ISSN 0778-3906
Published in JTRM in Kinesiology an Online Peer-reviewed Research and Practice Journal
June 18th 2019

Weight Loss Methods and Effects on the Elite Cadet Greco-Roman Wrestlers

Rifat YAGMUR[1], Ozkan ISIK[2*], Yakup KILIC[3], Ilkay DOGAN[4]

[1]School of Physical Education and Sports, Afyon Kocatepe University, Afyon, Turkey
[2]Faculty of Sports Sciences, Sakarya University of Applied Sciences, Sakarya, Turkey
[3]Faculty of Sports Sciences, Fırat University, Elazig, Turkey
[4]Department of Biostatistics, Faculty of Medicine, Gaziantep University, Gaziantep, Turkey
*Corresponding Author: ozkanisik86@hotmail.com

Abstract The aim of this study was to examine body weight loss methods and its effects on elite cadet Greco-Roman wrestlers' performance. The sample of research consisted of 146 elite Greco-Roman wrestlers. The "Athlete weight loss methodology and effects scale" and a personal information form were used. In addition to descriptive statistics, One-way ANOVA was used for data analysis. Additionally, a Pearson correlation analysis was used to determine relationships between variables. Results showed that 47.9% of the wrestlers lose weight and 52.1% did not engage in a rapid weight loss regimen. It was calculated that on average weight loss wrestlers reduce their body weights by 4.68%. Statistically significant differences were found between dietary, physiological, and psychological sub-dimension effects in the weight loss groups. In addition, there was weak but positive correlations between weight loss percentage and diet (r=0.305), as well as physiological (r=0.231), and psychological (r=0.168) sub-dimensions. Accordingly, as the percentage of weight loss increases, wrestlers' level of nutrition and fluid restriction increases. For this restriction, the physiological and psychological effect sub-dimensions levels also increase. As a result, when the diet sub-dimension of weight loss wrestlers was examined, it was found that 92.9% of the wrestlers engaged in food and fluid restriction. When the physiological effect sub-dimension was examined, it was found that 72.9% were exposed to muscle cramps and 72.9% to injury. Moreover, when the psychological effect sub-dimension of the wrestlers was examined, it was determined that 87.1% were exposed to stress, and 90.0% had decreased performance. As a result, weight loss before the competition was determined to cause physiological and psychological negative effects on athletes.

Keywords: *Weight loss; wrestling; cadet athletes; competition*

1. Introduction

First introduced into the ancient Greek Olympic Games in 708 B.C.E., wrestling is considered as one of the earliest competitive sports (Greko-Roman wrestling, 2019). Nearly 25% of the medals in the modern Olympic Games represent combat sports and these sports are watched by millions of spectators (Isik & Gumus, 2018). In almost all combat sports, athletes compete after they are classified according to their body weights. Thus, to gain an advantage over weaker and smaller competitors, many athletes lose weight before the competition. Although the adverse effects of rapid weight loss on health status are well documented (e.g., athletic performance, competition success, and injury), rapid weight loss is prevalent in combat sports such as Judo, Karate, Taekwondo, Boxing, and Wrestling (Franchini, Brito, & Artioli, 2012). Previous studies have reported that 60-90% of wrestlers engage in rapid weight loss at the high school, university, and international level wrestling (Alderman et al., 2004; Oppliger, Steen, & Scott, 2003; Steen & Brownell, 1990).

To lose weight, athletes engage in various methods, such as, sauna, food and fluid restriction, repetitive intensive exercises, nylon or rubber dressing, and/or usage of diuretics before the competition to reduce levels of body liquids (Wroble & Moxley, 1998). In dehydration, physical (body weight, body mass index, etc.) and physiological (basal metabolic rate, total body water, fat-free mass and fat mass etc.) changes occur in the organism, primarily due to food and fluid restriction (Demirkan et al., 2014; Alpay et al., 2015). Dehydration reduces body water both in intracellular and extracellular spaces and increases physiological stress in the human body (Lieberman, 2007). Moreover, it has been reported that a wrestler's body may be exposed to hyperosmolar pressures due to increases in sodium levels prior to the competition and may lead to hypernatremic responses (Isik et al., 2018). Increased extracellular osmolarity in hyperosmolar state results in cellular dehydration that mostly affects brain cells. In addition, anxiety,

overreaction, lethargy, muscle withdrawal reflex, spasticity, convulsions, coma and eventually death can occur (Zümrütdal, 2013). Indeed, many studies have reported that dehydration at the rate of 2-3% will cause cognitive impairment, body temperature irregularity, cardiovascular dysfunction, weakness of muscle endurance and muscle strength in the human organism (Shirreffs, 2003; Silva et al., 2010; Casa et al., 2010; Demirkan et al., 2010). Additionally, according to a 2018 HBO report presented by the American Council on Science and Health, since 2000 30 NCAA football players have died during practice (HBO, 2018). Moreover, the deaths of wrestlers in the United States of America have supported our hypothesis (Litsky, 1997).

