EFFECT OF 8 WEEKS OF AEROBIC ON BODY COMPOSITION AND BLOOD PRESSURE IN POSTMENOPAUSAL WOMEN

Shahram Gholamrezai[1], Mina Zali[1], Ramin Shabani[1], Rastegar Hoseini[2]
Islamic Azad University, Rasht, Iran[1]
University of Guilan, Rasht, Iran[2]

Annotation. *Aim:* Nowadays increasing blood pressure is the most important risk factor of coronary, cerebral and renal vessel diseases. Epidemiological studies indicate that Physical inactivity adversely affects the blood pressure in postmenopausal women. The purpose of this study was to determine the impact of aerobic on body composition and blood pressure in postmenopausal women. *Methods:* 20 healthy postmenopausal women with similar age and weight were randomly devided in intervention and control groups. Subjects completed an informed consent form and health history questionnaire. The intervention group was trained in an aerobic exercise program for 8 weeks (3 sessions weekly). Weight, body fat percentage (BF%), body mass index (BMI), waist to hip ratio (WHR), Lean body mass and blood pressure (BP) were measured in the beginning and the end of the study for all of the subjects. Data were analyzed by the Paired t-test and independent t- test. *Results:* The results showed that BF% , WHR, BMI decreased and Lean body mass increased significantly in training group after 8 weeks training (P<0.05), while BF% significantly increased in control group. The results show that resting systolic BP (SBP) and diastolic BP (SBP) decreased following both training modes; while it remained unchanged in control subjects (p>0.05). *Conclusions:* It seems that a period of aerobic training for 8 weeks can be effective as a non-pharmacological treatment strategy for improvement some physical fitness and body composition indexes, blood pressure in postmenopausal women.
Key words: aerobic, training, blood pressure, women, postmenopausal.

Introduction

As medical technologies have developed in modern society, average human life span has been gradually extended and mortality rate has been decreased, so the number of old people is increasing worldwide (Hyung and Kim., 2001). As a result, issues in aging of population along with maintaining the quality of life have become serious problems (Hong et al., 2005). The proportion that the elderly population takes is rapidly increasing in Iran.

In this population, there is a higher observed prevalence of chronic diseases such as hypertension (Nesterov et al., 2009); especially in women. Currently, it is estimated that among postmenopausal women, the prevalence of hypertension may reach 80%. (De Lyra Júnior at al., 2006). The treatment of hypertension includes pharmacological and nonpharmacological interventions (Bacon et al., 2004; Roberts et al., 2002). Among the nonpharmacological interventions, regular exercise has been recommended in the prevention (Cornelissen et al., 2010). Among the principal physiological benefits of physical training in hypertensive patients are reductions in heart rate (HR) and peripheral vascular resistance (Collier et al., 2008). These factors are related to the fall of systolic and diastolic blood pressure (BP) (MacDonald et al., 1999). In addition to improvements in BP, aerobic training is associated with a reduction of Weight, body fat percentage (BF%), body mass index (BMI) and waist to hip ratio (WHR), which often is above the reference values in hypertensive subjects (Ferrara et al., 2002).

The efficacy of aerobic exercise for lowering blood pressure (BP) in postmenopausal women, especially those with only modest BP elevations, has not been established. Importantly, aerobic exercise training often results in increases in maximal aerobic capacity and reductions in body weight. Because maximal aerobic exercise capacity and body weight are independently associated with BP in humans (Blau et al., 1984; McGowan et al., 2006); at least some of the BP-lowering influence of regular exercise in a particular population may be related to these factors rather than to a primary effect of exercise per se (Fagard., 2006).

However, there are controversies about the effects of regular exercises compared with the studies on blood pressure. Beside the studies reporting that there have been positive developments in the blood pressure as a result of acute exercise (Berg et al., 1983; Foger et al., 1994), there are also studies stating that there have been improvements as a result of not acute but long term exercises (Sucic and Oreskovic 1995; Yanagibori et al., 1993).

The effects of aerobic exercise training on cardiovascular and metabolic parameters in hypertensive postmenopausal women remain unclear and controversial. Some studies indicate beneficial effects (MacDonald et al., 1999; Moraes et al., 2011); and others report no significant changes (Church et al., 2007; Stewart et al., 2005). These effects seem to depend on duration, intensity, and frequency of the exercise (Moraes et al., 2011; Manson et al., 2002).

