

Prevalence of rapid weight loss and its effects on elite cadet wrestlers participated in the final stage of national championships

Abstract. *Aim:* The purpose of this study was to investigate the prevalence of rapid weight loss (RWL) and its effects on elite cadet wrestlers participated in final stage of national championships.

Material and methods: The wrestlers comprised of 56 adolescents (25 freestyle and 31 Greco-Roman wrestlers). Wrestlers divided into three weight groups (light weight, middle weight and heavy weight). The average age and weight of wrestlers were (16 ± 0.72 , 16.82 ± 0.63 and 16.42 ± 0.69 years) and (50.80 ± 5.27 , 63.74 ± 4.94 and 88.26 ± 10.51 kg) respectively. Prevalence of RWL and its effects were assessed using the standard Oppliger questionnaire.

Result: The maximum weight loss (MWL) among light, middle and heavy weight groups were 3.95 ± 1.31 , 4.47 ± 1.53 and 5.07 ± 1.32 kg respectively. In addition to the extracted data from questionnaire, wrestlers' body weights were measured in the morning of competition day and its difference with the weight at the weigh-in time, as a marker of their normal body weight, was calculated. This index was applied for the first time in Iran and all the wrestlers participated in this part of investigation. The results for light, middle and heavy weight groups were 3.09 ± 1.56 , 2.64 ± 1.34 and 2.12 ± 1.41 kg respectively.

Conclusion: The results showed that the most used methods for weight loss were increased physical activity and gradual dieting, and the most frequent side effects after RWL were dizziness, muscle cramp and irritability respectively.

Keywords: wrestling, competition, Oppliger questionnaire, weigh-in, combat sports

Introduction

sports are becoming more and more relevant to the worlds' sports scenario. Today, they include about 25% of the total medals in Olympic Games. Also, worldwide combat events, such as Mixed Martial Arts and Boxing gathering lots of viewers from all over the world [1]. In almost all of combat sports, competitions are organised into weight classes, that aim to increase fairness and equalization between competitors. However, many of combat sport athletes tend to reduce high amounts of their natural weight in a short period of time before weight-in and/or competition in order to confer competitive advantage by competing against a lighter and weaker opponant. The use of RWL methods in these kinds of sport has long been a matter of concern and may even be used via young children and adolescents [1]. Because these individuals are in prepuberty statues, poor nutrition as a result of limitation of food and fluid intake may affect the health of their hight [3] and cause temporary growth impairment [1]. Also, Employing the RWL techniques by competitive wrestlers has lately caused a great deal of concern especially, after the three tragic deaths in 1997. Hence, some organizations such as NCAA and the national governing body of USA decided to institute new policies to prohibit unsafe weight loss practices. However, any prohibiting policies have not yet been adopted for Greco-Roman and freestyle wrestling in international level [2].

The effects of rapid and intensive weight loss on wrestlers' performance and health has been the issue for researchers in last a few decades [4]. Since 1970, numerous studies have been conducted to document weight management patterns among high school and college wrestlers. The American Medical Association and the American College of Sports Medicine published one and two position statements respectively in order to advocate against these unhealthy weight loss practices [5].

In many cases, wrestlers attempt to decrease lots of their weight in a short time through food and fluid restriction. Also, they take advantage of some other methods like intense exercise, vomiting, starvation and use of diuretics and laxatives [4]. Mirzaei et al. investigated the methods of RWL in Iranian elite wrestlers (cadets,

juniors and seniors). The results showed that the most frequent methods in these wrestlers were fasting, increased exercise, skipping 1 meal, exercise in heated rooms, saunas and rubber/plastic suit, and none of these wrestlers used extreme methods of weight loss (vomiting, diuretics, laxatives and enemas) [4]. The RWL techniques using by wrestlers have changed a little over the past 25 years because it has been shown that these techniques pass down from wrestler to wrestler, or coach to wrestler. Also, parents and health professionals provide very rarely input on how to lose weight appropriately [6]. A combination of these methods often conducted the day before competition. These methods together or alone have harmful effects on cardiovascular functions, thermoregulation, renal function, fluid and electrolyte balance, body composition and muscle strength/endurance. In addition, increased weight cycling (weight reduce and regain) during competition season has harmful effects on mood profile, decreases short and long memory and associated with obesity in long time [4].

