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The Investigation of the Effects of Short-Term Body Weight Loss on Elite Wrestlers on Anaerobic Performance and Reaction Time in Tournament Conditions*

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Abstract

Athletes, who engage in wrestling, perform weight adjustment before the competitions like all weight loss category sports. For this reason, weight management is a very important factor prior to matches. When the studies on weight loss are examined, it is seen that athletes lose weight in a short time close to the competition. This study aimed to investigate the effects of short-term body weight loss in elite wrestlers on anaerobic performance and reaction time during tournament conditions. Ten experienced international level male wrestlers participated as a volunteer in this study. Participants lost 5% of their body weight within 48 hours, in 72 hours; 1 kg tolerance was given over 5% of body weight. During this process, body composition measurement, Wingate anaerobic performance test (WAnT), Countermovement Jump (CMJ), and visual and auditory reaction tests were conducted. In this study, a randomized crossover design was used and applications lasted four days. Two-way ANOVA with repeated measures was used for statistical analysis. Due to short-term body weight loss in body composition, total body water (TBW) and fat-free mass (FFM) were significantly reduced. In contrast, there was no statistically significant difference in body fat percentage (BF %), visual and auditory reaction time, CMJ and average power (AP). However, there was a significant increase was seen in Peak power (PP) and fatigue index (FI). The results indicate that 5% loss of body weight within 48 hours caused significant changes in body composition and negatively affected the fatigue index. For this reason, athletes who lose weight should avoid rapid weight-loss practices that will cause sudden changes in body composition in order to maintain their athletic performance.
Keywords: Wrestlers, Rapid weight loss, Anaerobic power, Reaction time

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INTRODUCTION

Wrestling is a combat sport that includes many motor features such as strength, speed, endurance, flexibility, technique, and reaction. It consists of various weights categories and styles. Since wrestling is a sport branch based on body weight, weight adjustment is one of the important issues that closely concern many athletes participating in competitions. Athletes who are engaged in wrestling adjust their current weight according to certain weights and apply this process many times during a year (Yarar et al., 2017). In general, the weight adjustment process in athletes is carried out in the form of weight gain, weight loss, and maintaining the athlete's current weight. In terms of time, this process is carried out systematically in the long term, but it is carried out in a short time, within a few days before the competition. When the studies conducted on weight loss are examined, it is seen that athletes perform the weight adjustment procedure in a time close to the competition (Kordi et al., 2011; Sundgot-Borgen and Garthe, 2011). In addition, it is reported that the average weight loss is 4-5% of the athlete's body weight (Rashidlamir et al., 2009; Reljic et al., 2013; Timpmann et al., 2008).

In order to reach the targeted weight in a short time, the athlete's fir reduces food and liquid consumption. In addition, they use wrong methods and techniques such as vomiting the consumed food, using laxative pills (diarrhea medication), diet pills, diuretic pills, exercising intensely, and staying in the sauna for a long time (Roklicer et al., 2022). Considering that the athletes participate in more than one competition during the season and lose weight by using the methods and techniques listed above, we can better understand the severity of the situation.

When the physiological effects of massive weight loss in a short time are examined, it is thought that it causes a large amount of fluid loss, and that the fluid loss will negatively affect both health and performance. The most striking example of this is the death of three university student wrestlers in the USA in 1997 due to the loss of 15% of their body weight associated with hunger and dehydration (Centers for Disease Control and Prevention, 1998; Oppliger et al., 2003). Due to these and similar events, various policies have been developed to ban unsafe weight loss methods. In 1967, a banner headline on the front page of the Des Moines, Iowa Register newspaper proclaimed "Heath Peril in Wrestling" (Des Moines Sunday Register, 1967). In 1969, the Lowa Health Community proposed prohibiting high school wrestlers from losing weight. In 1976, the American College of Sports Medicine (ACSM) published that the fat ratio of wrestlers should be determined before the season and it should not be allowed to fall below 5%, and dehydration should be prohibited (Oppliger et al., 1996). In 1996, a new regulation on weight loss was introduced, and it was stated that weight loss should be bound by a rule and a limit should be set by enacting a law (Convertino et al., 1996). Starting from the 1998-1999 season, the National Collegiate Athletic Association (NCAA) made the decision to determine the minimum bodyweight of each wrestler at the beginning of the season and to perform the weighing of athletes one hour before each competition in order to prohibit rapid weight loss (Kondo et al., 2020).

