THE IMPACT OF FAST AND SHORT-TERM WEIGHT LOSS ON THE HORMONES AND PERFORMANCE OF IRANIAN YOUNG ELITE WRESTLERS

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Abstract

Purpose: To evaluate the effects of fast weight loss (FWL) and short terms weight loss(SHWL) on the salivary free testosterone and cortisol and performance of young elite wrestlers. Methods: 14 wrestlers (mean age of 17.79 ± 0.75 years, height of 172.06±4.61 cm, weight of 70.04 ± 8.72 kg, and BMI of 23.21 ± 2.09) who were randomly assigned into two groups: fast-term weight loss group (FWL) (performed exercises with conventional method during 24 hours, with severe food restriction and water and using thick clothing) and short-term weight loss group (SHWL) (performed the exercises in a 10-day program with a daily calorie reduction from 4 to 5% and exercise program included 3 sessions in which each session lasted 40 minutes) participated in this study. Exercise program by weight was also similar in both groups. The salivary free testosterone, cortisol and function indicators were measured in two phases (pre-test and post-test). Results: The results showed that SHWL had no significant impact on hormone and functional variables (p≥0.05). Although in the FWL, time of Rockport test improved, causing to reduce aerobic fitness compared to pretest (p≤0.05), it had no significant effect on other variables (P≥0.05). Also the percentage of inter-group changes showed no significant difference between the groups (P≥0.05). Conclusion: SHWL has some advantages over FWL, since it leads to less reduction in functional indices and athletes can participate in competitions with high confidence.

Key words: *weight loss, testosterone, cortisol, wrestlers.*

Introduction

Wrestling is one of the Olympic sports, which much attention has been paid to it over the past 100 years, and its competitions have always been held regularly around the world. Wrestling competitions have been held in different weights for many years, and many athletes try to lose weight to compete in lower weight to gain more chance to win championship in different competitions. In spite of risks followed by weight loss, wrestlers try to lose weight several times during the season of competitions and during their sports lives [1-3]. Weight loss more than 5% of the body weight of the athlete during 72 to 96 hours leaves negative impact on wrestler's function, especially on large muscles of lower extremity, psychosocial concentration, immune system, and body temperature regulation capabilities [4]. In addition, weight loss reduces nutritional status of the protein and changes the hormone status [5]. Another factor is reduced blood glucose as a result of severe food restriction, leading to brain deaths and death of athletes in some cases in this sport [6]. Several methods are used to lose weight, including fast weight loss and short-term weight loss (SHWL) [7]. Fast weight loss (FWL) is one of the factors destructing the hormonal system, leading to reduced anabolic hormones and increased catabolic hormones [6, 8-13]. This type of weight loss occurs through severe food restriction and by reducing body water through thick clothing and being exposed to heat [14]. On the other hand, short-term weight loss is one type of weight loss, which is performed by reducing daily calorie intake and using endurance exercises to reduce the level of calories [15]. As testosterone and cortisol plays vital role in athletes' function, the function-related hormones has been considered and discussed in the scientific communities worldwide. Existing evidences and information indicates that FLW reduces testosterone anabolic hormone significantly and increases cortisol catabolic hormones significantly [16-18]. As a result of reduced testosterone levels and increased cortisol, the athlete is being exposed at over-exercising situation, leading to severe reduced function and immune system weakness [18]. Testosterone is a very important anabolic hormone, and the ratio of testosterone and cortisol indicates whether athlete's function will decline or not [5]. The athletes losing their weight continuously and for a long time are at the risk of infectious diseases and over-exercising situation, leading to declined athlete's function, endangered health and well-being [19]. Doing research in this area is essential for wrestlers who are faced with weight loss during the competition season, especially for national team wrestlers facing with weight loss several times during the season. This study was conducted based on the vital role of testosterone and its relationship with cortisol and the relationship of these hormones with functional indices during weight loss. Additionally, it compares the destructive effects of fast and short-term weight loss and it reveals that which method is less risky.