Particularly, combat sports athletes (wrestler, boxer, judokas, karate players) try to lose weight through excessive sweating (sauna, wearing plastic or rubber sports suits) and restricting food and fluid greatly a few days before competitions (5-7 days) so that they can compete against opponents who are less strong and weaker than themselves in order to gain an advantage (Reljic et al., 2013; Cicioglu et al. 2017). According to the old wrestling competition rules (International Wrestling Rules, 2014), the athletes thought that the time interval between weigh-in and competition time ~18 hours) was sufficient for rehydration after dehydration (Isik and Dogan, 2017). Nevertheless, studies report that this time period of ~18 hours is not enough to regain the body-weight lost (Sagayama et al., 2013), and dehydration decreases athletes' performances, too (Buford et al., 2006). In order to prevent weight loss, the competition weigh-in time was changed by the United World Wrestling and according to the new arrangement, it is decided that the competition weigh-in will be held on the morning of the competition and there are ~2 hours between the weigh-in and competition time (International Wrestling Rules, 2018). With the change of the weigh-in time, decrease of the prevalence of the athletes who perform weight loss consists the hypothesis of this study. In this context, the aim of this study was to determine the methods by which the cadet wrestlers lose weight and the possible effects of these weight losses on the cadet wrestlers.

2. Material and Method

2.1. Participant

Of the entire population of 298 wrestlers eligible to participate in the cadet Greco-Roman wrestling championship in Turkey, a sample of 146 volunteers (Age: 16.07±0.80; Height: 169.61±9.56 cm; Body weight: 69.47±17.86 kg) took part in this study. Since the wrestlers' parents were not present at the competition site, consent for data collection was given by the participants and their corresponding coaches.

2.2. Collection of Data

In order to determine the weight loss methods and possible effects on the participants, the "Athlete weight loss methodology and effects scale" developed by Yarar et al. (2016) and a personal information form were used. The scale is a five-point Likert type scale (1=Never, 2=Rarely, 3=Sometimes, 4=Often, and 5=Always) consisting of nineteen questions broken into five sub-dimensions. The reliability or internal consistency coefficients (Cronbach's

alpha) were determined for the physiological effect sub-dimension (5 items) as 0.74, psychological effect sub-dimension (5 items) as 0.69, ergogenic support sub-dimension (3 items) as 0.86, diet sub-dimension (3 items) as 0.81, and dehydration sub-dimension (3 items) as 0.56. As demographic variables to the wrestlers "What is your real body weight" and "What is your weight category?" were asked. The percentages of weight loss according to the responses of the wrestlers are calculated by the formula Δ = [(Weight category - Real body weight) / Real body weight] × 100 and classified as weight loss and non-weight loss groups. In addition, a comparison was performed according to the percentage of weight lose classification as described in Casa et al. (2000). According to the classification of Casa et al. (2000), exercise-induced of +1 to -1% hydration were classified as well hydrated, -1 to -3% dehydration as minimal dehydration, -3 to -5% dehydration as significant dehydration, and more than -5% dehydration as serious dehydration.

2.3. Statistical analysis

In addition to descriptive statistics (i.e., percent and frequency), the Kolmogorov-Smirnov test was used for the normality test. One-way ANOVA was used for comparing the means of more than two groups. A Tukey post-hoc test was applied for determining the source of the difference between groups. A Pearson correlation analysis was used to determine the relationship between variables. Significance was set at $p<0.05$ and $p<0.01$ respectively.

3. Results

Table 1. Hydration status and percentage of the lost weight of cadet wrestlers

Variables	Groups	f	%	%Δ
Hydration	Non-weight loss	76	52.1	0.97
Status	Weight loss	70	47.9	4.68

An examination of Table 1 determined that 47.9% of the cadet wrestlers lost on average 4.68% of their total body weight.

