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Original article

Monitoring change of urine specific gravity levels of the wrestlers in an official wrestling tournament

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Abstract. *Study Objectives:* Wrestling is a weight sport with a weight classification and wrestlers is performed weight loss frequently before the wrestling competitions and they exposed dehydration. In this context, the aim of this study was to monitor the change in the urine specific gravity (U_{SG}) of wrestlers in an official wrestling tournament. Thirty-six wrestlers competing in an official wrestling tournament were included in the study. *Methods:* Bioelectric impedance analyzer and refractometer were used to determine the change of body weights and the U_{SG} levels of the wrestlers between the weigh-in and the competition times. Shapiro-Wilk test was used for the normality test of the obtained data. Wilcoxon Signed-Rank test was used to analyze non-normally distributed data. *Results:* According to the results of this study, it was determined that there was no difference in the body weights of the wrestlers between the weigh-in and the competition times, whereas there was a difference in the U_{SG} levels. Accordingly, although U_{SG} levels decreased, it could not be reduced to the reference range between the weigh-in and the competition times. *Conclusion:* These results indicate that the lose body weight before the competition is regained between the weigh-in and the competition times, whereas dehydration in the U_{SG} levels continues in the wrestlers.

Keywords: Combat Sports, Dehydration, United World Wrestling, Urine Specific Gravity, Weight Loss

Introduction

Wrestling is one of the most ancient sports (1) and today, it has millions of spectators worldwide (2). In today's wrestling, opponents are paired by size (bodyweight) and power. Nevertheless, it is probable and expectable that opponents at the same weight class might differ in relative power (3). Of course, lean body weight is important for aerobic performance as the total weight for anaerobic performance (4). In wrestling, athletes compete after they are classified according to their body weights (5). For this reason, to gain an advantage over weaker and smaller competitors, many wrestlers lose weight before the competition. In wrestling, although the adverse effects of weight loss on health status are well documented, weight loss practices (e.g. food and fluid restriction) are widely used by the wrestlers (6).

United World Wrestling (UWW) often makes minor changes to the wrestling competition rules to increase the popularity of wrestling, to make more understandable for the spectators, and to protect the athletes' health. For example, even though the duration between the weigh-in (one day before competitions, at 06:00 pm) and the competition (one day after the weigh-in, at 12:00 am) times of the official national and international competitions was ~18 hours according to old wrestling competition rules and therefore, wrestlers were frequently performing weight loss practices before the competitions (7). A study on a similar sport, judo, showed that more time between weigh-in and competition does not mean less dehydration. Although there were 15 hours between the weigh-in and competition it was seen that 81% of the athletes were still dehydrated (8). For this reason, the UWW has decided to carry out the competition weigh-in

(two hours before competitions) on the morning of the competition according to the new wrestling competition rules to prevent weight loss in wrestlers (9). Because the hydration level is one of the most important physiological variables for athletic performance especially in combat sports. However, wrestlers are still known to carry out weight loss practices.

Many studies have reported that wrestlers who lose weight using various methods such as sauna, food and fluid restriction, repetitive intensive exercises, nylon, or rubber dressing were exposed to dehydration (6,10,11). Moreover, there are many methods in determining dehydration in athletes such as urine specific gravity (U_{SG}), urine color (U_{Col}), urine osmolality (U_{Osm}), and plasma osmolality (P_{Osm}), and it was reported to have positive relationships between these methods and have a cut-off point for each dehydration measurement method (12-14). Testing and measurements are two important components of the performance assessment, some details during the procedures that may seem underestimated may however directly affect the test results (15). For example, dehydration cut-off points are ≤700 (mmol/kg) for U_{Osm}, ≤290 (mOsm/L) for P_{Osm}, ≤4 (U) for U_{Col}, and ≤1020 (g/cm³) for U_{SG} (16). If a measured hydration marker has a value above the cut-off point, hypohydration and/or dehydration occurs and this dehydration can cause athletes to lose athletic performance.

U_{SG} is a measure of the ratio between the density of urine and the density of water. Urinary concentration is determined by the number of particles (electrolytes, phosphate, urea, uric acid, proteins, glucose, and radiographic contrast media) per unit of urine volume (13). The National Collegiate Athletic Association recommends U_{SG} as the most practical and optimal method for determining the hydration status of athletes (17,18). It is important to determine the change in the hydration status of the wrestlers using U_{SG} between the weigh-in and the competition times according to the new wrestling competition rules. Thus, we have tested the new weigh-in rule in the wrestling competition. In this context, the aim of this study was to monitor the change in the wrestlers' U_{SG} levels dehydration-induced in an official wrestling tournament.