Weight loss in wrestlers can be attributed to reductions in body water, glycogen, lean tissue, and only a small amount of fat. In addition, dehydration methods, e.g., sweating and catharsis, cause the loss of electrolytes [6]. Wrestlers hope to replenish body fluids, electrolytes, and glycogen in the short period (30 min-20 h) between the weigh-in and competition. However, reestablishing fluid homeostasis may take 24-48 h; replenishing muscle glycogen may take more than 72 h, and replacing lean tissue might take even longer. Briefly, RWL appears to adversely influence the wrestlers' energy stores and fluid and electrolyte balances [1].

Therefore, it is important to study and diagnose the RWL practices which can cause negative impacts on physical and psychological health. In addition, it is necessary to understand the nutritional behaviors of wrestlers. Also, the methods of RWL and its negative effects were not investigated comprehensively in Iranian elite cadet wrestlers. According to the mentioned reasons, the objective of this study was investigation the prevalence of RWL and its effects on Iranian elite cadet wrestlers participated in the final stage of national championships. Because of the large weight

difference between weight classes, wrestlers divided into three groups, light weight group (LWG), middle weight group (MWG) and heavy weight group (HWG).

Material and methods

Participants: The population of present study were Iranian elite cadet wrestlers (age range, 15 to 17 years) from different states of Iran, participated in last stage of national championships in 2016. Fifty-six adolescents (25 freestyle and 31 Greco-Roman wrestlers) from mentioned population voluntarily participated in this study.

Procedure: We obtained information of rapid weight loss by using an Oppliger (2003) standard questionnaire which consisted of 31 items [5]. The validity of the questionnaire was confirmed by the University of Northern Michigan and the validity of its translation in Iran was determined by Mirzaei et al [3, 4]. Oppliger questionnaire consists of four parts. The first part with 7 questions investigate the wrestlers' personal information like age, normal weight, competitive weight, age category, style (freestyle or Greco-Roman) and experience. The second part includes 17 questions which assess the dietary history and dietary patterns of wrestlers. This part begins with questions such as starting age of wrestling, weight loss and gain status in the current year, maximum weight loss (MWL), weight fluctuations during the season also weekly weight fluctuations. The third part includes 3 questions that investigate the methods and the effects of RWL. This part contains two tables, the first one evaluates fifteen methods of weight loss used by wrestlers at different times. The second one identifies the influence of different people on the weight loss of wrestlers. The wrestlers were asked the side effects following RWL. And the final part of questionnaire consists of four questions which assess the sources of information on weight cutting [3, 4].

Before distribution the questionnaires in competition, we took the agreement of wrestling federation of Iran (IAWF) also the agreement of coaches of different wrestling teams, then questionnaire was fully explained to wrestlers and they answered it accordingly.

Statistical analysis: For description and explanation of obtained data descriptive statistics (mean and standard deviation) in form of tables and graphs were used. Also, inferential statistics, Kruskal-Wallis H and Mann-Whitney U, at significantly level of ($p < 0.05$) were used to check the differences between three weight groups. In addition, Shapiro-Wilk test was used for normality distribution of data. Excel and SPSS (version 22) software were used to draw the graphs and for data analyzing respectively.

Results

Wrestlers' personal information are presented in the following table (Table 1). 44.6 percent of these wrestlers were among the top three wrestlers in national championships in last year and 55.4 percent in addition to were among the top three national champions, had the experience of contribution in international, Asian and world championships in last year.

Table 1. wrestlers' profile (mean \pm SD)

Variable	LWG	MWG	HWG
Age (year)	16 \pm 0.72	16.82 \pm 0.63	16.42 \pm 0.69
Age began wrestling (year)	11.20 \pm 2.37	11.76 \pm 2.04	10.68 \pm 2
Age began cutting (year)	14.10 \pm 1.55	14.11 \pm 1.36	13.94 \pm 1.84
Normal weight (kg)	50.80 \pm 5.27	63.74 \pm 4.94	88.26 \pm 10.51
Weekly weight fluctuation (kg)	2.27 \pm 1.44	1.97 \pm 0.90	3.21 \pm 1.71

The results showed that more than 60 percent of LWG, 41.2 percent of MWG and 52.6 percent of HWG wrestlers imagined they are overweight. Likewise, the most frequent method (MFM) among these wrestlers for RWL included gradual

dieting, increased exercise and skipping one meal. Also, none of them used extreme methods such as vomiting, enemas and use of diuretics or laxatives (Chart 1). There were no significant differences between different weight groups of Iranian elite cadet wrestlers in using of RWL methods except using of diet pills. The post hoc test conduction indicated that HWG used diet pills significantly more than MWG ($p<0.05$).