In the wrestling branch, before 2018, weighing used to be performed one day before the competitions, and the athletes would draw their lots after the weighing process and participate in the competitions the next day. While there were about 16-17 hours between weighing and competition, the matches were completed on the same day. These rules were changed on January 1, 2018 (Kondo et al., 2020). In the new rules, the competitions last for two days, and every morning before the competitions, athletes are weighed and athletes with appropriate weight participate in the competitions. The wrestler, who cannot adjust his/her weight, is deemed to be defeated by default and cannot take place in the classification, and his/her opponent in the match is considered the winner by default. On the second day, on the other hand, a tolerance of 2 kg was applied (only for 2018). There is a period of 2 hours between the weighing and the competition (Türkiye Güreş Federasyonu, 2017).

In terms of its characteristics, wrestling is a dynamic sport that requires continuous action consisting of two 3-minute periods of high intensity. In a high-intensity wrestling competition, the amount of lactic acid in the blood can rise up to 16-20 mmol/L (Hübner-Wozniak, 1993). For this reason, wrestlers must have a good anaerobic capacity. Therefore, the relationship between sudden weight loss and anaerobic capacity is important. However, the limited number of studies examining the effect of short-term weight loss on the performance of the wrestlers during the tournament period, especially in the new system, led us to plan this study. The aim of this study was to investigate the effects of short-term weight loss on anaerobic performance and reaction time in tournament conditions.

METHODS

Research Model

In this study, a crossover experiment design was used with random sample selection method to determine the anaerobic performance and reaction times of wrestlers before and after weight loss.

Participants

Ten experienced international-level male wrestlers (age: 22.5±1.5 years, body height: 173.2±6.4cm, bodyweight: 77.8±11.6kg, body fat %: 14.0±5.2) participated as a volunteer in this study. Written informed consent was obtained from the participant prior to participation and following an explanation of the purpose of the study, measurement procedures, and possible adverse events. Participants in the study were determined by random sampling method among athletes who had lost weight before.

Ethical Approval

All the procedure of this study was approved by the Clinical Research Ethics Committee of Abant Izzet Baysal University (Decision no: 2018/48 Date: 22.03.2018).

Data Collection Tools

Body composition measurements: Body height was measured to the nearest ±0.1cm via a stadiometer via a manual scale (Seca 700, Germany). Participants were asked to remove all clothing, shoes, jewelry, and other accessories except light shorts for the measurements. The body fat, fat-free mass, and total body water were measured by a bioelectrical impedance analyzer (Tanita BC-418 MA, Tanita, Tokyo, Japan).

Urine specific gravity: For the determination of urine specific gravity E-Line Hand Held Refractometer (B+S Code 44-891) with a scale ranging from 1.000 to 1.050 was used. Urine samples were collected in sterile containers and examined immediately. Moreover, all measurements were conducted by the same person in order to prevent possible errors. The tests were conducted (Baseline, after wake up, after weight in, the second day after wake up, and after weight in) five times.

Wingate 30s anaerobic test: The 30s WAnT performance was conducted with a cycle ergometer (Monark Ergomedic 894E, Peak Bike, Sweden). Seat height was adjusted for each subject and toe clips were used to prevent the slipping of the feet from the pedals. Each participant cycled at 70–80 rpm after the standard warm-up. At the beginning of the test, the subjects were instructed to pedal as fast as possible against unloaded resistance (Inbar et al., 1996). The resistance applied was adjusted relative to body weight (0.075 * body weight in kg). During the test when the subject reached 150 rpm 30 s, the measurement phase was started automatically. Verbal encouragement was given to each subject till the end of the test. In this test, peak power (PP), mean power (MP), minimum power, and their relative values were obtained from the software. The fatigue index (FI) was calculated by the formula of Inbar et al., (1996).
Fatigue index = [peak power (W) – minimum power (W)] / peak power (W) *100.

