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A Study of Kazakh Judokas Hypohydration Levels During Training at a Weight-Stable Period

Elite judo athletes frequently utilize rapid weight loss (RWL) strategies, which can trigger dehydration during competition periods. While previous research has documented hypohydration during competition, this study aimed to determine the hydration status of elite male and female Kazakh national team judokas during a non-competitive, weight-stable preparation period and to examine changes across a typical training day. A descriptive, repeated-measures study was conducted with 18 competitive judo athletes (9 men and 9 women) from the Kazakh national team. Hydration status was evaluated using urine specific gravity (USG), urine color (UC), and body weight (BW) measured in the morning, immediately before training, and immediately after training. Hypohydration was defined as a USG > 1.020 g/mL. Mean USG values did not differ significantly among measurement times (Morning: 1.027 ± 0.006; Pre-training: 1.026 ± 0.005; Post-training: 1.025 ± 0.006; p=0.14). Similarly, UC remained stable across the day (p=0.40). However, BW significantly decreased during the training session (p=0.002), dropping from a pre-training mean of 66.34 ± 16.06 kg to a post-training mean of 65.71 ± 15.78 kg. Hypohydration was highly prevalent: 15 athletes were hypohydrated in the morning, 17 were hypohydrated before training, and all 18 athletes (100 %) were hypohydrated following the training session. Hypohydration is a widespread and persistent condition among elite Kazakh judo athletes, even during weight-stable periods without competitive pressure. The high prevalence of hypohydration suggests that suboptimal fluid intake may be an ingrained habit rather than a response to acute weight-cutting. These findings highlight an urgent need for hydration education and intervention strategies to optimize training quality and protect athlete health.

Keywords: hydration, judo, Kazakh judokas, weight-stable period, hypohydration, training session, judo athletes

Introduction

Judo is an Olympic combat sport where athletes resort to rapid weight loss (RWL) methods before competitions to gain a competitive advantage [1]. RWL typically involves strategies that create physiological stress, such as fluid restriction, sauna use, and exercising in plastic clothing [2, 3], which can trigger dehydration [4]. Dehydration is defined as the acute loss of total water content in the body and is widely accepted to negatively impact athletic performance, including muscle strength, endurance, motor skills, and cognitive function [5, 6, 7]. Additionally, it is known that dehydration causes cardiovascular load and physiological strain through increased heart rate and decreased cardiac output [8].

Despite the negative effects of dehydration on performance, hypohydration (e.g., urine specific gravity — USG > 1.020 g/mL) was found to be prevalent in judo athletes during the competition period, even during the rehydration process after official weigh-in [9, 10]. While the new rules implemented by the International Judo Federation (IJF), such as weighing athletes approximately 15 hours before competition and limiting weight gain to 5 %, aim to ensure athletes compete in an optimal state of hydration, studies show that despite these regulations, elite judo athletes still exhibit a high rate of RWL and remain hypohydrated [9, 11, 3, 12, 13, 14].

Considering the negative effects of hypohydration and its prevalence during competition periods, it is important for athletes to maintain optimal hydration status during training periods when they are not required to lose weight. However, some studies in the literature have shown that even young and adolescent judo ath-

letes are frequently dehydrated during training sessions in the preparation period [14, 15]. These findings suggest that judo athletes may have insufficient knowledge of hydration strategies or that their RWL habits may have carried over into their training period. This raises the question of whether elite-level senior athletes can maintain their hydration status even during weight-stable training periods without competitive pressure. A recent study has filled this gap by showing that even during a weight-stable training camp, elite senior judo athletes exhibited a high level of hypohydration (92.6 %), and training sessions exacerbated this condition [14]. This finding suggests that hypohydration has become a deep-rooted problem in the elite judo community and is not just a condition specific to the competition period.

In this context, the aim of this study is to determine the hydration status of competitive male and female judo athletes from the Kazakhstan national team, who are in a non-competitive, weight-stable preparation period, through measurements of urine specific gravity (USG), urine color (UC), and body weight (BW), and to examine their changes on training day. The findings aim to confirm the prevalence of dehydration during training even among elite national team athletes, thereby highlighting the urgent need for hydration education and intervention strategies for these athletes.

Methods and Materials

Study Design

This single-blinded study was descriptive in nature and followed a repeated-measures design. This study aimed to determine and compare the magnitude of dehydration via USG, UC and BW in competitive men and women judo athletes in training environment. Body mass and urinary measures of hydration were evaluated in the morning, pre and post-training in Kazakh judo team.

