

**FEATURES OF RESTORING THE PERFORMANCE OF KARATE KILLERS IN THE CONDITIONS OF A BUSY COMPETITION SCHEDULE**

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A B S T R A C T	K E Y W O R D S
<p>This article analyzes the recovery process for karatekas in kumite, particularly during a busy competition schedule. It examines the physiological, neuromuscular, hydration, and cognitive components of fatigue that develop during multiple bouts over the course of one or more competition days. Based on an analysis of current scientific data, key principles and priorities for recovery are summarized, taking into account limited rest periods between bouts. The most effective recovery strategies applicable directly during competition are presented. It is demonstrated that effective recovery in kumite should be multi-component and phased, including active recovery, rehydration, carbohydrate supplementation, sleep management, and heat stress management.</p>	<p>Karate, kumite, recovery, busy schedule, tournament, performance, active recovery, hydration, carbohydrates, sleep.</p>

**Introduction**

The scientific novelty of the article lies in the comprehensive and karate-specific examination of the processes of restoring performance in the conditions of a tight kumite competition schedule, with the identification of priority components of fatigue and their practical hierarchization depending on the duration of intervals between fights.

Modern competitive karate (WKF), particularly the kumite discipline, is characterized by a high intensity of training on tournament days: athletes may engage in several bouts in a row with limited rest intervals, and during multi-day events, repeat this cycle over 2–3 days. Kumite is an intermittent activity with multiple, short, high-intensity bouts, which imposes significant cardiorespiratory and metabolic strain and creates the preconditions for fatigue accumulation with short recovery intervals. This has been confirmed by studies comparing official and simulated bouts in highly skilled karatekas, where high physiological responses (including heart rate and metabolic rate) were recorded [1].

The importance of recovery is further emphasized by competition regulations: WKF rules stipulate that athletes are entitled to a rest period between bouts equal to the standard duration of the match (with exceptions, such as changing the color of their equipment). In practice, this means that the

recovery window between bouts can be very short, making it particularly important to have standardized and effective recovery protocols in place during competition day [2].

Under tight schedules, it's critical not only to restore overall performance, but also to maintain the speed-strength and coordination components that determine the effectiveness of offensive and defensive actions. Karate-specific testing protocols, such as Karate Specific Aerobic Test (KSAT) demonstrate that intense, competition-like loads cause pronounced signs of fatigue and changes in physiological and biomechanical parameters, which requires targeted recovery [3].

A separate limiting factor for recovery during competitive periods is sleep, which is impaired by the stress of the start, changes in routine, and logistics (travel, early weigh-ins/accreditations, late end of the program). The 2021 expert consensus in the British Journal of Sports Medicine highlights that elite athletes often experience sleep deprivation and fragmentation, and sleep deprivation is associated with decreased athletic performance and impaired recovery [4].

Despite the extensive research on recovery in sport in general, karate prioritizes the practical adaptation of recovery approaches to tournament conditions: short intervals between bouts, inter-day recovery, and the need to maintain high levels of readiness during repeated bouts. Significantly, recent studies are already analyzing the impact of various recovery strategies specifically on karatekas after Karate-Specific Standardized Training (KSAT), reflecting the growing interest in evidence-based recovery protocols in this sport [5].

In this regard, the purpose of this article is to summarize modern data on the nature of fatigue in kumite and to highlight the most significant (from the standpoint of evidence and applicability) strategies for restoring the performance of karatekas under the conditions of a tight competition schedule.

This study utilizes a narrative review of the scientific literature on the characteristics of fatigue and recovery in athletes under intense competition schedules. The analysis includes publications reflecting the physiological demands of competitive activity in karate ( kumite ), as well as data on recovery strategies used in martial arts and other sports involving repetitive, high-intensity exercise.

Search sources was carried out V international scientific bases PubMed, Scopus and Web of Science data using key words And their Combinations of karate, kumite , recovery, competition schedule, fatigue, active recovery, sleep, hydration, and nutrition. The review included original studies, systematic and narrative reviews, as well as position papers and expert consensus statements from international sports medicine organizations.

Competitive kumite activity is characterized by an intermittent nature, involving multiple short-term explosive actions (attacks, counterattacks, movements, changes of direction) with relatively short rest periods. In a tournament setting, an athlete may compete several times in a single day, and sometimes over several consecutive days, leading to the accumulation of various forms of fatigue. To develop effective recovery programs, it is crucial to understand which components of performance are most affected.

Studies of official and simulated karate matches show that kumite is accompanied by a high heart rate, close to submaximal values, and a significant increase in blood lactate levels . This indicates a significant contribution of anaerobic processes and the development of metabolic stress, which, with short rest periods, can persist into the next bout. Incomplete recovery of metabolic parameters limits the athlete's ability to maintain a high pace and the effectiveness of repeated attacks.

The repeated explosive efforts characteristic of kumite cause fatigue in the neuromuscular system, manifested by a decrease in strength, power, and speed of movement. Experimental data indicate that neuromuscular parameters are closely linked to the competitive performance of karatekas, and their decline during a busy schedule can impair both offensive and defensive performance.

During competition day, athletes lose a significant amount of fluid through sweat, especially in warm and stuffy gyms. Insufficient Rehydration leads to a decrease in blood plasma volume, increased subjective fatigue, and impaired recovery processes. At the same time, muscle glycogen stores are depleted, limiting the ability to perform repeated high-intensity actions in subsequent bouts.

Karate requires high-speed decision-making, precision, and concentration. Accumulated fatigue and a lack of recovery can lead to impaired reaction times, an increased incidence of tactical errors, and decreased emotional stability . factors especially are significant in decisive fights tournament .

