Effect of six-week aerobic exercise on Chemerin and Resistin concentration in hypertensive postmenopausal women

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Abstract:
Background: Physical activity reduces symptoms of cardiovascular diseases. The aim of this study was to examine the effect of six-week aerobic exercise upon Chemerin and Resistin concentration in women with menopause who had hypertension.
Methods: The population of this quasi-experimental study included postmenopausal women diagnosed with hypertension. They were 50 to 55 years old and lived in Amol, a city in north part of Iran. Twenty volunteers were filled the personal consent and Health Questionnaire. They were randomly assigned to Experimental and control groups equally (n=10 per group). The experimental group conducted a 6-week aerobic training program from 8-10am every day.
Results: Endurance exercise decreased Chemerin ($t=10.41$, $P<0.000$) and Resistin ($t=2.42$, $P<0.051$); indicating the decline of inflammation and cardiovascular disease.
Conclusion: Considering anti-inflammatory effects of exercise, training plays an important role in reducing inflammatory indices in human; and endurance training can be a good strategy to deal with inflammation and cardiac- vascular risk factors.

Keywords: Aerobic exercise; Chemerin; Resistin; Postmenopausal

Additional Information for citing this article:
Title of Journal: Electronic physician; Abbreviated title of journal: Electron. Physician
doi: 10.14661/2013.623-630

Editorial information:
Type of article: Original
Published: February.01.2013

1. Introduction

Nearly 233 percent growth in 2025 is expected to be in the world's elderly population- the majority are women (1). Menopause is not a disease, but is associated with many physical and psychological problems (2). Studies show that the incidence of some diseases such as hypertension in women increases after menopause (3, 4). Hypertension is a global problem; a disease that is asymptomatic and often called the silent killer (5). According to the World Health Organization, hypertension is the third leading cause of mortality in humans worldwide (6). Studies show that the treatment and control of hypertension reduce the risk of cardiovascular diseases and their complications (7). In addition to beneficial effect on blood pressure, regular exercise reduces cholesterol and body fat and diseases such as arteriosclerosis (blocked arteries) (8). In addition to hyper cholesterolemia, the factors such as diabetes, smoking, inactivity, obesity, and hypertension are known as the risk factors in arteriosclerosis disease (9).

Resistin as an important inflammatory marker has a role in trauma and the development of arteriosclerosis and it has direct relationship with the risk of arteriosclerosis and High Sensitive C-reactive protein (10, 11, and 12). The reports show that Epicardial adipose tissue plays an important role in pathogenesis and the progression of Coronary artery disease with creating inflammatory adipocytokine. The Chemerin is a recently discovered Chemokine (13)

found in the liver and white adipose tissue (14), and is associated with obesity, hypertension, inflammation and arteriosclerosis (15). Little research has been done regarding the effects of aerobic exercise on plasma Resistin; all show that regular aerobic activity can reduce levels of Resistin in human (16, 17). The result of studies also suggests that regular aerobic exercise has reduced Chemerin levels, body mass index and blood pressure (18, 19, 20). In addition, little research has been done about the effects of aerobic exercise on Resistin and Chemerin concentrations in postmenopausal women. Therefore, due to the little information on the effects of regular physical activity on menopausal women, this study investigated the effect of 6 weeks of regular aerobic activity on Chemerin and Resistin levels of postmenopausal women –who had hypertension disease.

The results of a study reported 15 % prevalence of hypertension in women over 18 years of Zabol in 2002 (21). Also, the mean systolic blood pressure in people over 18 years old in Mashhad has been 17.97±122.40in 2005 (22). In recent decades, the researchers have emphasized on the effects of aerobic exercise on cardiovascular risk factors (23, 24). There is also substantial information indicating that regular aerobic activity prevents the structural and functional abnormalities of the limbs (25) and reduces the development of blood pressure (26). In research conducted in this field, the decrease of blood pressure in people with hypertension followed by regular physical activity has been reported approximately 7.5 ml of mercury (27).

Through impairment of glucose and lipid metabolism, Resistin may increase plaque vulnerability by stimulating pro-inflammatory cytokines (28). In some studies, men showed no significant change in the Resistin level up to 48 hours after aerobic exercise (29); while in others studies, regular aerobic exercise has shown good results in reducing the concentration of Resistin (30). Some research showed (31, 32) but some studies did not show (33-35). Chemerin is an important factor for Adiposyte process and state regulation of genes involved in glucose and lipid balance (36). It has been reported that in Adipocytes, Chemerin enhances the insulin-stimulated glucose and causes the phosphorylation of tyrosine in Insulin receptor substrate. According to the studies, Chemerin may increase insulin sensitivity in adipose tissue and is largely associated with Body mass index, triglycerides, and blood pressure in those with normal glucose tolerance (37). Studies showed that Chemerin levels were contributed to adipose tissue and skeletal muscle and is negatively related to obesity and insulin sensitivity (38). The results also show the impact of aerobic exercise on improved cardiovascular and metabolic risk factors in obese people and reduced amount of Chemerin (39).

