The Effect of a Concurrent Training on Rest Level of Leptin in non-Athletes

Otadi Kh*, Emamdoost S, Faramarzi M, and Tavakoli P

Abstract---Recently, Leptin response to concurrent training is assessed in several studies; however, few studies have been conducted on the effect of concurrent training. This study was extorted to determine the effects of a concurrent training on rest level of leptin of plasma in non-athlete subjects. Non-athlete employees were randomly divided into case (those who underwent the exercises) and control groups man of 15 in each group. The exercises consisted of 8 weeks of exercise, three sessions a week and each session included 10-12 station resistance, strength exercises and aerobic running in the end. Blood samples were collected before and after exercising, at rest time and after night fasting. Following serum collection, plasma Leptin levels was measured by ELISA method. The results indicated that serum Leptin level was significantly decreased in 8-week concurrent training compared with control groups ($P<0.01$), however serum WHR levels was not changed in 8-week concurrent training compared with control group. Our findings show that, concurrent training can have a proper effect on reducing Leptin.

Keywords----Concurrent training, Leptin, non-Athletes.

I. Introduction

IT has been determined in recent years that Leptin is the byproduct of obesity gene. Fat tissue is the main source of producing Lepin [1]. Discovering Leptin led to performing many tests to further recognize its performance and a part of the present study is focused on Leptin and sport activities.

In addition to its fundamental effects on controlling appetite and energy costs, it has been indicated that Leptin can greatly affect free Fatty Acid (FFA) metabolism and some endocrine procedures [2]. In fact, high density blood Leptin has a strong correlation with upper limb obesity, glucose intolerance, excessive triglyceride increase and hypertension, i.e. metabolic syndrome (Met S) factors. Such metabolic disorders can finally lead to cardiac diseases, heart attack and type II diabetes [3]. Most studies performed on impacts of sport activities on Leptin have mainly concentrated on aerobic exercises and some findings are conflicting. The short-term (7 consecutive days) effect of aerobic exercises (one hour a day with 75% VO2Max) on Leptin and insulin density in young normal men. Findings of the study demonstrated that exercising improved insulin sensitivity but did not have any effect on Leptin density [4]. It has been observed that impact of a nine-week exercising program on Leptin density of middle-aged obese women. The program included 3-4 days of sport exercises consisting of 20-30 minutes of aerobic exercise, i.e. running on a treadmill. Although cardiac-respiratory preparation level increased after the exercise, there was no change in the fat mass or Leptin density [5].

On the other hand, researchers reported a significant reduction in fasting Leptin levels in young women after 12 weeks of performing aerobic exercises for four days a week and 30-45 minutes. This Leptin reduction took place without any changes in the fat mass [6].

Few studies have been conducted on the effect of resistance exercises (working with weights) on Leptin. Kanaley et al (2001) reported a decrease in leptin plasma levels following about 24 hours of upper and lower limb resistance exercises in patients with diabetes type II; however, normal cases did not have any reduction and their leptin levels were not affected by long-term resistance exercises [7]. In another study, Nindl et al (2002) measured leptin density at night following 50 courses of resistance exercises including of the squat, bench press, leg press, and lat pull-down [8].

Recently, simultaneous resistance and strnegth exercises have become popular. Moreover, researchers have mentioned positive changes in body composition including FFM increase as well as FM (Fat Mass) and fat percentage decrease after doing cobined resistance and strength exercises. Therefore, considering limited studies carried out on the impact of concurrent training on Leptin and their potential effect on energy costs and body composition changes, particularly fat mass and fat percentage, studying the effect of this exercise on leptin changes can be considerable and taken into account as a new and effective intervention in changing hormonal risk factors of cardiovascular diseases. Considering the mentioned points, this study aims at investigating the effect of a course of concurrent training on plasma leptin changes that is a new exercising approach and can be accompanied by physiologic effects of both strength and resistance exercises.

II. Material And Methods

Non-athlete male employees of Tehran university of Medical Sciences without organized sport activities , no smokers and without high blood pressure or diabetics were the cases under study. The sample, 30 cases, was taken from among the volunteers and then, they were randomly divided into the case

Khadijeh Otadi (PhD)(*corresponding author) is with Department of physiotherapy, Tehran University of Medical Sciences, Tehran, Iran. (e-mail: k_otadi@razi.tums.ac.ir).

Saeid Emamdoost (MSc. in Sport Physiology), Endocrine & Metabolism Science Research Institute, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran.