This study aimed to evaluate the effects of 8 weeks of aerobic on body composition and blood pressure in postmenopausal women.

Materials and methods

Subjects

The target population consisted entirely of postmenopausal women in city of Rasht in Iran. Among them 20 healthy postmenopausal women with similar age and weight were randomly dшvided into intervention and control groups. Also, none of the subjects were taking any medication, including antihypertensives or aspirin, and all were non-

doi:10.15561/20755279.2014.0514

smokers. The condition of the study was thoroughly explained to all subjects, and written informed consent was subsequently obtained. The protocol was approved by the Ethics Committee of Islamic Azad University Rasht Branch, Guilan, Iran.

Anthropometrics

Whole-body plethysmography (Bod Pod; Life Mea-surement Inc., Concord, CA, USA) was used to assess body composition (Katch et al. 1967), and body weight was measured using the Bod Pod scale. Height was measured using a stadiometer to the nearest 0.5 cm, and body mass index was calculated as weight (kg) per height ^{2}(m^2).

Haemodynamic monitoring

Blood pressure was measured by a trained investigator by standard sphygmomanometry following a quiet rest for 15 min in the supine position. SBP and DBP were measured manually at the brachial artery after the resting period and at the start of each testing session using the first and fifth Korotkoff sounds, according to American Heart Association standards (Kirkendall et al. 1981).

Exercise training

The exercise group participated in an 8 week supervised aerobic exercise program. The exercise group trained for 50 min/day, and the program was composed of 3 steps: warm-up for 10 min, aerobic exercises for 30 min (which consisted of treadmill running for 30 min at intensity of 60–80% of their heart rate reserve (HRR)), and cool down for 10 min. The exercise group trained for 3 day/week for 8 weeks, while the control group was asked to maintain their normal sedentary activities..Exercise intensity was monitored during the training sessions by using a Polar real time system (Polar S610, Finland).

Statistical Analysis

SPSW statistical software (version 18) was used to analyze. Both descriptive (mean and standard deviation) and inferential statistical were used to analyze the data Paired t-test and independent t- test.

Results

Subjects

Subject age data are present in table 1. The results showed that BF% , WHR, BMI decreased and Lean body mass increased significantly in training group after 8 weeks training (P<0.05), while BF% significantly increased in control group. The results show that resting systolic BP (SBP): RE, pre 13.10±1.52 vs post 11.40±1.26; CG, pre 12.60±0.96 vs post 12.60±1.34 mm Hg, P=0.001; and resting diastolic BP (DBP): RE, pre 8.10±0.99 vs post 7.60±1.03; CG, pre 8±0.47 vs post 8.60±0.23 mm Hg, P=0.035; decreased following both training modes; while it remained unchanged in control subjects (P>0.05).

Table 1

Subject characteristics

	Aerobic exercise (AE)	Control group (CG)
Age	52.50±3.83	51.40±3.06

Table 2

Changes in body composition and blood pressure after aerobic exercise for 8 weeks

Items	Exercise	Pre-exercise	Post-exercise	Paired t-test	P Value	Independent t-tests	P Value
BMI, kg/m2	**Exercise**	30.56±3.41	29.27±2.33	3.26	0.01*	2.10	0.002*
	Control	29.27±2.33	29.37±2.30	-2.96	0.64		
WHR	**Exercise**	0.91±0.10	0.87±0.04	1.25	0.02*	1.18	0.003*
	Control	0.91±0.10	0.92±0.9	-1.87	0.45		
Muscle mass, kg	**Exercise**	0.67±0.03	0.71±0.02	-0.041	0.02*	1.37	0.03*
	Control	0.672±0.02	0.673±0.02	1.15	0.27		
Body Fat, %	**Exercise**	32.72±3.63	28.52±2.72	3.15	0.01*	1.07	0.04*
	Control	32.61±2.52	32.77±2.53	-1.15	0.27		
SBP (mmHg)	**Exercise**	13.10±1.52	11.40±1.26	3.28	0.01*	3.55	0.001*
	Control	12.60±0.96	12.60±1.34	0.00	1.00		
DBP (mmHg)	**Exercise**	8.10±0.99	7.60±1.03	1.23	0.05*	1.94	0.035*
	Control	8±0.47	8.60±0.23	-1.32	0.22		