Reaction time: For the assessment of visual and audial reaction time, the Newtest 1000 reaction timer was used with both hands. The subjects showed a response to the stimulus immediately. The subjects were tested three times and the best score was used.

Countermovement jump (Bosco): In order to determine the vertical jump performance of the participants, the time they stayed in the air was measured using the Bosco Mat (Newtest 1000, Oulu, Finland). In this test, the athlete stood on the mat with weight evenly distributed over both feet. Hands were placed on the hips. The athlete squats down until the knees were bent at approximately 90°, and the upper body is kept straight. The athlete jumped vertically as high as possible and landed back on the mat with both feet hitting the ground at the same time. The best score of three attempts was recorded. One minute rest was given between trials. The maximum flying time from experiments was recorded. Power is calculated with the formula shown below (Sayers et al., 1999): Peak power (W) = [60.7 * Jump height (cm)] + [45.3 * Body mass (kg)] – 2055.

Collection of Data

By holding a meeting with the participants two weeks prior to starting the research, detailed information was given to them about the purpose and duration of the research, the tests to be applied in the research, the possible risks that may occur during the study and the benefits to be obtained from the study. Later, the subjects who participated in the study were asked to read and sign the form prepared in accordance with the Helsinki Declaration stating that they volunteered to take part in the study and containing detailed information about the study. Later, the test equipment to be used in the research was introduced to the participants, and the athletes were allowed to do some exercises with this equipment to get used to them. Participants were asked to continue their routine sleep patterns, to sleep a minimum of 7 hours the day before the tests, and also not to consume stimulants or diuretics such as caffeine and alcohol 24 hours before the tests.

This study was designed to simulate the tournament process of wrestling (weight, tournament duration, number of matches during the day, and rest periods between matches). Before starting to lose weight, the body weights of the athletes were determined on an empty stomach in the morning, and after the ratio to be reduced was determined, the participants were informed and the weight reduction process was initiated at 09:00 in the morning on the same day. At the end of the 48-hour period, 5% of the body weight at 09:00 and then at the end of the 72 hours, 1 kg tolerance over 5% of the body weight was applied, and the weight reduction process was completed. During the weight reduction process, the weight of the athletes was checked at regular intervals, and a determined rate of weight loss was achieved by weighing time. The study started with 12 athletes, and two athletes who could not lose weight were excluded from the study. Running, basketball, wrestling training, food restriction, and sauna application were used as weight-loss methods for athletes. After 48 hours, competition weighing was conducted between 08:00 and 09:00 in the morning, and performance tests were applied at 10:00, 13:00, and 15:00 on the first day. On the second day, between 08:00 and 09:00 in the morning, competition weighing was performed again, and the athletes who lost weight by applying a tolerance of 1 kg over 5% of their body weight were taken to performance tests at 11:00 and 14:00. The competition lasted for 2 days, and during this period, the athletes were subjected to weighing 2 times and performance tests 6 times. The control group performed all applications similarly, except for weight loss. The summary of the research design described above can be seen in Table 1.

