ARTICLE

THE EFFECTS OF TEN-WEEK TRAINING FOLLOWED BY FOUR-WEEK DETRAINING ON SERUM RESISTIN OF NON-ATHLETE IRANIAN MALE STUDENTS

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ABSTRACT

Given the importance of physical exercise in human health and prevention of cardiovascular disease among people, the purpose of this pretest-posttest quasi-experimental study is to evaluate the effect of physical exercise followed by a detraining period on serum resistin of non-athlete male students in Iran. 39 subjects were selected randomly from 339 non-athlete male students in Zahedan, Iran who had chosen physical education course volume one in 2013-2014 school year, divided into the three groups of 13 including endurance, sprint, and control. They exercised separately with a specified durations and intensity three times per week for ten weeks and then after 48 hours, they entered a four-week detraining period. To assess the effects of endurance and sprint training on serum resistin , blood sampling was carried out in 3 stages for 12-hour overnight fasting before starting and 48 hours after completion of training. In this respect, body mass index (BMI), Waist to hip ratio (WHR), subcutaneous fat percentage, and maximal oxygen uptake (vo2max) were measured. For analysis, statistical test were used: One-Way ANOVA for comparing within-group mean differences and Least Significant Difference (LSD) post hoc test for between-group mean differences. Obtained results showed that the serum resistin level in endurance and sprint groups were significantly reduced compared to control group (p<0.05), and after four-week detraining, its amount increased again. Also we found out that after ten-week training, BMI, WHR, weight, and subcutaneous fat of two endurance and sprint groups significantly decreased in comparison with control group (p<0.05), while Vo2max in endurance group was significantly increased. We concluded that ten-week endurance and sprint exercises can be a nonpharmacological method for the prevention of cardiovascular diseases.

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KEY WORDS
endurance training; sprint training; detraining; resistin; non-athlete students

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INTRODUCTION

Physical exercises are considered as one of the strategies to improve cardiovascular health. Regular exercises are often recommended, but the impact of these exercises on cardiovascular risk factors, such as resistin is not well known [1]. Resistin plays an important role in obesity-related diseases by regulating metabolic processes and the immune system Resistin was discovered in 2001 by Steppen et al. [2]. It was called "resistin" because of the observed insulin resistance in mice injected with resistin. The human resistin gene is located on chromosome 19p13 and with a molecular weight of 12.5 kDa, is formed of 108 amino acids as cysteine-rich pre-peptide, and its various isoforms has been reported [3,4]. Also, resistin, by impairing glucose metabolism, leads to an increased risk of atherosclerosis. Human studies have shown that because of low resistin expression in human adipocytes, its role as an important factor linking obesity with insulin resistance is not fully understood, because there are a lot of resistin protein in the human circulatory system, and may be released from these cells into serum [5]. It has been shown that the lack of physical activity increases the risk of obesity and Inactive lifestyle is also associated with increased risk of insulin resistance [6]. Given that the impact of physical exercise metabolism in obesity and insulin resistance has been a lot of attention; however, there are limited information about the effects of physical activity on insulin resistance-causing mechanisms and their relationship with each other. In addition, it is unclear whether changes in resistin may be due to changes in insulin resistance after aerobic exercise or not. The studies that have been done in the last decade about the relationship between resistin and insulin resistance have shown contradictory results. Some research have shown a direct association, some shown no association, and even some studies have shown an inverse association of these hormones with insulin resistance [7,8].Jones et al. [9] observed a significant decrease in serum resistin and no change in insulin resistance after eight- month exercise in overweight adolescents. Kadoglou et al. [10] and Liu et al. [11] showed a significant reduction in both resistin and insulin resistance after aerobic trainings. In contrast, Monzillo et al. [7] observed increased insulin sensitivity and no change in resistin after 6-month program consisting of combined hypocaloric diet and moderate physical activity. Thus, according to several studies and different results obtained in the past and given the importance of the resistin in the human body, and also since research on endurance and sprint training and detraining period in non-athletes is less, in the current study, our purpose is to investigate the effect of ten- week strength and sprint training and a 4-week detraining period on resistin levels of the non-athlete male students in Iran.

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MATERIALS AND METHODS

In this pretest-posttest quasi-experimental study, 39 subjects were selected randomly from 339 non-athlete male students who had chosen physical education course volume 1 in school year 2013-2014, and divided into the three groups: endurance group (n=13), sprint group (n=13), and the control group (n=13). The inclusion criteria were: no regular physical activity, and no history of hospitalization and specific diseases and surgery. A written consent was taken from participants. One day before the start of training protocols and 12 hours of overnight fasting, in an upright position 10 cc blood was collected from antecubital vein in the right arm of subjects. After centrifugation for 5 min at 4000 rpm, serum was isolated from plasma and kept in micro-tubes in the laboratory at 20 ° C. Then endurance and sprint training protocol was administered for 10 weeks, according to [Table 1] [12, 13]. 48 hours after the last training session, in similar conditions blood sampling was repeated, and then participants entered a four-week detraining period. During this period, they had no physical activity and they just were doing their own chores. After 4 weeks, the final blood sampling was taken again in previous conditions.

