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Do acute weight loss and gain affect hydration status in adolescent wrestlers?

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Background & Study Aim: The rapid weight loss and gain is a common practice in wrestlers within a week before the competition. The aim of this study was the effects of rapid weight loss and gain before official weigh-in, along with during the competition in adolescent wrestlers.

Material & Methods: Twenty-four collegiate wrestlers (twelve of them as the competitors, other as non-competitor wrestlers) volunteered as subjects in the present study. Body composition was assessed by using a bioelectrical impedance device (bioelectrical impedance analysis; abbreviation BIA). Hydration status was determined via to urine specific gravity (USGV) that taken urine samples. The body mass and hydration status were evaluated: seven days before official weigh in (a); three days before the official weigh-in (b); morning of the official weigh-in (c); the official weigh-in time (d); before the beginning of the first bout (e); the following day morning (f).

Results: There was a significant difference in body weight changes between the first weight assessment (a) and weigh in competition (d) in competitor wrestlers ($p<0.05$). In hydration status, there was a significant difference between the first USGV analysis (a) and other assessments (b, c, d, e, f) ($p<0.05$). However, there was no significant difference in hydration status between the weigh-in competition USGV (d) and others (e, f) ($p>0.05$).

Conclusion: The duration of the official weigh-in and the competition is not enough for wrestlers to rehydrate. The process of weight loss and hydration status should be monitored by coaches, not before a week but in a long time. Individual fluid intake strategies should be developed for athletes to be minimising dehydration risk before and during the competition.

Keywords: body composition • competition • dehydration • urine specific gravity

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Bioelectrical impedance analysis – ***noun*** an accurate method of measuring body fat using an electrical current. Abbreviation **BIA** [27].

Body composition analysis – noun a method of testing the proportions of different fat and lean tissues that make up a person's body. Abbreviation **BCA** [27].

Competition: two competing athletes to act or process of trying to get or win something (such as a prize or a higher level of success).

Competition training – ***noun*** athletic training that specifically prepares the athlete for the competition situation competitive adjective [27].

Dehydration – ***noun*** a dangerous lack of water in the body resulting from inadequate intake of fluids or excessive loss through sweating, vomiting or diarrhoea [27].

Hydration – noun the state of having a healthy fluid balance in the body[27].

Urine specific gravity (**USGV**) – the comparing the density of urine to the density of water.

Wrestling – ***noun*** a sport in which two contestants fight by gripping each other using special holds, each trying to force the other's shoulders onto a mat [27].

Performance – ***noun*** the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [27].

INTRODUCTION

In sports with weight categories such as wrestling, reduced body weight just before the tournament is a common practice [1, 2]. The loss of body weight occurs in a short time (1-7 days) to compete in a weight class below their usual weight class to gain an advantage. Restriction of fluid and energy intake along with the inclusion of heavy exercises to increased sweating can result in dehydration which will deteriorate in the athletes' physiology and psychology, and thus their performance will decrease [1-4]. Dehydration is a quite common situation encountered during competition and training in sport events. This situation is endeavoured to be compensated for by nutrition and fluid intake during the recovery period. Inadequate compensation for the fluid loss that occurs in the body not only results in a reduction in performance levels but can also cause some health problems and even death among athletes [5]. Rapid weight loss causes changes such as a decrease in blood plasma volume, increased rectal heat, an increased heart rate and a decrease in cardiac output. Also, the distributions of nourishment energy resources are affected, the removals of metabolic wastes are slowed down, and cellular metabolism changes have also been observed [6]. Urine specific gravity (USGV) is the most practical and effective measure for assessing hydration status during the weight certification procedure [7-9]. As a criterion, The National Collegiate Athletic Association (NCAA) has accepted a limit of 1.020 g/cm^3 or below values of USGV as the indicator of dehydration status of an athlete [3, 10, 11]. However, acute changes in body weight appear to represent equal changes in hydration status [12] Changes in body weight have been widely used for determination of acute changes in hydration status over a short period of a few hours [12]. NCAA has suggested that weight loss per week should not exceed 1.5 % of body weight [3].

