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ORIGINAL RESEARCH

Effects of acute weight loss on serum mineral homeostasis in elite male judoka

Burcu Yenturk[1,*], Mihrac Koroglu[1], Nuri Muhammet Celik[1], Cuneyt Sensoy[2], Fıkret Soyer[3]

[1]Department of Coaching Education, Faculty of Sport Sciences, Batman University, 72000 Batman, Türkiye
[2]Pakistan Embassy International Study School, 06000 Ankara, Türkiye
[3]Department of Coaching Education, Faculty of Sport Sciences, Kyrgyzstan Turkiye Manas University, 720085 Biskek, Kyrgyzstan

***Correspondence**
burcu.yenturk@batman.edu.tr
(Burcu Yenturk)

Abstract

Background: Acute weight loss practices among judoka, typically aimed at qualifying for a lower weight class to gain a competitive advantage, may pose significant health risks. Maintaining optimal serum mineral levels is critical for both physiological function and athletic performance. This study aimed to examine the effect of acute weight loss on serum mineral concentrations in elite male judoka. **Methods**: The study included 32 elite-level male judoka who were participating in the Turkish Judo Championship and were selected through convenience sampling. Among these athletes, 15 individuals who engaged in rapid weight loss were assigned to experimental group, while the remaining 17 athletes who did not undergo weight reduction were assigned to control group. Demographic data, including age, height, and training experience, were collected using standardized forms. Body weight and venous blood samples were obtained at two time points: one week and one day prior to the competition. Weight, body mass index (BMI), and serum concentrations of sodium, potassium, calcium, magnesium, and chloride were analyzed. Paired Samples T-Test and Independent Samples T-Test were utilized to assess within-group and between-group differences, respectively. **Results**: In the experimental group, post-test values demonstrated a statistically significant increase in serum sodium levels ($p < 0.05$), along with notable decreases in magnesium and chloride concentrations ($p < 0.05$). No significant changes were detected in the other serum minerals within the experimental group or in any parameter among the control group. Moreover, post-intervention sodium levels were found to be significantly higher in the experimental group when compared to the control group ($p < 0.05$). **Conclusions**: Acute weight loss results in measurable alterations in specific serum mineral levels among elite male judoka, emphasizing the potential health risks of rapid weight reduction strategies in high-level competitive sports. These findings underscore the need for evidence-based guidance on weight management practices among athletes.

Keywords

Weight loss; Judo; Mineral

1. Introduction

Judo is a weight-classified combat sport that originated in the Far East and has since gained global popularity across amateur and professional levels. As with other sports categorized by body weight, judoka frequently seek to compete in a lower weight class, based on the assumption that this will provide an advantage over similarly skilled but lighter opponents. This strategic approach often motivates athletes to adopt sudden and sometimes extreme weight reduction methods in the final days leading up to competition. These methods are collectively referred to as acute weight loss and are widely observed across combat and weight-category sports. Among younger athletes, especially those still undergoing physical development, natural growth patterns may prevent them from reaching desired weight limits. As a result, many turn to rapid weight-cutting techniques, believing these strategies will help level the competitive playing field and overcome perceived physical disadvantages [1].

Rapid weight loss methods commonly include partial or total food deprivation, significant fluid restriction, excessive use of saunas, high-intensity training in heated environments, and sometimes the intake of pharmacological substances some of which may be banned under anti-doping regulations [2]. One of the major challenges for athletes competing in weight-class sports is maintaining target weight consistently without compromising overall health. Although these rapid weight reduction strategies can achieve short-term goals, they often do so at the cost of the athlete's physiological integrity.

Unhealthy acute weight loss can lead to substantial decreases in plasma volume and total blood volume. This physiological burden, particularly during submaximal exercise, can result in increased heart rate, reduced stroke volume and cardiac output, diminished oxygen delivery, impaired thermoregulation, electrolyte imbalance, decreased renal filtration efficiency, elevated urine concentration, and decreased liver glycogen. These changes collectively undermine athletic performance and recovery capacity [1].