Thus, the aim of this study was to evaluate the impact of fast and short-term weight loss on the ratio of testosterone and salivary cortisol and young wrestlers' function.

Methods and procedures

Participants
Fourteen wrestlers (age = 17.79 ± 0.75 years, height= 172.06±4.61 cm, weight= 70.04 ± 8.72 kg, BMI= 23.21 ± 2.09 and years of experience =5.49 ± 0.59 years) volunteered to take part in the experiment. Before any participation, the experimental procedures and potential risks were explained fully to the participants, and all provided written informed consent. Before any baseline testing, all participants attended a laboratory familiarization to become oriented with all testing procedures and training protocols at least 3 days before baseline testing. Following the testing, participants were randomly assigned to either a fast weight loss group (N = 8) and short-term weight loss group (N = 8). All procedures were in accordance with ethical principles of the Declaration of Helsinki, approved by ethical committee of University of Mohaghegh Ardabili.

Training program
In order to avoid measurement error or reducing the probability of occurrence of errors, all subjects participated in a justifying session and they were completely justified to comply with necessary points in the implementation of the tests and during the exercise. SHWL group performed the exercises in a 10-day program with a daily calorie

reduction from 4 to 5% (Table 1). The SHWL exercise program included 3 sessions in which each session lasted 40 minutes and the exercise intensity was same for all subjects using the formula of: 220-subject age * 0.77=? Exercise program by weight training was also similar in both groups and it was performed during 10 days, with intensity of 67 to 85% of maximum repeat in each 3 sessions at 16-18 hours (Table 2).

Table 1. Ten-day diet program for weight loss of 4 to 5% in short-term weight loss group.

Experimental Group	The amount of food reduced in lunch	The amount of food reduced in dinner
First day	10%	10%
Second day	10%	10%
Third day	10%	10%
Fourth day	20%	20%
Fifth day	20%	20%
Sixth day	20%	20%
Seventh day	30%	30%
Eighth day	30%	30%
Ninth day Tenth day	30% Reduce 20% of the amount of food consumed before the weight loss period	30% Reduce 20% of the amount of food consumed before the weight loss period

Table 2. Weight training program for both group

Movement	Barbell bench press	Front barbell squat	Push press – front the neck	Push press - behind the neck	Barbell curl	Triceps with dumbbell	Reverse flies
Set	4	4	4	4	4	4	4
Repeat	8	8	8	8	8	8	8

The FWL group performed exercises with conventional method during 24 hours, with severe food restriction and water and using thick clothing, and they reached to their controlled weight at 5 pm.

Hormonal measurement
In order to measure free salivary testosterone and cortisol, ELISA Kit (DEMEDITEC Diagnostige Co, made in country of Germany) and Colorimitery method were used. Experiments were performed at the Rojan Azma Research Laboratory in Karaj city of Iran, and all experiments were performed by ELISA Reader Device (made in Chinese, AUTOBIO LABTEC) in fully automated way.

Statistical analysis
All results were reported as mean ± SD. Kolmogrov-Smirnov test was used to examine the normal distribution of data. To analyze the data, two-factor mixed variance analysis with inter-group factor (fast weight loss and short-term weight loss)

and repeat factor (pre-test and post-test) were used by using the SPSS 21 software. The alpha level for significance was considered to be 0.05.

Results

After 10 days of FWL or SHWL programs, no significant changes were found in hormonal and functional variables (p≥0.05). Also, fast and short-term weight loss had no significant effect on hormonal variables (p≥0.05) (fig. 1).

However, in the functional variables, time of Rockport test significantly increased when compared to pretest (p=.01). Moreover, and it caused reduced aerobic fitness compared to pretest, and it had no significant impact on other variables in the both groups (P≥0.05) (Table 3).