Participants

Nine men and nine women judo athletes from the Kazakh national team voluntarily participated in the current study. All athletes were eligible to participate in the study, i.e. they did not participate in any competition in the last one month and have any injuries, trained regularly, were healthy enough to compete in the national championship. Data were collected during trainings in the preparation period. Written informed consent form was obtained from each athlete before the measurements and the study was carried out in accordance with the latest version of Declaration of Helsinki.

Measurements

Body composition: Athletes' height was measured with a stadiometer to the nearest 1 cm and their body mass was measured to the nearest 0.1 kg using a digital scale.

Hydration status: A urine sample was taken from each athlete immediately before each body mass measurement. The samples were placed in plastic cups and USG was determined with a digital refractometer (ATAGO PAL-10S, Japan) and UC was classified by the same researcher each time. As soon as the urine samples were analyzed for USG, they were immediately disposed. USG was classified according to suggestion by National Athletic Trainers' Association hydrated (<1.020) and hypohydrated (≥ 1.020) [16]. USG whose correlation with urine osmolality that is acceptable as gold standard for hydration measurement in combat sports was $r=0.89$ ($p=0.000$) is accepted as an affordable, valid and reliable tool to monitor hydration status in combat sports [17].

Statistical Analysis

Data analysis was carried out using JASP software (Version 0.19.1.0, The Netherlands). Mean, standard deviation and 95 % confidence interval for mean (CI) was presented. Data normality was checked with Shapiro-Wilk test and skewness and kurtosis coefficients. A one-way repeated measures ANOVA was implemented to see changes in USG, UC and BW of the athletes among different measurement times (i.e., morning, before and after the training session). When the assumption of sphericity was violated, Greenhouse-Geisser correction was used. In case of a significant difference, a post-hoc comparison with Holm correction was made. Effect size for analysis of variance was classified according to eta-squared (η^2) and classified 0.01, 0.06 and 0.14 as trivial, medium and large effect, respectively [18]. Significance was set at $p<0.05$.

Results and Discussion

According to one-way ANOVA, athletes' USG values did not differ among measurement times ($F_{2,34}=2.11$, $p=0.14$, $\eta^2=0.11$, ES= Medium). USG values of the athletes were 1.027 ± 0.006 , 1.026 ± 0.005 and 1.025 ± 0.006 in the morning, pre and post training, respectively.

UC were similar at different time points ($F_{1,47,24,97}=0.86$, $p=0.40$, $\eta^2=0.05$, ES= Medium). Athletes' UC was classified as 5.11 ± 1.57 for the morning, 4.83 ± 1.54 for the pre-training and 5.22 ± 1.31 for the post-training.

Athletes' BW differed significantly at different measurement times ($F_{2,34}=15.98$, $p<0.001$, $\eta^2=0.49$, ES= Large). Athletes' BW did not change between the morning and pre-training points ($p>0.05$), but athletes significantly lost weight during the training session ($p=0.002$). BW of the athletes can be seen in Table 1.

Table 1

Athletes' BW changes in the morning, pre and post-training

Time points	Mean \pm SD	95 % CI
Morning	66.34 \pm 16.06	58.35-74.33
Pre-training	66.34 \pm 16.06	58.35-74.33
Post-training	65.71 \pm 15.78	57.85-73.55

Athletes' hydration classification can be seen in Figure 1. As seen in the figure, most of the athletes were hypohydrated according to morning USG values and they arrive at training hypohydrated and completed it hypohydrated again.