Other research also suggests a significant impact of sport and physical activity on blood pressure (40). Although the effect of aerobic exercise on Resistin and Chemerin concentration in postmenopausal women is unknown, the results of many studies suggest lowering effect of exercise on blood pressure; so walking and cycling have been known as other positive factors in the regulation of blood pressure (41). Augustine Sohn examined the effects of exercise (walking) in a large population of African-Americans with high blood pressure. That study was performed on 19 patients in two groups: Work and control group. They showed that more than 30 minutes of walking in a day reduces blood pressure in African-American adults who have high blood pressure (42). Exercise is the basis of health in individuals –regardless of age, sex or group. Individuals in each age or sexual group should have activity and mobility; it is more important, especially in high-risk populations (43). In this study, the followings set as the specific objectives of the study: 1) To determine the effect of a six-week regular activity and exercise on the Resistin level in postmenopausal women, 2) To determine the effect of a six-week regular activity and exercise on the Chemerin level in postmenopausal women, and 3) To determine the relation between Chemerin and Resistin level in postmenopausal women before and after six weeks of aerobic activity.

2. Material and Methods

2.1. Study design and sampling

This study was a quasi-experimental research with a pre-post test design. The population of this study included postmenopausal women diagnosed with hypertension; they were 50 to 55 years old and from Amol, a city in Mazandaran province, Iran. After required examination and verification of high pressure by the physician, 20 volunteers were selected through a purposive sampling. Participants completed a questionnaire indicating the lack of sports history during the past six months, the lack of anti-hypertension drugs use, hormone therapy, cardiovascular problems, and complete stoppage of menstrual cycle.

Filling out the personal consent and Health Questionnaire, subjects were randomly assigned to two equal groups (n=10 per group): Experimental and Control groups. The experimental group conducted a 6-week aerobic training program at 8 to 10 am. The control group did not participate in any training program. In this study, ethical

considerations included the complete description of the objectives to the study participants, ensuring the confidentiality of their information.

2.2. Experiment

The aerobic exercise program of experimental group consisted of 6 weeks aerobic exercise, three times a week for 45 minutes at 50 percent maximum heart rate reserve during the first week and 60 minutes of exercise at the sixth week with 60% of maximum heart rate; thus, every two weeks, 5% was added to the intensity of aerobic activity. The aerobic activity included a 10 minutes warm-up such as stretching, exercise and running, 30 to 45 minutes main training exercises and 10 minutes cool-down exercises. The subjects were also advised to refuse any other exercise during the six-week program.

2.3. Data collection

2.3.1. Heart rate measurement

Using a stethoscope, heart rate was controlled during the aerobic exercise. The participants' maximum heart rate was calculated using equation (Age - 220).

2.3.2. Blood Pressure Measurement

The systolic and diastolic BP of participants in the experimental group was measured before and after 6 weeks of exercise training in different circumstances in a sitting position using a mercury sphygmomanometer based on guidelines.

2.3.3. Height Measurement

The height was measured in the morning using the height gauge with an accuracy of 0.1 ± cm in the standing position without shoes, while the shoulders were in a normal condition.

2.3.4. Measurement of body weight

Weight was measured using a German digital scale with a 0.1 ± kg precision with minimal clothing without shoes. Body mass index (BMI) was calculated by dividing weight (kg) by height (in meters).

2.3.5. Blood sampling method

To examine variables, blood sampling was done on two stages: before the start of training and the sixth week. Subjects were instructed to refuse any exercise and eat light foods 24 hours before phlebotomy. Blood samples were taken of experimental and control groups after 12 hours of fasting in pre-test stage and 48 h after the last training session on the post test stage. For plasma separation, blood samples were centrifuged at the speed of 3000 rpm for 15 min and were frozen at 80 - ° C, and stored for subsequent analysis.

2.3.6. Biochemical analysis

Measurement was done using a commercial ELISA kit according to the manufacturer's instruction.

2.4. Statistical methods

Kolmogorov-Smirnov and Levin test were used for determining the normal distribution of data and homogeneity of variances, respectively. Both dependent and independent t-tests were used to investigate the changes in the intra-group and the differences in inter-group of variables. Statistical operations were performed using SPSS 15 and the significance level of the tests was considered at $P<0.05$.

3. Results

The mean age of the participants was 54 years (±3.75). Table 1 shows the general characteristics of subjects in each group. The data shows that at the beginning of research, there was no significant difference between the values for age, height and body weight between the groups. Then the groups were homogeneous.

The results in Table 2 show that the lowest concentration of Chemerin in the experimental group was after six weeks of aerobic activity was 250.66 pg/ ml and the highest concentration of Chemerin in this group was 337.48 pg/ ml. According to our findings, the lowest concentration of Chemerin in the control group after six weeks of aerobic activity was 343.70 pg ml and the highest concentration of Chemerin in this group was 348.99 pg/ml. Six weeks growing aerobic exercise has no significant effect on Chemerin concentrations in postmenopausal women. The data in Table 3 shows that the obtained t is smaller than table's t ($t=2.44$); There was no significant difference between Chemerin concentrations in postmenopausal women before and after a period of six weeks ($P>0.160$).

