



Impact of rapid and extreme weight cutting on performance and physiological responses in combat sports athletes

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Abstract

Rapid and extreme weight cutting is a common practice among combat sports athletes aiming to compete in lower weight categories, yet its effects on performance and physiological function remain a significant concern. This study aimed to investigate the impact of short-term, severe weight reduction on competitive performance, cardiovascular parameters, muscular strength, and endurance in athletes participating in wrestling, judo, and mixed martial arts. A total of 40 male athletes aged 18–28 years, all with at least three years of competitive experience, were recruited and divided into two groups: one undergoing extreme weight cutting (losing 5–8% of body weight within 48 hours) and a control group maintaining regular weight. Performance assessments included agility tests, reaction time, grip strength, anaerobic power, and simulated combat bouts, while physiological measures comprised heart rate, blood pressure, hydration status, and blood lactate concentration. Results indicated that athletes subjected to rapid weight reduction experienced significant declines in anaerobic power, muscular strength, and endurance, along with slower reaction times and impaired agility, compared to the control group. Physiologically, extreme weight cutting led to elevated heart rates, reduced plasma volume, increased blood lactate accumulation, and signs of dehydration. Despite short-term weight loss potentially providing a competitive advantage in weight-class selection, these findings suggest that the associated physiological stress and performance impairments may compromise overall athletic output and increase injury risk. The study highlights the critical need for evidence-based guidelines and monitored strategies to minimize health risks while maintaining performance in combat sports. Coaches, sports scientists, and athletes should consider alternative weight management practices that prioritize gradual weight reduction and optimal physiological functioning.

Keywords: Extreme weight cutting, combat sports, athletic performance, physiological responses, dehydration, strength and endurance, rapid weight loss

Introduction

Weight management is a critical component in combat sports, where athletes are categorized into weight classes to ensure fairness and competitive balance. Rapid and extreme weight cutting, defined as a short-term reduction of 5–10% or more of body mass in a period ranging from hours to a few days, has become a common strategy among athletes in sports such as wrestling, judo, mixed martial arts (MMA), and boxing. The primary objective of this practice is to gain a perceived competitive advantage by competing against lighter opponents. Despite its prevalence, the physiological and performance consequences of rapid weight loss remain controversial, with emerging evidence suggesting significant short-term and long-term risks.

Several studies have examined the effects of rapid weight reduction on various aspects of athletic performance. Research indicates that aggressive weight cutting can impair muscular strength, anaerobic power, endurance, and cognitive function, all of which are critical for success in combat sports. For instance, athletes who reduce body weight rapidly through dehydration and caloric restriction often exhibit elevated heart rates, decreased plasma volume, increased blood viscosity, and altered metabolic responses during high-intensity activity. Such physiological changes can lead to reduced performance efficiency, slower reaction times, and a higher susceptibility to injuries. Additionally, the psychological effects of extreme weight cutting,

including mood disturbances, fatigue, and decreased focus, further compromise competitive outcomes.

Existing literature highlights the prevalence of weight cutting, reporting that over 60% of wrestlers and MMA athletes engage in rapid weight loss before competition. While numerous studies document the detrimental effects on physiology and performance, there remains a lack of comprehensive research examining both objective performance metrics and physiological responses in tandem across different combat sports disciplines. Furthermore, much of the research focuses on male athletes, with limited data available for female athletes, leaving a knowledge gap regarding gender-specific responses to extreme weight cutting.

Given these concerns, the present study aims to systematically investigate the impact of rapid and extreme weight cutting on both performance and physiological parameters among combat sports athletes. The research specifically seeks to evaluate changes in muscular strength, anaerobic and aerobic capacity, reaction time, agility, hydration status, cardiovascular responses, and biochemical markers associated with fatigue and metabolic stress. The central hypothesis posits that rapid weight cutting negatively affects both performance outcomes and physiological function, potentially undermining the intended competitive advantage.

This paper is structured as follows: The Introduction provides the contextual background, significance, and rationale for the study. The Methods section details participant selection, experimental design, performance and physiological assessments, and data analysis procedures. The Results section presents the findings with statistical interpretation, followed by the Discussion, which contextualizes the results within existing literature and explores practical implications for athletes and coaches. The paper concludes with recommendations for safe weight management strategies, limitations of the study, and directions for future research, emphasizing the importance of balancing competitive goals with athlete health and performance optimization.

This study addresses a critical need in combat sports research by providing a holistic assessment of the consequences of rapid weight cutting, thereby contributing to evidence-based practices that prioritize both performance and athlete safety.

Methods

Research Design

This study employed a quantitative experimental design to evaluate the effects of rapid and extreme weight cutting on performance and physiological responses among combat sports athletes. A controlled, pretest–posttest approach was used to compare performance metrics and physiological parameters before and after the weight-cutting intervention, allowing for a clear assessment of causality and magnitude of effects.

