

## **The Effect of Start of Season Maximal Strength Training on Body Composition and Some Strength Parameters in Elite Wrestlers**

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### **Abstract**

The purpose of this study was to examine the effects of start of season maximal strength training applied to elite athletes on body composition and some strength parameters of the athletes. **Material and Method:** 17 elite wrestlers at national team level with an average age of 18 who were staying at a camp and who had the same dietary conditions participated in the study. Strength trainings were made three days a week (Monday-Wednesday-Friday) before noon. The training program applied to athletes was applied as 75% intensity and 8 repetitions in the first set, 80% intensity and 6 repetitions in the second set, 85% intensity and 4 repetitions in the third set, 90% intensity and 3 repetitions in the fourth set, and 95-100% intensity and 2 repetitions in the fifth set. The training program included shoulder press, bench press, lat pull, squat, butterfly, barbell curl, jerk, and leg curl moves. The study lasted for 8 weeks. Specified tests were taken starting from the first training and they were taken before the last trainings of weeks 4 and 8. Body composition was measured with TANITA TBF 300A make device (BMI, Fat, Fat mass, FFM, TBW). As for strength tests, back and leg measurements were made with Baseline Back Leg Chest DAWOB660 make leg and back dynamometer, while handgrip strength was measured with Takei Hand Dynamometer (Handgrip). **Results:** According to the results of the study, participants' body weight (BW) values were not found to differ significantly based on the period of training ( $p>0.05$ ). Similarly, no significant differences were found in BMI values depending on the period of training ( $p>0.05$ ). In addition, significant differences were found in total body water (Tbw), fat, and fat mass values depending on the period of training ( $p<0.05$ ). In strength tests, significant differences were found in handgrip strength, leg strength and back strength values ( $p<0.05$ ). **Discussion and Conclusion:** The present study researches the differences caused by start of season maximal strength trainings on elite athletes. The results of the study showed that there were decreases in body fat ratios and increases in fat free body mass although no significant differences were found in BMI and BW of the athletes. Significant increases were also found in measured strength parameters. Decreases and increases in athletes were found to occur after week 4. It is thought that this result can be associated with the period of adaptation.

**Keywords:** Wrestling, Body Composition, Maximal Strength, Strength

## Introduction

Sport has become an indispensable part of our lives in today's society. Due to the increase in societies' interest in sport and as a result of countries' developing sport policies of their own, sport and science have become more intertwined with each passing day and scientists' interest in sport and sport physiology has increased. The presence of major sports organizations which countries attach great importance to motivate athletes to be more successful and athletes are loaded more for optimal success. Among these loads, strength training have a vital significance in annual training periods. It is an undeniable fact that elite athletes already have a specific strength level. Athletes' psychological relaxation and breaking their dietary habits during the resting period in-between seasons can cause regression in body posture and strength. Following the resting period at the end of the season, the effects of pre-season strength training on the strength increase and anthropometry of elite athletes is an issue of concern.

Muscle hypertrophy is defined as the growth in muscle diameter as a result of the increase in myofibril proteins. Hypertrophy response is a late adaptation of the muscle to strength training. For hypertrophy, training needs to be applied at least for 6-8 weeks (Deschenes et al., 1993; Hakkinen et al., 1992; Ruther et al., 1995). Intense resistance training is an effective mechanism which stimulates muscle hypertrophy and increases muscle strength (Fry et al., 1991; Staron et al., 1991). Body fat ration is one of the primary factors determining body composition. Since fat cells are not primary sources of energy in energy consumption, high body fat percentage is harmful to performance (Elliot et al., 1989; Ağgön and Ağırbaş, 2015).

The purpose of the present study is to examine the start of season maximal strength training reactions of athletes who start a resting period at the end of the season. Anthropometric changes and strength changes which occur during strength training with the new season and after this training period were monitored in elite athletes who have a specific level of readiness. It is thought that the study will provide feedback to trainers and athletes.