Table 1 - The main components of fatigue and directions of recovery of karatekas' performance under conditions of a tight competition schedule

Performance component	Signs of fatigue	Potential consequences for kumite	Priority areas for recovery
Metabolic function	Increased lactate, delayed heart rate recovery	Slower pace of combat, decreased reactivity	Low intensity active recovery
Neuromuscular function	Decreased strength and power, impaired coordination	Loss of attack speed and effectiveness	Restorative exercises, sleep
Hydration status	Fluid loss, electrolyte imbalance	Increased fatigue, deterioration of thermoregulation	Rehydration with electrolytes
Energy supply	Glycogen depletion	Decreased power and endurance	Carbohydrate nutrition during the recovery period
Cognitive and psycho-emotional sphere	Decreased concentration, increased stress	Tactical errors, slow reaction	Sleep, psychological regulation

Therefore, under the pressure of a tight kumite competition schedule , recovery must be multifaceted and aimed not only at reducing subjective fatigue but also at normalizing metabolic, neuromuscular, hydration, and cognitive indicators. Ignoring even one of these components can lead to a decrease in a karateka's competitive performance in subsequent bouts.

Given the tight competitive schedule in kumite, recovery should be viewed as a continuous and structured process, beginning immediately after a bout and continuing until the athlete's next appearance on the tatami. Limited rest time between bouts necessitates the use of quick, simple, and evidence-based recovery measures that don't require sophisticated equipment and can be implemented directly during competition.

A key principle is to prioritize recovery tasks based on the duration of the recovery "window." During short intervals, the primary focus should be on reducing acute fatigue and stabilizing functional status, while during longer breaks, the role of adequate energy replenishment, hydration, and sleep increases. It's important to emphasize that there is no universal recovery method: the effectiveness of specific strategies depends on the individual athlete, competition conditions, and accumulated workload.

An additional principle is the pre-standardization of recovery protocols. The athlete and coaching staff must practice the post-competition sequence (physical activity, hydration, nutrition, psychological regulation) in advance, so that recovery occurs automatically under competitive stress and does not depend on subjective decisions.

Table 2 - Priorities for restoring the performance of karatekas depending on the duration of the interval between fights

Recovery interval	The main goal	Priority recovery tools	Practical Emphasis
Very short (3-10 min)	Reducing acute fatigue and preparing for the next fight	Low-intensity active recovery, breathing exercises	Avoid sudden stops; maintain a gentle movement
Short (10-60 min)	Partial replenishment of fluid and energy	Rehydration with electrolytes, easily digestible carbohydrates	Small portions, good gastrointestinal tolerance
Medium (1-3 hours)	Restoration of energy and neuromuscular resources	Carbohydrate-protein nutrition, passive rest	Counting down the time until the next fight
Interday (12-24 h)	Full restoration of functionality	Sleep, nutrition, hydration, reduction of psycho-emotional stress	Sleep as a priority factor in recovery

Therefore, effective recovery for karatekas during a busy competition schedule requires a flexible and phased approach based on the duration of intervals between bouts and the priorities of their current functional state. Systematic application of such principles helps reduce the negative impact of accumulated fatigue and maintain high competitive performance throughout the tournament.

Given the tight competition schedule, karatekas' recovery programs must be targeted, simple, and adapted to the short time intervals between bouts. Strategies with proven effectiveness in karate and other sports involving intermittent high-intensity exercise have the greatest practical value.

One of the most effective strategies between bouts is active recovery, which involves light physical activity (walking, slow pedaling, mobilization exercises) lasting 3-6 minutes. Research shows that active recovery promotes a more rapid reduction in blood lactate levels and improves the subjective perception of readiness for subsequent work compared to passive rest [6,7]. This is especially important for kumite, as accelerated "metabolic calming" enhances the ability to perform repeated explosive actions.

During competition, karatekas lose significant amounts of fluid, which can negatively impact thermoregulation and functional readiness. Position papers on sports nutrition emphasize the need for early and systematic rehydration, preferably with sodium supplementation, especially during busy schedules and high sweat rates [8]. Adequate rehydration reduces subjective fatigue and maintains cardiorespiratory fitness in subsequent bouts.

Depletion of muscle glycogen stores is one factor in reduced performance. According to ACSM recommendations and applied reviews, when there are multiple bouts within a day or short intervals between bouts, it is advisable to use easily digestible carbohydrates in the early recovery phase [8,9].

This is especially relevant for kumite , where maintaining power and tempo directly depends on the availability of carbohydrate substrates.

During multi-day tournaments, the quality and duration of sleep becomes a crucial factor in recovery. Expert consensus : Journal of Sports Medicine notes that sleep deprivation is associated with decreased physical and cognitive performance, as well as slower recovery processes in athletes [4]. For karatekas, this means prioritizing sleep management on competition days, especially after evening bouts.

In hot or overheated conditions, cooling procedures (e.g., cold water therapy) can be used to reduce heat stress and subjective fatigue. Meta-analyses show that such methods can improve short-term recovery, but their use requires an individualized approach and consideration of the time until the next bout [10].

Thus, under the conditions of a tight competition schedule, the most significant limitations to recovery for karatekas are metabolic stress, neuromuscular fatigue, insufficient fluid and carbohydrate replenishment, and decreased sleep quality. Since the WKF regulations only allow for limited rest time between bouts, recovery must be as standardized as possible, and "quick" (between bouts) recovery must be supplemented by high-quality inter-day rest. Recovery. Individualized protocols and training "rehearsals" of recovery actions before the start are key to maintaining performance.

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