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Effect of Endurance Exercise Training on Blood Pressure in Elderly Patients with Hypertension

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ABSTRACT: This study is conducted with the aim of investigating the effect of moderate physical activity (60% of maximal heart rate-MHR) on blood pressure in elderly people with hypertension. Hypertension is considered a modifiable risk factor for cardiovascular disease through physical activity. The purpose and significance of this study, was to investigate the role of exercise as an alternative therapy, since some patients exhibit sensitivity/intolerance to some drugs. Initially, 65 hypertensive males (average age = 49.7 years), (systolic blood pressure, SBP >140 mmHg and/or diastolic blood pressure, DBP>85 mmHg) and 25 hypertensive males as control group (average age = 50.3 years and systolic blood pressure, SBP >140 mmHg and/or diastolic blood pressure, DBP>85 mmHg) were selected. The subjects were divided based on their age, duration of disease, physical activity, and drug consumption. Then, blood pressure and heart rate (HR) were measured in all of the patients using sphygmomanometer (pre-test). The exercise sessions were consisted of warm up, aerobic activity and cool down (total duration 20 minutes for first session up to 55 minute in last session). At end of the 12thsession (mid-test) and final session (24thsession), blood pressure measured for last time (post-test). The control group was without any exercise during the study. The results were analyzed using t-test. Our results indicated that moderate physical activity was effective in lowering blood pressure by 6.4/5.6-mm Hg for SBP and 2.4/4.3-mm Hg for DBP in hypertensive patients, irrespective of age, duration of disease, and drug consumption (P<.005). the control group indicate no changes in BP. Physical activity programs with moderate intensity (approximately at 60% MHR), three days per week, can be used not only as a preventive measure for diastolic hypertension (DBP>90 mmHg high blood pressure), but also as an alternative to drug therapy in the treatment of hypertension, as well.

Keywords: Hypertension, endurance exercise, elderly patients

INTRODUCTION

The increasing urbanization of modern society has led to profound changes in behavior, in particular a growing trend towards sedentary lifestyles. It is estimated that children nowadays expend 600kcal/day less in physical activity than their counterparts 50 years ago [1]. However, there is clear evidence of an inverse dose-response relation between total quantity and intensity of exercise and cardiovascular mortality, in both healthy individuals and in those with cardiovascular disease (CVD) [2, 3]. It is important to differentiate physical activity from exercise and sports [4]. The definition of them showed in Table 1, but all three are useful at all stages of the natural history of CVD.

Table 1: Key concepts.

Physical activity	body movements resulting in contraction of skeletal muscle, increasing energy expenditure above baseline levels
Exercise	planned, structured and repetitive body movements, for a specific purpose
Sport	activity requiring a range of physical abilities and vigorous physical exercise

Exercise therapy is recommended in all the main clinical guidelines on CVD [5, 6, and 7] and if properly implemented, it also has beneficial effects on risk factors for CVD, including hypertension, dyslipidemia, insulin resistance, obesity, and inflammation [8, 9]. In the case of hypertension in particular, the contribution of non-pharmacological treatment is central to reducing cardiovascular morbidity and mortality. This article reviews the mechanisms of the response to exercise and its modulators, the main benefits and risks involved guidelines for prescribing exercise in hypertensive people. High blood pressure is a serious public health challenge worldwide. Epidemiologic studies indicate that elevated blood pressure leads to stroke, coronary heart disease, congestive heart failure, and end-stage renal disease1. Clinical trials have demonstrated that lowering blood pressure reduces incidence of and death from cardiovascular disease [10, 11]. A sedentary lifestyle has been characterized as an independent risk factor for cardiovascular disease [12]. Studies have shown the inverse association between physical activity level and the incidence of cardiovascular diseases [13, 14 and 15]. Various mechanisms could be involved in the cardiovascular protective effects of physical activity, including improvement in endothelial function, a decrease in sympathetic neural activity and a reduction in arterial stiffness. Increased arterial stiffness has been associated with hypertension in elderly subjects [16, 17]. Regular physical activity is considered a cornerstone in the prevention and management of hypertension [18, 19]. Epidemiological studies indicate that greater physical activity or fitness is associated with a lower blood pressure (BP), and meta-analyses of randomized controlled trials have shown that chronic dynamic aerobic endurance training is able to reduce BP [19]. The exact amount and type of exercise that is best for BP control is not really known. However, scientific studies support that regular aerobic exercise reduces resting BP and also reduces BP during light exercise and daily activities. Additionally, aerobic exercise protects against developing hypertension in the future [20]. People can monitor their BP at home for extended periods. Specialists also sometimes monitor the BP continuously for 24 hours while the person goes about daily activities. The higher the BP due to the higher risk of cardiovascular disease, therefore, doctors prescribe medication and lifestyle changes (e.g. diet and exercise) for people with high BP to reduce the risk. Hypertension is described on a graded scale from mild to severe (see table below). A BP of 180 over 110 (or higher for either pressure) is classed as severe hypertension (grade 3). Classification of blood pressure for adults age 18 and older*

Table 2.