Furthermore, severe weight reduction in a brief period adversely affects the body's hydration status, often resulting in dehydration. This fluid imbalance is usually accompanied by a loss of essential minerals, further compounding physiological stress [3]. Mineral deficiencies induced by dehydration can impair cardiovascular stability, reduce the efficiency of oxygen transport, and increase the likelihood of muscle cramps, all of which compromise an athlete's ability to perform at an optimal level [4]. When acute weight loss exceeds 5% of total body mass, the athlete may struggle to sustain repeated bouts of high-intensity activity [5]. In addition to physical consequences, these methods may also adversely affect psychological well-being and cognitive performance. Overall, sudden, and excessive weight loss can detrimentally impact nearly every aspect of athletic output.

A growing body of literature has explored various aspects of acute weight loss, including its methods of implementation [6], its effects on body composition and mental health [7], strength output [8], and motor performance capabilities [9]. While some studies have also examined changes in serum mineral concentrations due to dehydration or rapid weight loss in combat sports, the findings remain inconsistent and are often not specific to individual disciplines. Given these gaps in the literature, the current study aimed to provide a more discipline-specific evaluation by investigating the effects of acute pre-competition weight loss on serum levels of sodium, potassium, calcium, magnesium, and chloride in elite male judoka. By comparing blood samples collected from judoka who undertook rapid weight loss with those from athletes who did not engage in such practices, the study sought to generate a more detailed understanding of the physiological consequences associated with acute weight reduction in elite judo.

2. Materials and methods

2.1 Participants

A total of 32 elite-level male judoka voluntarily participated in this study. Sample size calculation was performed using G*Power 3.1.9.2 software (Heinrich Heine Düsseldorf University, Düsseldorf, NRW, Germany). Based on an effect size of 0.60, a statistical power of 0.95, and a significance level of 0.05, a sample of 32 participants was deemed sufficient. All participants were recruited from among athletes competing in the 2024 Türkiye Judo Championship, with the study commencing on May 15, 2024. Based on their pre-competition practices, 15 athletes who planned to undergo acute weight loss were assigned to the experimental group, while 17 athletes who maintained their usual weight served as the control group. Body weight measurements and venous blood samples were collected from all participants at two time points: one week and one day before the competition. Athletes in the experimental group engaged in deliberate weight-cutting protocols during the week preceding the event, which included caloric and fluid restriction, increased training intensity, and induced sweating via sauna use. All participants had prior experience with similar rapid weight loss strategies in previous competitions. Written informed consent was obtained from each participant after they were informed of the study's aims and procedures, in compliance with ethical research standards.

2.2 Research design

This study followed a quantitative, comparative design using a convenience sampling method, a non-probability approach that allows the inclusion of participants who are readily accessible and willing to participate [10]. The research process began with a literature review to establish theoretical foundations and identify key study variables. During the fieldwork phase, data were collected using standardized forms, anthropometric measurements, and venous blood samples to test the study hypotheses. Collected data were statistically analyzed and interpreted in the context of existing literature.

2.3 Data collection tools

Demographic data, including age, height, and training experience, were gathered via a structured questionnaire. Height was measured in the anatomical standing position using a tape measure with 0.01 cm precision. Body weight was recorded using a Dynamic-brand digital scale, with participants wearing lightweight clothing and no shoes.

Body Mass Index (BMI) was calculated using the standard formula:

BMI = weight (kg)/height (m)^2.

Venous blood samples were obtained by trained healthcare professionals under sterile conditions, both one week and one day before the competition. These samples were analyzed for serum mineral concentrations.

2.4 Statistical analysis

Data were analyzed using IBM SPSS software (version 25, Armonk, NY, USA). The Shapiro-Wilk test was applied to assess the normality of data distribution, which confirmed that the data were normally distributed. Accordingly, the Paired Samples T-Test was used for pre- and post-test within-group comparisons, and the Independent Samples T-Test was employed for between-group comparisons. A p-value of $<$ 0.05 was considered statistically significant.

