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Effect of strength training on lipid profile and hormonal responses of blood testosterone and cortisol in young male Greco Roman wrestlers

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ABSTRACT

The present study aims at determination of effect of strength training on blood lipid profile and hormonal responses of testosterone and cortisol in young Greco Roman wrestlers.Methods: 8 young male Greco Roman wrestlers with mean age of 20.50±1.195 were selected voluntarily. Strength training consisted of 8 weeks of strength training with 55% of one repeated maximum (1RM) in 2 times with 10 repetitions which reached 85% 1RM in the eighth week in three times with 6 repetitions. Concentrations of sub factors (i.e. lipid, testosterone and cortisol of blood serum) were measured in pre-test, end of fourth week, and end of eighth week at 8 in the morning. Data analysis was performed through within group variance analysis with iterative amounts in three stages and Kolmogorov-Smirnov Test was adopted for normality of the data; also, significance level was set to be p≤0.05. Results: no significance difference was detected in LDL-C, TG, TC, COR, TT and TC: HDL-C (p>0.05). However, HDL-C concentration in the subjects of strength group showed a significance difference (p<0.035).Conclusion: decreased concentration of HDL-C and increased serum testosterone caused by 8 weeks of strength training in young Greco Roman wrestlers may be effective in appearance of cardiovascular diseases (CVD); intensity of the influence in a function of training duration and other related factors to training program.

Keywords: strength training, cardiovascular diseases, hormones, young Greco Roman wrestlers.

INTRODUCTION

Strength training is used a one the prominent factors of physical competency in majority of athletes and non-athletes in order to develop motive capabilities. There many factors during training causing oxidation stress such as activation of xanthenes oxidase [17] catecholamine auto-oxidase [7]; these may be activated in such a way that poses more limitation during short-term anaerobic training. Strength training brings about effective changes in blood

serum lipid tests [1]. Nevertheless, some authors have reported that the available results in the case of effects of strength training on blood serum lipids are antagonistic [20]. Strength training program (intensity, duration, repetition) may be effective as result of performance, age, gender, and status of primary training. Although strength training possesses some advantages like empowering muscles and reducing the risks of diseases related to aging considering muscles size, some authors concluded there were no positive variations in the case of blood serum lipids in strength training [8]. On the other hand, strength training can cause negative consequences [9]. Heavy and intensive strength training increases serum testosterone concentration. Training authors have proved that testosterone stimulates muscle power and hypertrophy. Deep studies have shown different response of testosterone to various protocols of strength training where intensive strength training with enough duration increases muscle mass and testosterone concentration [24]. Therefore, many studies have been conducted to evaluate the relationship between testosterone and cortisol [10]. CVD are one of the unpreventable and chronic diseases which killed over 3.5 million people in 1990 [10]. Epidemiological and experimental Evidence has shown high total cholesterol (TC) level, high low-density lipoprotein cholesterol (LDL-C) level and high concentration of high density lipoprotein (HDL-C) to be associated with reduction of CVD risk and they are attributed to increased risk of coronary artery disease (CAD). Lipid uptake ability has been proven to be the main characteristic of HDL-C [16]. Also, HDL-C has been reported to possess an antioxidant property which is highly marked by performance of paraoxanase 1 (PONO1). The enzyme catalyzes decomposition of LDL-C phospholipids and plays anti-adherence and anti-inflammation roles and improves vascular reaction [3] and protects body against infection factors. Men pose to higher risk of CAD compared to women. Thus, effect of strength training on blood lipid profile and hormonal response of testosterone and risk of CVD in terms of variations of testosterone concentration and blood serum lipids according to type of training formed the hypothesis of the present study.

MATERIALS AND METHODS

Subjects:

8 volunteer young male Greco Roman wrestlers, whose anthropometry characteristics were shown in Table 1, ranging from 19 to 22 years old formed the participants of the present study. They were selected after filling in questionnaires and stating their personal agreement to participate in the study. The subjects were chosen from a same economic-cultural level with normal nutrition and they participated in regular trainings for 8 weeks. A written agreement was acquired from morality committee for performing blood tests. The subjects were selected on the basis of having intact cardiovascular and pulmonary health, lacking any disease at least from 2 months before onset of the study, not facing with hormonal disorders, and no drug use. Also, the subjects avoided consumption of any stimulator, such as caffeine and alcohol, before onset of the trainings. They had been performing 3 session of wrestling training per week for 8 months which was decreased to 2 sessions per weeks after addition of training plan of the present study.