BMI; Body mass index/** *P*<0.01; Tested by dependent and Independent t-tests

Discussion

Epidemiologic studies have shown that sedentary life relates to the increases of age and heart disease. Obesity is one of the factors that cause heart disease. Beneficial effects of aerobic training programs on body composition and blood pressure have been evaluated. In the current study, BMI and fitness were both independently associated with the risk of hypertension. The results showed that BF% , WHR, BMI decreased and Lean body mass increased significantly in training group after 8 weeks training (P<0.05), while BF% significantly increased in control group. Saavedra et al., (2007), applied water aerobics on healthy 43.1 ± 9.7 years old middle-aged females twice a week for 8 months. They established that the values of the last tests of BW and BFP after 8-month exercise were significantly different from the initial tests and positive in favor of the final tests (Saavedra et al., 2007). Kafkas et al., (2009), are of the opinion that12-week regular aerobic and stress exercises have positive effects on BW, BMI, BFP, WHR and blood pressure (Kafkas et al., 2009). Pressue et al., (1997), have found in their study carried out on 97 sedentary male-female subjects that regular aerobic exercises have positive effects on BMI and BFP (Pressue et al., 1997).

Based on previous studies, Aerobic exercise, adds up the exercise capability of your body to use fat as a substrate increases and total fat oxidation during. In addition, there is a high correlation between the content within the muscle and insulin resistance. It may be suggested that the body mass increases due to increased blood flow and capillary in skeletal muscle and adipose tissue. Lipolyze triacylglycerol is high, and the transfer of fatty acids from blood to muscle sarcoplasm is high; these are the effects on fat during exercise and these effects support by activation of certain enzymes in the oxidative pathway, supports this process. Aerobic exercise activates lipoprotein lipase and increased lipoprotein lipase (LPL) activity may play an important role in reducing insulin resistance during exercise (Irving et al., 2008; Fenkci et al., 2006). Elderly women have increased pulse and blood pressure compare to young people. However, exercise decreases the blood pressure and gives positive effects (Jeon et al., 2010). During exercise, changes in blood pressure is due to the activation of sympathetic nerves and the reduction of parasympathetic nerve stimulation which causes increase in the systolic pressure but the diastolic pressure maintains it's level. However, exercise causes drops in both systolic and diastolic pressure (Martynov, 2007).The results show that resting systolic BP (SBP): RE, pre 13.10±1.52 vs post 11.40±1.26; CG, pre 12.60±0.96 vs post 12.60±1.34 mm Hg, P=0.001; and resting diastolic BP (DBP): RE, pre 8.10±0.99 vs post 7.60±1.03; CG, pre 8±0.47 vs post 8.60±0.23 mm Hg, P=0.035; decreased following both training modes; while it remained unchanged in control subjects (P>0.05).

Our findings are similar to those reported in the Heritage family study,26 which showed small changes (o3mmHg) in resting SBP and DBP in normotensive to mildly hypertensive subjects following a longer and progressively more intense training programme (20 weeks, 55–75% VO2max) (Wilmore et al., 2001). Hagberg et al., (1989), also demonstrated a decrease in SBP (20mmHg) in hypertensive men following 9 months of low- to moderate-intensity aerobic training, with a concomitant decrease in DBP (11–12mmHg) (Hagberg et al., 1989). Fagard, (2006), who has shown that AE decreases in BP in normotensives of _3.0 (SBP)mmHg and _2.4 (DBP)mmHg with even greater reductions in resting BP in hypertensives (_6.9 and _4.9mmHg in SBP and DBP, respectively) (Fagard., 2006). One previous study reported that 4 months of endurance training in middle-aged men resulted in no changes in resting SBP and o5mmHg decrease in resting DBP. Our results support these earlier studies (Hagberg et al., 1989; McGowan et al., 2006)