## Materials and Method

17 elite wrestlers at national team level with an average age of 18 who were staying at a camp and who had the same dietary conditions chosen among wrestlers who had degrees in European and World Championships and who had represented Turkey in Rio Olympics participated in the study. Before the study was conducted, the participants were informed about the training program and care was taken for the athletes to be volunteers. In this study, to find out 1TM, each athlete's maximal strength was found for each move planned in the strength training program while the athletes were in resting position before the strength training started. Strength training were made three days a week (Monday-Wednesday-Friday) before noon. The training program applied to the athletes was as follows: The athletes performed the moves with an intensity of 75% and 8 repetitions in the first set, 80% intensity and 6 repetitions in the second set, 85% intensity and 4 repetitions in the third set, 90% intensity and 3 repetitions in the fourth set, and 95-100% intensity and 2 repetitions in the fifth set. The content of the training program included Shoulder Press (shoulder), Bench Press (chest), Lat Pull (back), Squat (half), Butter Fly (chest), Barbell Curl (forearm), jerk (lifting), Leg Curl (back upper calf). The study lasted for 8 weeks. Specified tests were taken starting from the first training and they were taken before the last trainings of weeks 4 and 8. Body composition was measured with TANITA TBF 300A make device (BMI, Fat (%), Fat mass (kg), FFM (kg), TBW(kg)). As for strength tests, back and leg measurements were made with

Baseline Back Leg Chest DAWOB660 Lb make leg and back dynamometer, while hand grip strength was measured with Takei Hand Dynamometer (Handgrip).

### Data Analysis

Descriptive statistics of all variables were presented as average± standard deviation (Ave±SD). In order to find out the effect of strength training on biochemical parameters, one-way repeated-measures ANOVA was applied on values obtained in 3 different test points (Starting, week 4, week 8). Sphericity hypothesis of repeated measures was validated by Mauchly Test. In cases where hypothesis was not validated, Greenhouse- Geisser correction was applied on degree of freedom in case of Epsilon ( $\epsilon$ ) <0.75, while Huynh- Feldt correction was applied in case of Epsilon ( $\epsilon$ ) >0.75. Multiple corrections were performed by applying Bonferroni correction. For all of the analyses, significance level was determined as  $p \leq 0.05$  and SPSS 20.0 computer program was used for statistical analysis.

### Results

Participant’s descriptive analyses are given in Table 1.

**Table 1.** Participants’ descriptive statistics

Blood lipids	Ave	SD	Min	Max
Age (years)	18,53	20,13	17	23
Height (cm)	169,18	6,09	162	180

Table 2 gives participants’ physical changes in 8-week-long maximal strength training.

**Table 2.** Changes in physical characteristics during the 8-week-long training period

	Starting point Ave ± SD	Week 4 Ave ± SD	Week 8 Ave ± SD	F	p
BMI	24,09 ± 2,01	24,14 ± 1,95	24,30 ± 1,88	2,923	0,068
TBW (Kg)	45,15 ± 5,03	45,60 ± 4,89	46,11 ± 4,82	14,027	<b>0,000</b>
FAT (%)	10,64 ± 3,13	10,11 ± 2,92	9,60 ± 2,87	19,379	<b>0,000</b>
FATMASS (Kg)	7,58 ± 3,08	7,21 ± 2,80	6,91 ± 2,77	14,214	<b>0,000</b>
FFM (Kg)	61,67 ± 8,87	62,29 ± 6,69	62,99 ± 6,58	14,274	<b>0,000</b>

Table 2 shows the values of some physical parameters before the starting of the training period, in weeks 4 and 8 (post-training).

Participants’ BW (Body weight) values were not found to differ significantly in terms of the period of training (F=2,944; p=0,067). Similarly, no significant difference was found in BMI values in terms of the period of training (F=2,923; p=0,068).

However, significant differences were found in the values of TBW (F=14,027; p=0,000), FAT (%) (F=19,379; p=0,000), FAT MASS (kg) (F=14,214; p=0,000) and FFM (Kg) (F=14,274; p=0,000) depending on the period of training (F=19,379; p=0,000). According to the results of Bonferroni Post-Hoc test, which was conducted to find out between which measurements

the differences were, the differences were found to be significant between 1-3 and 2-3 in TBW, between 1-2, 1-3 and 2-3 in fat percentage, between 1-2 and 1-3 in fat mass and between 1-3 and 2-3 in fat-free mass.

Table 3 shows the changes in strength in 8-week-long maximal strength training of the participants.