Experiment Design:

The present study was performed on the basis of strength training. The subjects were evaluated according to the variables related to maximum power and concentration of lipids and hormones. The study was performed for 8 weeks and 3 days a week. The subjects were tested before the test (as control), at the end of fourth week, and at the eighth week. Therefore, all blood test were performed three times during the study where the first test (control) was adopted to assign resistance and reliability. The test was performed at the same time of the day. Total weight of the subjects (without clothes and shoes) was measured via digital measuring devices and their height was measured through stadiometer with standard grading with minimum degree of millimeter.

Strength training:

All the subjects of strength training trained for two sessions before onset of training period in order to get acquainted with training pattern. All training parts were started with a whole-body warm-up. To warm up specialty muscles, the subjects performed trainings with one set, 25 repetitions with very light load on higher and lower body. Strength training consisted of toe raise, bench press, leg curl, shoulder press, squat, and lateral pull down which were performed circularly. 90 to 120 seconds break was set between each station. In the first week, the strength training was performed with 2 sets, 10 repetitions and 55% of one rep max (1RM) which changed to 3 sets, 6 repetitions and 85% of 1RM at the end of eighth week. During the fourth week, intensity of training was reduced so as to prevent much injury and improve the performance; after this stage, the entire subjects performed strength test in order to assign 1RM. Training program of second 4weeks was designed according to obtained 1RM at the end of fourth week. in each set, intensity and repetition were constant and adjusted.

Blood sampling method:
5 cc blood samples were drawn at 8-8:30 a.m. (in pre-test, after the fourth week, after the eighth week) after 8 hour sleeping and 12-14 hours fasting in each stage. The samples were centrifuged for 10 min at 2500 rpm and the resulted serum was frozen at -20°C. The estimated variables consisted of LDL-C, VLDL-C, HDL-C, TC, TG, testosterone, and cortisol. TT level was measured by using Monobind inc made in the USA and TC and TG levels were estimated using Pars-Azmoon Kits through photometric method.

Statistical analysis:
SPSS Software was adopted in the present study. Because the experimental design involved within-case factors (three measurement stages) and inter-case (strength and concurrent groups), mixed factorial test (within-case variance analysis with repeated measurements) or split-plot were used. Comparison of scores of the variables in pre-test, mid-test, and post-test groups was performed through analysis of variance between groups(ANOVA). Furthermore, Kolmogorov-Smirnov Test (K-S) was adopted for normality of data. The least significance level in the tests was set to be ($p<0.05$).

Table 1: anthropometric characteristics of subjects

variables	Strength training (n=8)
Age (year old)	20.50±1.19
Height (cm)	1.73±0.31
Weight (kg)	67.900±5.03
Body mass index (kg/cm^2)	22.604±1.25

RESULTS

Table 2 shows mean values and standard deviation. The results revealed that total cholesterol (TC) had no significant difference in three steps of measurement (F_2=0.280; p=0.814). Also, no significant difference was detected in TG of serum during the measurement stages (F_2=0.956; p=0.401). Serum LDL-C showed no significant difference in three stages of measurement (F_2=0.722; p=0.498) while HDL-C showed a significant difference which is attributable to 8 weeks of strength training where HDL-C decreased (F_2=6.209; p=0.035). A considerable increase was seen in TC: HDL-C ratio caused by 8 weeks of strength training although it was no significant. Total testosterone (TT) of blood serum showed no significant difference in three stages of measurement (F_2=1.6; p=0.892). The mean serum cortisol showed no significant difference in three stages of measurement (F_2=1.242; p=0.354).

Table 2:Mean and SD Lipid Profile and Concentration of Hormones

Strength Training				Variables	
P	Post Test	Mid Test	Pre Test		
0.81	125. 38± 28.09	132.88±16.46	127.25 ±24.29	TC	Mg/dl
0.40	88.00 ±5.45	82.75 ±2.96	87.00 ±9.5	TG	Mg/dl
0.49	67.50 ±24.36	67.00 ±18.96	67.00 ±27.09	LDL-C	Mg/dl
0.03	39.50 ±12.63	52.75 ±10.12	43. 00±8.58	HDL-C **	Mg/dl
0.05	3.35 ±0.89	2.60 ±0.57	3.13 ±1.17	TC:HDL-C	Mg/dl
0.89	19.05 ±2.91	20.45 ±8.74	18.80 ±4.13	TT	Nmol/l
0.35	441.56 ±10.23	364.38 ±91.17	490.81 ±24.64	Cor	Nmol/l

** Significance level f serum TC, TG, HDL-C, LDL-C, VLDL-C, TC:HDL ($p \leq 0 . 05$)*
***Significant difference between Mid Test And Post Test (P=0.03)*

