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Serum Chemerin Levels and Insulin Resistance Response to High-Intensity Interval Training in Overweight Men

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ABSTRACT
chemerin secreted from adipose tissue are associated with insulin resistance. The aim of this study was to evaluate the effect of 10 weeks of high- intensity interval training on chemerin. 18 male undergraduates were purposefully selected from among eligible persons. Participants were randomly assigned to two experimental groups (n = 9) and control (n = 9) groups. The experimental group received a10-week exercise training, three times a week, each session for duration 35 minutes, With intensity 80 to 90% target heart rate. In accordance to principle of overload, 80% in the first three weeks, 85% for second three weeks and last four weeks of the 90% target heart rate. Blood samples were taken before and after 10 weeks of training. For data analysis of 2 × 2 ANOVA with repeated measures were used. The results showed that after 10 weeks of training a significant decrease insulin resistance, body weight, body fat percentage, body mass index in the experimental group compared with the control group(P <0/05). In contrast, no significant difference was observed in chemerin levels(P> 0/05). 10 weeks of high- intensity interval training, without significant changes in adipocytokinechemerin levels, decreased insulin resistance, body weight, body fat percentage, body mass index and resistinleves. Therefore high- intensity interval training can be used as a new training program for people with overweight and obesity recommended.
Keywords:*chemerin, high- intensity interval training, overweight men.*

INTRODUCTION

Modern lifestyle has drawn sedentary, overeating and stressful daily life. This lifestyle leads to overweight and obesity and various diseases including insulin resistance, Type 2 diabetes, Hypertension, Hyperlipidemia, Metabolic Syndrome and ischemic coronary disease [1,2]. Adipose tissue is now recognized as an endocrine organ that plays an important role in energy metabolism [3]. Adipocytokines or adipokines are proteins that are released by adipose tissue [4].Recently, the rapidly growing adipokine family was expanded by chemerin (RARRES2 or TIG2), a secreted chemoattractant protein Initially discovered in body fluids associated with inflammatory processes [5,6]. chemerin is crucial for normal adipocyte differentiation and modulates the expression of adipocyte genes involved in glucose and lipid homeostasis, such as glucose transporter-4, fatty acid synthase, and adiponectin via its own receptor. In 3T3-L1 adipocytes, chemerin was reported to enhance insulin-stimulated glucose uptake and insulin receptor substrate-1(IRS-1) tyrosine phosphorylation, suggesting that chemerin may increase insulin sensitivity in adipose tissue [4,7]. In humans, circulating chemerin was shown to be associated with multiple components of the metabolic syndrome, including body mass index, triglycerides, high-density lipoprotein cholesterol, and hypertension [8]. Studies show a direct link between chemerin with obesity and metabolic syndrome [9]. Therefore, chemerin is known as an Adipocytokine with effect of enhancing insulin sensitivity.

Several authors agree that continued physical training may be beneficial for prevention and management of kind of diseases [1]. Nowadays most of the people due to lack of time during the day, avoid exercise training[10, 11].so researchers suggested that high- intensity interval training (HIIT), for it takes less time and is effective. Moreover, recent evidence suggests that HIIT is perceived to be more enjoyable than moderate-intensity continuous exercise. Accumulating evidence suggests that high-intensity interval training (HIIT) has the potential to be an economical and effective exercise protocol for reducing fat of overweight individuals[11].Studies have shown that exercise training improves insulin sensitivity to a

variety of training programs and increased expression of insulin receptors (IRS-1) [12]. Conflicting results have been reported in the field of exercise on chemerin. Some studies show no change, and some have reported decreased levels of chemerin on the effect of exercise. So that Kim and et al findings demonstrated that a 12-week intensive lifestyle intervention significantly decreased serum chemerin level compared to usual care. Decrease in serum chemerin level was associated with improved insulin sensitivity, and this may be involved in the beneficial effects of lifestyle intervention in overweight and obese type 2 diabetic patients[13]. Also Stefanov and et al the 6-month combined strength and endurance training program led to a significant reduction in circulating chemerin levels in overweight or obese individuals[14]. In contrast Askari and et al after 12 week combinat training showed that no significant decrease in chemerin levels. According to the studies showed no effect of high- intensity interval training on chemerinlevels[15], therefore the aim of our study was to define of Serum chemerin levels and insulin resistance response to ten week high- intensity interval training in overweight men.