Table 1. Experimental design of the study

Baseline		**1th competition day**		**2nd competition day**
• Urine specific gravity **<u>08:00-09:00 Weigh-in</u>** • Body composition **<u>10:00 am</u>** • Wingate test • Reaction time test • Countermovement Jump test	**5% weight loss in 48 hours**	• Urine specific gravity **<u>08:00-09:00 Weigh-in</u>** • Body composition • Urine specific gravity • Breakfast **<u>10:00 am</u>** • Wingate test • Reaction time test • Countermovement Jump test **<u>13:00 pm</u>** • Wingate test • Reaction time test • Countermovement Jump test • Limited lunch **<u>15:00 pm</u>** • Wingate test • Reaction time test • Countermovement Jump test • Limited dinner	**Weight loss with a tolerance of 1 kg over 5% in 72 hours**	• Urine specific gravity **<u>08:00-09:00 Weigh-in</u>** • Body composition • Urine specific gravity • Breakfast **<u>11:00 am</u>** • Wingate test • Reaction time test • Countermovement Jump test **<u>14:00 pm</u>** • Wingate test • Reaction time test • Countermovement Jump test

Analysis of Data

All statistical tests were processed using SPSS software (Version 20.0; IBM, Armonk, NY, USA). To test normality, we used the Shapiro-Wilk test and Levene's test for the homogeneity of variance. Once the assumption of normality was confirmed, parametric tests were performed. Following the normal distribution, mean and standard deviations (M ± SD) were calculated for all variables. Two-way ANOVA with repeated measures was used to compare the differences between application (experimental weight loss and control) and times (at baseline, three times on the first day, two times on the second day 2x6) for each variable. When appropriate, significant differences between means were determined using the Bonferroni test.

When a significant difference was found between times, a one-way analysis of variance for repeated measures was used for the statistical analysis between consecutive measurements. When significant differences were found in the application and time effect according to variance analysis, a paired-sample t-test was used for assessing the differences between baseline and other times. Effect sizes were calculated for all variables. The thresholds used for the interpretation of the effect size were: .01 small effect size, .06 medium effect size, .14 large effect size (Cohen, 1988). For the description of changes from baseline percent change (Δ %) was calculated. The significance level was stated at $p \leq .05$.

FINDINGS

The changes in body composition variables during experimental and control applications at baseline, 1st and 2nd competition days are presented in Table 2.

Table 2. Body composition variables during experimental and control applications

Variables		Baseline M ± SD	1th Competition day M ± SD	2nd Competition day M ± SD
BW (kg)	Experimental Δ%	77.8±12.5	73.8±12.0^{a-b} -5.2	74.2±12.0^{a-b} -4.6
	Control Δ%	77.1±12.8	77.0±12.6 -0.03	77.7±12.9 +0.8
BF (%)	Experimental Δ%	11.4±4.1	11.3±4.0 -0.6	10.6±4.6 -6.9
	Control Δ%	11.0±4.5	11.4±3.8 +3.4	10.5±4.5 -4.7
TBW (kg)	Experimental Δ%	49.3±6.6	47.0±6.8^{a-b} -10.8	47.5±5.9^{a-b} -3.6
	Control Δ%	49.0±6.9	48.9±6.9 - 0.2	49.8±7.5 +0.4
FFM (kg)	Experimental Δ%	67.4±9.0	64.5±9.3^{a-b} -4.2	65.1±8.1^{a-b} -3.3
	Control Δ%	67.0±9.5	66.7±9.4 -0.4	67.7±10.3 +1.0

Note. **BW**: Body weight. **BF%**: Body fat percentage **TBW:** Total body water **FFM**: Fat-free mass, Δ% = percent change from the baseline. [a]Significant application x time effect. [b]Significantly different from baseline

Significant application and time effect was found in BW [$F_{(2-18)}$=130.454; p=0.000, partial η^2=0.935]. TBW [$F_{(2-9)}$=14.283; p=0.000, partial η^2=0.613], FFM [$F_{(2-9)}$=8.830; p=0.002, partial η^2=0.495]. The experimental application was significantly different from the control regarding the continuum of BW, TBW, and FFM from baseline to 1st competition day and 2nd competition day. Due to the rapid weight loss practice decrease was observed in BW (Δ%:-5.22), TBW (Δ%:-10.8), and FFM (Δ%:-4.2). Moreover, the significant main effect for applications was indicated regarding BW [$F_{(1-9)=}$ 39.170; p= 0.000, partial η^2=0.813); TBW [$F_{(1-9)}$=20.502; p=0.001, partial η^2=0.695], FFM [$F_{(1-9)}$=7.160; p=0.025, partial η^2=0.443. On the other hand, there was no statistically significant difference was found in BF% [$F_{(2-9)}$=1,040; p=0,832, partial η^2=0.019]. According to the follow-up test a significant decrease was found in BW, TBW, and FFM owing to weight loss practice on the 1stand 2nd competition days during the weight-loss period.