While there was no statistical difference between the dehydration and ergogenic support sub-dimensions ($p>0.05$), there was a statistically significant difference between the diet, physiological, and psychological effects sub-dimensions according to the percent of total body weight loss of cadet wrestlers ($p<0.05$). According to these results, the highest mean of the diet sub-dimension was in the serious dehydration group (more than -5%) and

highest means of the physiological and psychological effect sub-dimensions were in the significant dehydration group (-3% to -5%) (See Table 2).

An examination of Table 3 discovered no significant correlation between the percentage of weight loss and the levels of dehydration and the ergogenic support sub-dimensions ($p>0.05$). A positive correlation was found between the percentage of weight loss in cadet wrestlers via dietary restriction, and the physiological, and psychological effects sub-dimensions ($p<0.05$).

Table 2. Comparison of weight loss methods and effects scale according to Casa et al. (2000) classification

Sub-dimensions	Hydration Status	n	Mean±S.D.	f	p
Diet	Well hydrated (+1 to -1%)	76	2.79±1.21[b]	6.678	**0.001****
	Minimal dehydration (-1 to -3%)	27	3.21±1.12[b]		
	Significant dehydration (-3 to -5%)	13	3.38±1.22[ab]		
	Serious dehydration (more than -5%)	30	3.88±1.01[a]		
Dehydration	Well hydrated (+1 to -1%)	76	2.34±0.93	1.677	0.175
	Minimal dehydration (-1 to -3%)	27	2.07±0.87		
	Significant dehydration (-3 to -5%)	13	2.46±0.78		
	Serious dehydration (more than -5%)	30	2.57±0.59		
Ergogenic support	Well hydrated (+1 to -1%)	76	1.30±0.82	0.503	0.681
	Minimal dehydration (-1 to -3%)	27	1.22±0.67		
	Significant dehydration (-3 to -5%)	13	1.33±0.82		
	Serious dehydration (more than -5%)	30	1.12±0.32		
Physiological effect	Well hydrated (+1 to -1%)	76	1.80±0.82[b]	2.752	**0.045***
	Minimal dehydration (-1 to -3%)	27	1.73±0.72[b]		
	Significant dehydration (-3 to -5%)	13	2.23±0.79[ab]		
	Serious dehydration (more than -5%)	30	2.15±0.68[a]		
Psychological effect	Well hydrated (+1 to -1%)	76	2.25±0.92[b]	3.193	**0.026***
	Minimal dehydration (-1 to -3%)	27	2.54±1.14[ab]		
	Significant dehydration (-3 to -5%)	13	2.94±0.56[a]		
	Serious dehydration (more than -5%)	30	2.65±0.64[a]		

*p<0.05; **p<0.01; S.d: Standard deviation; ab: the different letters represent the difference between the groups.

Table 3. The relationship between the percentage of weight loss and weight loss methods and effects of cadet wrestlers

Variables		Percentage of weight loss	Diet	Dehydration	Ergogenic support	Physiological effect
Diet	r	.305**				
	p	.001				
Dehydration	r	.114	437**			
	p	.172	.001			
Ergogenic support	r	-.076	.053	.461**		
	p	.359	.526	.001		
Physiological effect	r	.231**	.309**	.572**	.597**	
	p	.005	.001	.001	,001	
Psychological effect	r	.168*	.364**	.380**	.297**	.522**
	p	.042	.001	.001	.001	.001

*p<0.05; **p<0.01

Cadet wrestlers who followed a weight loss diet reported that they reduced total food consumption, and specifically reduced the consumption of dietary fat and carbohydrates at the rate of 92.9%, 95.7%, and 87.1% respectively (See Table 4).

The weight loss sub-group cadet wrestlers reported that they were exposed to injury and muscle cramps,

respiratory dyspnea, and tachycardia with the prevalence of 72.9%, 65.7%, 61.4% respectively (See Table 5).

Also, some 90.0% of weight lost sub-group cadet wrestlers reported that they experienced decreases in performance in conjunction with excessive fatigue, 87.1% reported elevated levels of stress, 82.9% experienced hyper nervousness, and 70% reported a lower desire to compete (See Table 6).

