



Effect of 12 Weeks of Resistance Training on Serum, Vaspin and Chemerin in Obese Middle-Aged Women

Sahar Avazpour ^{1,*}, Jamal Fazell Kalkhoran² and Fatemeh Mohseni ^{3,4,**}

¹PhD Student of Sport Biochemistry and Metabolism, Shiraz University, Shiraz, Iran

²Exercise Physiology Department, Sport Science Faculty, Tehran University, Tehran, Iran

³Anesthesia Department, School of Nursing, Gerash University of Medical Sciences, Gerash, Iran

⁴Department of Medical Education, Medical School, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding author: Exercise Physiology Department, Sport Science Faculty, Tehran University, Tehran, Iran. Email: s.avazpour.98@gmail.com

**Corresponding author: Anesthesia Department, School of Nursing, Gerash University of Medical Sciences, Gerash, Iran; and Department of Medical Education, Medical School, Tehran University of Medical Sciences, Tehran, Iran. Email: mohseni_f@sums.ac.ir

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Abstract

Background: Adipokines, including vaspin and chemerin, have different biological roles associated with body mass index, insulin resistance, metabolic syndrome, polycystic ovary syndrome, diabetes and cardiovascular diseases.

Objectives: The objective of this study was to evaluate the effect of 12 weeks of resistance exercises on serum levels of vaspin and chemerin in middle-aged obese women.

Methods: In this study, 20 inactive obese women with the mean and standard deviation of age and body mass index of 52.13 ± 10.06 and 30.87 ± 2.01 were divided into two groups of resistance ($n=10$) and control ($n=10$) exercises. Resistance exercise program included 3 sessions per week for 12 weeks (50% - 75%, one repetition maximum). Anthropometric indices, vaspin, and chemerin levels were measured before and after exercises.

Results: The results suggested that changes in serum levels of chemerin and vaspin after 12 weeks of resistance exercises showed a significant difference compared to the control group ($P = 0.001$, $P = 0.002$).

Conclusions: It can be concluded that 12 weeks of resistance exercise is effective in reducing vaspin and chemerin and reducing body fat percentage in middle-aged obese women, and the response rate varies according to the type and duration of the exercise protocol.

Keywords: Resistance Training, Vaspin, Chemerin, Middle-Aged, Obesity

1. Background

The prevalence of obesity worldwide is rapidly increasing, this problem exists not only in industrialized nations but also in developing countries (1). Today fat tissue is considered as a very active endocrine organ that is involved in the regulation of metabolism and several hormones' secretion (2, 3). A study by the National Cholesterol Control Program's expert panel has shown that obesity, especially abdominal obesity is the most common cause of metabolic disorders such as metabolic syndrome (3, 4). Aging process makes elderly women and men more prone to this syndrome due to simultaneous inactivity and increased abdominal visceral fat deposits and reduced muscle mass (4, 5). Recent findings have shown that obesity, blood lipid disorders, and hypertension are closely associated with adipose tissue secretory function (6, 7). Vaspin and chemerin are of secreted peptide cytokines from fat tissue that af-

fect the pathogenesis of obesity and associated disorders (5, 8). Vaspin (serine protease inhibitor derived from visceral fat tissue), is a protein with a molecular mass of 47 kDa that is secreted from fat tissue (9). Vaspin protein in rats, mice, and humans is formed by 412, 414, and 415 amino acids respectively (9). Vaspin visceral secretion is significantly associated with BMI, body fat percentage and glucose tolerance of blood. Some studies show that the induction of mRNA vaspin in human fat tissue, may be a mechanism associated with obesity and insulin sensitivity (10, 11). Chemerin is of the adipokines that exist as an immature polypeptide with 18 kDa molecular weight that can be mapped on chromosome 7; this adipokine is secreted from visceral fat tissue and liver. Then with the help of serine protease enzymes and removing 6 amino acids from the polypeptide carboxyl terminal, matured chemerin with 16 kDa molecular weight will be produced (12, 13). In humans, chemerin is the most common adipokine that is produced