3. Results

According to the results of the Independent Samples T-Test, there were no statistically significant differences between the experimental and control groups in terms of mean age (p = 0.325), height (p = 0.457), or training experience (p = 0.814), indicating that both groups were demographically comparable and well-matched at baseline (Table 1).

Statistical analyses performed to assess intra-group differ-

TABLE 1. Demographic information of the experimental and control groups.

	Experimental Mean ± SD	Control Mean ± SD
Age (yr)	20.96 ± 2.51	19.36 ± 2.84
Height (cm)	179.32 ± 5.52	177.40 ± 6.81
Training Age (yr)	9.65 ± 2.78	9.93 ± 2.27

SD: standard deviation.

ences in weight, body mass index (BMI), and serum mineral concentrations revealed that, within the experimental group, there was a statistically significant increase in serum sodium levels, as well as statistically significant decreases in serum magnesium and chloride levels ($p < 0.05$). However, no statistically significant differences were observed in weight, BMI, potassium, or calcium concentrations before and after weight loss in this group ($p > 0.05$). In contrast, the control group showed no statistically significant changes in any of the measured parameters over the same time period ($p > 0.05$) (Table 2).

Statistical analyses performed to determine intergroup differences in the weight, BMI, and serum mineral values revealed that only the post-test sodium level between the experimental and control groups showed a statistically significant difference ($p < 0.05$). In contrast, no significant differences were observed between the groups in terms of weight, BMI, potassium, calcium, magnesium, and chlorine values ($p > 0.05$) (Table 3).

4. Discussion

In judo, as in many other weight-class sports, athletes often engage in rapid weight loss through unhealthy means, including food and fluid restriction, excessive sauna use, vomiting, laxative use, diuretics, and diet pills. These methods, aimed at qualifying for lower weight categories, pose both physiological and psychological risks some of which can be fatal. The deaths of three collegiate wrestlers in the United States in 1997 due to extreme dehydration highlight the dangers of such practices [11, 12]. This study sought to evaluate the differences in serum mineral concentrations between judoka who underwent acute weight loss and those who maintained stable weight. The experimental and control groups were statistically similar in terms of age, height, and training experience (Table 1). Unlike many studies that only examine pre- and post-comparisons within the same group or only contrast groups cross-sectionally, this study used both within-group and between-group analyses for a more robust comparison. No statistically significant differences were found between pre- and post-test weight and BMI values within or between groups ($p > 0.05$). This aligns with the findings of Yasul *et al.* [8], though some other studies have reported conflicting results [13, 14].

Post-test sodium concentrations were significantly higher in the experimental group compared to the control group. Furthermore, sodium levels increased significantly within the experimental group after weight loss ($p < 0.05$). This rise is likely due to fluid loss from sweating and dehydration. Similar findings have been reported in related studies [15]. However, contrasting results were noted by Öcal [16], who reported decreased sodium levels in dehydrated swimmers, and Reljick [17], who found no significant change. Sodium plays a vital role in maintaining extracellular fluid balance, and along with potassium, is crucial for regulating hydration and cell function [18]. Potassium concentrations did not differ significantly either within or between groups ($p > 0.05$). Alpay *et al.* [19] similarly found no significant difference in potassium levels between wrestlers who lost weight and those who did not. However, Öcal [16] reported increased potassium levels post-dehydration in both male and female athletes.

Calcium, another vital mineral, constitutes approximately 1.7% of total body weight. While 99% of calcium is stored in bones, the remaining 1% circulates in extracellular fluid and plays essential roles in energy metabolism and muscle contraction [20]. In this study, no statistically significant differences in calcium levels were found within or between groups. These findings align with those of other studies [17, 19]. Magnesium, an essential cofactor in over 300 enzymatic processes including energy production, muscle function, and protein synthesis [20], decreased significantly within the experimental group from pre- to post-test ($p < 0.05$). This decrease is presumed to be a consequence of dehydration. However, other studies have reported no such change in magnesium levels [17, 21]. A significant decrease in chloride levels was also observed in the experimental group between pre- and post-tests ($p < 0.05$), likely attributable to fluid loss associated with acute weight reduction. Multiple studies have shown decreased serum chloride levels following short-term dehydration or acute weight loss [16, 22–24]. Nevertheless, Alpay *et al.* [19], in a comparison of wrestlers with and without pre-competition weight loss, did not observe significant differences.