Table 4. Examination of diet methods in weight loss of cadet wrestlers

Items of Diet Sub-dimensions	**Likert**	**f**	**%**	No/**Yes**
Item 1: I reduce food consumption.	Never	5	7.1	7.1
	Rarely	14	20	
	Sometimes	18	25.7	
	Often	10	14.3	**92.9**
	Always	23	32.9	
	Total	70	100	
Item 2: I reduce the consumption of carbohydrate foods.	Never	9	12.9	12.9
	Rarely	9	12.9	
	Sometimes	20	28.6	
	Often	17	24.3	**87.1**
	Always	15	21.4	
	Total	70	100	
Item 3: I reduce the consumption of fatty food.	Never	3	4.3	4.3
	Rarely	7	10.00	
	Sometimes	14	20.00	
	Often	20	28.6	**95.7**
	Always	26	37.1	
	Total	70	100	

4. Discussion and Conclusion

Greco-Roman Wrestling is a combat sport in which athletes are matched by predetermined weight classes. In order to compete in the desired weight class, wrestlers often engage in concurrent training in hot conditions to enhance fluid loss, as well as engage in food and/or fluid restriction. In addition, wrestlers also train while wearing nylon or rubber outfits (Oppliger et al., 2003). Weight loss achieved via such methods in sports that use weight classes have recently attracted the attention of scientists and have been the subject of numerous studies (Artioli et al., 2010; Franchini, Brito, & Artioli, 2012; Isik et al., 2013). In response to deaths of three college wrestlers in six weeks in 1997, the National Collegiate Athletic Association (NCAA) proposed precautions to prevent unsafe weight loss practices (Utter et al., 2003, Stuempfle et al., 2003). It has been reported that wrestlers continue to engage in fast and high weight loss before competition, despite newly established measures to prevent rapid weight loss practices given the many harmful side effects and health risks (Cengiz & Demirhan, 2013; Alpay et al., 2015; Yildirim, 2015; Isik et al., 2018). Many studies reported that 60-90% of the wrestlers at the high school, university, and international level engaged in rapid weight loss (Alderman et al., 2004; Oppliger, Steen, & Scott, 2003; Steen & Brownell, 1990). As an added precaution, the United World Wrestling tried to minimize rapid weight loss practices in wrestlers by shortening the time between the weigh-in and competition (International Wrestling Rules, 2018). Results of the present study show that 47.9% of the cadet Greco-Roman wrestlers reduced their body weight on average by 4.68% and were thus exposed to excessive dehydration (See Table 1). This result indicates that changing the weigh-in time prior to a competition has a positive effect as it reduces athlete involvement in rapid weight loss practices.

Previous studies have reported that a <2% kg weight loss of total body weight will not have a negative effect on athletic performance. For example, Maughan and Shirreffs (2008) have reported that dehydration by 1–2% of body mass had no effect on endurance-exercise performance when the exercise duration was less than 90 minutes. However, they observed that performance was impaired when the level of dehydration was greater than 2% of body mass and the exercise duration was longer than 90 minutes. In another study, Sawka et al., (2001) have reported that running performance was impaired at all race distances for the hypohydration condition (decreased body weight by 2%), but to a greater extent in the longer races (~5% for the 5000 and 10 000-m.) than the shorter race (3% for 1500-m.). These results indicate that 2% and

Table 5. Examination of physiological effects in weight loss of cadet wrestlers

Items of physiological effects sub-dimensions	**Likert**	**f**	**%**	No/**Yes**
Item 10: I am exposed to muscle cramps.	Never	19	27.1	27.1
	Rarely	28	40.0	
	Sometimes	18	25.7	**72.9**
	Often	4	5.7	
	Always	1	1.5	
	Total	70	100	
Item 11: My body temperature increases.	Never	27	38.6	38.6
	Rarely	21	30.0	
	Sometimes	16	22.8	**61.4**
	Often	3	4.3	
	Always	3	4.3	
	Total	70	100	
Item 12: I am exposed to tachycardia.	Never	40	57.1	57.1
	Rarely	15	21.4	
	Sometimes	12	17.2	**42.9**
	Often	3	4.3	
	Always	-	-	
	Total	70	100	
Item 13: I am exposed to respiratory dyspnea.	Never	31	44.3	44.3
	Rarely	18	25.7	
	Sometimes	18	25.7	**65.7**
	Often	2	2.9	
	Always	1	1.4	
	Total	70	100	
Item 14: I am exposed to injury.	Never	19	27.1	27.1
	Rarely	26	37.2	
	Sometimes	19	27.1	**72.9**
	Often	3	4.3	
	Always	3	4.3	
	Total	70	100	

more weight loss will contribute to loss of physiological function.