The aim of this study was the effects of rapid weight loss and gain before official weigh-in, along with during the competition in adolescent wrestlers. It was hypothesised that the acute weight loss and gain occurred in a short time before and after the weigh-in competition, although acute weigh gain occurs after the weigh-in competition, this does not affect the hydration status and so recovery time is inadequate for the occurrence of suitable hydration status.

MATERIAL AND METHODS

Participants

Twenty-four collegiate wrestlers volunteered as subjects in the present study. Twelve of them participated in the national wrestling championship, named as competitor wrestlers (age: 18.1 ±1.2 years, height: 173.0 ±6.6 cm, weight: 69.9 ±15.4 kg), and the other wrestlers (n = 12) were named as non-competitor wrestlers and also as control group (age: 18.0 ±1.2 years, height: 173.3 ±6.9 cm, weight: 70.1 ±15.5 kg). The wrestlers and their coaches were informed in detail about the study procedures and the possible risks and benefits of the study. The study complied with the Declaration of Helsinki and was approved by the Bioethics Commission of the University of Ondokuz Mayıs. The written consent form was obtained from the wrestlers prior to participation.

Procedures

The competitor wrestlers' body mass and hydration status were evaluated on six separate occasions, however non-competitor wrestlers' body mass and hydration status were evaluated on three separate occasions: 1) Body mass and urine samples were taken: seven days before official weigh in (a); three days before the official weigh-in of the National Championship (b); morning of the official weigh in between 07:00 and 07:30 h (c); the official weigh in time (17:30 and 18:00 h) (d); before the beginning of the first bout (at the official weigh-in and 13-18 h later, right before competing) (e); the following day morning between 07:00 and 08:00 h (f). 2) The wrestlers' body composition: body mass, body fat percentage, and fat-free mass percentage were determined estimated using a calibrated scale (Tanita BC-418, Tanita Corp., Tokyo, Japan). 3) The urine samples were collected for the hydration status.

Measurements of height and body weight

Body height and weight measurements were made using a digital scale (Seca 664, Hamburg, Germany) in bare feet and wearing only shorts.

Body composition analysis

Body composition of each athlete included in the study was assessed by using a Bioelectrical Impedance device (Tanita Body Composition Analyzer BC- 418), according to the instructions of the device. Taking measurements were done in the morning before breakfast after a 12-hour prohibition of food and water intake, and the athletes were allowed to wear shorts only.

Urine specific gravity (USGV) measurement

Urine samples (50 ml) were collected in plastic cups in the morning just after the wake-up and before breakfast from each wrestler. Urine samples were taken from the competitor wrestlers a total of six times to assess the hydration status during the study. Four times were before the competition and two times after the competition. Non-competitive wrestlers' urine samples were taken three separate occasions (seven days before official weigh in; three days before official weigh in; the morning of official weigh-in). USGV measurements were performed immediately after by an optical pen refractometer (Atago Inc., pen wrestling model 3749, Japan) by the same experienced investigator.

Statistical analysis

The characteristics of both competitor and non-competitor wrestlers were presented as means and standard deviations (±). The differences between the groups (competitor and non-competitor wrestlers) were determined using independent *t*-test. The differences between the body weight changes and urine specific gravity for hydration status that were analysed at different times were used in the one-way analysis of variance (ANOVA). Post hoc comparisons were made using the Tukey procedure. The level of significance for all statistics was set at $p<0.05$.

RESULTS

No significant differences were found between the characteristic features of the competitor and non-competitor wrestlers ($p>0.05$) (Table 1). There was a significant difference in body weight changes between the "a" and "d" ($p<0.05$) (Table 2). In USGV status, there was a significant difference between the "a" and other assessments "b, c, d, e, f" ($p<0.05$).

Table 1. Some of the physical characteristics (mean and standard deviation) of investigated wrestlers.

