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The effect of Endurance training on resting level of serum leptin and insulin functional in healthy obese woman

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ABSTRACT

Associated with overweight and obesity is an increased risk for the development of cardiovascular disease, type 2 diabetes mellitus, hypertension, dyslipidemia, and other complications .Leptin and insulin had been noted to regulate energy balance and metabolism and thus to influence body weight. The objective of present study evaluated the effects of endurance training on serum concentration of leptin and insulin sensitivity in healthy obese Woman. For this purpose, 30 female overweight volunteer students (BMI ≥ 26) of Azad University Shahre Qods Campus were selected and randomly divided into two groups: endurance training group and control group. Training groups exercised for 12 weeks, three sessions a week with definite intensity and distance. Leptin, insulin, glucose, body weight, fat percentage, BMI And maximum oxygen consumption were measured both before and after the 12-week exercise. Using independent T-test, the results showed that endurance training had significant effect on leptin, insulin resistance index, body weight, fat percentage, BMI and maximum oxygen consumption ($p \leq 0.05$). Our study finding demonstrated that endurance training leads to significant decrease of leptin levels and insulin resistance.

KEYWORD: Endurance Training - leptin - Insulin Sensitivity - Obese woman

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INTRODUCTION

Adipose tissue as an active endocrine organ in involved in obesity-related disorders by secreting cytokines that influence energy homeostasis [1]. Leptin, the anti-inflammatory adipocytokine secreted from white adipose tissue, is effective on energy homeostasis and body weight control by affecting the hypothalamus and decreasing appetite and by increasing sympathetic nervous activity and lipolysis [2]. The exact mechanism in the control of leptin secretion is not yet fully known, however, given the role of leptin in regulating energy expenditure, the use of two therapeutic strategies of increasing physical activity and caloric restriction would be effect on leptin levels by adjusting the level of energy intake and changing the amount of energy [3]. Researchers have looked into the changes of leptin resulted by endurance exercise and in some cases reduction [2, 4, 5, 6, 7 and 8] and in some others lack of significant changes [9] of leptin has been observed.

Some researchers relate changes in plasma leptin to changes in adipose tissues [10] yet some others consider reduction in plasma leptin concentration or expression independent of changes in fat mass. It is therefore possible that except for aerobic exercise, other factors contribute to reduction of plasma leptin concentrations [11]. Since insulin modulates the synthesis and secretion of leptin, insulin, some researchers have suggested insulin as the main candidate of such control [12]. Mechanisms responsible for such control are unknown to date.

Limited number of studies has examined the concurrent changes of blood leptin and hormones that are effective on it in response to endurance exercise. However, the Bouassida and colleagues (2009) Demonstrated performance in the short time Protocol cycling submaximal (45 Minute) And long-term (85 Minute), Despite the reduction in plasma leptin and insulin plasma levels, has no significant effect [8]. Contradict the results of studies ˝ Protocol is due to differences in design features.

So given the widespread prevalence of obesity in Iran and around the world, especially in women, due to lower physical activity and its increasing consequential complications and diseases [13], and taking into consideration the conflicting results of the abovementioned studies and identification of mechanisms of exercise that impact on leptin levels and insulin resistance index, the aim of this study is to explore the effects of 3 Months of sporadic aerobic exercise on leptin concentrations and insulin resistance index in the overweight female Students.

MATERIALS AND METHODS

First of all call notices were posted in Azad University Qods City Campus in which the researcher invited to identify overweight and obese individuals who were willing to run exercise for weight adjustment and improvement of their physiological conditions. In the next stage the candidates were invited for the purpose of the Initial assessments and from among them, at least 30 individuals with BMI ≥ 26 whose being overweight or obese was not associated with thyroid under-activity and did not have a history of exercise or calorie restriction diet were selected. After obtaining consent letters from the participants, they were asked to avoid rigorous physical activity 48 hours before the test and attend the pathobiology laboratory for blood sampling after 12 hours of fasting. The anthropometric measurements and maximal oxygen consumption of the subjects were done in the gym. The subjects were then divided randomly into two exercise and control groups.

The height was measured using a medical height meter; weight and body composition were measured using a body composition monitor (OMRON, Finland). The maximum oxygen consumption of all the subjects was measured twice using the Cooper test; once before the test and once after the test. The subjects ran for 12 minutes at their maximum speed. The mileage was then placed in this formula:

$$\mathbf{Vo2max} = \text{Mileage (M)} - \frac{504/9}{44/73}$$

The aerobic capacity of the subjects was calculated milliliters of oxygen for each kilogram of the body weight per minute. The amount of calories intake of the subjects was determined by data collection method using a three-day questionnaire, at the beginning, at the end and every fortnight during the exercise period [10]. The subjects were advised to keep up their usual diet during the research period.