Enzyme-linked immunosorbent assay (ELISA) technique was employed for measuring resistin by using the kit made by Boster Germany. The size of the anthropometric indices such as height, weight, body mass index (BMI), Waist to hip ratio (WHR), subcutaneous fat percentage, maximal oxygen uptake (vo2max) were measured in experimental conditions. Subcutaneous fat thickness of subjects was measured using a caliper (Yeongdeok-dong, Korea) at three points (below the scapula, abdominal and triceps) on the right side of the body. Measurement of each point was repeated three times, and then the average was obtained and compared by its formula. Vo2max also was measured by Bruce protocol on Runrace HC1200 treadmill.

To test the research hypotheses, first, In order to investigate the homogeneity of research data, the Kolmogorov-Smirnov test was used. Afterwards, One-Way ANOVA was used to evaluate the within-group mean differences, and Least Significant Difference (LSD) post hoc test was employed for between-group mean differences. All statistical analyzes were performed using SPSS version 17 and significance level was set as 0.05.

Table 1: Endurance and sprint training program

Training weeks		1	2	3	4	5	6	7	8	9	10
Endurance training	Time (min)	20	22	24	26	28	30	32	34	36	38
	Vo_2 max	50%	50%	55%	55%	60%	60%	65%	65%	70%	70%
Sprint training	Meter (M)	30	30	30	30	30	30	30	30	30	30
		60	60	60	60	60	60	60	60	60	60
		100	100	100	100	100	100	100	100	100	100
	Repeat	3	3	5	5	7	7	9	9	11	11
		2	2	3	3	4	4	5	5	6	6
		1	1	1	1	1	1	1	1	2	2
	Vo_2 max	95%	95%	100%	100%	100%	100%	100%	100%	100%	100%

RESULTS

[Table -2] shows the mean and standard deviation of the 39 subjects' age, height, weight, BMI, and WHR in three groups. Mean and standard deviation of resistin before and after training are presented in [Table 3]. As can be seen, changes in serum resistin values in endurance and sprint groups were significantly reduced after ten weeks of endurance (1.22 ± 0.08 ng/ ml) and sprint training (0.97± 0.06 mg/ ml) ($P \leq 0.05$). After four weeks of detraining, these values were significantly increased as 1.35±0.11 and 1.1 7 ± 0.06 ng/ml, respectively. The results of change in anthropometric factors [Table-4] showed that after ten-week training, BMI, WHR, weight, and subcutaneous fat of two endurance and sprint groups significantly decreased in comparison with control group ($p \leq 0.05$). After four weeks of detraining, these indices increased. Also, Vo2max in endurance group at the end of ten-week training was significantly increased (29.08 ± 0.97 ml/kg/min).

DISCUSSION

Many studies have shown that a regular physical activity has known cardiovascular benefits which reduce the prevalence of cardiovascular disease healthy people and patients [14], because physical exercise increases muscle mass and strength on the one hand, and on the other hand it will increase energy consumption and oxidation [15]. Regular endurance exercise with several mechanisms can increase blood volume, stroke volume, maximum energy consumption, and reduce the fat percentage and maximum energy consumption which directly affects the cardiovascular system. Increased plasma volume is one of the most important changes caused by the effect of endurance training. With the increase of plasma volume, blood volume also increases and as a result more blood enters the heart, and stroke volume and cardiac output is increased. These factors increase the maximum oxygen consumption. Endurance exercise increases the plasma volume through two processes: (a) with increasing secretion of antidiuretic hormone (ADH) and aldosterone; it causes water retention in the kidneys and hence, plasma volume increases, (b) With increasing plasma proteins, especially albumin, blood osmotic pressure increases and therefore more fluid stays in the blood. As a result of these two processes, the liquid part of blood (plasma) increases, and blood viscosity decreases [16-19]. In our study, endurance training reduced average body weight, BMI, WHR, and percentage of subcutaneous fat while Vo2max increased. Also, our results showed that endurance training reduced resistin level significantly. Our results are consistent with the results of [9-11], [20, 21], but is against the findings of [22]. Park et al. [21] demonstrated that twelve-week aerobic exercise can reduce serum resistin in obese middle-aged women. Jones et al. [9] after eight-month endurance training, observed the significant reduction of serum resistin but found no changes in insulin resistance of overweight adolescents. Kadoglou et al. [10] and Liu et al. [11] also showed that after endurance training resistin and insulin resistance reduces significantly. Rashidlamir et al. [20] examined the effects of eight weeks of aerobic exercise on the concentrations of fibrinogen and resistin in healthy overweight middle-aged men in Iran. They observed increased resistin due to endurance training and concluded that pro-inflammatory cytokines such as IL-1beta, TNF-alpha, and IL-6 stimulate resistin gene expression in peripheral blood mononuclear and increase the resistin. They attributed the increase in resistin after endurance exercise to the role of this hormone in Oxidative defense of the body, and stated that resistin in response to inflammatory stimuli acted as an antioxidant, is secreted from blood mononuclear cells in response to mild inflammation. On the other hand, Perseghin et al. [22] studied serum resistin in 23 elite athletes (sprinters, middle-distance and marathon runners) and in 72 sedentary men including lean and obese individuals and showed that endurance athletes had high resistin levels than sedentary men. Increased resistin was detected in the middle-distance and marathon runners, but not in the sprinters when compared with sedentary men.