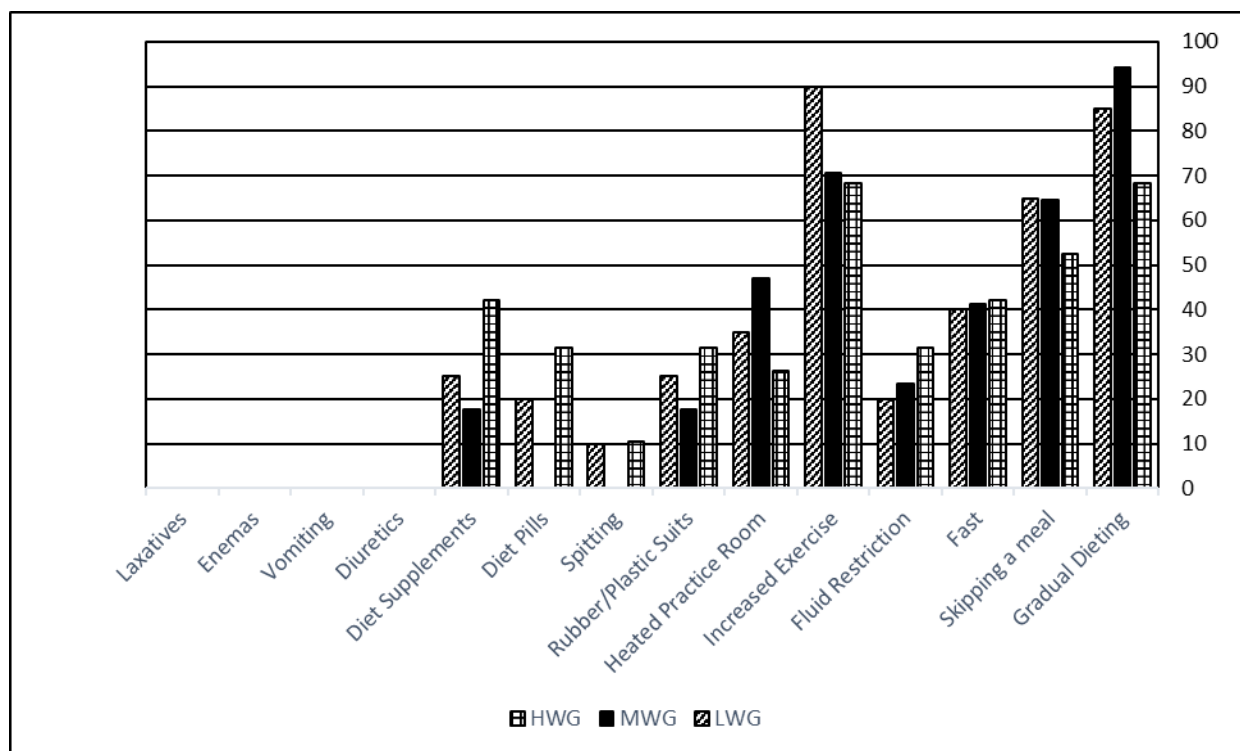


Chart 1. Methods of RWL among wrestlers (%)

When wrestlers were questioned, how long they absolutely avoided eating, LWG, MWG and HWG wrestlers expressed 1.32 ± 0.74 , 1.20 ± 0.30 and 1.47 ± 0.51 (day) respectively. And there were no significant differences between them.

The most common side effects as result of RWL among wrestlers were dizziness, muscle cramps and irritability, also nosebleeding showed to be the least frequent side effect among wrestlers (Table 2). The LWG wrestlers significantly experienced more heart rate than the wrestlers in other groups ($p<0.05$).

Table 2. Side effects after RWL (%)

Variable	LWG	MWG	HWG
Dizziness	12	18.5	25.7
Headaches	2.4	3.7	11.4
Muscle cramps	24.4	22.2	14.3
Nosebleeding	2.4	0	0
Feverish	2.4	7.4	5.7
Nausea	2.4	0	5.7
Increased heart rate	19.5	0	0
Decreased concentration	4.9	18.5	5.7
Irritability	17.1	25.9	11.4
Hot flashes	9.8	3.7	11.4
Disoriented	2.4	0	8.6

The MWL to make weight averaged 4.49 ± 1.44 kg among Iranian elite cadet wrestlers in the year leading up to the final stage of national championships and this amount as a percentage of body weight was 6.65 %. In addition, the frequency of cutting weight averaged 2.33 ± 1.10 times in the same time (Table 3). The MWL were not significantly different between three weight groups. However, a significant difference was observed in frequency of cutting weight between LWG and MWG which showed MWG cut weight more times compared to the LWG ($p < 0.05$).