Clarkson et al., (1999), indicated that endothelium-dependent dilation in young men enhanced by aerobic exercise training was beneficial in preventing CV Diseases. These exercises maintain a high level of fitness, prevent age-related decline of microvascular NO-mediated vasodilator function, the higher levels of NO confer anti-atherogenic benefit and prevent microvascular dysfunction in humans (Clarkson et al., 1999). It is worth mentioning that regular moderate intensity exercise can be used to improve metabolic risk factors such as insulin and leptin levels in overweight/obese postmenopausal women (Frank et al., 2005). Furthermore, exercise per se has been shown to be an important factor in the reduction of hypertension by decreasing the elevated activity of the sympathetic nervous system (SNS). According to Mueller, exercise may reduce the resting blood pressure and sympathetic outflow even in normal individuals (Mueller, 2007). It is important to point out that almost two decades ago two cohort studies also demonstrated that regular physical activity prevents the development of hypertension, moreover it has been found to lower the blood pressure in hypertensive individuals (Greenland et al., 2010; Vianna et al., 2012).

Aerobic exercise training promotes the reduction of risk factors of cardiovascular diseases in postmenopausal obese hypertensive women. Results of this work can be employed by clinicians to help postmenopausal women to overcome the increased risk of morbidities associated with menopause.

Conclusion

Based on these finding, it seems that a period of aerobic training for 8 weeks can be effective as a non-pharmacological treatment strategy for improvement some physical fitness and body composition indexes, blood pressure in postmenopausal women. Furthermore, there is a need for appropriate health education emphasizing the importance of cardiovascular health at this level of education.

Acknowledgement

The authors would like to thank the postmenopausal women for their willing participation in this study.

References

1. Bacon S.L., Sherwood A., Hinderlite A., & Blumenthal J.A. Effects of exercise, diet and weight loss on high blood pressure. *Sports Medicine*. 2004, vol.34, pp. 307-316.
2. Berg A., John J., & Baumstalk M. Change on HDL subfractions after a single extended episode of physicalexercise. *Atherosclerosis1*. 1983, vol.47, pp. 231-240.
3. Blau S.N., Goodyear N.N., & Gibbons L.W. Cooper KH Physlcal lirncss and mcldcnce of hypenensmn in healthy normo~nwe men and women. *JAMA*. 1984, vol.252, pp. 487-490.
4. Church S.T., Earnest C.P., Skinner J.S., & Blair S.N. Effects of different doses of physical activity on cardiorespiratory fitness among sedentary, overweight or obese postmenopausal women with elevated blood pressure: A randomized controlled trial. *JAMA*. 2007, vol. 297, pp. 2081-2091.
5. Clarkson P., Montgomery H.E., Mullen M.J., Donald A.E., Powe A.J., & Bull T. Exercise training enhances endothelial function in young men. *Journal of the American College of Cardiology*. 1999, vol.33(5), pp. 1379-1385.