METHODS

Method of study was Quasi-experimental study with pretest and post test control group. 18 overweight men (age 20±2.29) and(BMI 29.2±2.7) were purposefully selected through a call for volunteers. Inclusion criteria included no use of tobacco, lack of any physical activity for a period of one year, without taking any medication or supplement types and lack of disease. All participants received complete information about the study and informed consent was obtained from all participants. 18 subjects were randomly matched by body mass index and maximal oxygen consumption in the two experimental groups (n = 9) and control (n = 9) groups.

The experimental group received a10-week high- intensity interval training, three times a week, each session for duration 35 minutes, With intensity 80 to 90% target heart rate. In accordance to principle of overload, 80% in the first three weeks, 85% for second three weeks and last four weeks of the 90% target heart rate.At the end of the session have a 5 minute walk for cool down [10]. Also during this period, the control group did not participate in any exercise program. karvonen formula was used to determine target heart rate[16].

Target Heart Rate = ((max HR − resting HR) × %Intensity) + resting HR example

Blood analysis

All participants completed before starting an exercise program, after 12 hours of fasting blood test at 8 am. Blood samples were centrifuged for15 minutes at 4 ° C and plasma samples were stored at _80 °C for subsequent analyses. Blood samples were collected 2 days before the start of the training program and 72 hours after the last exercise session. Glucose was measured using an autoanalyzer method and kit with a sensitivity of 0.1 mg /dL(BioRex, England). Serum insulin was measured using a ECL and kit with a sensitivity 0.01 mU/mL (Roche, Germany). Serum chemerin levels were measured using a specific sandwich enzyme-linked immune sorbent assay (ELISA) and kit with sensivity 10.2 ng/L(Bioassay Tech Lab, china). The intra-assay coefficient of variation (CV) was 5.7 %. The HOMA-IRwas calculated using the Matthews et al(1985) formula [17].

HOMA-IR = [fasting glucose(mg/dL) × fasting insulin (mU/mL)/405]

Statistical analyses

To describe the datawere used from descriptive statistics (means and standard deviations). Normal distribution of data was used for Kolmogorov–Smirnov test. Given normal distributions, for comparisons of groups were performed using ANOVA with repeated measures 2 × 2, (mixed factorial design). Statistical significance was set at $p < 0.05$ and SPSS 16.0 was used forall analyses.

RESULT

The mean and standard deviation are participants in the experimental group and control features in Table 1.Using ANOVA with repeated measures 2 × 2 shows the experimental and control groups in Table 2.After ten week of HIIT training on chemerin showed that, there was no significant in Greenhouse-Geisserwithin-subjects effects($p= 0.107$, $F (1,16) = 2.917$) with $\eta2= 0.154$, and no significant changes group × time interaction ($p= 0.383$, $F (1, 16) = 0.806$) with $\eta2= 0.048$, and there was no significant between-subjects effects ($p= 0.483$, $F (1, 16) = 0.516$) with $\eta2= 0.516$. In generalten week of HIIT training, there was a significant decrease in insulin resistance index (p=0.008), body mass index (p=0.001) and fat percent (p=0.001) of overweight men. Also there was a significant increase in maximal oxygen consumption (p=0.003).

Table1

Characteristics of participants in the experimental and control groups

	Control group	Experimental group
Age (year)	20±1.58	21±2.73
Height (cm)	178.8±5.84	176.5±7.16
Body weight (kg)	91.68±9.93	92.06±7.26
BMI (kg/m2)	28.9±2.55	29.6±2.98
WHR(cm)	0.96±0.2	0.94±0.3
Glucose(mg/dL)	91±5.23	95±10.13
Insulin (mU/mL)	13.5±5.18	17.5±6.4

Table2

ANOVA with repeated measures 2 × 2 shows the experimental and control groups

Variables	Groups	Steps		Within-subjects changes		Interaction changes		between-subjects changes	
		Pre test	Post test	F	Sig	F	Sig	F	Sig
BMI (kg/m2)	Control	28.9±2.55	29.1±3.04	8.46	0.010*	14.67	0.001*	0.005	0.954
	Exper	29.6±2.98	28.3±2.95						
Fat present	Control	29.8±1.25	28.5±1.57	10.59	0.005*	18.39	0.001*	0.396	0.538
	Exper	28.9±2.55	29.1±3.04						
Vo2max(ml/kg/min)	Control	45.07±1.60	45.56±1.96	20.75	0.000*	12.66	0.003*	0.40	0.843
	Exper	43.45±2.56	47.47±0.98						
HOMA-IR	Control	3.04±1.3	3.22±1.6	5.73	0.029*	9.19	0.008*	0.198	0.622
	Exper	4.17±1.89	2.62±1.50						
Chemerin (ng/L)	Control	507.5±493.4	493.5±463.7	2.91	0.107	0.806	0.383	0.516	0.483
	Exper	389.9±257.1	354.6±463.7						