Performance variables during experimental and control applications baseline, 1st and 2nd competition days are presented in Table 3.

Table 3. Performance variables during experimental and control applications

Variables		Baseline M ± SD	1th Competition day M ± SD 1th Measurements	2nd Measurement	3th Measurement	2nd Competition day M ± SD 1th Measurement	2nd Measurement
PP (W/kg)	Experimental	11.4±1.6	12.7±2.03[a]	12.8±1.5 [a]	12.8±1.8 [a]	12.6±1.3 [a]	12.9±1.5 [a]
	Δ%		+11.3	+12.4	+11.8	+10.2	+12.8
	Control	11.9±1.3	12.4±1.4	12.4±1.6	12.0±1.4	12.2±1.3	12.2±1.5
	Δ%		+4.0	+3.4	+0.2	+2.3	+2.0
AP (W/kg)	Experimental	7.4±0.7	8.2±0.8	8.3±0.6	8.1±0.8	8.1±0.6	8.3±0.5
	Δ%		+9.9	+11.6	+8.5	+9.6	+11.9
	Control	7.7±0.5	8.0±0.5	8.1±0.5	8.07±0.4	8.0±0.4	8.1±0.5
	Δ%		+3.8	+4.6	+3.9	+3.2	+4.5
FI (%)	Experimental	64.2±8.4	65.5±6.2	68.9±8.9	69.9±11.4 [a]	64.5±7.1	63.8±8.3
	Δ%		+1.9	+7.2	+8.8	+0.3	-0.5
	Control	62.2±7.1	65.4±8.4	66.1±7.4	60.8±5.2	66.0±9.1	62.8±6.3
	Δ%		+5.0	+6.2	-2.3	+6.6	+0.9
CMJ (W)	Experimental	3621.3±549.2	3505.6±648.8	3505.7±547.1	3456.2±615.5	3479.3±565.0	3471.6±616.8
	Δ%		-3.1	-15.7	-4.5	-3.9	-4.1
	Control	3575.1±51.2	3580.3±670.5	3598.5±590.8	3503.0±588.8	3526.5±587.7	3612.8±634.3
	Δ%		+0.1	+0.6	-2.01	-1.3	+1.0
RT Right-hand (ms)	Experimental	240.6±28.4	231.8±21.6	217.5±16.7	226.9±25.0	210.3±29.5	200.4±29.2
	Δ%		-3.6	-9.6	-5.6	-12.5	-16.7
	Control	241.5±28.4	222.1±21.6	215.0±16.7	227.7±25.0	222.1±29.5	233.4±29.2
	Δ%		-8.0	-10.9	-5.7	-8.03	-3.3
RT Left-hand (ms)	Experimental	232.1±30.3	227.5±35.0	204.9±24.7	232.1±23.9	213.6±27.5	219.1±26.2
	Δ%		-1.9	-11.7	0	-7.9	-5.6
	Control	232.7±22.9	216.1±18.1	219.9±19.4	222.4±21.7	211.5±28.2	225.5±22.3
	Δ%		-7.1	-5.5	-4.4	-9,1	+3.0
RT Auditory (ms)	Experimental	181.6±40.1	173.0±20.4	174.6±21.3	175.4±11.7	171.3±18.3	166.1±16.8
	Δ%		-4.7	-3.8	-3.4	-5.6	-8,5
	Control	176.0±25.4	172.9±28.6	171.5±22.5	170.5±12.4	164.2±12.2	174.0±22.5
	Δ%		-1.7	-2.5	-3.1	-6.7	-1.1