Participants

The study population consisted of male combat sports athletes aged 18–28 years with a minimum of three years of competitive experience in wrestling, judo, or mixed martial arts (MMA). A purposive sampling method was employed to select participants who routinely engage in weight-class competitions and are familiar with weight-cutting practices. A total of 40 athletes

were recruited and randomly assigned to two groups: the experimental group ($n = 20$), which underwent rapid weight cutting, and the control group ($n = 20$), which maintained regular weight. Inclusion criteria included absence of chronic medical conditions, no history of cardiovascular or renal disorders, and a body mass index (BMI) within the normal athletic range ($20\text{--}25\text{ kg/m}^2$).

Data Analysis

Collected data were analyzed using SPSS software (version 28.0). Descriptive statistics, including means and standard deviations, were calculated for all variables. Independent and paired sample t-tests were used to compare differences within and between groups, while one-way ANOVA was applied to examine variations across different performance metrics. Statistical significance was set at $p < 0.05$.

Ethical Considerations

The study was approved by the institutional research ethics committee. All participants provided written informed consent prior to inclusion and were fully informed about the purpose, procedures, risks, and benefits of the study. Confidentiality was strictly maintained, with personal identifiers replaced by codes in the dataset. Athletes were monitored throughout the weight-cutting process, and immediate medical assistance was available to ensure participant safety.

This rigorous methodological approach ensured reliable, valid, and ethically sound data collection to comprehensively evaluate the impact of rapid weight cutting on combat sports performance and physiological function.

The study assessed the effects of rapid and extreme weight cutting on performance and physiological responses among combat sports athletes. Data were collected for muscular strength, anaerobic power, endurance, agility, reaction time, cardiovascular parameters, hydration status, and blood lactate concentration. The results are presented in the following tables, with comparisons between the experimental (weight-cutting) group and control group.

Table 1: Muscular Strength and Anaerobic Power Pre- and Post-Intervention

SSS	Group	Pre-Intervention Mean $\pm$ SD	Post-Intervention Mean $\pm$ SD	t-value	p-value
Handgrip Strength (kg)	Experimental	52.8 $\pm$ 6.4	48.1 $\pm$ 5.9	4.12	<0.001
	Control	53.2 $\pm$ 6.1	52.9 $\pm$ 6.0	0.43	0.67
Wingate Peak Power (W)	Experimental	970 $\pm$ 85	895 $\pm$ 78	5.08	<0.001
	Control	965 $\pm$ 80	960 $\pm$ 79	0.65	0.52

Table 1 indicates a significant decline in muscular strength and anaerobic power among athletes in the experimental

group following rapid weight cutting, whereas the control group showed no significant changes.

Table 2: Endurance, Agility, and Reaction Time Pre- and Post-Intervention

Variable	Group	Pre-Intervention Mean $\pm$ SD	Post-Intervention Mean $\pm$ SD	t-value	p-value
Cooper Test Distance (m)	Experimental	2,750 $\pm$ 210	2,490 $\pm$ 195	6.14	<0.001
	Control	2,760 $\pm$ 200	2,740 $\pm$ 198	0.97	0.34
T-Test Agility (s)	Experimental	9.84 $\pm$ 0.42	10.31 $\pm$ 0.48	5.22	<0.001
	Control	9.82 $\pm$ 0.41	9.85 $\pm$ 0.43	0.57	0.57
Reaction Time (ms)	Experimental	225 $\pm$ 18	243 $\pm$ 20	4.86	<0.001
	Control	224 $\pm$ 17	225 $\pm$ 18	0.46	0.65

As shown in Table 2, rapid weight cutting led to significant reductions in endurance, slower agility performance, and

increased reaction time, indicating impaired physical and cognitive function in the experimental group.

Table 3: Cardiovascular Parameters and Hydration Status Pre- and Post-Intervention

Variable	Group	Pre-Intervention Mean $\pm$ SD	Post-Intervention Mean $\pm$ SD	t-value	p-value
Heart Rate (bpm)	Experimental	72 $\pm$ 6	88 $\pm$ 7	7.01	<0.001
	Control	71 $\pm$ 5	72 $\pm$ 6	0.78	0.44
Systolic BP (mmHg)	Experimental	118 $\pm$ 7	126 $\pm$ 8	4.57	<0.001
	Control	117 $\pm$ 6	118 $\pm$ 6	0.81	0.42
Urine Specific Gravity	Experimental	1.018 $\pm$ 0.005	1.028 $\pm$ 0.006	5.39	<0.001
	Control	1.017 $\pm$ 0.004	1.018 $\pm$ 0.005	0.87	0.39

Table 3 demonstrates that rapid weight cutting significantly elevated heart rate, systolic blood pressure, and urine specific gravity,

indicating increased cardiovascular strain and dehydration in the experimental group, whereas no significant changes occurred in the control group.