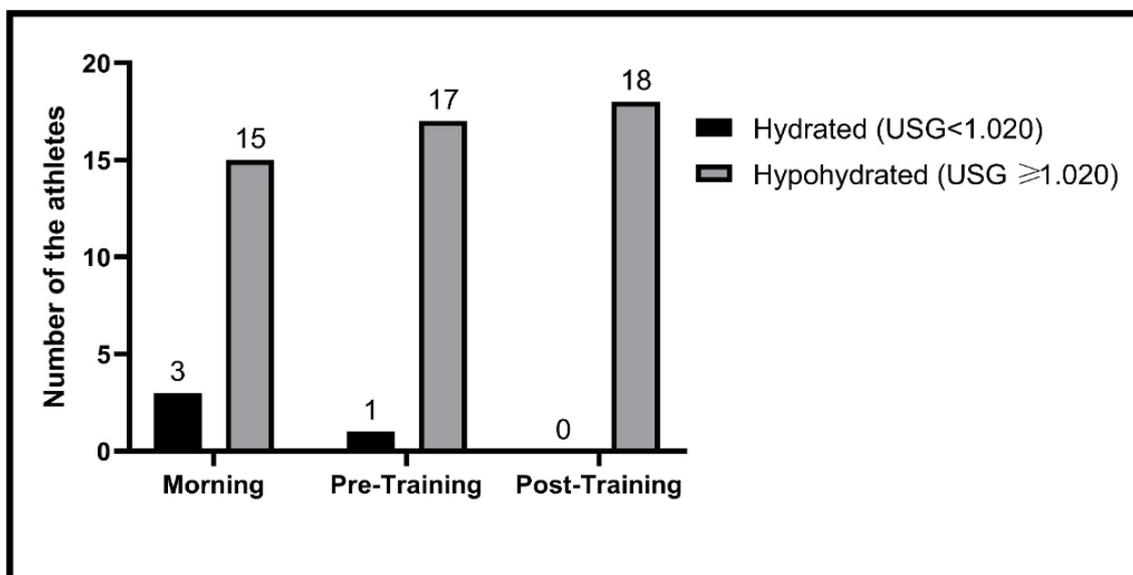


Figure 1. Athletes' hydration classification in the morning, pre and post-training

Conclusions

The aim of the present study was to observe the hydration practices of Kazakh judo athletes during a training day. The main finding of this study was the widespread condition of hypohydration among elite male and female Kazakh judo athletes, even during a weight-stable, non-competitive training camp. The consistently high mean USG values and high rates of athletes classified as hypohydrated ($USG>1.020$) at all measurement times strongly support this conclusion. Our findings indicate that 17 out of 18 athletes presented hypohydration at the pre-training assessment, and all completed the training session in a hypohydrated state. This underscores that suboptimal fluid balance is not confined to the acute weight-cutting phase but may represent a persistent concern in elite judo.

The mean USG values observed in this study (ranging from 1.025 ± 0.006 to 1.027 ± 0.006) suggest that hypohydration, previously well-documented in competitive environments, has become habitual even when competition pressure is absent. This level of dehydration is comparable to that reported in similar studies on judo athletes during both training and competition periods [19, 13, 3, 9, 12, 20, 14]. For instance, one study found elite judo athletes averaged 1.027 ± 0.005 pre-weigh-in and 1.025 ± 0.005 pre-match, despite a 15-hour recovery period [3]. Crucially, the USG values did not show a statistically significant difference over the course of the training day, suggesting that fluid intake was insufficient to counteract sweat loss during train-

ing or to fully recover from prior fluid deficits. This mirrors findings in elite senior judo athletes where hypohydration worsened across a 24-hour period despite free fluid intake [14].

The significant decrease in body weight (BW) observed during the training session confirms that the judo training provided a substantial physiological load resulting in fluid loss through sweating. The lack of subsequent change in USG or UC suggests that the consumed fluids post-training were inadequate to restore the fluid balance. This persistent state of hypohydration carries significant risks for the athletes. Dehydration is known to negatively impact athletic performance, impairing muscle strength, endurance, motor skills, and cognitive function [21, 5, 22]. Furthermore, hypohydration increases the cardiovascular load, a phenomenon marked by elevated heart rate and decreased cardiac output, which can increase physiological strain during exercise [8, 23]. Acute dehydration, for instance, has been shown to impair judo-specific performance and significantly elevate heart rate responses during the Special Judo Fitness Test (SJFT) [4]. Therefore, while the current study focused on a non-competitive period, the observed hypohydration levels place the athletes at chronic risk of sub-optimal recovery and training adaptation.

The observation that elite athletes remain chronically hypohydrated, even during a period without the external pressure of making weight, suggests that the practices typically associated with RWL may have become ingrained behaviors. RWL often relies on fluid restriction and other methods that induce dehydration [24]. It has been noted that the high prevalence of hypohydration in elite combat sport athletes is related to insufficient fluid intake habits rather than other factors like sex [10]. This raises the question of whether this behavior stems from a habitual carryover from competitive periods or a fundamental knowledge gap in appropriate fluid intake for optimal recovery and performance. Given that judo athletes are exposed to RWL practices from an early age, establishing poor hydration habits early may explain the resistance to adequate fluid intake even years later.

A few limitations should be acknowledged. First, the modest sample size, while representative of an elite cohort, should be considered when generalizing results. Second, the study design did not monitor fluid intake to precisely quantify the degree of under-rehydration, and urine markers, while practical, have noted limitations when applied to the athletic population with high muscle mass. However, the large magnitude and consistency of hypohydration observed across all measures provide a strong foundational finding.

For future research, longitudinal studies should track fluid intake and educational interventions specifically aimed at improving hydration knowledge and habits in elite judo athletes during preparatory periods. This is critical because mitigating the adverse effects of hypohydration is essential for enhancing training quality, maximizing recovery, and protecting the long-term health of elite judokas.

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