Note. PP: Peak power, AP: Average power FI: Fatigue index CMJ: Counter movement jump RT: Reaction time, Δ% = percent change from the baseline. [a]Significant application x time effect. [b]Significantly different from baseli

Significant application and time effect was found in PP [$F_{(5-9)=}$2.915; p=0.023, partial η^2=0.245], FI [$F_{(5-9)=}$2.423; p=0.050, partial η^2=0.212]. The experimental application was significantly different than the control regarding the continuum of PP at baseline to all other measurement times' Table 3. Moreover, there were statistically significant differences in 3rd measurement. Due to the rapid weight loss practice increase was observed in PP (Δ%: +11.3, +12.4, +11.8, +10.2, +12.8) and FI (Δ%: +8.85). Moreover, the significant main effect for applications was indicated regarding PP [$F_{(1-9)=}$ 4.758; p= 0.057, partial η^2=0.346]; FI [$F_{(1-9)}$=4.937; p=0.053, partial η^2=0.354]. On the other hand there were no significant differences found in AP, [$F_{(5-9)=}$ 1,334; p=0,267, partial η^2=0.129], CMJ, [$F_{(5-9)=}$ 1,567; p=0,189], partial η^2=0.148) and reaction times (right hand-left hand and auditory) after body weight loss [$F_{(5-9)=}$ 1,384; p=0,247, partial η^2=0.134], [$F_{(5-9)=}$ 0,759; p=0,584, partial η^2=0.078], [$F_{(5-9)=}$ 150,075; p=0,910, partial η^2=0.032].

The changes in urine-specific gravity variables during experimental and control applications at baseline, 1st and 2nd competition days are presented in Table 4.

Table 4. Urine-specific gravity during experimental and control applications

Variables			**Measurements**			
			1st Competition day M ± SD		**2nd Competition day M ± SD**	
		Baseline	**After wake up**	**Before the first match**	**After wake up**	**Before the first match**
USG (gr/ml)	Experimental	1027,7	1034,6[b]	1034,2	1032,3[b]	1031,7
	Δ%		+0.6	+0.6	+0.4	+0.3
	Control	1023,5	1026,4	1027,8	1021,7	1026,0
	Δ%		+0.2	+0.3	-0.1	+0.2

Note. USG: Urine specific gravity. Δ% = percent change from the baseline. [a]Significant application x time effect. [b]Significantly different from baseline

The experimental application was significantly different than the control [$F_{(1-9)=}$1232,010; p=0,000, partial η^2=0.772] regarding the continuum of USG at 1st and 2nd competition day after wake up Table 3. Due to the rapid weight loss practice, a significant increase was observed in USG (Δ%:+0.6, +0.4).

DISCUSSION and CONCLUSION

The purpose of this study was to examine the effect of short-term body weight loss on anaerobic performance and reaction time during a tournament process in elite wrestlers. The most important findings of the study are that after 5% body weight loss within 48 hours and body weight loss performed with a tolerance of 1 kg over 5% weight loss within 72 hours, there was a decrease in BW, FFM, TBW, and increase in FI and USG values. In addition, there was no statistically significant difference in BF%, PP, AP, CMJ, and reaction times.

In this study, the participants lost an average of 5.2% of their body weight within 48 hours and 4.6% of their body weight within 72 hours (Table 2). When the studies on body weight loss are examined, the average weight loss before the competition was determined by Almasi et al., (2013) as 5.2%, Gulati et al., (2006) as 5%, and above, Hall and Lane (2001) as 5.1%, and Reljic et al., (2013) as 5.6%. Bodyweight loss in the present study is similar to the literature.

When the BF% values were examined, there was no statistically significant difference (p=0.839) was found between the experimental and control groups (Table 2). Similarly, Coufalova et al., (2014) and Gulati et al., (2006) reported that there was no significant difference in BF% values in their studies. When the effect of weight loss on body composition is examined, 70% of the weight loss realized within a week is reduced from body fluids, 25% from fats, and 5% from proteins (Katch et al., 2011). When this period becomes shorter, the rate of fluid loss increases. Since weight loss was realized within 48 hours in this study, it is thought that most of the reduction in weight loss was due to fluid loss.