Over 12 weeks the subjects exercised 3 time a week with a specific intensity and distance. Karvonen heart rate reserve formula was used to determine the exercise intensity. The exercise intensity was controlled using a heartbeat monitor (Polar, made in Finland). A session of training program included a ten-minute warm-up with and stretching exercises. The subjects then continued with running a distance of 1600 to 3200 meters with the intensity of 60 to 75% of their maximum heart rate reserve (Table 1). They cooled off for five minutes.

Table 1 – Endurance training programs

Week	1	2	3	4	5	6	7	8	9	10	11	12
Target heartbeat (percentage)	60-65%	60-65%	60-65%	60-65%	65-70%	65-70%	65-70%	65-70%	70-75%	70-75%	70-75%	70-75%
Distance (meter)	1600	1600	1800	1800	2400	2400	2800	2800	3000	3000	3200	3200

Five milliliter of blood was taken from each subject after 12 hours of fasting from the brachial vein and was reserved degrees by test time. Blood sampling in both phases was done between 8 and 9 AM in the follicular phase of every subject. Biovendor and DRG kits were used accordingly to measure serum leptin and insulin using ELISA method. Glucose oxidase enzyme calorie metric method was used for measurement of glucose by calorimetric method. Also to calculate the insulin resistance index homeostasis model assessment (HOMA) was used through measuring fasting insulin and glucose according to the following formula:

Insulin resistance index = Fasting glucose (mmol / lit) × Fasting insulin (µIU /milt) /22.5

Statistical analysis: All values are represented as mean ± SD. As to the inferential statistics, first the Kolmogorov–Smirnov test was used for normal distribution Leuven test was used for data homogeneity. Then independent t test was used for testing significance between groups. All the statistical operations were performed by spss software and significance level of tests was considered $p \leq 0.05$.

RESULTS

The descriptive profile of the groups in variables of age, height, weight, body mass index, body fat percentage, insulin, glucose, leptin serum and insulin resistance index as well as the independent t-test are presented in the table 2. After 12 weeks of Continues training leptin level (p= 0.000) (Diagram 1) and insulin resistance index (p= 0.000) (Diagram 2) showed a significant decrease. Also the difference of measurements of variables of the two groups including Body weight (p= 0.000), Body mass index (p= 0.000), Body fat percentage (p= 0.000), Maximum oxygen consumption (p= 0.000), Insulin (p= 0.000) and Glucose (p= 0.000) was significant (0.05≥ P) (Table 2).

Table 2- Pre-and post-test physical, physiological and biochemical variables and t test in the two groups

Group	Endurance		Control		P
Index	Pre test	Pos test	Pre test	Pos test	-
Age (year)	22.4 ± 1.64	-	22.77 ± 1.63	-	-
Height (cm)	160.80 ± 3.43	-	158.80 ± 3.99	-	-
Weight (kg)	75.01 ± 6.32	72.80 ± 2.44	75.08 ± 2.52	75.20 ± 2.49	0.000
Body mass index (kg/m^2)	29.13 ± 1.99	28.12 ± 0.89	30.12 ± 1.83	30.17 ± 1.84	0.000
Fat percentage (%)	31.26 ± 1.40	27.75 ± 0.88	31.80 ± 1.57	31.96 ± 1.57	0.000
Vo_2max (ml/kg/min)	23.48 ± 1.30	29.56 ± 1.36	23.13 ± 1.49	23.03 ± 1.50	0.000
Insulin (µIU/ml)	12.64 ± 0.29	8.39 ± 0.19	12.60 ± 0.32	12.81 ± 0.17	0.000
Glucose (mmol/l)	4.56 ± 0.29	3.68 ± 0.24	4.75 ± 0.26	4.99 ± 0.28	0.000
Leptin (ng/dl)	11.84 ± 0.26	9.61 ± 0.81	11.87 ± 0.34	11.93 ± 0.36	0.000
Insulin resistance index	2.56 ± 0.17	1.37 ± 0.11	2.66 ± 0.16	2.84 ± 0.14	0.000

Data are expressed as mean and standard deviation

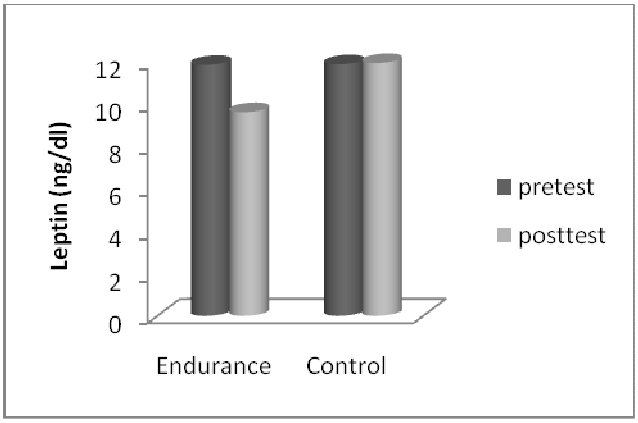

Diagram 1: The pattern of changes in leptin levels before and after 12 weeks Of exercise in endurance training and control groups