Mohammad Faramarzi (Assitant Professor of Physical Education, Shahrekord University of Physical Education& Sport Sciences).

Parisa Tavakoli (BA) Young Researchers Club, Department of Biology, Islamic Azad University, Eslamshahr Branch, Eslamshahr, Iran)

(15 persons) and control (15 persons) groups who respectively took part in combined exercises and routine activities.

All cases participated in the study were fully aware of the objectives and method of the study and entered the study voluntarily; they were also assured that they could leave at any point of the study. In addition, all subjects completed and signed the informed consent of human volunteers participating in research studies of the University of Medical Sciences.

The anthropometric information including height, weight, BMI and WHR were measured using the relevant relationships. BMI was calculated by dividing weight (Kg) by square height (m) and WHR was determined through dividing waist round in the narrowest area (around the navel) by hip circumference. The maximum consumed oxygen was evaluated by a 12-minute running/walking test.

Basic information was gathered in the pretest and was similarly repeated in all posttests after the intervention [8 weeks of exercise).

Before and after exercising, at rest time and after night fasting, blood samples were taken from both groups. At rest leptin plasma levels were analysed through ELISA using Leptin Human Elisa Kit, a specialized kit, from Biosource Company. Following the 8-week program, blood samples were taken at rest time and after night fasting to re-assess their leptin levels amd examine probable changes.

The combined group had three sessions of concurrent training within one week and the control group was following their routine program.

The resistance combined exercising program consisted of 10-12 station strength exercises including major moscular groups. The intensity of the exercises within the first and the second four-week course was 70-75% of 1RM and 75-80% of 1RM, respectively. In the combined exercise group, a 10-minute run with 70-75% of MHR intensity in the first four-week round and a 13-minute run with 75-80% of MHR intensity in the second round were added to the rsistance exercising program.

The data were classified based on descriptive statistics and the preliminary statistical indices were determined. In order to specify the difference in each group, dependent and independent t-tests were used within each group and between the groups, respectively.

TABLE I
CONCURRENT TRAINING PROGRAM

Endurance – resistance training protocol

Training pattern over first month phase				
	program design	intensity	repetitions	Number of sets
1st station	Leg press	70-75% 1RM	10-12	1
2nd station	Bench press	70-75% 1RM	10-12	1
3rd	Leg curl	70-75% 1RM	10-12	1
4th	Barbell biceps	70-75% 1RM	10-12	1
5th	Leg extension	70-75% 1RM	10-12	1
6th	Triceps pull down	70-75% 1RM	10-12	1
7th	Seated leg curl	70-75% 1RM	10-12	1
8th	Cable raise lateral	70-75% 1RM	10-12	1
9th	Calf raise	70-75% 1RM	10-12	1
10th	Lateral raise	70-75% 1RM	10-12	1
11th	Sit-ups	70-75% 1RM	10-12	1
12th	Back extension	70-75% 1RM	10-12	1
endurance	10 min running	70-75% MHR		

Training pattern over second month phase				
	program design	intensity	repetitions	Number of sets
Resistance training	Same protocol	75-80% 1RM	6-8	2
endurance	13 min running	75-80% MHR		

III. RESULTS

Table II shows the descriptive characteristics of the testees in pre and post tests as well as the results of examining intra-group changes.

TABLE II
INTRA-GROUP CHANGES OF VARIABLES

Index	Groups	Pre-test	Post-test	P
Age (yrs.)	*concurrent training*	33.13±5.15	33.13±5.15	-----
	Control	32.13±5.15	32.13±5.15	-----
Height (cm)	*concurrent training*	174.77±7.11	174.77±7.11	-----
	Control	172.73±6.88	172.73±6.88	-----
Weight (kg)	*concurrent training*	90.23±15.90	15.03±87.43	0.01 *
	Control	15.56±93.05	15.28±93.64	0.07
Leptin	*concurrent training*	6.52±4.30	5.85±3.28	0.20
	Control	9.31±6.84	11.33±6.36	0.11

P is versus control group. * indicates significant difference.

Table III shows the results of comparing the experimental and control groups in the post-test.

TABLE III
INTER-GROUP CHANGES OF VARIABLES

Index	Groups	Pre-test	Post-test	P
Weight (kg)	*concurrent training*	90.23±15.90	15.03±87.43	0.27
	Control	93.05±15.56	93.64±15.28	
	Control	37.99±5.13	39.48±5.68	
Leptin	*concurrent training*	6.52±4.30	5.85±3.28	0.01*
	Control	9.31±6.84	11.33±6.36	

The present study indicated that 8 weeks of concurrent training significantly affects leptin levels of non-athletes (P=0.01). Moreover, exercise leads to the significant reduction of BMI (P=0.01) and the insignificant reduction of weight in the subjects. However, WHR amounts did not change significantly after 8 weeks of exercise.