Material and Method

Participants

At the beginning of the study, all participants were informed of the research procedures, purposes of the investigation, and taken their written consent prior to participation. Thirty-six volunteer elite male wrestlers (age: 21.67±1.82) participated in the research. Wrestlers who did not have an acute or chronic disease and did not use diuretics while performing weight loss for the competition were included in the study. The study was conducted in accordance with the guidelines of the revised Helsinki Declaration.

Experimental Design

All measurements (Body weight and U_{SG}) were performed in an official competition in the 2019 Interuniversity Wrestling Turkey Championships. The first measurements for the weigh-in time were between 8:30-9:00 am in the morning of competition and the second measurement for the competition time was between 10:30-11:00 am. The wrestlers followed their routines (food and fluid consumption etc.) within 2 hours and no encouragement was provided for consuming fluid between the two measurements.

Measurement Body Weight

Body weights of the wrestlers were measured two times (before the weigh-in and the competition times) with wrestling singlet using Bioelectric Impedance Analyzer (TANITA BC 418, USA). From the total body weights of the wrestlers, 250 g tare was subtracted for the wrestling singlet.

Measurement of U_{SG}

The urine samples were taken two times (before the weigh-in and the competition times) from each wrestler immediately before each body weight measurement. In agreement with the American College of Sports Medicine´s hydration testing guidelines, (19) each participant was instructed to provide a small urine sample collected mid-flow from the first void in the measurement times. The samples were placed in plastic cups and the U_{SG} levels of the wrestlers were determined with a digital refractometer (ATAGO PAL-10S, Tokyo, Japan; measurement range USG 1.000–1.060 with a resolution of 0.001). Refractometry is an indirect estimation of USG by measuring the ratio of the velocity of the light

in urine (20). The digital refractometer was calibrated before the analysis of each urine sample. As soon as the urine samples were analyzed for U_{SG}, they were immediately disposed. The cut-off point of U_{SG} for assessment of the hydration status was determined as ≤1020 (g/cm³).

Statistical Analysis

The normality test of the obtained data was tested with the Shapiro-Wilks test. Descriptive statistics were given with mean and standard deviation. Wilcoxon Signed-Rank test was used for comparisons of the measurement times in the analysis of non-normally distributed data. Significance was set at $p < 0.05$.

Results

Body weights of the wrestlers for weigh-in and competition times were found 78.73±14.98 and 78.98±14.77, and U_{SG} were 1.026±.007 and 1.021±.009, respectively. This result shows that the U_{SG} levels of the wrestlers were above the reference range in both the weigh-in and competition times (Table 1).

It was determined that there was no difference between the body weights of the wrestlers between the weigh-in and the competition times, whereas there was a difference in the U_{SG} levels. However, although U_{SG} decreased, it could not be reduced to the reference range between the weigh-in and the competition times (Table 2; Fig. 1).

Discussion and Conclusion

The death of six college wrestlers in six weeks in the United States of America drew the attention of the world. As a result of the autopsy, it was found that the wrestlers died of weight loss performed in a short time and they performed 15% of dehydration of total body weight (21). After these deaths, many methods have been designed by the researchers to detect hydration levels in the human body such as a change in percentage of body weight (22), bioelectric impedance (23), skinfold thickness (24), and hematological (25) and urine parameters (26). Especially, U_{SG} is one of the

Table 1. Descriptive statistics of wrestlers' body weights and U_{SG} levels

Variables	Measurement Times	Mean±S.D.	Reference Range
Body Weight (kg)	Weigh-in	78.73±14.98	-
	Competition	78.98±14.77	
U_{SG} (g/cm³)	Weigh-in	1.026±.007	≤1.020
	Competition	1.021±.009	

Table 2. Comparison of wrestlers' body weights and U_{SG} levels

Variables	Measurement Times	Median	z	P
Body Weight (kg)	Weigh-in	78.20	-.480	.631
	Competition	77.50		
U_{SG} Levels (g/cm³)	Weigh-in	1.025	-3.214	.001
	Competition	1.024		