DISCUSSION AND CONCLUSION

We analyzed effect of 8 weeks strength training on lipid profile and concentration of testosterone and cortisol hormones on CVD risk. Our results showed no significant difference in TC:HDL-C, LDL-C, TG, TC, cortisol, and testosterone of serum in three stages of pre-test, mid-test, and post-test. Several studies have shown that TC: HDL-C ratio is a proper method to predict CHD risk in men. In the present study, a considerable increase was seen in TC: HDL-C ratio in serum of the wrestlers. Secretive glands system plays regulative-repairing role in muscles. The studies in this case show that there are variations in the balance between anabolic (testosterone) and catabolic (cortisol) hormones caused by physical training which may affect interfering influence of training [15]. Therefore,

the results show that the subjects have not experienced any harsh catabolic status and their anabolic status improved after the training. Authors have found that decreased level of HDL-C and increased levels of TC and LDL-C have been observed in cardiovascular patients [5] which prove the effect of 8 week training to decrease concentration of HDL-C in young Greco Roman wrestlers. In this case, authors have proven that low levels of HDL-C are along with increased risk of CHD even if TC is not high. Also, low levels of HDL-C and TC in patients have been shown in compared to control group. As it can be inferred from the findings of authors, considerable increase in TC: HDL-C and lower concentration of HDL-C in strength training is consistent with authors' observation in the case of increased risk of CVD. It has been shown that when testosterone acts effectively in long term, levels of LDL-C, TC, TG, and Apo-B of serum will increase and level of atherogenic HDL-C in people will decrease. This is to show that primary reduction of CVD in males may happen considering adverse effects of high levels of androgens in lipid and lipoproteins status [12]. The results obtained from the present study showed that during 8 weeks of strength training, serum testosterone had increasing trend which was along with decreased serum HDL-C in young Greco Roman wrestlers which is consistent with the results obtained by Anderson *et al.* (1995); they showed that serum HDL-C level decreased drastically after vein injection of testosterone (200 mg per week for 12 months) while TC:LDL-C and triglyceride level of plasma were not affected [2]. HDL-C level in plasma is attributed to CAD development possibility. Also, in this case, Honda *et al.* (1997) reported that high level of free testosterone in plasma is along with lower level of HDL-C. in humans, short-term treatment with steroids is done in order to empower HPA and sympatric reaction to stress which increases adrenocorticotropin hormone (ACTH). Wang Si et al. (2000) showed that decreased level of testosterone in elderly men is along with gradual decrease in muscle mass and increase body lipid; the findings were related to 227 men affected by hypogonadism under treatment by testosterone gel (50 mg and 100 mg per day). Their data showed that after 90 days, all test groups showed increase in muscle mass where the subject who received 100 mg gel daily showed twice muscle mass increase [24]. In a double study, Marian Pei *et al.* (1995) showed that vein lipid decreased in obese men under testosterone treatment [19]. However, precise studies have shown persistent relationship between low levels of testosterone and high level of cholesterol. Tan *et al.* (1998) showed that testosterone may decrease HDL-C concentration and it seems to have atherogenic effect [22]. Nonetheless, decreased testosterone is effective on HDL-C and it seems that it forms at least secondary atherogenic particles. Also, change in activity of androgen is along with minimal decrease in density of serum HDL-C [22]. Controversial and antagonistic results in different studies in the case of testosterone and CAD have drawn attentions. Decreased level of testosterone shows a pathogenic effect on CAD development. Therefore, Rosa *et al.* (2007) showed that many CVD patients had high levels of androgens and atherosclerosis [13]. So, many studies have shown a positive relationship between testosterone and CAD where higher levels of androgens pose higher risk of CAD [25]. On the other hand, Chen *et al.* (1996) reported in their in-vivo studies that lower level of testosterone may cause development of atherosclerosis of coronary in men [6]. In general, there are evidences to support the results that cardiovascular effects of treatment with testosterone may seem not to be effective.

In conclusion, the results obtained from the present study showed that strength training, considering the duration of the training, may affect decrease in HDL-C and TC: HDL-C ratio in blood serums of young Greco Roman wrestlers. Also, it seems that androgens cause variations in levels of blood serum HDL-C causing increased atherosclerosis. Our data shows that increasing trend of testosterone in strength training and decreased blood serum HDL-C may increase the risk of CVD and development of coronary atherosclerosis in young Greco Roman wrestlers. Of course, it should be noted that further investigations with different training protocols and various participants should be considered in this case.

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