by fat tissue, it should be noted that the liver and the lungs are also chemerin producers and known as Chemer23 in the human body (14). Many factors influence the secretion of adipokines (vaspin, chemerin, etc.) including exercise. In recent years, increased physical activity has been proposed as a way to control fat tissue and obesity-related diseases. Exercise can be effective in various forms and there are several recommendations for effective participation in physical activities (intensity, duration, type, and number of sessions per week) in order to reduce fat tissue in healthy people and patients. Regular physical activity has several benefits such as reduced body weight, reduced body fat, increased insulin sensitivity, glycemic control, decreased blood pressure and reduced risk of cardiovascular disease (15, 16). A few studies examined the impact of intensity and different volumes of exercise on vaspin and chemerin in the elderly with overweightness or obesity. Due to the difference in intensity, volume, break frequency and volume of work performed, the results of these studies were not in line with each other.

In a study conducted by Mogharnasi et al. (9) and in another study by Youn et al. (17) on men and women with different insulin sensitivities after 4 weeks of exercise, increased vaspin serum concentrations were observed. On the other hand, Khademosharie et al. (18) studied the effect of an aerobic exercise program on women with type 2 diabetes and concluded that no significant change happened in vaspin plasma levels, while chemerin concentration decreased significantly compared to the stage before activity. In this regard, in a study conducted by Saremi et al. (19), after 12 weeks of strength exercise (3 sessions per week) in the samples who had metabolic syndrome, they observed that chemerin serum concentration significantly reduced compared to the levels before strength activity. The researchers of this study, have not observed research examining the impact of resistance exercise on vaspin and chemerin serum levels in obese middle-aged women. On the other hand, the research undertaken by Seghatoleslami et al. showed that strength training in elderly people improves their mental motor condition (20). Also, another research showed that pillates exercise can improve elderly women's body composition, balance and walking speed (21). But in none of these researches a measurement of the changes in vaspin and chemerin serum levels as a result of exercise has been undertaken.

2. Objectives

Due to the difficulty of research on middle-aged people, middle-aged and old people and the need need to improve their level of health, limited research in this field, conflicting research results and the large capacity

of vaspin and chemerin hormones in regulating obesity and other metabolites, the aim of this study is to evaluate the effect of 12 weeks of resistance exercise on vaspin and chemerin serum levels in middle-aged obese women.

3. Methods

This is a quasi-experimental applied study approved by Shiraz University, with the aim of determining the effect of 12 weeks of resistance exercise on vaspin and chemerin serum levels in middle-aged obese women.

3.1. Participants

At first, by installing enrolment notices, obese or overweight people who tend to run exercises to control weight and improve their physiological status and attended one of the sports complexes in Yasouj, were identified by the researcher. Inclusion criteria included having no history of cardiovascular, kidney and pulmonary disease and diabetes, having no orthopedic restriction (which can interfere with the exercises), having not participated in regular exercise activities in the last 3 years, having a fat percentage between 35 and 45 (this fat percentage was determined by body composition device, and 20 people were chosen randomly from amongst the 53 people who had a fat percentage between 35 and 45). On a certain day, the volunteers were invited, and after presenting full comments on the process of the study, the benefits and potential harms of the study, written informed consent was obtained from volunteers. Participants were informed about the confidentiality of their information. They were also ensured that they could withdraw from the study whenever they desired.

After completing questionnaires on health standard and amount of daily physical activity, 20 eligible women between 49 and 58, with a body mass of more than 30 (whose obesity was not associated with hypothyroidism), health (no history of cardiovascular, hepatic, renal, pulmonary disease, or diabetes and lack of orthopedic limitations that interfere with the implementation of exercises), disabled (no participation in regular physical activity in the past 3 years) were selected and randomly divided into two groups (a group of resistance exercise and a control group).

3.2. Study Design

The experimental group performed the exercise program during the study and the control group continued its activities without intervention. Before starting the exercise program, the initial assessments such as a maximum repetition (1 RM) were conducted for each subject by

free weights ($1RM = \left[\left(\frac{\text{number of repetition}}{30} \right) + 1 \right] \times \text{used weight}$), and anthropometric indexes like height, weight, body mass, physical environment and thickness of subcutaneous fat were measured in experimental conditions. Studied physical indexes were again measured and recorded after the end of the exercise period. For the prevention of acute inflammation induced by exercise on vaspin and chemerin serum levels, blood samples were collected at least 48 hours after the last exercise session (22).