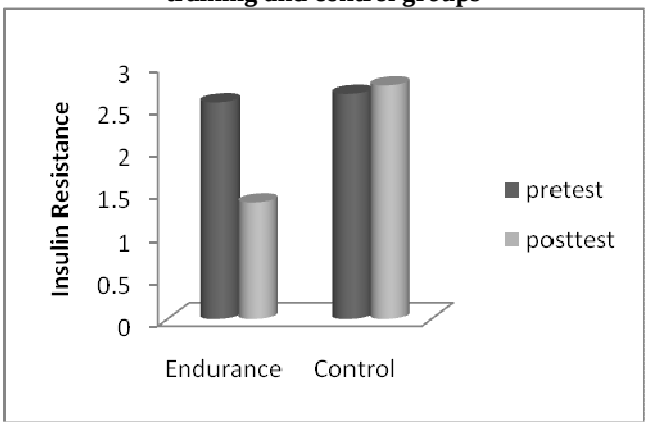

Diagram 2: The pattern of changes in insulin resistance before and after 12 weeks Of exercise in endurance training and control groups

DISCUSSION

The results of this study showed that insulin resistance and insulin concentrations significantly decreased due to endurance training. In this context, longitudinal studies have shown that prolonged exercise leads to improved insulin function and insulin resistance [15]. Recent studies suggest that exercise especially prolonged exercise leads to increased insulin sensitivity, reduced insulin resistance and improved lipid profile in obese individuals and obesity-related diseases [16].

Regular exercise improves insulin sensitivity and blood glucose levels by decreasing levels of visceral fat and body weight without decreasing the lean mass [17]. Exercise increases insulin sensitivity in skeletal muscle and adipose tissue and both of these factors decrease fasting glucose and insulin levels [18]. The results of this study showed on the one hand that endurance training by health obese women significantly reduces insulin and insulin resistance; and brings about significant changes in weight loss, body fat percentage and body mass index on the other hand. So may the reduced levels of visceral fat and body weight may have caused the reduction in insulin resistance in the above subjects.

Also the results of this study showed that endurance training causes significant decrease in leptin serum of health obese women. Regardless of the mechanisms of this reductive change, this finding of ours was consistent with certain findings of previous researchers who had also reported a decrease in leptin levels [19, 20] and contradictory to some others that had emphasized no change in leptin levels [21]. In fact earlier findings about the effect of exercise training on circulating leptin levels are not consistent [22].

Ning et al (2005) declared that regular physical activity and leptin concentrations are independently and inversely correlated. To put it more clearly, consistent with some of the researchers found that plasma leptin concentrations would decrease in men and women as a result of regular physical activity [23]. Thong et al. (2000) concluded that the reduction in adipose tissue subsequent to weight loss concomitantly reduces circulating leptin and also that, sport, independent of its effects on weight loss, has no certain effect on leptin secretion [24].

Although based on previous findings, serum leptin levels are highly correlated with body fat percentage, but for any given amount of body fat, differences in serum leptin concentrations have been observed, and this suggests the possibility that other factors than body fat can be involved in the regulation of leptin levels. Insulin, corticosteroids, free fatty acids, food intake and exercise are the most important of these factors [25].

Leptin is probable involved in inhibition of insulin secretion in obese individuals and even in impaired insulin function in their peripheral tissues [26]. Insulin and leptin can be said to be interrelated, although the mechanism and the direction of this interaction is unknown. Hence a close connection between plasma leptin levels, fat content and insulin concentrations was observed after exercise protocol in this study; the relationship of leptin and insulin levels was about 85%. Also serum leptin levels after exercise training decreased significantly in the exercise group. One of the most important reasons is that leptin is a hormone involved in cell metabolism and its dysfunction can be compensated by regular physical activity and increased sensitivity of hypothalamic cellular receptors [27]. The possible mechanism is that due to exercise leptin levels would decrease as a result of the sympathetic nervous system activity or by epinephrine available in blood circulation, while reducing the cellular volume of fat tissues and increase sensitivity of receptors to leptin [28]. Thus less leptin produced by fat tissue due to the endurance training may be important in the pathophysiology of obesity, but it also shows that tissue sensitivity to leptin would probably increase and leptin concentration would adapt accordingly.

CONCLUSION

In general, the findings of this study showed that Endurance training can affect serum Leptin and insulin sensitivity in healthy obese Woman.

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