This study's strength lies in the synchronized measurements of elite-level judoka participating in the same sanctioned competition, which minimized confounding variables. Nonetheless, several limitations exist. First, the study's scope was limited to a single competition, preventing longitudinal analysis. Second, the sample consisted solely of male judoka in a narrow age range, which restricts generalizability. Third, the relatively small sample size may limit the statistical power to detect subtler effects. Fourthly, athletes in the senior category participated in the study. In order to increase generalizability, studies should also be conducted with athletes in the junior, cadet, and veteran categories. Fifth, hydration status was not measured in this study and the weight loss experienced was relatively low. Future studies should include female athletes, competitors from multiple weight divisions, amateur athletes, and other combat sports to broaden applicability and strengthen evidence-based recommendations.

5. Conclusions

This study demonstrates that acute weight loss immediately prior to competition can significantly influence serum mineral concentrations in elite male judoka. Although changes in sodium, magnesium, and chloride levels remained within established clinical reference ranges, the observed trends suggest

TABLE 2. Intragroup comparison of experimental and control groups.

Values	Tests	Reference Range	Pre-test Mean ± SD	Post-test Mean ± SD	*p*
Weight (kg)					
	Experimental	-	81.99 ± 14.63	79.87 ± 14.17	0.074
	Control		80.83 ± 13.46	80.20 ± 13.58	0.123
BMI (kg/m^2)					
	Experimental	-	25.62 ± 3.49	25.53 ± 3.37	0.665
	Control		25.56 ± 3.17	25.55 ± 3.22	0.988
Sodium (mmol/L)					
	Experimental	136–145	136.88 ± 1.85	141.27 ± 2.32	0.041*
	Control		138.15 ± 1.18	137.74 ± 1.65	0.259
Potassium (mmol/L)					
	Experimental	3.5–5.1	3.97 ± 0.32	3.84 ± 0.28	0.652
	Control		4.05 ± 0.71	3.92 ± 0.67	0.547
Calcium (mg/dL)					
	Experimental	8.6–10.2	8.97 ± 0.68	8.84 ± 0.53	0.258
	Control		9.21 ± 0.41	9.12 ± 0.65	0.354
Magnesium (mg/dL)					
	Experimental	1.6–2.6	2.19 ± 0.41	1.83 ± 0.36	0.021*
	Control		2.03 ± 0.69	2.00 ± 0.55	0.234
Chlorine (mmol/L)					
	Experimental	98–107	104.42 ± 2.78	100.45 ± 3.44	0.033
	Control		102.07 ± 2.30	101.98 ± 3.00	0.273

**p* < 0.05. *BMI: body mass index; SD: standard deviation.*

TABLE 3. Intergroup comparison of experimental and control groups.