Table 3. MWL and frequency of weight cutting

Variable	LWG	MWG	HWG
Maximum weight loss (kg)	3.95±1.31	4.47±1.53	5.07±1.32
Maximum weight loss (%)	7.77	7.01	5.74
Frequency of weight loss (times)	1.90±1.07	2.70±0.84	2.47±1.21

The results of this investigation showed that the primary source of information on weight cutting were coaches. Moreover, physicians, medical assistants, others and other sources of information (media, internet etc) had no role in giving the information on weight cutting. Even some wrestlers had no information around weight cutting (Table 4).

Table 4. Sources of information on weight cutting (%)

Variable	LWG	MWG	HWG
Coaches	80	82.4	63.2
Parents	0	0	10.5
Physicians	0	0	0
Medical assistants	0	0	0
Others	0	0	0
Other sources	0	0	0
No data	20	17.6	26.3

20 % of LWG, 35.5 % of MWG and 26.3 % of HWG have measured their body composition in last year and 10, 11.3 and 5.8 % respectively of LWG, MWG and HWG wrestlers have used the body composition data to lose weight.

In addition to the extracted data from questionnaire, wrestlers' body weights were measured in the morning of competition day and its difference with the weight at the weigh-in time, as a marker of their normal body weight, was calculated (Table 5).

Table 5. Average weight at weigh-in and morning of match day (mean±SD).

Variable	LWG	MWG	HWG
Weight-in (kg)	48.34±4.23	63.37±4.81	87.12±9.60
Competition day (kg)	51.43±4.55	66.02±4.64	89.48±9.69
Difference (kg)	3.09±1.56	2.64±1.34	2.12±1.41

Discussion

It has been shown that combat sport athletes often use RWL methods to make weight in order to confer competitive advantage by competing against a lighter and weaker opponant but it seems that RWL have effects beyond the physical advantages. For instance, Pettersson et al. (2013), reported that athletes expressed RWL practicing before the competition helps them to increase their self-confidence (self-confidence is a key factor for success in combat sports) also they pursued RWL practicing as a part of their competitive preparations [8]. Even, some athletes believed that it is an inseparable part of the culture and tradition of combat sports [8, 9] and they should try to reduce weight if they want to be a real athlete [8]. It also seems combat sport athletes begin weight loss practicing since they are teenagers. The beginning age of weight loss in the present study averaged 14.05±1.57 years which was lower than result of Mirzaei et al. (2011), 15.50±0.98 years and greater than results reported by Viveiros et al. (2015), and Artioli et al. (2010), 12.1±1.3 and 12.6±6.1 years respectively. These differences can be attributed to the different number of subjects with different sexuality. The subjects of Mirzaei et al. were 12

adolescent wrestlers (just boys), also, 31 athletes (15 men and 16 women) and 822 athletes (607 men and 215 women) were participated in Viveiros et al. (2015) and Artioli et al. (2010) respectively. Some studies indicated that the age at which athletes of weight categorized sports began weight loss practicing, have a close relationship with more extreme weight management behaviors in adulthood [11].

The present study found that the MFM used by Iranian elite cadet wrestlers were gradual dieting, increased exercise and skipping one meal. Also, extreme methods such as enemas, diuretics, laxatives and vomiting were in the lowest level and fortunately there were no frequencies for them in this investigation.

It has been shown that the MFM for weight loss are gradual dieting and increased exercise which is in accordance with obtained result from the present study. The using of these methods (gradual dieting and increased exercise) as the MFM of RWL have shown in lots of studies such as Amirasan et al. (2013), Mirzaei et al. (2011), Khodaei et al. (2015), James and Shirreffs (2015), Oppliger et al. (1996 and 2003), Werner et al. (2013), Brito et al. (2012), Artioli et al. (2010), Reljic et al. (2015), Viveiros et al. (2015), Pettersson et al. (2013) and the policy statement of the American academy of pediatrics (2005). All the aforementioned studies expressed extreme methods as the least frequent methods of RWL which is in accordance with obtained results of our study but the rate of using these methods is different among them. For example, in this study none of Iranian elite cadet wrestlers have used extreme methods but in other mentioned studies subjects have used these methods in different rates. This difference may be due to the diverse quantity of participants or can attributed to the participants more awareness of RWL consequences in the present study because the present study is up to dated comparing with other studies.

