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Full Length Research Paper

Does regular aerobic training affect basal leptin level (difference between male and female)?

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There is discrepancy about the effects of regular exercise training on basal leptin level and most of the existing data have been collected from obese/thin subjects. In this study, the effects of one year aerobic exercise was investigated in normal weight untrained healthy volunteer male and female subjects. The sample included 60 non-athletes, male and female university students. First, all samples were randomly divided into four groups. The practice program including selected aerobic exercises and volleyball drills with specific intensity was applied. The blood samples of subjects were taken once 24 h before the first section of the exercise program and 24 h after the last section of the exercise program. Resting plasma leptin level was determined using ELISA method in pre and posttest and in paired sample T test, whereas one way and two way (factorial) ANOVA was used to analyze the data. Studies show that basal plasma leptin levels in healthy young non-athlete individuals in response to regular exercise in the long term did not fluctuate. Aerobic exercise for one year showed no significant effect on plasma leptin levels (that is about the role of fat tissue as the most significant source of leptin), and it seems that it occurs because fat tissue in subjects did not change.

Key words: Aerobic exercise, leptin, long- term, non-athlete.

INTRODUCTION

Obesity has become a global epidemic in developed countries. More than 1.6 billion people are overweight and 0.4 billion people suffer obesity (Janghorbani et al., 2007). Most of the time, obesity leads to different health problems such as diabetes mellitus, hypertension, cardiovascular diseases and sudden deaths (Ren et al., 2004). Excess weight prepares the grounds for the overweight to come down with osteoarthritis and other respiratory system problems like sleep apnea. Thus, obesity increases the responsibilities and problems of the public health (Kraemer et al., 2002). The Great Britain has faced a tripled adiposity over the last two decades and nearly 60% of the people suffer obesity. It is quite certain that the main reasons for this problem are the decrease in physical activities and increase in eating foods of very high calorie as a part of modern lifestyles (Huuskonen et al., 2010). A study conducted in 2007 investigated the rate of adiposity in Iranian adults between 15- 65 revealed that 42.8% of men and 57% of women were overweight (BMI≥25) and 11.1% of men and 25.2% of women were obese (BMI≥ 30). The researcher concluded that lack of descent physical activity is the main cause of adiposity in Iran (Henderson et al., 2006).

Leptin is the protein of obesity gene which is emitted in a pulsantory way to general blood movement by fat cells which transfers feedback signals between fat cells and central nerve system especially moving centers in hypothalamus and participating in hemostat balance of body weight (Pasman et al., 1998; Speakman et al., 2004). This protein hormone, excreted from fatty tissue, is released mainly from mass molecule 16 kDa and plays a key role in maintaining body weight. It is worth saying that leptin acts as a warning mechanism for maintaining fat content of the body. This hormone increases the level of consumed energy by enhancing the activity of sympathetic and lipolis nerves. Leptin controls appetite through affecting hypothalamus receivers (Hickey et al., 1997). Although several studies have failed to prove the pathologic role of leptin in obesity, this deficiency can be related to impotency of leptin in passing the brain-blood

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Table 1. Exercise program of on session volleyball, 3 times in a week (1 year).

Type of exercise	Stretches	Aerobic running	Joints warm-up	Practicing skills	Volleyball game	Recovery	Exercise program
Length of exercise in each session	8 min.	12 min.	7 min.	18 min.	40 min.	5 min.	90 min.
Severity of exercise		70% HR_{MAX}			Competitive		