Comparing the percentage of inter-group changes showed no significant difference between the groups (P≥0.05).
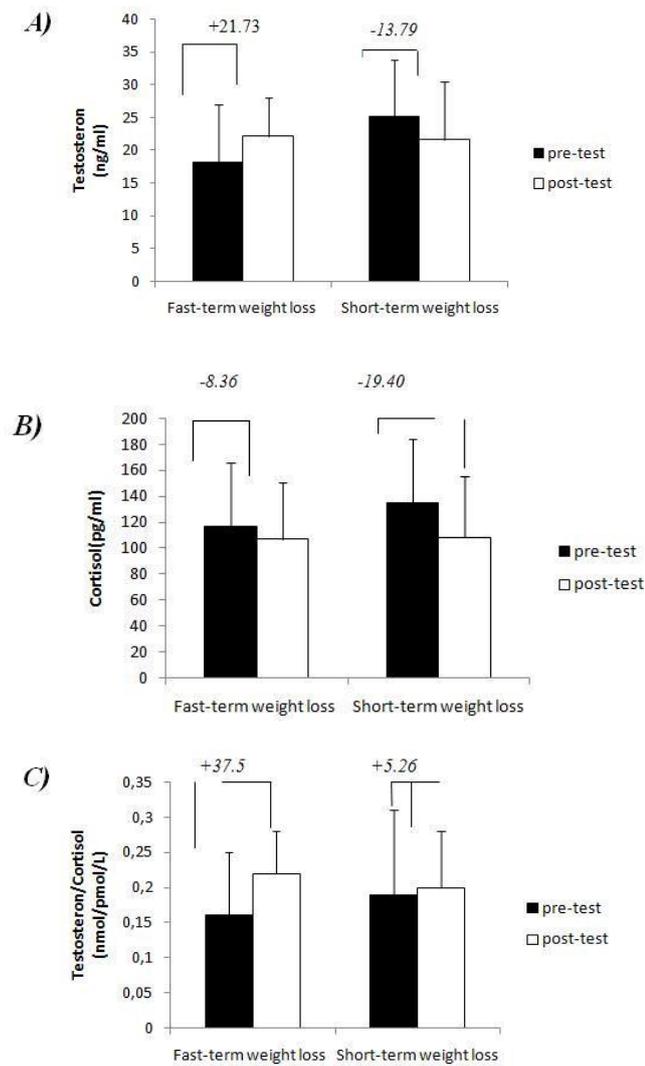
Figure 1. Effects fast and short term weight loss on A) salivary Δ testosterone from pre-test to post-test, B) Δ salivary cortisol from pre-test to post-test and C) Δ salivary testosterone/cortisol from pre-test to post-test. Values above the bars denote percent changes of T, C, and T/C (pre- to post-test).

Table 3. Pre-training vs. post-training values for Upper body strength (kg), Aerobic (Endurance) (min), Agility.

| | Group | |
	Fast	Short
Upper body strength Pre Post %Δ	83.36±20.47 80.40±18.15 -3.55	79.85± 17.54 79.55± 17.64 -0.37
Aerobic (Endurance) Pre Post %Δ	8.13± 0.58 8.41± 0.57* +3.44	8.24±0.50 8.34±0.62 +1.21
Agility Pre Post %Δ	16.83±0.66 16.94±0.47 +0.65	17.17±0.62 16.71±0.48 -2.67

*Significantly greater than pre-training value (p < 0.05).
† Significantly different change between groups (p < 0.05).

Discussion and conclusion

Findings of this research revealed that short-term weight loss had no significant impact on free salivary testosterone level, the ratio of free salivary testosterone to salivary cortisol, cortisol, upper extremity strength, aerobic fitness, and agility of young wrestlers. These findings are not in line with findings some previous studies [2, 20-23], while they are in line with findings of some other studies [6, 24, 25]. In the current research, the salivary testosterone levels of young wrestlers did not decrease significantly after short weight loss. It means that the hormone and immune system will not be weakened and the athlete will not be exposed to over-exercising situation. Results suggest that recovery after weight loss might have a significant impact on lack of changes in these hormones and their ratio. Given properties of testosterone hormone, it has been introduced as a constructive and so called anabolic hormone, and properties of this hormone in interaction with cortisol can create balance in metabolism [26].