There was a statistically significant (p=0.00) decrease in FFM during the experimental application group compared to the control group (Table 2). Similarly, Reljic et al., (2013), found that FFM values decreased during body weight loss and increased again after body weight loss in their study. In addition, Coufalova et al., (2014) and Almasi et al., (2013) obtained similar results in their studies. FFM consists of muscles, body fluid, and various elements in our body (Birch et al., 2004). Combat athletes greatly reduce their consumption of food and fluids during weight adjustment. In this case, energy intake is insufficient, and the body converts amino acids in the body to glucose to provide the necessary energy. As a result, a decrease in muscle tissue occurs. In addition, there is a decrease in the total amount of body fluid as well as a decrease in body fluids and muscle density (Coufalova et al., 2014). In this study, the decrease in FFM values is thought to have occurred due to the reasons listed above.

In this study, there was a statistically significant decrease was seen in TBW during the experimental application (Table 2). Similarly, Coufalova et al., (2014), Kukidome et al., (2008), Reljic et al., (2013), Sagayama et al., (2014), and Yoshioka et al., (2006) found in their studies that there was a significant decrease in the total amount of body fluid during weight loss. The reason for the decrease in the total amount of body fluid is thought that the combat athletes decreased their fluid consumption while losing weight, did intense training, and stayed a long time in hot environments such as saunas, causing a decrease in body fluids.

When the PP (W/kg) values of the participants after their body weight loss were examined, it was found that there was a statistically significant increase (p=0.02) in the experimental group compared to the control group (Table 3). Similarly, Yadollahzadeh et al., (2015) found a significant increase in anaerobic power (W/kg) values in their study. In contrast to these studies, Almasi et al., (2013) stated in their study that there was a significant decrease in anaerobic power (W/kg) values. Apart from these studies, Marttinen et al., (2011) reported in their study that there was no statistically significant difference in anaerobic power (W/kg) values. When the present study and the above study results are examined, the results obtained are contradictory.

Anaerobic power can be expressed in two different ways W and W/kg (Özkan et al., 2010). Watt is an absolute expression used without taking the weight of the body into account, whereas w / kg is a more relative expression, and since it is calculated by taking the body weight of the person into account, it reveals the differences that may occur between individuals more meaningfully. Therefore, it would be more correct to use (W/kg) if PP is compared in weight sports. In relative values (W/kg), when the participant loses weight, the current anaerobic power may appear to be increased or unchanged on the contrary. It is thought that the increase in PP (W/kg) values in the present study may be explained in light of the above explanation.

When AP (W/kg) values after body weight loss were examined, it was found that there was no statistically significant difference (p=0.26) between the experimental and control groups (Table 3). Similarly, Marttinen et al., (2011) stated in their study that there were no significant differences in AP (W/kg) values after weight loss. In contrast to these studies, Almasi et al., (2013) found that there was a significant decrease in AP (W/kg) values in their study. Inconsistent results from studies on the effects of rapid weight loss may have stemmed from different tests applied in the studies, different rates of weight loss, durations in weight loss, weight loss methods, and different recovery times after rapid weight loss.

When the FI (%) values after body weight loss were examined, it was found that there was a statistically significant difference (p=0.05) between the experimental and control groups (Table 3). The difference between the experimental and control groups reached the highest level during the 3rd match. Similarly, Cengiz, (2015) stated in his study that there was an increase in FI values. In addition, in the study they conducted, Cengiz and Demirhan, (2013) examined the lactate levels of wrestlers during the competition and determined that the lactate level reached the highest level during the 3rd match. The decrease in body fluid due to rapid weight loss determined in the present study and the increase in lactate level after weight loss as mentioned in the above study is thought to be the reasons for the increase in FI values in the present study.