Values	Tests	Reference Range	Experimental Mean ± SD	Control Mean ± SD	*p*
Weight (kg)					
	Pre-test	-	81.99 ± 14.63	80.83 ± 13.46	0.174
	Post-test		79.87 ± 14.17	80.20 ± 13.58	0.159
BMI (kg/cm^2)					
	Pre-test	-	25.62 ± 3.49	25.56 ± 3.17	0.785
	Post-test		25.53 ± 3.37	25.55 ± 3.22	0.997
Sodium (mmol/L)					
	Pre-test	136–145	136.88 ± 1.85	138.15 ± 1.18	0.087
	Post-test		141.27 ± 2.32	137.74 ± 1.65	0.042*
Potassium (mmol/L)					
	Pre-test	3.5–5.1	3.97 ± 0.32	4.05 ± 0.71	0.251
	Post-test		3.84 ± 0.28	3.92 ± 0.67	0.094
Calcium (mg/dL)					
	Pre-test	8.6–10.2	8.97 ± 0.68	9.21 ± 0.41	0.741
	Post-test		8.84 ± 0.53	9.12 ± 0.65	0.684
Magnesium (mg/dL)					
	Pre-test	1.6–2.6	2.19 ± 0.41	2.03 ± 0.69	0.523
	Post-test		1.83 ± 0.36	2.00 ± 0.55	0.069
Chlorine (mmol/L)					
	Pre-test	98–107	104.42 ± 2.78	102.07 ± 2.30	0.098
	Post-test		100.45 ± 3.44	101.98 ± 3.00	0.177

**p* < 0.05. *BMI: body mass index; SD: standard deviation.*

potential physiological risks particularly with more substantial or repeated episodes of weight reduction. Notably, the decline in magnesium, though not reaching pathological thresholds, may reflect early signs of muscle damage or dysfunction, potentially resulting from dehydration induced by fluid restriction and intensified training. An average weight loss of approximately 2.12% did not trigger critical mineral disturbances; however, the findings underscore the importance of gradual and well-regulated weight management protocols. While this study did not directly assess hydration status, the observed shifts in mineral levels strongly suggest that dehydration contributed to the physiological changes documented. To safeguard both health and performance, athletes should be discouraged from engaging in aggressive, short-term weight-cutting practices. Coaches, trainers, and support personnel must play an active role in monitoring weight management and guiding athletes toward evidence-based, safe methods of weight control, scientifically supported practices. In summary, while modest short-term weight loss may not immediately endanger health, the cumulative effects and risks associated with repeated dehydration and mineral imbalance warrant careful oversight and proactive intervention.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed in the current study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

BY—were responsible for the study concept and design, drafting and revision of the manuscript. MK—was responsible for the design of the research study and experimental concept and design. NMC—were responsible for the data collection and analysis. CS—were responsible for writing the manuscript. FS—were responsible for data collection and revision of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The necessary permissions for this study were obtained from the ethics committee with the decision of Batman University Scientific Research and Publication Ethics Committee dated 14 May 2024 and numbered 2024/03-54. All study participants provided informed consent.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] İrfan Y. Associations among dehydration, testosterone and stress hormones in terms of body weight loss before competition. The American Journal of the Medical Sciences. 2015; 350: 103–108.

[2] Martínez-Aranda LM, Sanz-Matesanz M, Orozco-Durán G, González-Fernández FT, Rodríguez-García L, Guadalupe-Grau A. Effects of different rapid weight loss strategies and percentages on performance-related parameters in combat sports: an updated systematic review. International Journal of Environmental Research and Public Health. 2023; 20: 5158.

[3] Sarıakçalı B, Şahin FN, Başoğlu B, Ceylan L, Güler Ö, Yamak B, *et al.* The dual impact: physiological and psychological effects of rapid weight loss in wrestling. Frontiers in Psychology. 2025; 15: 1513129.

[4] Heffernan SM, Horner K, De Vito G, Conway GE. The role of mineral and trace element supplementation in exercise and athletic performance: a systematic review. Nutrients. 2019; 11: 696.

[5] Barley OR, Chapman DW, Abbiss CR. The current state of weight-cutting in combat sports. Sports. 2019; 7: 123.

[6] Kons RL, Athayde MSDS, Follmer B, Detanico D. Methods and magnitudes of rapid weight loss in judo athletes over pre-competition periods. Human Movement. 2017; 18: 49–55.

[7] Çağlar EÇ, Ceylan L, Ağralı Ermiş S, Çamiçi F, Eliöz M, Uzun RN, *et al.* Rapid weight loss and combat athletes: a study on psychological resilience and mechanical hyperalgesia. Frontiers in Psychology. 2025; 16: 1545048.

