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A comparison of 8-week-resistance and endurance exercise programs on levels of plasma apelin and blood pressure in obese postmenopausal women

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Abstract

Background: Studies show that apelin vasodilator peptide plays an important role in vascular tone and cardiovascular function, but the effect of resistance training and comparison of resistance and endurance training on plasma apelin has not been well documented.

Aim: The purpose of the study was to compare the effects of eight weeks of resistance and endurance exercise programs on levels of plasma apelin and blood pressure in obese postmenopausal women

Material and Methods: The present study was 24 postmenopausal women obese (age: 55.5 ± 5.63 y, height: 154.31 ± 4.69 cm, weight: 72.65 ± 11. 44 kg, and BMI: 30.62 ± 3.63) were randomly divided into two groups of 12 people (endurance and resistance) groups (resistance training with 60 to 80% 1RM, and endurance training with 55 to 70% of heart rate Karvonen). Apelin plasma levels and blood pressure 24 h before and 48 h after the end of the program were measured. Data were analyzed using repeated measures. The significance level was $P<0.05$.

Results: The results showed that changes in intragroup and intergroup blood pressure decreased significantly and plasma apelin increased in both groups, but this increase was not significant ($P<0.05$).

Conclusion: Following eight- week resistance training and endurance training reduces blood pressure in postmenopausal obese women and were significantly associated with increased plasma Apelin but not as significant.

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1. Introduction

Menopause, or the normal interruption of more than 12 months of menstruation, is an inevitable event that occurs around the age of 51 [1, 2]. when women spend about a third of their lives [2]. Menopause is a completely natural phenomenon in a woman's life; Menstruation ends due to decreased ovarian activity and lack of estrogen and leads to the end of pregnancy in women. Hormonal changes are one of the most important changes during menopause, for example, reducing the ratio of anabolic to catabolic comparisons in reducing physical strength and, muscle volume; In meanwhile aerobic power play an important role [3]. Increase body fat and reduce lean mass (sarcopenia obesity) are associated with problems of the joints and bones as well as hot flashes of menopausal complications which should be given more attention [4]. These problems, along with aging, can have adverse effects on various aspects of women's lives and daily activities. However, doing sports activities and especially strength training can have positive results in improving skeletal muscle function and thus improving women's quality of life [4].

The results of studies have shown that postmenopausal women are at greater risk for central obesity [5]. Obesity is the most important health problem in developed and developing countries and can increase the risk of various diseases including heart attack, osteoarthritis, type 2 diabetes, stroke, high blood pressure and other diseases. Fat tissue is not just an inactive tissue that stores energy rather, it is an active endocrine organ that produces and expresses various biological substances. Adipose tissue also plays a central role in regulating energy homeostasis. This tissue exerts its regulatory effect by producing hormones called adipokines.

There are several adipokines: Interleukin 6, Resistin, Tumor Necrosis Factor TNF-α, Vaspin, Adiponectin, Apelin, and Omentin. Recently, a new protein called apelin, an adipokine, was discovered in 1998 by Professor Fujino. This hormone is a peptide that acts on the APJ receptor. Apelin is made up of 36 amino acids, which in turn are derived from 77 amino acids (periapropylene) [6]. It has been shown that various factors can affect the secretion of adipokines, including exercise.

Exercise can also be effective in different ways [7] depending on its intensity and duration be [8]. In women, there is a sharp increase of 6% [9, 10]. High blood pressure is one of the most common and important health threats. About a quarter of all deaths in the elderly are due to high blood pressure or complications [11]. Chronic hypertension is a common and asymptomatic disease caused by general or functional disorders and is called primary or idiopathic hypertension [12]. High blood pressure is one of the major problems of the health system and it has side effects such as heart failure, stroke and kidney failure. It is often referred to as the latent killer due to the lack of symptoms [7]. Hypertension in adults to increase systolic blood pressure ≥ 140 mm/hg and/ or diastolic blood pressure ≥ 90 mm/hg is said alone or together [13]. Increased arterial blood pressure is more important in developing countries hypertension as a common, asymptomatic, and usually treatable disease and if left untreated, it can have deadly consequences [14]. Hypertension is the most common disorder as a risk factor in the diagnosis of myocardial infarction, stroke peripheral vascular disease and the main factor in the development of cardiovascular disease and its mortality [15, 16].

Researchers have suggested that a peptide imbalance called apelin causes increased cardiac arrest [15]. Various factors are involved in balancing the physiological process of the cardiovascular system, including antihypertensive peptide, or apelin, which is thought to play a key role in cardiovascular function and makes changes in blood pressure.