Dizziness, muscle cramp and irritability had the most prevalence in Iranian elite cadet wrestlers after RWL. And the other presented consequences were decreased concentration, hot flashes, increased heart rate, headache, feverish, disoriented, nausea and nosebleeds respectively. Also, in the investigation by

Amirsasan et al. (2013) which was conducted on Iranian elite cadet wrestlers, participants experienced dizziness, irritability, decreased concentration, headache, muscle cramp, disoriented, hot flashes, increased heart rate, nausea, feverish and nosebleeds respectively. In addition, Mirzaei et al. (2011) applied the same investigation on Iranian elite wrestlers (seniors, juniors and cadets) and the findings showed that wrestlers felt irritability, dizziness, muscle cramp, decreased concentration, increased heart rate, headache, disoriented, nausea, feverish, hot flashes and nosebleeds respectively. There are not many differences between these surveys probably because of the same community which they were conducted on. In another study by Alderman et al. (2004), results showed more differences which can be attributed to the subjects different age (cadet and junior wrestlers) compared with present study (cadet wrestlers). There are some other studies that reported negative side effects after RWL but they interviewed athletes differently or used different questionnaire which are the reasons for their dissimilar findings. For instance, Khodaei et al. (2015) in a review article reported decrease in memory, concentration and confidence with increase in confusion, depression, rage and fatigue. Also, Franchini et al. (2012) reported decrease in short-term memory, concentration and confidence with increase in dizziness, rage, fatigue, depression and isolation. A theory suggested by some authors supposed that increase in anger and tension may increase in performance. In addition, some other researchers believe that negative effects of RWL on mood will disappear after regaining weight [12]. On the other hand, some authors believe that these consequences may cause decrease in performance. For example, decreased short-term memory can impair the ability of athlete to follow their coaches' instructions. The lack of focus and concentration may affect the ability of athletes to deal with distractions during competition. A low self-esteem may result in difficult to consider the possibility of winning against a high-level opponent. Confusion can have negative effects on capacity of making quick decision also increased rage and anger may increase the possibility of illegal action which can result in athlete disqualification. Finally, isolation and depression may result in difficulty in following training sessions [18].

In the present study, the MWL among Iranian elite cadet wrestlers in the last year before final stage of national championships averaged 4.49 ± 1.44 kg and it was 6.65 % as a percentage of body weight. And these amounts separated for each weight group (LWG, MWG and HWG) were 3.95 ± 1.31 , 4.47 ± 1.53 and 5.07 ± 1.32 kg, and as a percentage of wrestlers' body weight were 7.77 (%), 7.01 (%) and 5.74 (%) respectively for LWG, MWG and HWG. Also, there were no significant differences between groups. Amirasan et al. (2013), reported the MWL in their survey and their findings were 2.46 kg for light, 4 kg for middle and 2.91 kg for heavy weight wrestlers. In addition, Mirzaei et al. (2011) reported the MWL averaged 2.72 ± 1.37 kg for the same subjects which is common in two mentioned investigations with the present study. But, the reported amount of MWL is lower in these studies compared with the present study. The reason of this difference can be due to the different level of championships which wrestlers participated or were preparing to participate in. The participants of Amirasan et al. (2013) and Mirzaei et al. (2011) were Iranian elite cadet wrestlers who already pasted the national championships and were meant to participate in international championships but the participants of the present study were participated in the final stage of national championships and if they could not take the favorable result they would never be a member of national team to participate in international championships. So, it is really clear that the national championships are at the first priority for wrestlers especially in a country like Iran which has a great background in international championships and always has a high-level of national championships in all age categories.