barriers, impotency in being matched with noropeptid Y and after all the change in the amount of food received, problems in sending message to leptin receiver in brain (Pasman et al.,1998). It is known that the level of serum leptin correlates greatly with the fat content of the body, and as the body weight decreases, it decreases as well (Casimiro-Lopes et al., 2009; Ramazankhany et al., 2010). Leptin is one of the hormones controlling energy hemostas in normal conditions; however, presence of abnormal amounts of it in the blood causes severe problems (Olive and Miller, 2001). It is shown that the amount of energy received regulates leptin gene either positively or negatively and thus, the change in energy consumption through physical activity may change leptin level (Piri et al., 2009). Various reports on the effect of physical exercises in serum leptin are contradictory (Patrick et al., 2010; Neary et al., 2004; Martins et al., 2007; Hickey et al., 1997; Fatouros et al., 2005). Some indicate that the serum leptin does not change by running in a moderate speed (Magdalena et al., 2010; Fatouros et al., 2005; Bouassida et al., 2006) while others prove that hard practices are one of the reasons for the decrease in leptin level (Leila Maria et al., 2010; Piri et al., 2009; Reinehr and Andler, 2002).

On the contrary, there have been studies having revealed that plasma leptin level does not change by short term exercises (Esteghamati et al., 2010; Neary et al., 2004). On the other hand, there are clues that show different results in excretion of leptin and gerlin hormone in men and woman when exposed to special levels of exercises (Faruk et al., 2010; Haghighi and Hamedi-Nia, 2008).

Moreover, in most studies the effects of physical activity on the leptin level of obese and thin people is examined and there is not enough information about the weight of ordinary people (Unal et al., 2005). Thus, the present paper has attempted to study these effects in normal people that seem to be helpful in providing information on prevention of process of leptin change in these people.

This study measured the effect of a long-term (1-year) activity and in addition, comparison of the results tried to separate the effect of sex, exercise style, inactive lifestyle and their relation with the leptin release in long-term creativity in this regard and could definitely provide every exercise as well. Therefore, it seems that this study is of precise and comprehensive information for experts.

METHODOLOGY

This study is a quasi-experimental one in which 60 nonathletic healthy subjects, who has no experience of participation in any sport program or diet, contributed. They first signed an agreement of the subject volunteriness. Subjects in this study neither used any medicine, cigarettes or anti- pregnancy drugs nor they were not pregnant. In addition, they did not have any kind of heart disease, respiratory, kidney, metabolic or menstrual disorders. However, it should be noted that in the 1-year time spent on conducting the research, the number of the subjects under study reduced, so we had to just analyze just 44 people (men 24 and women 20). The subject's features are listed in Tables 1 and 2.

Exercise time was designed to be done in stipulated time of day (8 to 10:30 in the morning) to keep its full time rhythm. Subjects had their ordinary lifestyle during the study. Annual program included selected aerobic exercises and volleyball matches according to Table 1.

Blood sampling and biochemical measurement

Blood samples (10 ml) were taken from the vein after nocturnal breakfast for 12 h and before exercising began. After sampling, test tubes were fixed until clotting in order to keep blood samples. Then the serum was separated from the blood through centrifuge and was kept in normal room temperature. Then they were moved to -80 degrees centigrade for biochemical measurements. Leptin was measured using ELISA method (Japan IBL Inco).

RESULTS

In order to elicit the role of sex (male and female) and group (training situation/exercise) and their interaction with leptin changes in the intervals between pre and post tests in 4 groups, at first, the normal distribution of dual sex blocks (including male and female) and exercise situation (control and athlete) were assured. Then the effects of the dual blocks were studied through double variance analysis (2*2) test results are in Table 3, 4 and 5.

DISCUSSION AND CONCLUSIONS

The main result of this study revealed that one year aerobic exercise with an average severity has no finding is in contrast to results of (Unal et al. 2005) who measured leptin concentration in athletic, young males trained in various sport fields and healthy inactive people. They observed that after exercising, leptin meaningfully

Table 2. Features of the subjects.