6. Collier S.R., Kanaley J.A., Carhart R.J.R., Frechette V., Tobin M.M., & Hall A.K. Effect of 4 weeks of aerobic or resistance exercise training on arterial stiffness, blood flow and blood pressure in pre- and stage-1 hypertensives. *Journal of Human Hypertension*. 2008, vol.22, pp. 678-686.
7. Cornelissen V.A., Verheyden B., Aubert A.E., & Fagard R.H. Effects of aerobic training intensity on resting, exercise and post-exercise blood pressure, heart rate and heart-rate variability. *Journal of Human Hypertension*. 2010, vol.24, pp. 175-182.
8. De Lyra Júnior D.P., Do Amaral R.T., Veiga E.V., Cárnio E.C., Nogueira M.S., & Pelá I.R. Pharmacotherapy in the elderly: A review about the multidisciplinary team approach in systemic arterial hypertension control. *Rev Lat Am Enfermagem*. 2006, vol.14, pp.435-41.
9. Fagard R. Exercise is good for your blood pressure: effects of endurance training and resistance training. *Clin Exp Pharmacol Physiol*. 2006, vol.33, pp.853–856.
10. Fenkci S., Sarsan A., Rota S., & Ardic F. Effects of resistance or aerobic exercises on metabolic parameters in obese women who are not on a diet.Adv Ther. 2006, vol.23, pp.404–13.
11. Ferrara L.A., Guida L., Iannuzzi R., Celentano A., & Lionello F. Serum cholesterol affects blood pressure regulation. *Journal of Human Hypertension*. 2002, vol.16, pp.337-43.
12. Foger B., Wohlfarter T., Ristch A., Lechleitner M., Miller C.H., & Patsch J.R. Kinetics of lipids, apolipoproteins, and cholesterol ester transfer protein in plasma after a bicyle marathon. *Metabolism*. 1994, vol.43, pp. 633-639.
13. Frank L.L., Sorensen B.E., Yasui Y., Tworoger S.S., Schwartz R.S., & Ulrich C.M. Effects of exercise on metabolic risk variables in overweight postmenopausal women: a randomized clinical trial. *Obesity Research*. 2005, vol.13(3), pp. 615-625.
14. Greenland P., Alpert J.S., Beller G.A., Benjamin E.J., Budoff M.J., & Fayad Z.A. Guideline for assessment of cardiovascular risk in asymptomatic adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2010, vol.122(25), pp. 584-636.
15. Hagberg J.M., Montain S.J., Martin III W.H., & Ehsani A.A. Effect of exercise training in 60- to 69-year-old persons with essential hypertension. *American Journal of Cardiology*1989, vol.64, pp. 348–353.
16. Hong Y.J., Lee S.M., Jo Y.H., & Kang S.Y. The study on exercise and quality of life for elderly female. *Korean Physical Education Association for Girls and Women*. 2005, vol.19(3), pp. 97-105.
17. Hyung H.K., & Kim H.S. The effect of brisk walking exercise program on body composition, blood pressure, blood glucose and blood lipid for middle-aged woman with obesity. *Society of Biological Nursing Science*. 2001, vol.3(1), pp. 11-28.
18. Irving B.A., Davis C.K., Brock D.W., Weltman J.Y., Swift D., & Barrett E.J. Effect of exercise training intensity on abdominal visceral fat and body composition. *Medicine & Science in Sports & Exercise*. 2008, vol.40, pp.1863–1872.
19. Jeon J.G., Lee W.R., Park H.G., Yoon A.R., Joung S.H., & Lee Y.R. Effects of water exercise program for 24 weeks on the body composition, health related fitness, and quality of life in elders. *Journal of Physical Education and Sport Science*. 2010, vol,12(3), pp. 25-33.
20. Kafkas M.E., Açak M., & Karademir T. *Education and Sports Sciences Journal*. 2009, vol.3, pp. 3-8.
21. Katch F., Michael E.D., & Horvath S.M. Estimation of body volume by underwater weighing: description of a simple method. *Journal of Applied Physiology*. 1967, vol.23, pp. 811–813.
22. Kirkendall W.M., Feinleib M., Freis E.D., & Mark A.L. Recommendations for human blood pressure determi-nation by sphygmomanometers. Subcommittee of the AHA Postgraduate Education Committee. *Stroke*.1981, vol.12, pp. 555–564.
23. MacDonald J., MacDougall J., & Hogben C. The effects of exercise intensity on post-exercise hypotension. *Journal of Human Hypertension*. 1999, vol.13, pp. 527-531.
24. Manson J.E., Greenland P., LaCroix A.Z., Stefanick M.L., Mouton C.P., & Oberman A. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. *New England Journal of Medicine*. 2002, vol.347, pp. 716-725.
25. Martynov A.I. New features assess arterial stiffness - early marker for cardiovascular disease. *Publishing House-Russian Doctor*. 2007, vol.8, pp. 43-48.
26. McGowan C.L., Levy, A.S., Millar P.J., Guzman J.C., Morillo C.A., McCartney, N., & MacDonald M. J. Acute vascular responses to isometric handgrip exercise and effects of training in persons medicated for hypertension. *American Journal of Physiology - Heart and Circulatory Physiology*. 2006, vol.291, pp.1797–1802.
27. Moraes M.R., Bacurau R.F., Simões H.G., Campbell C.S., Pudo M.A., & Wasinski F. Effect of 12 weeks of resistance exercise on post-exercise hypotension in stage 1 hypertensive individuals. *Journal of Human Hypertension*. 2011, vol,26(9), pp. 533-539.
28. Mueller P.J. Exercise training and sympathetic nervous system activity: evidence for physical activity dependent neural plasticity. *Clinical and experimental pharmacology & physiology*. 2007, vol.34(4), pp. 377-384.
29. Nesterov V.P., Burdygin A.I., Nesterov S.V., Filenko S.A., & Tsygvintsev S.N. Age-related peculiarities of dynamic structure of wave of the human blood arterial pressure. *Zhurnal evoliutsionnoi biokhimii i fiziologii*. 2009, vol.45, pp. 505-510.
30. Pérusse L., Collier G., Gagnon J., Leon S.A., Rao C.D., & Skinner S.J. Acute and chronic effects of exercise on leptin levels in humans. *Journal of Applied Physiology*. 1997, vol, 83(1), pp. 5–10.