Degoutte et al. (2006) have reported that judo athletes undergoing rapid weight loss presented decreased vigor as well as increased tension, anger, and fatigue. Moreover, Isik et al. (2013) reported that wrestlers' depression levels increased as the amount of weight loss increased. These results show that unhealthy weight loss has negative psychological effects on athletes.

In this study, weight loss percentages of wrestlers were classified according to Casa et al. (2000). It was determined that there was a statistical difference between the sub-dimensions' averages of diet, physiological, and psychological effects. Accordingly, the mean value of the diet sub-dimension increased along with an increase in weight loss percentages. When the physiological effect sub-dimension was examined, there was a statistical difference between "serious dehydration" and "well hydrated and minimal dehydration". This finding indicates that serious dehydration affects wrestlers at a higher level physiologically than the wrestlers who have well hydrated and minimal dehydration.

When the psychological effect sub-dimension was examined, there was a statistical difference between "serious and significant dehydration" and "well hydrated". This finding suggests that significant and serious dehydration affects wrestlers at a higher level psychologically than the wrestlers who have well hydrated

(See Table 2). In addition, there was a positive relationship between weight loss and diet, physiological and psychological effect sub-dimensions of "athlete weight loss methodology and effects scale" (See Table 3). It was determined that the nutrient and fluid restriction levels increased as the weight loss percentage increased. An increase in nutrient and fluid restriction was associated with increased physiological and psychological effects. These results show that nutrient and fluid restriction before competition have a negative effect on the physiological and psychological aspects of a wrestler's performance.

A secondary question of this study was to examine the effects of various weight loss methods on weight loss in wrestlers. Results show that the wrestlers who reported to have engaged in weight loss practices often and always did it at a rate of 45.7-65.7%. Wrestlers reduced the highest rate of fatty foods consumption (See Table 4). Wrestlers that engaged in excessive rapid weight loss procedures reported exposure to harmful physiological effects and experienced the highest rate of muscle injury and cramps (See Table 5). Wrestlers that reported the highest levels of harmful psychological effects also reported the highest decreases in performance (See Table 6).

The causal relationship between dehydration and the loss of physical, physiological, and psychological function in wrestlers is well documented in the related literature (Alpay et al., 2015; Cengiz & Demirhan, 2013; Franchini, Brito, & Artioli, 2012; Isik et al., 2013; Isik & Dogan, 2017; Isik et al., 2018). Nutrient and fluid restriction following a heavy and intense exercise session for the purpose of weight loss leads to skeletal muscle mass loss, a decrease in performance, and an extended recovery time (Isik et al., 2018).

This study was limited to questions measuring the body weight loss methods and its effects on elite cadet Greco-Roman wrestlers' performance. Physiological and psychological effects of weight loss could be supported by medical measurement methods (Urine specific gravity, plasma osmolality, saliva flow rate). However, in this study, medical measurements could not be performed because athletes had limited time for rehydration (competition time) after dehydration (weigh-in time). Moreover, weight loss methods for other age categories (school boys, junior, and senior) and styles (man and women freestyle) can be identified and its effects can be investigated and / or compared.

Table 6. Examination of psychological effects in weight loss of cadet wrestlers

Items of psychological effects sub-dimensions	**Likert**	**f**	**%**	No/**Yes**
Item 15: I become hyper-nervous.	Never	12	17.1	17.1
	Rarely	22	31.4	
	Sometimes	19	27.1	**82.9**
	Often	11	15.7	
	Always	6	8.6	
	Total	70	100	
Item 16: I feel excessive fatigue myself.	Never	9	12.9	12.9
	Rarely	20	28.6	
	Sometimes	24	34.3	**87.1**
	Often	9	12.9	
	Always	8	11.4	
	Total	70	100	
Item 17: My Performance is reduces.	Never	7	10.0	10.0
	Rarely	22	31.4	
	Sometimes	26	37.1	**90.0**
	Often	10	14.3	
	Always	5	7.1	
	Total	70	100	
Item 18: My stress level is increases.	Never	9	12.9	12.9
	Rarely	21	30.0	
	Sometimes	22	31.4	**87.1**
	Often	11	15.7	
	Always	7	10.0	
	Total	70	100	
Item 19: My sports desire is reduces.	Never	21	30.0	30.0
	Rarely	24	34.3	
	Sometimes	15	21.40	**70.0**
	Often	7	10.0	
	Always	3	4.30	
	Total	70	100	