Group	Index / Exercise	Age (years)	Height (cm)	BMI (Kg/m²)	Duration of Follicle Period (day)
Female	Control (10)	26.25 ± 6.75	164.125 ± 9.14	23.21 ± 0.50	10/25 ± 0.99
	Exercise (10)	24.98 ± 5.12	166.375 ± 7.19	24.597 ± 1.27	10.38 ± 1.03
Male	Control (12)	24 ± 2.65	174.375 ± 6.92	23.206 ± 0.53	
	Control (12)	23.125 ± 1.93	175.775 ± 6.89	22.490 ± 0.377	

Table 3. Results of correlated T test on comparing each group's leptin in pre and post tests.

Group	Average difference	T	Sig
male control	0.066 ± 6.83	0.034	0.974
female control	-0.54 ± 4.89	-0.349	0.753
male exercise	1.22 ± 7.24	0.568	0.570
female exercise	3.68 ± 8.12	1.43	0.186

*There is no significant difference ($p<0.05$).

Table 4. The Results of different leptin data between pre and post tests in 4 groups (ANOVA).

Index	square average	F	sig
Leptin	35.470	0.747	0.531

*There is no significant difference ($p<0.05$).

Table 5. The Results of comparison of leptin changes in four groups (in intervals between pre and post tests) by variance (2*2) analysis.

Factor	Studying the effects	loan F	loan Sig	Square of averages	F	Sig	LSD test results		
							Average difference	Freedom degree	sig
Change in leptin	Sex	0.076	0.973	9.317	0.196	0.660	-	1	-
	Group			78.890	1.661	0.205	-	1	-
	Interaction sex/ group			25.565	0.538	0.467	-	1	-

decreases and concluded that regular exercise lessens blood leptin level by decreasing lipid percentage (Rahmani Nia et al., 2009). In another study, a 12-week aerobic exercise reduced serum leptin in females but not in males (Fatouros et al., 2005). Fatrouros et al. (2005) also reported that elder women show a lower leptin level after exercises (Duclos et al., 1999). These results were confirmed by Ryan et al (2003) when they proved that exercise females had lower levels of leptin compared to control women (Witek et al., 2003; Otsuka et al., 2006). Hickey et al. (1997) indicated that sexes special response to exercise is based on different resistances to insulin in males and females. Males who had the most resistance to insulin possibly needed more time for exercising and more powerful stimulant for leptin level decrease (Fatouros et al., 2005). In addition, researchers indicated that low leptin concentration is an indirect result of exercise. Perhaps decrease of bodies' fat tissue formed by exercise is the main reason of leptin changes (Duclos et al., 1999). There seems to be obvious differences in subjects and exercise protocols could justify the observed differences in exercise- leptin relation by different studies (Wadden et al., 1998). However, some other researchers believe that the decrease in leptin after physical training is attributed to the increase in production of saturated hydrocarbons (Considine et al., 1996; Hickey et al., 1997) that is in contrast to present study. It seems as if the most important reason for this difference is the age of the subjects in this study in which older subjects went under different exercise protocols.

In a study conducted on the effects of a period of aerobic exercise on serum leptin, cortisol and

