sports combat theory, sports psychology), provides the scientific framework and theoretical perspective for this compilation.

Sports sciences influence sports practice, especially in optimizing the sports training process [17,18]. Research results in the field of fighting arts have implications for both competitive combat sports and the role of martial arts in other areas of physical culture (physical education, recreational exercise, physical rehabilitation) [19–24]. Therefore, they are considered applied sciences. In the case of “non-competitive” martial arts (traditional martial arts), their use in lifelong or family recreational activities is significant [25,26]. It is worth noting that the editors of this publication, hailing from various academic centers, are both practitioners (masters) and researchers in fighting arts. This understanding of the relationship between theory and research and their practical application is essential.

The basis for this monographic publication was the Special Issue “Athletes Performance and Analysis in Combat Sports and Martial Arts” in the scientific journal *Applied Sciences*. Among the keywords were various forms of martial arts and combat sports, as well as important concepts for sports sciences: fight analysis, technical and tactical preparation, training control. It is important to mention that this Special Issue received 29 submissions, of which 11 were accepted. The thematic summary is based on the content of these eleven



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works, originating from research centers in different countries and resulting from studies in Olympic judo (five works), classical wrestling, taekwondo, MMA, karate (in various styles), sport ju-jitsu, and comparative studies across different combat sport disciplines. The topics mainly covered biotechnical and biomedical aspects, as well as sports psychology—the level of aggressiveness. This multidisciplinary approach is characteristic of sports sciences, as only through such an approach can we gain a relatively complete understanding of this segment of human reality.

## 2. Combat Sports in Scientific Research

The first of the mentioned articles, entitled “Rapid Weight Loss Coupled with Sport-Specific Training Impairs Heart Rate Recovery in Greco-Roman Wrestlers”, focuses on research into the impact of rapid weight loss and intense sport-specific training on the body’s ability to recover its heart rate. The results of this study suggest that the combined effects of these two factors can negatively affect the body’s ability to return to a resting state, especially in the case of sudden weight loss, which is often practiced by wrestlers. This is significant because effective heart recovery is crucial for maintaining the health and performance of athletes [27].

The second article, “Contributions of Body Segments to the Toe Velocity during Taekwondo Roundhouse Kick”, analyzes the influence of various body segment movements on the velocity of the roundhouse kick in taekwondo. The study reveals that movements of the thigh and torso significantly impact the kick’s velocity. This research can assist coaches and athletes in gaining a better understanding of the biomechanics of taekwondo kicks and adapting their training for increased effectiveness [28]. The third study, “Defining the Influence of Fatigue Protocol on Kinematic Parameters of Ippon Seoi Nage”, focuses on the analysis of how fatigue affects the kinematic parameters of the ippon seoi nage throw in judo. The results suggest that fatigue can significantly impact the execution of this technique, which is crucial for judo athletes who need to maintain full control over their movements even in high-intensity situations [29]. The fourth paper, “When and How a Judo Contest Ends: Analysis of Scores, Penalties, Rounds and Temporal Units in 2018, 2019 and 2021 World Championships”, provides an analysis of how judo matches concluded during the World Championships in 2018, 2019, and 2021. The results show that most matches ended with a technical score, and the activity and effectiveness of attacks were highest at the beginning of the match. This information can be valuable for judo athletes in developing match strategies and gaining a better understanding of the factors that determine match outcomes [30]. The fifth publication, “Physical and Morphological Differences between Young Elite Taekwondo and Karate Players”, presents a comparison of body morphology and strength between young taekwondo and karate athletes. The results indicate differences in body composition and muscle strength between these two disciplines. This can help coaches and athletes better tailor their training to the specific requirements of their sport and identify the benefits of cross-training in different martial arts [31]. The sixth and final article, “Analysis of Combat in Sport JU-JITSU during the World Championships in Fighting Formula”, focuses on the analysis of combat in the sport ju-jitsu during the World Championships in the fighting formula. The results suggest that most matches end based on technical point advantages, and the activity and effectiveness of attacks are highest at the beginning of the match. This information is crucial for athletes looking to develop effective strategies for this specific form of ju-jitsu competition. The insights gained from this analysis can also be used to construct training units based on the real structure of ju-jitsu combat [32].

## 3. Future Scientific Challenges in Combat Sports and Martial Arts

Even though this Special Issue has now concluded, there is an expectation for further research in the areas of motor preparation and technical–tactical training in combat sports. It can be anticipated that in the future, there will be a need for more detailed analyses to ensure even greater effectiveness in combat, given the rapidly evolving and increasingly

sophisticated nature of competition in combat sports. In such cases, one must be prepared to employ appropriate strategies in preparation for competitions, based on the results of ongoing monitoring and the utilization of research findings in this field, as well as current forecasts regarding future competition.

#### 4. Conclusions

Overall, the obtained results suggest that the use of rapid weight loss (RWL) techniques along with intensive training may lead to higher heart rate (HR) values during the preparatory period before wrestling competitions. This can have a negative impact on aerobic fitness and the proper preparation of athletes for competition. Tools such as hand-grip strength measurement and the Ditrich rod can be useful in selecting karate athletes. It has been indicated that there are differences in morphological structure and strength among young elite karate and taekwondo athletes.... In sport ju-jitsu, most matches end with a point victory, and the highest activity is observed at the beginning of the match. All the suggestions presented have practical value and should be utilized in sports training planning strategies.

As is evident from the provided compilation, this Special Issue serves as a comprehensive source of knowledge for all enthusiasts of combat sports and martial arts, including athletes and coaches. Each article contributes valuable insights into understanding these disciplines and their impact on the human body while also inspiring further research in this field.

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