Data in Table 3 shows that the obtained t is greater than table's t ($t=2.14$) and there was significant difference between the Chemerin level in exercise and control groups ($P < 0.05$). The data in Table 3 shows that the obtained t is smaller than table's t ($t=2.44$); There was no significant difference between Resistin concentrations in

postmenopausal women before and after a period of six weeks (P>0.051). Table 3 also shows that the obtained t is smaller than table's t (t=2.44); There was no significant difference between Resistin concentrations in postmenopausal women before and after a period of six weeks (P>0.625). As it is illustrated in the table 4, the obtained t is smaller than table's t (t=2.14); There was no significant difference between Resistin concentrations in postmenopausal women before and after a period of six weeks (P>0.05). Table 5 shows that there is no significant correlation between Resistin and Chemerin changes in treatment group. It also says there is no significant correlation between Resistin and Chemerin changes in exercise group.

Table 1. Mean and standard deviation of the physiological characteristics of subjects in each group (n=10, p <0.05)

Groups		**Age (year)**	**Weight (kg)**	**Height (cm)**
Exercise	Mean ± S.D	54 ± 3.75	29.74 ± 10.9	22.158 ± 51.7
Control	Mean ± S.D	53.22 ± 4.66	44.73 ± 38.9	56.157 ± 88.1

Table 2. Statistical description of chemerin and Resistin concentrations Mean (pg ml) in the exercise and control groups in terms of measures of central tendency and dispersion

Statistical indices Groups		**Mean**		**Standard deviation**	
		After	Before	After	Before
Chemerin	Exercise	250.66	337.48	31.22	35.56
	Control	343.70	348.99	31.89	29.61
Resistin	Exercise	2.22	3.13	0.84	0.63
	Control	3.02	3.03	0.57	0.62

Table 3. Independent t-test results to evaluate differences between Resistin concentrations before and after exercise and Chemerin concentration before and after exercise

Statistical indices Groups			Mean	Standard deviation	Df*	t value	Table's t	P value
Chemerin	Exercise	Before exercise	337.48	35.56	6	10.41	2.44	0.000
		After exercise	250.66	31.22				
	Control	Before exercise	348.99	29.61	6	1.60	2.44	0.160
		After exercise	343.70	31.89				
Resistin	Exercise	Before exercise	3.13	0.63	6	2.42	2.44	0.051
		After exercise	2.22	0.84				
	Control	Before exercise	3.02	0.62	6	- 0.475	2.44	0.652
		After exercise	3.03	0.57				

*df: Degree of freedom

Table 4. The comparison of chemerin and Resistin control and exercise group

Statistical indices Groups		Mean	Standard deviation	Differences in the mean	Df*	t value	Table's t	P value
Chemerin	Exercise	37.2	14.14	35.27	1	4.15	2.14	0.000
	Control	293.93	13.7					
Resistin	Exercise	3.02	0.44	0.52	1	1.15	2.14	0.130

*df: Degree of freedom

Table 5. Pearson correlation between Resistin and chemerin

Pearson correlation coefficient Group		r	P	R^2	P<0.05
Exercise Group	Resistin - chemerin	0.033	0.944	0.0008	0.666
control group	Resistin - chemerin	-0.513	0.239	0.263	0.666

4. Discussion

The results of this study show that endurance exercise decreases Chemerin and Resistin indicating the decline of inflammation and cardiovascular disease. The results are consistent with the earlier results showing regular aerobic

activity can reduce levels of Resistin in human (16, 21). However, further studies on the effects of long term exercise on Chemerin and Resistin are required. Considering anti-inflammatory effects of exercise, training plays an important role in reducing inflammatory indices in human; and endurance training can be a good strategy to deal with inflammation and cardiac- vascular risk factors. This study pointed out that 6 weeks of aerobic exercise significantly reduced blood pressure in postmenopausal women with hypertension. Then, at the end of the sixth week of aerobic exercise, heart rate in postmenopausal women has increased. The results are consistent with the earlier studies (1, 9). However, period of this study and training programs was short and more evidence is required to confirm the long-term effects of exercise.

5. Conclusion

In summary, results showed that six weeks of aerobic exercise training significantly decreased Resistin, Chemerin, and blood pressure in postmenopausal women. Therefore, aerobic exercise can be used as a non-pharmacologic method to improve the health of patients with coronary artery disease and hypertension. Paying more attention to all segments of society, especially the elderly and putting a light and a regular exercise program for patients with hypertension may increase the health status of the vulnerable elderly population.

Acknowledgements:

The authors would like to extend their gratitude to the Dr. Farzanegi for her invaluable support.

Conflict of Interest:

There is no conflict of interest to be declared.

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