IV. DISCUSSION

Although adaptabilities and responses of significant physiologic variables associated with cardiovascular risks including Leptin to endurance and resistance exercises were studied in some researches, few studies have been conducted on the impact of compound exercises, a relatively new method, on new risk factors of cardiovascular diseases like Leptin. The findings of the study showed that compound exercise can significantly decrease Leptin levels in male athletes. There is limited data on the effect of resistance exercises on leptin levels. In a study, leptin levels of diabetic individuals reduced within 24 hours following exercising [9] and other reports showed the decrease in 9-13 hours after exercise.

Fatouros et al. (2005) indicated a decrease in leptin levels for 6 months following resistance exercises. They mentioned that this was accompanied by a decrease in subcutaneous fat and BMI [10] and this was not compatible with the findings of the present study. According to the findings of the study, it was shown that the said three sport protocols in normal individuals were a comparative leptin serum response and that a single intense resistance exercise does not influence leptin serum levels [11]. The mechanism can be a hormonal factor, the role of which has been attended to in recent years [12]. Leptin serum levels are highly correlated with BMI and body fat percentage. The increase in leptin levels sends a signal to hypothalamic satiety centers that saves the excess energy and maintains compatibilities that decrease appetite; on the other hand, the required energy and consequently body fat levels are controlled by an increase in metabolism. Obese people are determined according to leptin resistance and the increase in blood leptin levels [13], [14].

Several studies have examined the effect of exercises on leptin levels. There are numerous reasons for leptin response to physical activities. One reason is BMI decrease, following which leptin levels change; this can provide explanations on conditions of the impact exercise may have on obesity [15]. The obese show leptin increase in their blood as a response to leptin resistance. Moreover, the effect of exercise on leptin density might be the major reason for the significance of physical activity in preventing obesity [16].

In another study, Bouassida et al (2006) reported that long-term exercises disturb energy balance and it generally leads to a decrease in leptin serum levels [17].

Many studies have demonstrated that leptin serum levels decline due to weight loss in humans. The diet and long-term exercise improve plasma leptin levels even if BMI does not change significantly [18].

Weight loss is one of the hypothetical mechanisms through which physical activities can reduce inflammation. Studies have shown that weight loss can reduce the production of adipose tissue cytokines [19]. Undoubtedly, one of the significant factors affecting body composition changes, especially fat tissue is the balance between energy expenditure and intake. Generally, endurance exercises are used due to their potential for increasing energy expenditure and fat consumption for changing body composition. It seems that the combination of resistance and endurance exercises in the present study led to the increase in energy expenditure considering the relatively high physiologic pressure.

V. CONCLUSION

Overall, considering the few studies conducted on the effect of resistance and endurance exercises on changes in leptin basic levels, findings of the present study suggest relatively desirable effects of this type of exercise on metabolic cardiovascular risk factors, especially leptin basic level. Further studies with longer time periods would be required for studying more stable and specific effects of the exercises; however, it seems that using such exercises compared to resistance or endurance exercises alone can have more useful impacts on leptin levels of the non-athletes.

ACKNOWLEDGMENT

We appreciate all who helped us to exert the present study.

REFERENCES

[1] Friedman JM. Obesity in the new millennium. Nature. 2000; 404:632-634.
[2] Matsuzawa Y, Funahashi T, Nakamura T. Molecular mechanism of metabolic syndrome X: contribution of adipocytokines adipocyte-derived bioactive substances.Ann N Y Acad Sci. 1999; 892: 146-154. http://dx.doi.org/10.1111/j.1749-6632.1999.tb07793.x
[3] Funahashi T, Nakamura T, Shimomura I, Maeda K, Kuriyama H, Takahashi M, et al. Role of adipocytokines on the pathogenesis of atherosclerosis in visceral obesity.Intern Med. 1999; 38: 202-206. http://dx.doi.org/10.2169/internalmedicine.38.202
[4] Wilding JP. Leptin and the control of obesity. Curr Opin Pharmacol. 2001; 1:656-661. http://dx.doi.org/10.1016/S1471-4892(01)00111-4
[5] Van Dielen FM, Van Veer C, Buurman WA, Greve JW. Leptin and soluble leptin receptor levels in obese and weight-losing individuals. J Clin Endocrinol Metab. 2002; 87: 1708-1716. http://dx.doi.org/10.1210/jcem.87.4.8381
[6] Ruhl CE, Everhart JE. Leptin concentrations in the United States:relations with demographic and anthropometric measures. Am J Clin Nutr. 2001; 74:295-301.
[7] Kanaley, J.A. Fenicchia, L.M. Miller, C.S. Ploutz-Synder, L.L.; Weinstock, R.S. Carhart, R. Azevedo, J.L. (2001). Resisting leptin responses to acute