Significant level ($p < 0.05$).*

BMI = body mass index, Vo2max= maximal oxygen consumption, HOMA-IR = homeostasis model assessment estimated insulin resistance

DISCUSSION

The results showed that ten weeks of high- intensity interval training significantly decreased insulin resistance index, body weight, body fat percentage, body mass index, waist-hip ratioand increased maximal oxygen uptake. However, chemerin levels were not significantly changed after high- intensity interval training.Since we observed a decrease in the mean chemerinvalues, but there wasnot a statistically significant.

Stefanov&et al (2013) studied the reduction of circulating chemerin in response to a combination of endurance training andresistance training. The subjects consisted of 79 men and two endurance &resistance training combined (n = 51) and control (n = 28) groups. The exercise group performed 6 months of training. Results showed chemerin decreased significantly with a decrease in total cholesterol, TG, fasting insulin, insulin resistance index, systolic blood pressure, high sensitivity CRP, leukocyte count and leptin. In conclusion, after 6 months, chemerin levels were significantly decreased in the experimental group [14].Stefanovresults are inconsistent with the present study. One possible reason maybe is duration of exercise,Stefanov study subjects were followed for 6 months of exercise training. Thisexercise training time create metabolicadaptation that shows statistically significant difference in the values chemerin.while the data in this study, exercise training has been conducted for 10 weeks.

So Hun Kim&et al (2013) studied the modifying effect of lifestyle changes on chemerin concentrations and with insulin sensitivity in overweight and obesity in adults with type II diabetes.Thirty-five overweight or obese subjects with type two diabetes were randomized to receive intensive lifestyle modification including supervised exercise sessions or usual care for 12 weeks. A 12-week intensive lifestyle intervention significantly decreased serum chemerin level compared to usual care. Decrease in serum chemerin level was associated with improved insulin sensitivity [13].Also Ascary& et al studied the effects of concurrent training onadipocytokines and insulin sensitivity in overweight women, the results showed chemerin values after 12 weeks, glucose, insulin was significant decrease insulin sensitivity (15). The results of this study are in line with the present study.TheOverall research present showed that ten weeks

of high- intensity interval training no change in levels of chemerin the men were overweight. However, few research have studied the effect of exercise on chemerin levels. Still have not achieved with a precise answer.A group of researchers, Rima Chakaroun (2011), Kim (2013),Stefanov (2013), Maria Neuparth (2014), Saremi (2010) Reducing the amount of chemerin reported in response to exercise training (8, 13,14,18, 19) and the askari (2011), and Zolfaghari (2013) in line with the values of chemerin study reported no change in response to exercise the (15, 20).Researchers have reported a decrease in chemerin the main cause of weight loss in the subjects mentioned. In contrast, researchers have shown that changes in response to exercise training, probably their subject not associated with metabolic syndrome and diabetes, to show sufficient change.

in general disputes arising from these studies may be due to differences in age, sex, sample size, differences in measurement techniques, the type and duration of exercise training programs, initial status of healthy participants or patients, visceral adipose tissue differences, otheradipocytokines changes. The mechanisms involved in chemerin changes in response to exercise training is not exactly clear, but considering the results of this study and other studies, it seems that exercise training cannot reduce the chemerin levels. However, these results should be interpreted with caution.

CONCLUSIONS

In this study ten weeks of high- intensity interval training significantly decreased insulin resistance index, body weight, body fat percentage, body mass index, waist-hip ratio and increased maximal oxygen uptake. But did not cause any change in chemerin serum. Note that this study did not control diet. However, to achieve more precise information should be more research done to chemerin and adipocytokines related to insulin sensitivity. On the whole high- intensity interval training can be recommended as an effective new training program for overweight and obese people to reduce weight and prevent obesity problem by considering other factors.

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