[8] Yasul Y, Akçınar F, Yasul ME, Kurtoğlu A, Eken Ö, Badicu G, *et al.* Effects of short-term pre-competition weight loss on certain physiological parameters and strength change in elite boxers. PLOS ONE. 2024; 19: e0304267.

[9] Fortes LS, Costa BDV, Paes PP, Cyrino ES, Vianna JM, Franchini E. Effect of rapid weight loss on physical performance in judo athletes: is rapid weight loss a help for judokas with weight problems? International Journal of Performance Analysis in Sport. 2017; 17: 763–773.

[10] Bhardwaj P. Types of sampling in research. Journal of the Practice of Cardiovascular Sciences. 2019; 5: 157–163.

[11] Centers for Disease Control and Prevention (CDC). Hyperthermia and dehydration-related deaths associated with intentional rapid weight loss in three collegiate wrestlers—North Carolina, Wisconsin, and Michigan, November–December 1997. The Morbidity and Mortality Weekly Report. 1998; 47: 105–108.

[12] Litsky F. Collegiate wrestling deaths raise fears about training. 1997. Available at: https://www.nytimes.com/1997/12/26/opinion/l-collegiate-wrestling-768120.html (Accessed: 15 January 2025).

[13] Artioli GG, Iglesias RT, Franchini E, Gualano B, Kashiwagura DB, Solis MY, *et al.* Rapid weight loss followed by recovery time does not affect judo-related performance. Journal of Sports Sciences. 2010; 28: 21–32.

[14] Fortes LS, Lira HAAS, Andrade J, Oliveira SFM, Paes PP, Vianna JM, *et al.* Mood response after two weeks of rapid weight reduction in judokas. Archives of Budo. 2018; 14: 125–132.

[15] Ozkan I, Ibrahim CH. Dehydration, skeletal muscle damage and inflammation before the competitions among the elite wrestlers. Journal of Physical Therapy Science. 2016; 28: 162–168.

[16] Öcal D. Searching some blood parametres for indication of dehydration following training in swimmers [master's thesis]. Institute of Health Sciences. 2007.

[17] Reljic D, Hässler E, Jost J, Friedmann-Bette B. Rapid weight loss and the body fluid balance and hemoglobin mass of elite amateur boxers. Journal of Athletic Training. 2013; 48: 109–117.

[18] Demirkan E. The body composition changes and hydration statuses of cadet wrestling national team athletes (15–17 age) during a camp [master's thesis]. Kırıkkale: Kırıkkale University Institute of Health Sciences. 2007.

[19] Alpay CB, Ersöz Y, Karagöz Ş, Oskoueı M. A comparison of weight loss, body composition and some mineral levels before competition in elite wrestlers. International Journal of Sport Culture and Science. 2015; 3: 338–348.

[20] Williams MH. Dietary supplements and sports performance: minerals. Journal of the International Society of Sports Nutrition. 2005; 2: 43–49.

[21] Fogelholm GM, Koskinen R, Laakso J, Rankinen T, Ruokonen I. Gradual and rapid weight loss: effects on nutrition and performance in male athletes. Medicine & Science in Sports & Exercise. 1993; 25: 371–377.

[22] Rivera-Brown A, Rowland T, Ramírez-Marrero F, Santacana G, Vann A. Exercise tolerance in a hot and humid climate in heat-acclimatized girls and women. International Journal of Sports Medicine. 2006; 27: 943–950.

[23] Kenefick RW, Hazzard MP, Mahood NV, Castellani JW. Thirst sensations and AVP responses at rest and during exercise-cold exposure. Medicine & Science in Sports & Exercise. 2004; 36: 1528–1534.

[24] Noakes TD, Sharwood K, Speedy D, Hew T, Reid S, Dugas J, *et al.* Three independent biological mechanisms cause exercise-associated hyponatremia: evidence from 2,135 weighed competitive athletic performances. Proceedings of the National Academy of Sciences. 2005; 102: 18550–18555.

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