As a result, it was observed that the frequency of rapid weight loss practices in wrestlers was reduced by the fact that the United World Wrestling shortened the time lag between competition weigh-in and competition start time. Especially athletes in the cadet category should not engage in rapid weight loss practices because they are in the adolescent growth spurt period and may thus be at a higher risk. Excessive weight loss may interfere with physical, physiological and psychological development in adolescents. Coaches and club managers should closely monitor cadet wrestlers' weight and prohibit rapid weight loss practices before the competition. By closely monitoring their athlete's weight, coaches will facilitate an environment where two young athletes are competing at their normal weight rather than two athletes engaging in a dangerous race to shed a few kilograms hours before a competition.

Disclosure statement

No potential conflict of interest was reported by the authors

References

Alderman, B. L., Landers, D. M., Carlson, J. O. H. N., & Scott, J. R. (2004). Factors related to rapid weight loss practices among international-style wrestlers. *Medicine & Science in Sports & Exercise*, *36*(2), 249-252.

Alpay, C. B., Ersöz, Y., Karagöz, Ş., & Oskouei, M. M. (2015). A comparison of weight loss, body composition and some mineral levels before competition in elite wrestlers. *International Journal of Science Culture and Sport*, *3*(4), 338-348.

Artioli, G. G., Iglesias, R. T., Franchini, E., Gualano, B., Kashiwagura, D. B., Solis, M. Y., & Lancha Junior, A. H. (2010). Rapid weight loss followed by recovery time does not affect judo-related performance. *Journal of Sports Sciences*, *28*(1), 21-32.

Buford, T. W., Rossi, S. J., Smith, D. B., O'Brien, M. S., & Pickering, C. (2006). The effect of a competitive wrestling season on body weight, hydration, and muscular performance in collegiate wrestlers. *The Journal of Strength & Conditioning Research*, *20*(3), 689-692.

Casa, D. J., Armstrong, L. E., Hillman, S. K., Montain, S. J., Reiff, R. V., Rich, B. S., ... & Stone, J. A. (2000). National Athletic Trainers' Association position statement: Fluid replacement for athletes. *Journal of Athletic Training*, *35*(2), 212-224.

Cengiz, A., & Demirhan, B. (2013). Physiology of wrestlers' dehydration. *Turkish Journal of Sport and Exercise*, *15*(2), 1-10.

Cicioglu, H. I., Isik, O., Yildirim, I., Unveren, A., & Karagoz, S. (2017). The effects of dehydration before competition upon body composition, leptin hormone, and ghrelin hormone among elite wrestlers. *Biomedical Research*, *28*(10), 4335-4341.

Degoutte, F., Jouanel, P., Begue, R. J., Colombier, M., Lac, G., Pequignot, J. M., & Filaire, E. (2006). Food restriction, performance, biochemical, psychological, and endocrine changes in judo athletes. *International journal of sports medicine*, *27*(01), 9-18.

Demirkan, E., Koz, M., Kutlu, M. (2010). Dehidrasyonun performans üzerine etkileri ve vücut hidrasyon düzeyinin izlenmesi. *Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 8*(3) 81-92.

Demirkan, E., Kutlu, M., Koz, M., Özal, M., Güçlüöver, A., & Favre, M. (2014). Effects of hydration changes on body composition of wrestlers. *International Journal of Sport Studies*, *4*(2), 196-200.

Franchini, E., Brito, C. J., & Artioli, G. G. (2012). Weight loss in combat sports: Physiological, psychological and performance effects. *Journal of the International Society of Sports Nutrition*, *9*(1), 52-57.

Greko-Roman wrestling (2019, March 15)__Retrieved from https://www.olympic.org/wrestling-greco-roman-equipment-and-history

HBO (2018). Retrieved from: https://www.acsh.org/news/2018/09/28/30-ncaa-football- players-have-died-during-workouts-2000-hbo-reveals-13456

International Wrestling Rules (2014). Retrieved from https://unitedworldwrestling.org/sites/default/files/1-wrestling_rules_july_2014_eng.pdf

International Wrestling Rules (2018). Retrieved from https://unitedworldwrestling.org/sites/default/files/2018-04/wrestling_rules.pdf

Isik, O., & Dogan, I. (2017). Body components changes and depression scores before competitions among elite female wrestlers. *Acta Kinesiologica*, *11*(1), 23-27.