Under severe pressure conditions, such as intense exercise, body may loses its ability to maintain this balance, and the immune system becomes prone to infections and the entry of bacteria and viruses, protein degradation, and athlete is faced with complications such as upper respiratory tract infections [27, 28]. Considering change in the anabolic and catabolic balance, it can be stated that when this ratio decreases by more than 30%, it can be a sign of over-exercising. This issue increases our concern on weakness in the hormone and immune system, and the lack of change in the ratio of free salivary testosterone to salivary cortisol means that the body has not been placed in the catabolic anabolic imbalance situation [30 29]. These findings can also be discussed from other viewpoints. The first viewpoint states that if weight loss is more than 4 to 5 percent, you should reduce your daily calorie intake or increase your diet days.

Thus, the mentioned hormones and their ratio may show more changes and athletes may be exposed to more risks. The second viewpoint is important since athletes in different sport fields will be faced with weight loss several times during the season of competitions, and this will put them in critical situation in terms of anabolic and catabolic balance. Being exposed to critical metabolic situation will also have harmful effects on young athletes' growth [6, 31].Some factors are involved in short-term weight loss that they might change the hormone. The first point in weight loss is reduction in daily calories, which is very important in achieving to anabolic and catabolic balance[4]. This might increase the mental and physical stress of athletes. The second point is that as exercise intensity increases and calorie decreases, glycogen stores of

the liver and muscles decrease and over-exercising will be likely in such situation [12]. The third point is important since immune system imbalance may result in infections in athletes, and infections interfere with exercising [32]. Thus, exercising will disrupted and participation in competitions will be restricted in some cases. However, athletes participating in very intense exercises (exercises lasting for more than 2 hours at an intensity of more than 75% of maximum heart rate) will be more likely exposed to infectious injuries, while this problem does not make us ignore the incidence of safety and infectious problems in sports like martial arts and wrestling[4]. Findings of functional tests in this research suggest that short-term weight loss has advantages over traditional (fast) weight loss.

However, if there are appropriate intervals between competitions, as athletes have experienced over-exercising due to short-term weight loss for several times at low intervals, their growth will be also endangered. In the chest press test, no significant reduction was found in the strength of the upper extremity of athletes. This suggests that short-term weight loss in important sporting competitions does not decrease the strength of athletes significantly, and athletes' function will not be affected so much. However, in fast weight loss group, no significant reduction was seen in upper extremity strength, while mean changes were reduced significantly in this group compared to short-term weight loss group.

In the Rockport test, no significant reduction in the aerobic fitness was seen in short-term weight loss group, but significant reduction in aerobic fitness was seen in the fast weight loss group compared to pre-test. These findings are in line with findings of most of studies [4, 16, 33]. This is important; since wrestling requires high aerobic fitness, and athletes use more this component of physical fitness in competitions .In functional test of agility, no significant impact was seen on two groups, suggesting that short-term and fast weight loss does not have a significant impact on the agility of athletes. The mean changes in the short-term weight loss group were reduced, but in the fast weight loss group, the mean changes showed an increase. These findings are in line with findings of other researchers, and previous research show that weight loss through dehydration and food restriction had no significant impact on agility and short-term functions [3, 4, 34]. However, some other studies indicated significant changes in agility function and maximum speed [35]. This lack of change might be related to the short duration of activity and non-intervention of aerobic system [3, 4, 34]. Although some previous studies have reported negative impact of both weight loss on hormones in young wrestlers who are at their growth age, this study revealed that short-term weight has some advantages over fast weight loss, since it leads to less reduction in functional indices and athletes can participate in competitions with high confidence.

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