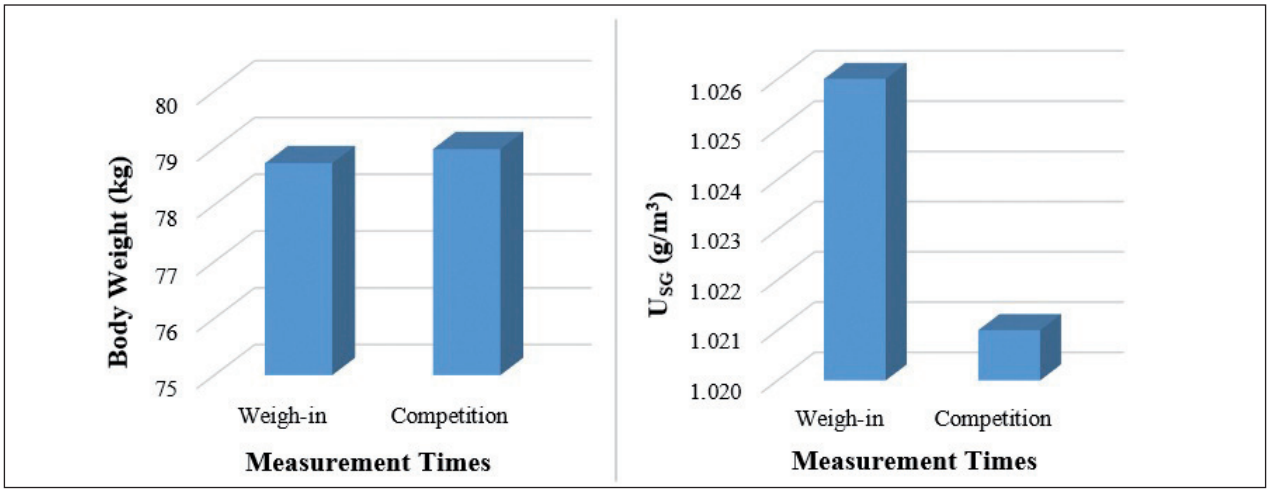

Figure 1. Changing of wrestlers' body weight and U_{SG} levels

most common and safe hydration measurement methods easily used in non-clinical situations.

Previous studies on the hydration status of the wrestlers have been including the results of a period of ~18 hours between the weigh-in and competition times (7,11). In the present study, the duration between weigh-in and competition times was 2 hours. For this reason, this study is the first study of determining the hydration status of the wrestlers according to the new weigh-in rule in wrestling.

Many studies on combat sports have emphasized that the duration between weigh-in and competition times is not sufficient for rehydration after dehydration. For example, Gürses et al. (2018) reported that the judo athletes regain their lost body weights between the weigh-in and the competition times (~13 hours) despite, the increase in U_{SG} could not be reduced (26). Moreover, Pettersson and Berg (2014) compared the rehydration status after dehydration for combat athletes weighed the one-day before and on the same day of competition for the official competitions, and reported that hypohydration status from both athlete groups continued (27). In sum, they reported that neither weigh-in close to competition nor evening weigh-in with more time for rehydration seems to prevent hypohydration before the competition. Also, they reported that the amount of body weight loss was lower in the branches held on the same day of competition and weigh-in. According to the results of the present study, it was determined that there was no difference between the body weights of the wrestlers between the weigh-in and the competition times, whereas there was a difference in the U_{SG}. These results show that the wrestlers regain their body weight between the weigh-in and the competition times. Moreover, although there was a decrease in U_{SG} levels, it was determined that U_{SG} levels had a value above the reference range before the competition and showed that dehydration continued in the wrestlers.

A small decrement in hydration status can impair cognitive, physical, physiologic function, and athletic performance (28-30). For this reason, weight loss practices must be prevented to perform high-level athletic performance of the wrestlers for a longer period. However, many previous studies show that the wrestlers have a higher amount of body weight loss due to the UWW's old weigh-in rule (31-33). Because the wrestlers thought the duration between weigh-in and competition times was sufficient for rehydration after dehydration. UWW's new weigh-in rule caused wrestlers to reduce their amount of body weight loss. Because in this study, body weight loss in wrestlers was almost non-existent but still we found above the reference range of the wrestlers' U_{SG} levels.

As a result of the present study, the wrestlers regained their lost body weight in duration between the weigh-in and competition times. In addition, although the wrestlers' U_{SG} levels decreased, it remained above the reference range. This result shows that wrestlers were still dehydrated. Moreover, when comparing the body weights of wrestlers in weigh-in and competition times, UWW's new weigh-in rule was minimized the amount of weight loss in wrestlers. However, supplementation of appropriate fluid in weight loss training may prevent hypohydration. Thus, athletes can be in euhydration status and achieve maximum performance.

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