Isik, O., & Gumus, H. (2018). Evaluation of effective demographic variables in competition performances of Turkish wrestling referees. *Journal of Human Sport and Exercise*, *13*(1), 60-71.

Isik, O., Gokdemir, K., Bastik, C., Yildirim, I., & Dogan, I. (2013). A study on elite wrestlers: weight loss and depression. *Journal of Physical Education & Sports Science*, *7*(3), 216-223.

Isik, O., Yildirim, I., Ersoz, Y., Koca, H. B., Dogan, I., & Ulutas, E. (2018). Monitoring of pre-competition dehydration-induced skeletal muscle damage and inflammation levels among elite wrestlers. *Journal of Back and Musculoskeletal Rehabilitation*, *31*(3), 533-540.

Lieberman, H. R. (2007). Hydration and cognition: a critical review and recommendations for future research. *Journal of the American College of Nutrition*, *26*(*Suppl*. 5), 555-561.

Litsky, F. (1997, December 19). Wrestling: Collegiate wrestling deaths raise fears about training. *The New York Times*. Retrieved from https://www.nytimes.com/1997/12/19/sports/wrestling-collegiate-wrestling-deaths-raise-fears-about-training.html

Maughan, R. J., & Shirreffs, S. M. (2008). Development of individual hydration strategies for athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, *18*(5), 457–472.

Oppliger, R. A., Steen, S. A. N., & Scott, J. R. (2003). Weight loss practices of college wrestlers. *International Journal of Sport Nutrition and Exercise Metabolism*, *13*(1), 29-46.

Reljic, D., Hässler, E., Jost, J., & Friedmann-Bette, B. (2013). Rapid weight loss and the body fluid balance and hemoglobin mass of elite amateur boxers. *Journal of Athletic Training*, *48*(1), 109-117.

Sagayama, H., Yoshimura, E., Yamada, Y., Ichikawa, M., Ebine, N., Higaki, Y., Kiyonaga A. & Tanaka, H. (2013). Effects of rapid weight loss and regain on body composition and energy expenditure. *Applied Physiology, Nutrition, and Metabolism*, *39*(1), 21-27.

Sawka, M. N., Montain, S. J., & Latzka, W. A. (2001). Hydration effects on thermoregulation and performance in the heat. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, *128*(4), 679-690.

Shirreffs, S. M. (2003). Markers of hydration status. *European Journal of Clinical Nutrition*, *57*(*Suppl*. 2), 6-9.

Silva, A. M., Fields, D. A., Heymsfield, S. B., & Sardinha, L. B. (2010). Body composition and power changes in elite judo athletes. *International Journal of Sports Medicine*, *31*(10), 737-741.

Steen, S. N., & Brownell, K. D. (1990). Patterns of weight loss and regain in wrestlers: Has the tradition changed? *Medicine and Science in Sports and Exercise*, *22*(6), 762-768.

Stuempfle, K. J., & Drury, D. G. (2003). Comparison of 3 methods to assess urine specific gravity in collegiate wrestlers. *Journal of Athletic Training*, *38*(4), 315-319.

Utter, A. C. (2001). The new National Collegiate Athletic Association wrestling weight certification program and sport-seasonal changes in body composition of college wrestlers. *Journal of Strength and Conditioning Research*, *15*(3), 296-301.

Wroble, R. R., & Moxley, D. P. (1998). Acute weight gain and its relationship to success in high school wrestlers. *Medicine and Science in Sports and Exercise*, *30*(6), 949-951.

Yarar, H., Eroğlu, H., Üzüm, H., & Polat, E. (2016). Athlete weight loss methodology and effects scale: Validity and reliability study. *Journal of Human Sciences*, *13*(3), 6164-6175.

Yildirim, I. (2015). Associations among dehydration, testosterone and stress hormones in terms of body weight loss before competition. *The American Journal of the Medical Sciences*, *350*(2), 103-108.

Zümrütdal, A. (2013). Basic principles in liquid electrolyte treatment. *Anadolu Kardiyoloji Dergisi*, *13*(2), 171-177.

Suggested Citation:

Yagmur, R., Isik, O., Kilic, Y., & Dogan, I. (2019). Weight loss methods and effects on the elite cadet Greco-Roman wrestlers. *Journal of Teaching, Research, and Media in Kinesiology, 5*, 33–40.