3.3. Training Protocol

Experimental group subjects (n = 10) participated in 12 weeks of resistance exercise. Resistance exercises started with: bench press, armpit stretch, shoulder barbell from back, leg, front thigh and hamstring press, 3 times a week, for 3 courses with 10 - 13 replicates per session and with the intensity of 50% - 75% of one maximum repetition and resting 60 - 90 seconds, and every four weeks, a new maximum repetition of subjects were calculated and values of weights were again adjusted. Around 3 - 5 minutes warm-up and 3 - 5 minutes cool-down per session including stretching and flexibility exercises were conducted. The participants were recommended to refrain from participating in any sports activity during the 12-week exercise program (23).

3.4. Measurements

After 12 hours of fasting at pre-test and 48 hours after the last exercise session in vitro, a 10 cc blood sample was taken from the left-hand vein. Blood samples were taken at 8 or 9 am to prevent reduction of vaspin and chemerin serum level by the circadian oscillations. Blood samples were frozen after centrifuge for 15 minutes at 3000 rpm at 80°C and stored for subsequent analysis. Biochemical analysis and vaspin and chemerin serum levels measurement were conducted by ELISA method using a microplate reader of Glory company of America. Serum vaspin was measured by ELIZA kit (CUSABIO BIOTECH, Wuhan, China), with the sensitivity of 225 ng/mL and Serum chemerin was measured by ELIZA kit (CUSABIO BIOTECH, Wuhan, China), with the sensitivity of 7.5 pg/mL according to the manufacturer's instructions (9, 24). Subcutaneous fat of subjects was calculated using a caliper in three points of triceps, abdomen, and pelvis, on the right side of the body and after implementing the general equation of Jackson and Pollock to determine the percentage of fat in women. Waist and hip circumferences were measured based on the method described by the National Institute of Health (24 Syrians).

3.5. Statistical Analysis

To ensure the normal distribution of collected data, the Kolmogorov-Smirnov (KS) test was used. Paired *t*-test was used in order to compare the results of pre-test and post-test and determine the effects of resistance exercise on the studied variables, and compare the surveyed groups' mean in research variables, according to the research project.

4. Results

Results of general features of subjects (weight, body fat percentage, body mass index and waist-to-hip ratio) and variables studied (vaspin and chemerin) are presented in Tables 1 and 2.

The results showed that the concentration of vaspin after the implementation of 12 weeks of strength exercise compared to the level before the implementation of activities in the exercise group was significantly reduced (Table 2), but in the control group, no significant change was observed in the quantities (Table 2). Also, the concentration of chemerin in the exercise group was significantly reduced, but in the control group, no significant changes were observed in chemerin level (Table 2). Body fat percentage was significantly reduced in both experimental groups, while none of the weight variables, BMI and waist-to-hip ratio (WHR) had any significant changes in any of the three groups.

5. Discussion

The study showed that a 12-week resistance exercise program results in a meaningful decrease in vaspin and chemerin in middle-aged fat women. The result of this study was consistent with the results of Lee et al. (25), Oberbach et al. (26) and Saremi et al. (19) in terms of the significant reduction of vaspin and chemerin. These results are inconsistent with the results of Hida et al. (2005), Bozaoglu et al. (14) and Oberbach et al. (26), who reported lack of significant change or increased vaspin and chemerin following physical activity (9). It seems that the reason for the difference in accountability of vaspin and chemerin after exercise can be explored in variables affecting vaspin and chemerin changes including fitness, weight, presence or absence of diseases like diabetes, cardiovascular and metabolic syndrome, age and sex of subjects and intensity, duration and type of exercise. Lee et al. (25) conducted a study on children between 7 and 11 (adjustment of lifestyle in children by creating a negative energy balance) and reported reduced levels of vaspin serum compared to the stages before. In a study by Oberbach et al. (26), following a period of one hour of exercise and also after a four-week

Table 1. Anthropometric Variables of Subjects Before and After Exercise Intervention^a