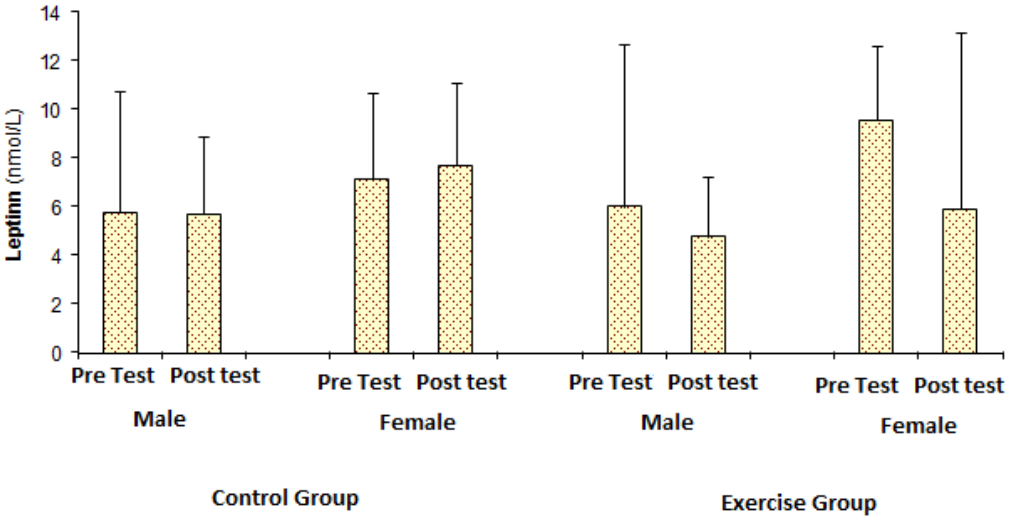

Figure 1. Table of subjects Leptin level in pre and post test.

testosterone level of obese and thin men, meaningful decrease of leptin level in both groups of obese and thin men was observed that the body mass index and weight of obese subjects decreased meaningfully (Sprung et al., 2008). In addition, a meaningful increase in cortisol, BMI and weight of thin group (Martins et al., 2008) was seen. On the other hand, results of inter-group comparison show a significant difference in leptin, testosterone, BM level, and weight in obese and thin groups (Blandine et al., 2006). According to these findings, aerobic exercise plays an important role in regulating body weight by changing some hormones like leptin, cortisol and testosterone (Zaferiridis et al., 2003).

Also leptin levels of blood are closely related to the amount of human and animal fat tissues, and their consistency against bodies' fat tissues is more than body weight. Leptin central and environmental injection in rodents leads to a decrease in food intake and body weight. Leptin increase in rodents happens a few minutes after having a meal and increase after a few days of over-indulgence in humans. In contrast, starvation decreases leptin level. The rate of these responses is adjusted to changes (Kraemer et al., 2002). Researchers usually think of leptin as a stabilizer before significant changes in weight (Haghighi and Hamedi-Nia, 2008; Marco et al., 2010; Sarigianni et al. 2010).

Blandine et al. (2006) reported that short and long term regular physical exercises meaningfully decrease BMI and plasma leptin level and increase testosterone which in that research decomposed fat and was believed to be related to increase in beta adrenergic, Adina sickles, protein kinase A and lipase receptors. It is certain that males encountered low level of free testosterone with decrease in decomposition of fat tissues in response to catecholamine and possibly these metabolic changes decrease decomposition. Besides, transfer of tri glyceride and compilation of fat tissue in body increase (Blandine et al., 2006).

Previous researches about males demonstrated that there is a strong negative relationship between leptin level and free plasma testosterone that is independent from insulin plasma level and other metabolic factors (Sprung et al. 2008). Nevertheless, in this research plasma leptin level did not have a meaningful effect (that is about the role of fat tissue as the most significant source of leptin) and it seems that it occurs because fat tissue in subjects did not change. It must be noted that lack of control in subjects' diet is the main reason for this.

It may be possibly females' regular physical exercises that causes changes in their reproduction system and shortness of leptin phase of subjects that kept leptin unchanged (Hickey et al., 1997; Okazaki et al., 1999; Thong et al., 2000), so intermittent studies in female encounter more problems. Considering the effects of sex hormones on related blood lipid even leptons to exercise effects seems a little difficult.

In general, results of the present study failed to show any significant differences between plasma leptin level of normal weight untrained healthy volunteer male subjects and also there were not significant effect of the sex, group (exercise/control) or their interaction upon the changes of leptin level between pre and post tests (Figure 1) .The need for further study on the relationship between fat tissue in response to leptin and exercise consistencies is felt. With regard to the young subjects studied, type of exercise, university life, and also the controversial reports in the existing literature about obese and thin people, it seems that other factors such as lifestyle or daily energy expenditure, and relation of aerobic exercise with diet or without it and considering endocrine factors which adjust leptin, should be certainly investigated to draw more obvious conclusions.

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