When the measurement times were compared for the CMJ values of the experimental and control groups after the participants' body weight loss, no statistically significant difference was found (p=0.18) (Table 3). Similarly, Fogelholm et al., (1993) showed that there was no change in jumping performance with loads of different weights after sudden weight loss. Filaire et al., (2001) revealed that rapid weight loss had no effect on vertical jump performance. Kraemer et al., (2001) found that there was no difference in vertical jump performance compared to the performance before weight loss.

The reason why there was no difference in anaerobic power values is that energy is supplied from the ATP-CP system in short-term high-intensity exercises (Katch et al., 2011). Houston et al., (1981) stated in their study that there was no change in muscle ATP and CP concentration after weight loss through 4 days of food and fluid restriction. In this study, muscle ATP-CP concentration was not measured, but it is thought that the reason for the absence of any change in PP, AP, and CMJ values due to the explanation mentioned above is due to the absence of the change in muscle ATP.

It was found that there was no statistically significant difference in reaction times (right hand-left hand and auditory) after body weight loss (p=0.247; p =0.584; p=0.910) (Table 3). Similarly, Wilson et al., (2014) stated that there was no significant difference in reaction times. Muscle activation is one of the most important factors affecting reaction time. Sodium and potassium are electrolytes responsible for muscle activation. Fogelholm et al., (1993) found that there were no changes in serum potassium, magnesium, and zinc levels after 59 hours of rapid weight loss. Reljic et al., (2013) stated in their study that there were no changes in plasma sodium, potassium, calcium, and magnesium levels after 5.6% body weight loss was realized in 5 days. Similarly, Filaire et al., (2001), Judelson et al., (2008), and Yang et al., (2014), found that there was no significant change in serum potassium levels in the studies they conducted. In light of these studies, it is thought that there was no significant difference in reaction time since there was no change in the electrolytes responsible for muscle activation.

When the USG values after body weight loss were examined, it was seen that there were statistically significant (p=0.00) differences was seen experimental group (Table 4). Périard et al., (2012) observed a statistically significant increase in USG values after short-term weight loss in their study. Evetovich et al., (2002) stated in their study that there was a significant increase in USG values after a rapid weight loss of 2.9%. Demirkan et al., (2011) stated in their study that there was an increase in USG values in wrestlers who lost 3.9% of body weight within 3 days, but this increase was not statistically significant. Teresa et al., (2004) found in their studies that there was a significant increase in USG values during short-term body weight loss.

The USG of the experimental group was found to be higher than that of the control group on both the first and second days of the competition. USG is briefly defined as the concentration of ions in the urine or the concentration of dissolved substances in the urine (Guyton and Hall, 2013). Depending on the amount of fluid taken into the body, it varies between 1.013 and 1.029 (gr/ml) in healthy adult individuals. In case of dehydration, it rises above 1.030 (gr/ml). USG is also affected by factors such as the amount of fluid taken and excessive sweating (Armstrong, 2005). For these reasons, the increase in urine density can be thought to have resulted from the subjects restricting fluid intake for weight loss, and the excretion of the existing fluid in the body with sweat as a result of weight-intensive training.

The results of this study revealed that 5% BW loss within 48 hours affects Peak power, body composition, USG, and physiological responses related to anaerobic performance, negatively. This indicates that if a wrestler is frequently more than 5% over his/her competing weight class, athletes and coaches should consider improving body composition by revising the training and habitual diet plans, or by changing the participants ‘weight class. Therefore, the respondents should avoid combat sports athletes from performing rapid weight loss in order to protect their athletic performance.

Conflicts of Interest: There is no financial or personal conflict of interest among the authors of the article within the scope of the study.

Authors' Contribution: Research Design; HY; RT, Data Collection- HY; RT, statistical analysis; HY, Preparation of the article; HY; RT

Ethical Approval

Ethics Committee: Clinical Research Ethics Committee of Abant Izzet Baysal University
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