**Table 3.** Changes in strength parameters during the 8-week-long training period

	Starting point Ave $\pm$ SD	Week 4 Ave $\pm$ SD	Week 8 Ave $\pm$ SD	F	p
<b>Hand grip (Kg)</b>	42,79 $\pm$ 5,53	43,28 $\pm$ 5,49	44,39 $\pm$ 6,02	13,375	<b>0,001</b>
<b>Leg (Kg)</b>	157,24 $\pm$ 10,41	158,18 $\pm$ 11,38	161,76 $\pm$ 11,42	32,006	<b>0,000</b>
<b>Back (Kg)</b>	150,41 $\pm$ 9,66	151,76 $\pm$ 8,44	156,06 $\pm$ 9,20	23,913	<b>0,000</b>

Table 3 shows the values of some strength test parameters before the starting of the training period, in weeks 4 and 8 (post-training).

According to these results, significant differences were found in hand grip strength (F=13,375; p=0,001), leg strength (F=32,006; p=0,000) and back strength (F=23,913; p=0,000) depending on the period of training. According to the results of Bonferroni Post-Hoc test, which was conducted to find out between which measurements the differences were, the differences were found to be significant between 1-2, 1-3 and 2-3 in handgrip strength, between 1-3 and 2-3 in leg strength and between 1-3 and 2-3 in back strength.

## Discussion and Conclusion

This study examines the anthropometric changes and changes in strength during and after maximal strength trainings of elite wrestlers who have maximal strength training at the beginning of the season. According to the results of the study, body weight (BW) values of the participants were not found to differ significantly depending on the period of training (p>0.05). Similarly, no significant difference was found in BMI values depending on the period of training (p>0.05). However, significant difference was found in total body water (Tbw), fat and fat mass values depending on the period of training (p<0.05). In strength tests, significant differences were found in handgrip strength, leg strength and back strength values (p<0.05). When the literature was examined, a review was found to report that except for endurance exercise, neither type nor amount of exercise did not have too much influence on weight loss (Votruba et al. 2000). The result of this study is in line with the results of our study. There are also studies which show that training does not cause changes in BMI (Uğraş et al., 2002; Savucu et al., 2006; Büyükyazı et al., 2008; Ağırbaş et al., 2009). There are also studies in literature reporting decreases in BMI values (Yalın et al., 2001; Çolakoğlu and Şenel, 2003; Lakka et al., 2004; Çolakoğlu and Karacan, 2006; Wong et al., 2008). The fact that our study group consisted of elite athletes and that they had a specific body composition can be shown as a reason that no changes were found. When different studies were examined, while no significant difference was found in body fat mass in one study, difference was found in fat free body mass (Wong et al. 2008). The results of this study are in parallel with our study with the increase in fat free mass. In a great number of studies conducted, decreases

were found in body fat mass as a result of exercises (Çolakoğlu and Şenel, 2003; Lakka et al., 2004; Karakaş et al., 2005). The results are in parallel with our results. In another study, a decrease was reported in fat mass with regular exercise and increases were found in fat free mass and intracellular fluid levels of the study group (Karakaş et al., 2005). When the results of our study are assessed, it is thought that this increase is in parallel with the fat free body mass. In a study conducted on Boxing National Team athletes, changes during the camping season were examined and body fat ratio was not found to change in pre-camp and post-camp measurements (Pala and Savucu, 2011). When strength tests were examined, in a study conducted on handball players, 6-week-long strength training was found to cause significant increase in hand grip, leg and back strength (Harbili et al., 2005). In the assessment of pre-season strength parameters of female football players, significant differences were found between weeks in measurements taken at three different times (Göksu, 2011). In strength trainings conducted on athletes of different branches, significant decreases in fat ratio and increases in right hand, leg and back strength were found (Akçan and Biçer, 2015). In 12-week-long table tennis applications, significant increase was found in hand grip and leg strength (Ağgön and Ağırbaş, 2015). In a study conducted on wrestlers, significant difference was found in right and left hand grip strength (Bağcı, 2016). The present study examined the changes caused by start of season maximal strength training on elite athletes. The results of the study showed a decrease in body fat mass and increase in muscle mass, although no significant differences were seen in athletes' BMI and BW. Significant increases were also found in the measured strength parameters. The increases and decreases in athletes were found to occur after week 4. It is thought that this situation can be associated with adaptation process. When literature is reviewed, similar studies were found. However, there is a limited number of studies on elite athletes in which maximal strength method is applied. Since measurements were taken at different times during the 8-week-long period and since the study also revealed the adaptation process, it is thought that the present study will contribute to trainers, athletes and sport science.

### Conflict of Interest

The author has not declared any conflicts of interest.

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