2. Materials and Methods

In the present study, 24 obese postmenopausal women were randomly divided into two groups of resistance training (12 people) and endurance training (12 people). They participated voluntarily in a purposeful selection method according to the criteria for entering the research and announcing their participation. Exclusion criteria included: cardiovascular, hepatic, renal, metabolic, diabetic and muscular diseases. Also, all subjects in the project were approved by a physician in terms of general health. However, the subjects were fully aware of the training and research conditions. However, after explaining the objectives and implementation of the research process and the researcher's expectations of the subjects in observing the above-mentioned cases, they signed the consent of the informed participant in the research. In addition, subjects were asked to control their diet three days before blood sampling and follow the nutrition reminder questionnaire completed by themselves and do not make any changes in it. After checking the health status by a questionnaire to perform physical activity and weight measurement, 10 cc of blood was taken from the vein of the arm in the elbow area by a laboratory specialist. Blood sampling was taken 24 hr before and 48 hr after the last training session and after 12 hr of fasting.

Blood pressure was measured using a standard mercury sphygmomanometer. This measurement was taken before Bruce test in pre-test and post-test and in a sitting and comfortable position and left hand. Subjects in the resistance group (60 to 80% of a maximum repetition that includes: foot press, lat pool of front, chest press, shoulder press, double and triple arm movement) did eight- week resistance training and in the endurance group they did eight- week endurance training (save 55 to 75% of your heart rate, which includes 20 to 26 min of walking on a treadmill). Blood samples were then stored in EDTA anticoagulation tubes (CBC). We then centrifuged for 20 min at 3000 rpm and plasma was separated and stored in disposable tubes with a door at -20°C in the freezer to be measured at the same time as the final blood draw. Plasma apelin surfaces were made with EASTBIOPHARM brand which made in China. ELISA method with ELISA device GDV Italy was used for 20 min at 3000 rpm. The sensitivity of the experiment was (P<0.05). After collecting and entering data in SPSS software environment version 22, raw data were analyzed. Descriptive statistics were used to calculate the central tendency and dispersion indices and plot the variables after confirming the normality of data distribution by Shapirovilk test and ensuring homogeneity of variances by Leuven test using repeated measures statistical test. Intra-group and inter-group changes were performed. The significance level was considered (P <0.05; Table 1).

Table 1. Central orientation measurements and data scatter

Indicators	Resistance training	Endurance training
Age (year)	63.5±5.55	61.4±12.55
Height (cm)	44.11±65.72	52.6±25.75
Weight (kg)	69.4±31.154	97.2±50.157
BMI (kg/m^2)	63.3±62.30	25.2±55.30

3. Discussion and Results

In this study, plasma aplin levels between groups showed significant changes ($P<0.05$), however, this increase was not significant within the group, but this increase was greater in the endurance training group ($P>0.05$). There was also a significant decrease in blood pressure in both groups ($P<0.05$), but this decrease was greater in the endurance training group ($P>0.05$; Table 2; Figures 1, 2).

The results of the present study showed that after eight- week resistance training, plasma apelin levels were not significant despite the increase. Also, the results of the present study showed that after eight- week resistance training, blood pressure levels were significant. At the time of the study, a study examining the effect of resistance training on plasma apelin was not found.

The results of the present study also showed that after eight- week endurance training, plasma apelin levels were not significant despite the increase. Also, the results of the present study showed that after eight- week endurance training, blood pressure levels were significant despite the decrease.

Table 2. Intragroup and intergroup changes in plasma apelin values and blood pressure

Variable	Group	Average ± Standard deviation		Intragroup changes		Intergroup changes	
		Pre-test	Post-test	F	Significance level	F	Significance level
Plasma apelin	Resistance	51.48±15	51.78±10.68	0.137	0.719	414.141	0.008*
	Endurance	47.18±4.29	48.11±2.78				
Blood pressure	Resistance	12.42±1.27	11.14±1.34	132.30	0.002*	1315.137	0.001*
	Endurance	13±1.41	11.28±0.95				