There are also some studies that implied no change in serum resistin after endurance training. For example, in the study of Abbasi et al [23] conducted on obese middle-aged men in Iran, anthropometric parameters in the experimental group were significantly reduced following the intervention of three month exercise training, but insulin resistance and serum resistin remained unchanged. In this regard, they suggested that physical activity in the absence of diet has no effect on serum resistin and insulin resistance of these men. Sliwicka et al [24] in a study of ten young male triathletes, reported that the effect of systematic training on basal adipokine and resistin concentration was in a small extent, however, acute exercise may affect the response of these molecules Haghighi et al. [25] showed that that nine-week aerobic training has no significant effect on serum resistin and adiponectin in obese Iranian women; however, aerobic training significantly reduced BMI, WHR, and body fat percentage, and caused significant increase in lean body weight and Vo_2max.

With respect to serum resistin level in detraining period, our study showed significant difference and in this period resisitin was significantly increased. This is consistent with the findings of [26] and [27]. Zarifi et al. [26] suggested that after 8 weeks of detraining, resistin levels increase. Siahkohian et al. [27] concluded that detraining reduce performance and increase the level of resistin.

The results of the current study indicated that serum resistin level of non-athlete male students in pretest period and after ten-week sprint exercise followed by four weeks of detraining showed a significant difference ($p \leq 0.05$).). This level decreased significantly after ten-week sprint exercise and increased again in detraining period. In relation to this result of the research, due to the novelty of the subject, a similar or inconsistent study was not found.

Table 2: General characteristics of subjects

Group	Age (Year) (M ± SD)	Weight (kg) (M ± SD)	Height(cm) (M ± SD)	BMI(kg/m2) (M ± SD)	WHR (M ± SD)
Endurance	21.41 ± 2.15	69.45 ± 1.18	171 ± 4.27	23.16 ± 4.17	0.86 ± 0.06
Sprint	20.58 ± 1.56	68.45 ± 1.17	170 ± 5.21	22.66± 2.96	0.82 ±0.05
Control	20.66 ±1.82	69.58 ± 1.12	175 ±7.33	22.16 ± 2.28	0.81 ± 0.09

Table 3: The mean and standard deviation of resistin of subject in three groups and three stages

Variable/ group		Before training (M ± SD)	10-week training (M ± SD)	4-weeks detraining (M ± SD)
Resistin (ng/ ml)	Endurance	1.77 ± 0.15	1.22 ± 0.08	1.35 ± 0.11
	Sprint	1.53 ± 0.12	0.97 ± 0.06	1.17± 0.06
	Control	1.28± 0.02	1.30 ± 0.02	1.31 ± 0.03

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Table 4: Results of changes in anthropometric factors of subjects in three groups and three stages

Variable	Group	Before training (M ± SD)	10-week training (M ± SD)	4-week detraining M ± SD
Weight	Endurance	69.57 ±1.18	*67.05 ± 1.02	*67.67 ± 1.03
	Sprint	67.95 ± 1.10	**66.00 ± 1.01	*66.52 ± 1.03
	Control	69.58 ±1.12	69.33 ± 1.13	69.16 ± 1.13
BMI	Endurance	23.16± 4.17	**22.00 ± 3.66	*22.37 ± 3.84
	Sprint	22.66 ± 2.96	**22.00 ± 2.69	*22.39 ± 2.60
	Control	22.16 ± 2.28	21.75 ± 2.05	21.91 ± 2.23
WHR	Endurance	0.86 ± 0.01	*0.84 ± 0.01	*0.87 ± 0.01
	Sprint	o.87± 0.01	*0.86 ± 0.02	0.88 ± 0.01
	Control	0.81 ± 0.02	*0.81± 0.03	0.81 ± 0.02
Subcutaneous fat	Endurance	0.08 ± 0.01	*0.05 ± 0.01	0.07 ± 0.01
	Sprint	0.07 ± 0.009	*0.06 ± 0.006	0.07 ± 0.008
	Control	0.07 ± 0.005	*0.07 ± 0.005	0.07 ± 0.005
Vo_2max	endurance	24.33± 0.96	*29.08 ± 0.97	26.16 ± 0.96

* p≤0.05 (within group), ** p≤0.05 (between group)

CONCLUSION

The aim of this study was to investigate the effect of ten-week physical exercise on serum resistin of non-athlete male students (n=39, with mean weight of 69.45 ± 1.18, 68.45 ± 1.17, and 69.58 ± 1.12 kg in three endurance, sprint, and control groups, respectively). Results showed that the serum resistin level in endurance and sprint groups were significantly reduced compared to control group (p≤0.05), and after four-week detraining, its amount increased again. In this regard, we can conclude that ten-week endurance and sprint exercises can be a good, cost-effective and non-pharmacological method for the prevention of cardiovascular diseases.

CONFLICT OF INTEREST

There is no conflict of interest.

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FINANCIAL DISCLOSURE

None.

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