and chronic resistance training in type 2 diabetic men and women.INTERNATIONAL JOURNAL OF OBESITY. VOL 25; PART 10, pages 1474-1480.
http://dx.doi.org/10.1038/sj.ijo.0801797

[8] Nindl B.C., Kraemer W.J., Arciero P.J., Samatallee N., Leone C.D., Mayo M.F., Hafeman D.L. (2002) Leptin concentrations experience a delayed reduction after resistance exercise in men. Medicine and Science in Sports and Exercise 34, 608-613
http://dx.doi.org/10.1097/00005768-200204000-00008.

[9] Haghighi A, Hamedinia M, et al. Effect of 13 weeks aerobic exercise on serum leptin in obese men. Olympic, 2008. (In Persian). 10. Khorshidi D, Assarzadeh M, et al. The Effect of a Period of Selective Aerobic Exercise on Serum Level of Leptin and Some Hormones in Obese Men. Annals of Biological Research. 2012; 3(3): 1415- 1423.

[10] Fatouros I.G., Tournis S., Leontsini D., Jamurtas A.Z., Sxina M., Thomakos P., Manousaki M., Douroudos I., Taxildaris K., Mitrakou A. (2005) Leptin and adiponectin responses in overweight inactive elderly following resistance training and detraining are intensity related. The Journal of Clinical Endocrinology & Metabolism 90, 5970-5977
http://dx.doi.org/10.1210/jc.2005-0261

[11] Ara I, Perez-Gomez J, Vicente-Rodriguez G, et al. Serum free testosterone, leptin and soluble leptin receptor changes in a 6-week strength-training programme. Br J Nutr. 2006; 96: 1053-1059
http://dx.doi.org/10.1017/BJN20061956.

[12] Bouassida A, Zalleg D, Bouassida S, Zaouali M, Feki Y, Zbidi A, Tabka Z. Leptin, its implication in physical exercise and training: a short review. Journal of Sport Science and Medicine. 2006; 5: 172- 181.

[13] Gaeeni A, Rajabi H. Physical fitness. Tehran: Samt pub. 2004; p:59. (In Persian)

[14] Ross. R, Rissanen. J, Pedwell, H. Influence of diet and exercise on skeletal muscle and visceral adipose tissue in men. J appl physiol. 1996; 81: 2445-2455.

[15] Livshits, G. Pantsulaia, I. and Gerber, L.M., 2005. Association of leptin levels with obesity and blood pressure: possible common genetic variation. International Journal of Obesity, 29: 85-92
http://dx.doi.org/10.1038/sj.ijo.0802933

[16] Wang Z, Zhou YT, Kakuma T, Lee Y. Leptin resistance of adipocytes in obesity: role of suppressores of cytokine signaling. Biochem Biophys Res Commun. 2000;N277: 20-26.
http://dx.doi.org/10.1006/bbrc.2000.3615

[17] Bouassida A, Dalenda Zalleg D, Bouassida S, Zaouali M. Feki Y, Zbidi A and Tabka Z. J Sports Sci Med. Jun 2006; 5(2): 172–181. Published online Jun 1, 2006. Leptin, its Implication in Physical Exercise and Training: A Short Review

[18] Reseland, J.E. Andessen, S.A. Solvoll, K. Hjermann, 53. Houmard, J.A. Cox, J.H. Maclean, P.S. Barakat, H.A., I. Urdal, P. Holme, I. Drevon, C.A., 2001. Effect of 2000. Effect of short-term exercise training on leptin long-term change in diet and exercise on plasma and insulin action. Metabolism, 49: 858-861. leptin concentration. Clinical Nutrition, 73: 240-245.

[19] Lutos lawski E. Plasma Leptin concentrations in Lean physically active males and females in regulation to body composition and metabolic variables. J SportMed Physiol Fit. 2004; 44: 200-206.