*Significance level ($P<0.05$) is considered

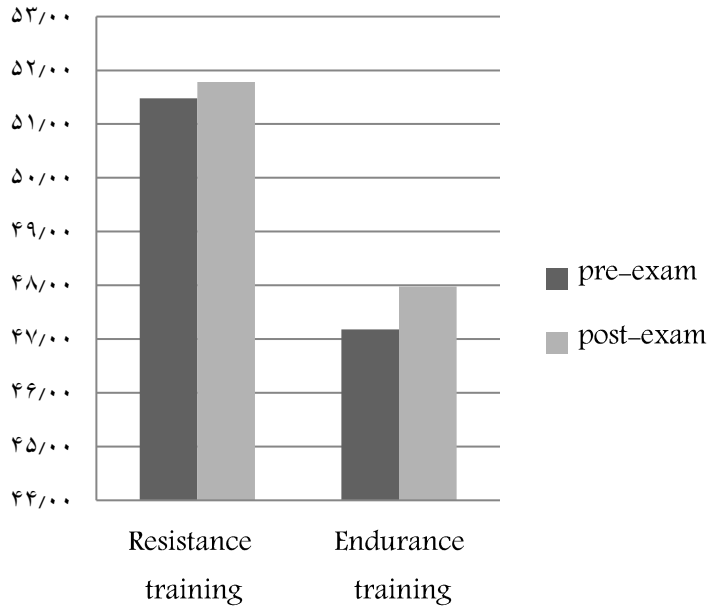

Figure 1. A comparison of eight- week resistance and endurance exercise program on levels of plasma apelin in obese postmenopausal women

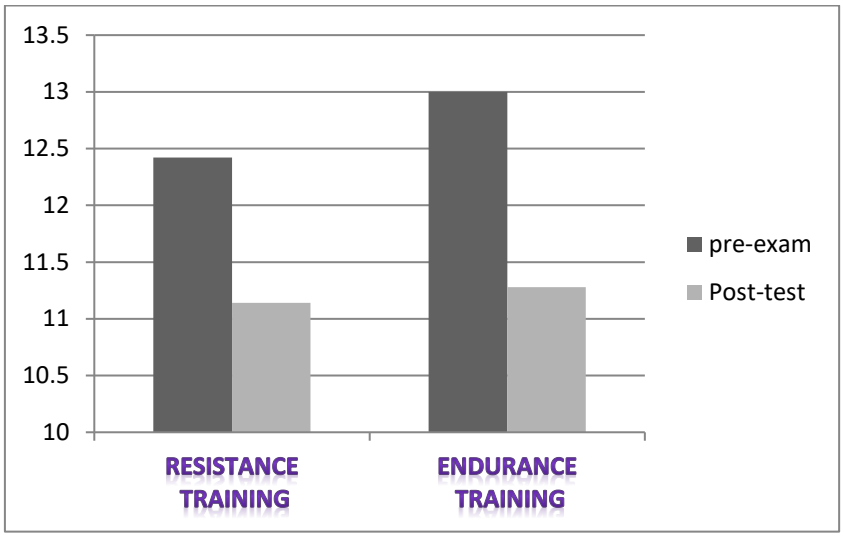

Figure 2. A comparison of eight-week resistance and endurance exercise program on blood pressure in obese postmenopausal women

Chen et al. (2012) showed that four-week swimming training increased applause and decreased blood pressure in male rats [10]. Zhang et al. (2006) showed that nine- week swimming training reduced systolic blood pressure and increases apelin and APJ in hypertensive mice [17]. Larry et al. (2014) Showed that 12- week aerobic exercise increases apelin in obese elderly women with hypertension [18]. Kazemi et al (2014) showed that six-week aerobic exercise increases plasma apelin concentration and decreases plasma glucose and insulin [12]. Shaibani et al. (2012) showed that rast training significantly reduces plasma apelin in female runners [7].

In the present study, plasma apelin levels in both groups were not significant despite the increase, but blood pressure in both groups showed a significant decrease which was in line with the research of Nikolaos et al. (2012) [9], Chen et al. (2012) [10], Zhang et al. (2006) [17] and Larry et al. (2014) [18].

4. Conclusions

According to the results of the study, it cannot be said conclusively that eight- week resistance training has no effect on plasma apelin in obese postmenopausal women. Eight- week resistance training significantly reduces blood pressure in obese postmenopausal women.

Due to little research, the effect of endurance training and lack of research on resistance training on plasma apelin is suggested. It is suggested that more research should be done on this hormone with different intensities in different groups of society.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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Referensces

[1] Orsatti FL, Naha EAP, Maesta N, Nahas-Neto J, Burini RC. "Plasma hormones, muscle mass and strength in resistance-trained postmenopausal women". *Maturitas*. 2008; 59: 394–-404. pmid 18499368.