Variable	Wrestlers		Deference	
	competitor (n = 12)	non competitor (n = 12)	results	p
Age (year)	18.1 ±1.2	18.0 ±1.2	0.1	ns
Height (cm)	173.0 ±6.6	173.3 ±6.9	–0.3	ns
Weight (kg)	69.9 ±15.4	70.1 ±15.5	–0.2	ns
BMI	23.1 ±0.35	23.4 ±0.39	–0.3	ns
Fat (%)	9.2 ±6.4	9.2 ±5.4	0.0	ns
FFM (kg)	62.8 ±10.4	63.7 ±10.1	–	ns
TE (year)	6.3 ±1.4	5.3 ±1.3	1.0	ns

TE training experiences; **ns** not significant

Table 2. Body weight and hydration fluctuation before and after weigh for the competitor wrestlers (n = 12).

Measurement days	Weight (kg)	WLG (kg)	p	USGV (gr/cm^3)	Hydration changes	p
a	^{a}69.9 ±15.4		a-d*	^{a}1.013 ±0.003		a-b*
b	^{b}69.3 ±14.3	–0.600	ns	^{b}1.026 ±0.007	+0.013	b-a*
c	^{c}68.6 ±14.2	–0.700	ns	^{c}1.026 ±0.005	0.000	c-a*
d	^{d}67.3 ±15.0	–1.300	ns	^{d}1.028 ±0.004	+0.002	d-a*
e	^{e}69.2 ±14.4	+1.900	ns	^{e}1.026 ±0.005	–0.002	e-a*
f	^{f}69.6 ±14.5	+0.400	ns	^{f}1.025 ±0.006	–0.001	f-a*
TLGBAW	–2.600 / +2.300 kg			+0.015 / –0.003		

*p <0.05; **WLG** weight loss – gain; **TLGBAW** total loss and gain before and after weigh-in; **ns** not significant; **a** seven days before official weigh in; **b** three days before official weigh in; **c** morning of official weigh-in; **d** official weigh-in time; **e** before the beginning of the first bout; **f** the following day morning.

There were no significant differences in body weight changes during the study (p>0.05). In USGV, the only significant difference was found between the first assessment "a" and the second assessment "b" (p<0.05) (Table 3).

DISCUSSION

The study was conducted in order to detect the changes that will occur in body mass, and hydration status of competitor and non competitor wrestlers together with rapid weight loss and gain during before and after the championship. The study results indicate that rapid weight loss occurred in seven days before official weigh in competition, significantly was seen to decreased: 69.9 ±15.4 (a) and 67.9 ±14.1 kg (d) respectively (Table 2). For the hydration status, in USGV values between the first assessment (a) and other assessments (b, c, d, e, f), were detected to significantly increased: 1.013 ±0.003 gr/cm^3 (a) and 1.028 ±0.004 gr/cm^3 (d) in hydration status (p<0.05) (Table 2). We observed that the competitor wrestlers' hydration status during the study was seen to more above than normal hydration criteria, except first assessment (a) (Table 2).

As a threshold value of USGV for dehydration, NCAA has accepted a limit of 1.020 g/cm^3 or below values of USGV as the indicator of dehydration status of an athlete [3, 10, 11]. According to this hydration threshold value of USGV (NCAA), the study results show that the wrestlers participating in the national competition were dehydrated during the three days before and during the competition.

The literature studies [13-18] reported that the rapid weight loss of 5% to 7% of body mass within one week before the competition is a common practice in combat sports. The literature studies about the hydration status in athletes, Demirkan et al. [16] reported that there was an increase in USGV values (1.024 g/cm^3 and 1.028 g/cm^3) between 3 days before weigh in and just before weigh in. Ozkan and Ibrahim [18] reported that the wrestlers (n = 72) who underwent fast weight-loss had higher levels of POsm (296.05 ±3.14) above the upper limit of the reference value (over 290) and suffered from dehydration at the official weigh-in time. Pallarés et al. [2] reported that the 163 combat sports athletes (boxing, taekwondo and wrestling) based on urine osmolality, at weigh-in, 42 % of the athletes were moderately hypohydrated (HYP) (700-1080 mOsm.kg), 42 % were severely hypohydrated (1081-1500 mOsm.kg), and only 16 % were not hypohydrated (<700 mOsm.kg).