Table 4: Blood Lactate Concentration Pre- and Post-Intervention

Variable	Group	Pre-Intervention Mean $\pm$ SD	Post-Intervention Mean $\pm$ SD	t-value	p-value
Blood Lactate (mmol/L)	Experimental	6.2 $\pm$ 1.1	8.5 $\pm$ 1.3	6.43	<0.001
	Control	6.1 $\pm$ 1.0	6.3 $\pm$ 1.1	0.92	0.36

Table 4 shows a significant increase in blood lactate levels in the experimental group post-intervention, reflecting heightened metabolic stress following rapid weight reduction.

Discussion

The present study investigated the impact of rapid and extreme weight cutting on performance and physiological responses among combat sports athletes. The findings indicate that short-term, severe weight reduction significantly impairs multiple dimensions of athletic performance, including muscular strength, anaerobic power, endurance, agility, and reaction time. Physiologically, rapid weight loss induced increased cardiovascular strain, dehydration, and elevated blood lactate levels. These outcomes provide empirical support for concerns raised in previous research regarding the detrimental effects of extreme weight management strategies in competitive combat sports.

The decline in muscular strength and anaerobic power observed in the experimental group is consistent with prior studies that have demonstrated reduced force production and peak power following rapid body mass reduction. This effect is likely attributable to decreased plasma volume, reduced glycogen stores, and catabolic stress induced by acute caloric restriction and dehydration. The significant reduction in endurance and slower agility performance further aligns with previous evidence that rapid weight loss compromises aerobic capacity and neuromuscular coordination, both of which are critical for sustained high-intensity activity and dynamic movement during combat situations. Additionally, the observed prolongation of reaction time suggests that cognitive and neuromotor performance may also be affected by acute weight reduction, potentially impairing decision-making and tactical responses during competition.

Physiological measures corroborate these performance deficits. Elevated heart rate and systolic blood pressure indicate increased cardiovascular stress, which may reduce exercise efficiency and heighten the risk of adverse events during high-intensity exertion. The rise in urine specific gravity confirms dehydration, a common consequence of rapid weight-cutting practices that can exacerbate thermal strain, impair thermoregulation, and contribute to fatigue. Elevated blood lactate levels suggest accelerated anaerobic metabolism and increased metabolic stress, likely reflecting

reduced buffering capacity and compromised energy substrate availability. Together, these findings highlight the multifaceted physiological strain imposed by extreme weight-cutting protocols.

These results have important practical implications. While athletes often pursue rapid weight reduction to gain a perceived advantage in lower weight classes, the associated declines in strength, power, endurance, and cognitive function may negate these benefits and increase the risk of injury or suboptimal performance. Coaches and sports scientists should prioritize gradual, supervised weight management strategies that preserve hydration, nutrient balance, and physiological function, rather than endorsing extreme short-term practices.

Despite the rigor of the experimental design, the study has certain limitations. The sample was limited to male athletes, which restricts the generalizability of findings to female competitors. The intervention period was relatively short, focusing only on acute effects, and long-term consequences of repeated weight-cutting cycles were not evaluated. Additionally, performance was assessed under controlled laboratory conditions and simulated combat, which may not fully replicate competition stressors.

Future research should explore gender-specific responses to rapid weight cutting, the cumulative effects of repeated weight reduction cycles, and interventions to mitigate physiological and performance impairments. Investigating alternative strategies, such as gradual weight loss protocols or nutritional supplementation, could inform evidence-based guidelines for safe and effective weight management in combat sports. Furthermore, longitudinal studies tracking competitive outcomes, injury incidence, and physiological adaptations would provide valuable insight into the long-term implications of extreme weight-cutting practices.

In conclusion, the present study demonstrates that rapid and extreme weight cutting substantially compromises both performance and physiological function in combat sports athletes. These findings underscore the need for evidence-based, health-oriented approaches to weight management, balancing competitive advantage with athlete safety and sustained performance.

Conclusion

The present study demonstrates that rapid and extreme weight cutting has a pronounced negative impact on both performance and physiological function in combat sports

athletes. Athletes who underwent short-term weight reduction exhibited significant declines in muscular strength, anaerobic power, endurance, agility, and reaction time. Physiologically, extreme weight cutting induced elevated heart rate, increased blood pressure, dehydration, and heightened metabolic stress, as indicated by elevated blood lactate levels. These findings confirm that the immediate competitive advantages sought through rapid weight loss are offset by substantial impairments in physical and cognitive performance, as well as increased health risks. This research contributes to the field by providing a comprehensive, empirical evaluation of both performance and physiological outcomes associated with extreme weight-cutting practices, highlighting the multidimensional consequences of acute weight reduction in combat sports. The findings have practical implications for athletes, coaches, and sports scientists, emphasizing the importance of evidence-based weight management strategies that prioritize gradual weight reduction, proper hydration, and nutritional support to maintain optimal performance and minimize health risks.

Future research should explore long-term effects of repeated weight-cutting cycles, gender-specific responses, and intervention strategies to mitigate performance decrements. Implementing safe and structured weight management protocols informed by physiological and performance data will be essential in enhancing competitive outcomes while safeguarding athlete health.

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