The average amounts of MWL in Alderman et al. (2004), Brito et al. (2012), and Oppliger et al. (2003), were reported 5.27 kg, 7.25 kg and 5.3 ± 2.8 kg respectively, and they are greater than the obtained results of our study. These differences can be attributed to the higher average age of mentioned studies compare to the present study. The subjects of Alderman et al. (2004) were a mixture of cadet and junior wrestlers and in Oppliger et al. (2003), and Brito et al. (2012) subjects age averaged 20 ± 1.6 and 25 ± 3.7 year respectively, while the average age of subjects in

the present study was 16.39 ± 0.75 year. This association between the age and the MWL is obvious in Mirzaei et al. (2011) study that included cadet (2.72 ± 1.37 kg), junior (4.79 ± 1.48 kg) and senior (3 ± 2.08 kg) wrestlers which shows that cadet wrestlers have the least amount of MWL. In addition, some studies with lower average age [Roemmich et al. (1997) and Wroble et al. (1998)] reported lower amount of MWL (2.8 kg and 2.8 percent of body weight, respectively) compare with the present study. Also, Koral et al. (2009) and Artioli et al. (2010) have reported lower amount of MWL as well (3.9 percent of body weight and 4 ± 3.1 kg, respectively), that can be due to the participation of men and women together in their studies who also had different combat sport (Judo).

The frequency of cutting weight averaged 2.33 ± 1.10 times in the last year before final stage of national championships and it was 1.90 ± 1.07 (times), 2.70 ± 0.84 (times) and 2.47 ± 1.21 (times) respectively for LWG, MWG and HWG. And a significant difference was observed between LWG and MWG that showed MWG cut weight more times compared to LWG ($p < 0.05$). Amirsasan et al. (2013), reported lower amount (1.67, 2 and 1.34 for light, middle and heavy weight groups, respectively) compare with the present sample. Mirzaei et al. (2011), also reported lower amount (2 ± 0.81 times) compare with the present study. And, Artioli et al. (2010) reported 3 ± 5 times per year.

It has been shown that coaches have the most impact on wrestlers' RWL behaviors and are the primary source of information on weight cutting [3, 4, 5, 10, 11, 15, 18]. Furthermore, Oppliger et al. (1996) expressed that RWL techniques have been passed down from coaches to wrestlers and have changed little over the past 25 years. Of note, Oppliger et al. (1996), published their investigation more than 20 years ago (1996-2017). These 20 years plus the mentioned 25 years in Oppliger's study means coaches are the primary source of information on weight cutting for about half a century. So, coaches of combat sports (which have weight categories) should increase their knowledge on weight cutting to guide their athlete appropriately. Also, they can encourage their athletes to take advices from sport

scientists, nutritionists, physicians and other qualified people. In addition, related national federations can organize seminars around this issue and help their coaches to increase their information.

In addition to the extracted data from questionnaire, wrestlers' body weights were measured in the morning of competition day and its difference with the weight at the weigh-in time, as a marker of their normal body weight, was calculated. This index was applied for the first time in Iran and almost all the wrestlers participated in this part of investigation. The results for LWG, MWG and HWG were 3.09 ± 1.56 , 2.64 ± 1.34 and 2.12 ± 1.41 kg respectively (average 2.67 ± 1.50 kg). Also, Viveiros et al. (2015), have conducted the same test on adolescent boys and girls (mean age 13 ± 2 years) and the results were 2.7 ± 1.4 kg for girls and 1.5 ± 0.09 kg for boys. These inconsistent results can be due to the lower average age comparing with the present study or the existence of both gender in their study. In another study, Alderman et al. (2004), considered the magnitude of weight gain after weigh-in (in the morning of the match day) as the result from the amount of RWL. The result of their study showed that wrestlers gain weight about 3.4 kg in a period of 3-7 hours. The average age of their participants was greater than the present subjects which can be the reason for their greater results. As we already mentioned, this part of investigation was applied for the first time in Iran and it can provide a new area for researchers and future studies.

Conclusion

The results of present study showed that the most used methods for weight loss were increased physical activity and gradual dieting, also the most frequent side effects after RWL were dizziness, muscle cramp and irritability respectively.

Some studies have followed the performance of wrestlers during the competition and showed that more successful wrestlers (placers) significantly lose more weight than less successful wrestlers (non-placers) [2, 9, 11, 19]. Also, some authors expressed if wrestlers had a short period (about 4 hours) between weigh-in

and competition to re-food and rehydrate, RWL would not impair their performance [1]. However, these findings are from a short number of studies and more studies are needed to make sure about them. Much as we had imagined these data were true, it's better to consider the health of adolescent athletes rather than their performance.

Our suggestion for future studies is to follow the performance of athletes after RWL and determine the amount of weight loss in successful and less successful athletes also, determination of differences between age categories. In addition, RWL prevalence among women combat athletes can be a new area for future studies in Iran because lately some kinds of combat sports are becoming more popular among Iranian women athletes.

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Conflict of interests

The authors declare that there is no conflict of interests.

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