Our data are in agreement with previous studies [13-18] that the results show that acute weight loss in a short time before the competition is a very common situation in wrestling. However, it indicates that the changes of hydration status with rapid weight loss occur together in this process. These results show that wrestlers often lose weight using the food- fluid limitation and using dehydration methods in a week before the competition.

The other important finding of this study showed that 2.3 kg (3.4 %) weight gain occurred between the official weigh-in (d) and before the beginning of the first bout (e) together the competition following day morning (f), but no significant change was seen in hydration status USGV: 1.028 g/cm^3 (d); 1.026 g/cm^3 (e); 1.025 g/cm^3 (f) respectively (Table 2).

The literature studies [2, 19-23] focused on the extent of weight gain between weigh-in and the

Table 3. Body weight and hydration fluctuation for the non competitor wrestlers (n = 12).

Measurement days	Weight (kg)	WLG (kg)	p	USGV (gr/cm^3)	Hydration changes	p
a	^{a}68.2 ±15.6		ns	^{a}1.025 ±0.004		a-b*
b	^{b}68.6 ±15.6	+0.400	ns	^{b}1.014 ±0.005	–0.011	b-a*
c	^{c}69.3 ±15.2	+0.700	ns	^{c}1.019 ±0.006	+0.005	NS
TLGBAW	+1.1 kg			–0.006		

*p<0.05; **WLG** weight loss – gain; **TLGBAW** total loss and gain before and after weigh-in; **ns** not significant; **a** seven days before official weigh in; **b** three days before official weigh in; **c** morning of official weigh in**.**

beginning of the competition and the relationship between weight gain and wrestling success. The current concept of rapid weight loss and gain not only should be based on wrestling performance effects, but also negative health effects on athletes. Scott et al. [20] found that collegiate wrestlers gained significant amounts of weight (mean: 3.7 ±1.3 kg) during the 20 hour period between the weigh-in and beginning of the competition. Wroble and Moxley [21] recorded weight gain (WG) between at official weigh-in and again, about 12 h later, immediately before the first round of wrestling. They reported that the mean WG for all wrestlers was 1.3 kg ±1.1 with a range of −2.0 kg to +4.4 kg. Pallarés et al. [2] reported that in the hypohydrated group 13-18 hour after the weigh-in, body mass of combat sports athletes was recovered by 1.2 and 3.1 %, respectively, but not fully reversed in the 13-18 h from weigh-in to competition. These results are agreement with our study result. In this study, although rapid weight gain occurred, the competitor wrestlers still were seen to dehydrate (Table 2). The literature studies [24, 25] reported that there was no change in the level of glycogen in skeletal muscle before weight loss when compared with 17 hour recovery period after losing weight. However, ACSM [26] stated that liquid homeostasis could only be renewed in 24 to 48 hours and the muscle glycogen can be replaced in 72 hours.

Our study result shows that although gain weight after weighs in competition cannot be renewed to the body hydration level during in a short time. The data is in agreement with previous studies [16, 26]. Our study and other studies [2, 16, 26] findings indicate that the recovery time is inadequate for preventing or deterring the occurrence of euhydration between the official weigh-in and the beginning of the competition rounds in combat sports.

CONCLUSIONS

The rapid weight gain also occurs after the official weigh-in and during the competition. However, the duration between the official weigh-in and the competition is not enough for wrestlers to rehydrate. The process of weight loss and hydration status should be monitored by coaches, not before a week but in a long time. Individual fluid intake strategies should be developed for athletes to be minimising dehydration risk before and during the competition.

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