[2] Copeland JL, Chu Samuel Y, Tremblay MS. "Aging, physical activity, and hormones in waomen-A review". *Journal of Aging and Physical Activity*. 2004; 11: 101-116. pmid 15211024.

[3] Zhong J.C, Huang D.Y, Liu G.F, Jin H.Y, Yang Y.M, Li Y.F, et al. "Effects of all-trans retinoic acid on orphan receptor APJ signaling in spontaneously hypertensive rats". *Cardiovascular Research*. 2005; 65 (3): 743-–750. pmid 15664402.

[4] Sotoudeh G, Khosravi S, Khajehnasiri F, Khalkhali HR. "High prevalence of overweight and obesity in women of Islamshahr, Iran". *Asia Pac J Clin Nutr*. 2005; 14(2): 169-72. pmid 15927935.

[5] Crampes F, Marion-Latard F, Zakaroff-Girard A, Glisezinski I, Harant I, Thalamas C, et al. "Effects of a longitudinal training program on responses to exercise in overweight men". *Obesity Research*. 2003; 11(2): 247-56. pmid 12582221.

[6] Tatemoto K, Hosoya M, Habata Y, Fujii R, Kakegawa T, Zou M-X, et al. "Isolation and characterization of a novel endogenous peptide ligand for the human APJ receptor*". Biochemical and Biophysical Research Communications*. 1998; 251(2): 471-6. pmid 9792798.

[7] Shaibani Sh, Shemshaki A, Hanachi P. "The effect of rast exercise on plasma levels of apelin and blood pressure in elite women runner". *Qom University of Medical Sciences Journal*. 2012; 6(3). pmid 22254245.

[8] Hida K, Wada J, Eguchi J, Zhang H, Baba M, Seida A, et al. "Visceral adipose tissue-derived serine protease inhibitor: a unique insulinsensitizing adipocytokine in obesity". *National Academy of Sciences of the United States of America*. 2005; 102(30): 10610-5. pmid16030142.

[9] Nikolaos PE.K, Ioannis S. V, Alkistis K, Stilianos L, Nikolaos S, Alkiviadis K, et al. "The impact of aerobic exercise training on novel adipokines, apelin and ghrelin, in patients with type 2 diabetes" *Medical Science Monitor*. 2012; 18(5): CR290-5. pmid 22534708.

[10] Chen S, Xue F, Jin HL, Chen L, Chen Y, Wang GF, et al. "Effect of swimming exercise on the expression of apelin and its receptor in pulmonary tissues of rats with hypoxic pulmonary hypertension". *Circulation*. 2012; 28(1): 5-8. pmid 22493882.

[11] Jing Zh , Cai X.R, Yong F.Q, Li X.L , Li Ch, Li K.Zh, et al. "Exercise training promotes expression of and physical activity for older adults". *Medicine & Science in Sports & Exercise*. 2009; 41(7): 1510-30. pmid 19516148.

[12] Kazemi F, Ebrahim K, Zahedi Asl S. "Effects of aerobic training on plasma concentration of apelin and insulin resistance in type 2 diabetic rats". *Medical Journal of Tabriz University of Medical Sciences and Health Services*. 2014; 36(3): 62-67. pmid 24691254.

[13] Aghdasi M. Major protests and The Treatment of heart disease. Esharat; 348.

[14] Harison. *Harrison Principles of Internal Medicine: Cardiovascular Disease*. Tarbiat Translation. Tehran: Publication of Noore Danesh; 2006 [in Persian]

[15] Vasan RS, Beiser A, Seshadri S, Larson MG, Kannel WB, et al. "Residual lifetime risk for developing hypertension in middle-aged women and men: the framingham heart study". *JAMA*. 2002; 287: 1003-1010.

[16] Stamler J, Stamler R, Neaton JD. "Blood pressure, systolic and diastolic, and cardiovascular risks: US population data". *Arch Intern Med*. 1993; 153: 598-615.

[17] Zhang J, Ren CX, Qi YF, Lou LX, Chen L, Zhang LK, et al. "Exercise training promotes

expression of apelin and APJ of cardiovascular tissues in spontaneously hypertensive rats". *Life Sciences*. 2006; 79(12): 1153-9. pmid 16674982.

[18] Larry Z, Daryanosh F, Koushki M, Mohammadi M, et al. "The effect of 12 weeks of aerobic training on apelin, omentin and serum glucose levels in obese elderly women diagnosed with type 2*". Journal of Arak University of Medical Sciences.* 2014; 17(4): 1-10.