Variables	Aerobic Exercise Group		Control Group		P Value (Within Groups)
	Pre-Test	Post-Test	Pre-Test	Post-Test	
Body weight (kg)	78.99 ± 1.64	76.73 ± 1.31	78.42 ± 5.57	78.63 ± 1.22	0.050
Body fat percentage (%)	43.99 ± 1.32	38.03 ± 2.54	41.42 ± 4.82	41.89 ± 4.05	0.011 ^b
BMI (kg/m ²)	31.38 ± 3.14	30.29 ± 3.9	31.22 ± 6.74	31.61 ± 1.05	0.051
WHR	0.98 ± 0.03	0.97 ± 0.08	0.96 ± 0.06	0.96 ± 0.20	0.040

Abbreviations: BMI, body mass index; WHR, waist-to-hip ratio

^aValues are expressed as mean ± SD.^bP > 0.05 is accepted to be statistically significant.**Table 2.** Changes of Research Variables (Vaspin and Chemerin) in the Experimental and Control Groups Before and After 12 Weeks of Resistance Training^a

Variables	Exercise Group		Control Group	
	First Week	Twelfth Week	First Week	Twelfth Week
Vaspin	0.54 ± 0.02	0.40 ± 0.01	0.52 ± 0.07	0.51 ± 4.1
Chemerin	162.19 ± 8.04	144.14 ± 6.11	164.7 ± 2.3	162.45 ± 7.09

^aValues are expressed as mean ± SD.

exercise program, vaspin serum concentrations were significantly decreased. Saremi et al. (19) conducted a study on patients with metabolic syndrome and studied the effect of a twelve-week strength program (three sessions per week). They observed that the vaspin serum concentration was decreased compared to the stage before exercise. They report that the intensity of exercise is effective as an important factor in reducing vaspin and chemerin serum concentrations in response to exercise (19, 26). Hida et al. (2005) reported increased in vaspin serum concentrations in rats. They pointed out the exercise volume (intensity, duration, and frequency) as an effective factor in vaspin and chemerin values so that the long-term physical activity (exercise period) with proper exercise volume (intensity, duration, and frequency) affects vaspin and chemerin concentrations (9). By the same token, Brooks et al. (22) reported that increased levels of physical activity can lead to an increase in vaspin and chemerin receptors, as a result, the need for high levels of plasma vaspin and chemerin decreases according to the inverse relationship between them. Abdel-lateif et al. (27) conducted a study on obese adolescents and showed that 8 months of exercise made significant changes in chemerin serum levels. Finally, Lau et al. (28) showed that when the exercise was applied to improve blood sugar in people who had normal weight, vaspin, and chemerin secretion was in a normal range. In the present study, despite the significant reduction of vaspin and chemerin in the experimental group, no significant changes were observed in body weight, WHR, and BMI. Although most studies have shown that reduction of vaspin and chemerin in blood circulation is associated

with weight or fat loss, some studies have not confirmed this result (14, 26). It has been reported that reduction of abdominal fat in men with diabetes of the second type as a result of exercise has been associated with no change in the concentration of serum vaspin and chemerin (14, 17). Other studies have reported that despite weight loss by exercise, no changes have been observed in the values of serum vaspin and chemerin (19, 22). The probable explanation for this finding is that since these hormones are secreted more from visceral fat tissue and the liver, the activity applied may not influence these areas so much.

5.1. Conclusions

To summarize, according to the findings of this study, it seems that applying twelve weeks of resistance exercise can be an efficient and practical way to reduce vaspin and chemerin and body fat levels in middle-aged obese women, and the answers are different depending on the type and duration of the exercise protocol. Also, we can note exercise activity duration as a crucial factor in reducing vaspin and chemerin in response to the exercise activities.

Footnotes

Authors' Contribution: Sahar Avazpour developed the original idea and the protocol, abstracted and analyzed data, wrote the manuscript, and is a guarantor. Fatemeh Mohseni and Jamal Fazell Kalkhoran contributed to the development of the protocol, abstracted data, and prepared the manuscript.

Conflict of Interests: The authors have no conflict of interest.

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Informed Consent: Written informed consent was obtained from volunteers.

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