31. Roberts C.K., Vaziri N.D., & Barnard R.J. Effect of diet and exercise intervention on blood pressure, insulin, oxidative stress, and nitric oxide availability. *Circulation*. 2002, vol.106, pp. 2530-2532.
32. Saavedra J.M., De L.A., Cruz E., Escalante Y., & Rodriguez AF. Influence of a medium-impact aquaerobic program on health-related quality of life and fitness level in healthy adult females. *Journal of Sports Medicine and Physical Fitness*. 2007, vol.47(10), pp. 468–474.
33. Stewart K.J., Bacher A.C., Turner K.L., Fleg J.L., Hees P.S., & Shapiro E.P. Effect of exercise on blood pressure in older persons: A randomized controlled trial. *Archives of Internal Medicine*. 2005, vol.165, pp. 756-762.
34. Sucic m., & Oreskovi C. Effect of kinesiologic recretion on plasma lipoproteins and apolipoproteins in fertile women. *Metabolism*. 1995, vol. 44, pp. 701-704.
35. Vianna M.V.A, Cader S.A., Gomes A.L.M., Guimara˜es A.C., Silva I.A.S., Rego A.R., Adao K.D.S., & Dantas E.H.M. Aerobic conditioning, blood pressure (BP) and body mass index (BMI) of older participants of the Brazilian Family Health Program (FHP) after 16 weeks of guided physical activity. *Archives of Gerontology and Geriatrics*. 2012, vol.54, pp. 210–213.
36. Wilmore J.H., Stanforth P.R., Gagnon J., Rice T., Mandel S., & Leon A.S. Heart rate and blood pressure changes with endurance training: the HERITAGE Family Study. *Medicine & Science in Sports & Exercise*. 2001. vol.33, pp. 107–116.
37. Yanagibori R., Kawakubo K., Gurji A., Aoki K., & Miyoshita M. Effects of 12 week-exercise walking on serum lipids, lipoproteins and apolipoproteins in middle aged women: does menopause status influence training effects. *Nippon Koshu Eisei Zasshi*. 1993, vol.40, pp. 459-467.

Information about the authors:

Shahram Gholamrezai: ORCID: 0000-0002-1459-2647; Gholamrezaei@iaurasht.ac.ir; Islamic Azad University; PO Box: 8514143131, Rasht, Iran.

Mina Zali: ORCID: 0000-0002-4777-4738; mina_zali_1984@yahoo.com; Islamic Azad University; PO Box: 8514143131, Rasht, Iran.

Ramin Shabani: ORCID: 0000-0002-2681-3814; shabani_msn@yahoo.com; Islamic Azad University; PO Box: 8514143131, Rasht, Iran.

Rastegar Hoseini: ORCID: 0000-0001-8685-2471; Rastegar.Hoseini@gmail.com; University of Guilan; P.O. Box 1841, Rasht, Iran.

Cite this article as: Shahram Gholamrezai, Mina Zali, Ramin Shabani, Rastegar Hoseini. Effect of 8 weeks of aerobic on body composition and blood pressure in postmenopausal women. *Physical education of students,* 2014, vol.5, pp. 74-78. doi:10.15561/20755279.2014.0514

The electronic version of this article is the complete one and can be found online at: http://www.sportpedu.org.ua/html/arhive-e.html

Received: 25.06.2014
Published: 30.06.2014