Blood Pressure Category	Systolic (mm Hg)	Diastolic (mm Hg)
Optimal †	<120	<80
Normal	<130	<85
High Normal	130-139	85-89
Hypertension ‡		
Stage 1(Mild)	140-159	90-99
Stage 2(Moderate)	160-179	100-109
Stage 3 (Severe)	≥180	≥110

MATERIALS AND METHODS

We studied 90 sedentary hypertensive male, this was a randomized, controlled trial to investigate the effects of endurance exercise training on blood pressure in elderly patients with hypertension. The subjects divided in two groups: 65 patients as Experimental Group (EG) diagnosed with hypertension for more than one past year, also 25 hypertensive male as control group (CG). All subjects underwent an exercise test to exclude electrocardiographic abnormalities. After 2 days, we performed PWV measurements by using a non-invasive device. The characteristics of the population are listed in Table 3. Subjects were eligible if they were an un medicated high normal Blood Pressure or stage 1 to 3 hypertension (mean clinic systolic BP [SBP] of 140-195 mm Hg and/or mean clinic DBP of 85-110 mm Hg on 4 separate occasions during a 3-week period). In addition, subjects were sedentary (not performing regular aerobic exercise) and overweight or obese of course many of subjects exclusion from study because they have problem to participate include history of cardiac disease, secondary hypertension, renal disease, atrioventricular conduction defects or high-grade arrhythmias, valvular disease, severe asthma or chronic obstructive pulmonary disease, diabetes requiring insulin or hypoglycemic agents, and orthopedic problems that would preclude participation in aerobic exercise.

Table 3: Subject's characteristics.

	Control	Experimental
Number of subjects	25	65
Age (years)	50±8	47±6
BMI (kgm_2)	28±4	29±5
Waist (cm)	92±12	91±10
W/H	0.88±0.07	0.87±0.06
PWV (ms_1)	10.15±1.66	10.23±1.82
Blood pressure		
Systolic	144±9	145±7
Diastolic	91±5	93±6

Abbreviations: BMI, Body Mass Index. PWV, pulse wave velocity; W/H, waist/hip.P>0.05 for all variables between groups.

Subjects exercised 3 times per week at a level of 60% to 70% of their initial HR reserve [21] determined at the time of the baseline treadmill test. The exercise routine consisted of (warm-up, aerobic exercise and cool-down)this exercise started with just 20 minutes in first session and then up to 55 minutes in last sessions (10 minutes of warm-up exercises, 35 minutes of cycle ergometry and walking and eventually jogging, and 10 minutes of cool-down exercises). Subjects were instructed in how to monitor their radial pulses, and maintained their HRs at, or above, their target HRs for at least 30 minutes. A trained exercise physiologist supervised all exercise sessions, and performed 2 to 3 random checks of HRs per session to ensure that subjects were exercising at a sufficient intensity. Subjects were instructed to maintain their usual diets. Blood pressure measurements were obtained by a trained technician with a random zero sphygmomanometer and were standardized for cuff size and position. Measurements were made on 3 separate visits include before training sessions(pre-test) and after the 12 sessions(mid-test) and finally in the end of the last training session (post-test). At each visit, BP was measured in the non-dominant arm in the sitting position 2 successive times at 2-minute intervals after an initial rest period of 5 minutes. The first BP measurement of each visit was discarded, and the average of the remaining 2 measurements represented the clinic visit BP.

RESULTS

Based on the results of the study and comparison of pre-test and post-test means revealed a significant difference among the experimental group (P<.005).

Planned contrasts revealed that treatment groups had significantly lower SBPs and DBPs compared with the controls. Participants exhibited an average 6.4 mm Hg reduction in clinic SBP and 2.4 mm Hg reduction for DBP and 0.8 mm Hg change for SBP and 0.3 mmHg reductions among control group. The results of this study also indicate weight loss among experimental group and indicate exercise alone is effective in reducing SBP and DBP, in addition Weight loss is caused the subjects are encouraged to do aerobic exercises. There were no statistically significant differences in the prevalence of uncontrolled hypertension according to, marital status, working status, smoking, duration of hypertension, and different types of medicines used to regulate blood pressure of the participants.

DISCUSSION

Over the past decade, the prevalence of hypertension remained stable or decreased in economically developed countries and increased in economically developing countries [22]. Fagard and co-workers in their article on effect of exercise on blood pressure control in hypertensive patients stated that exercise can be considered as a cornerstone therapy for the prevention, treatment, and control of hypertension [23]. Hagberg *et al.* on their review of 15 studies supported the recommendation that exercise training is an important initial or adjunctive step that is highly efficacious in the treatment of individuals with mild to moderate elevations in BP [24]. Previous investigations have demonstrated that low- to moderate-intensity exercise (35% to 79% of age-predicated maximum heart rate) is effective in lowering blood pressure [25, 26].

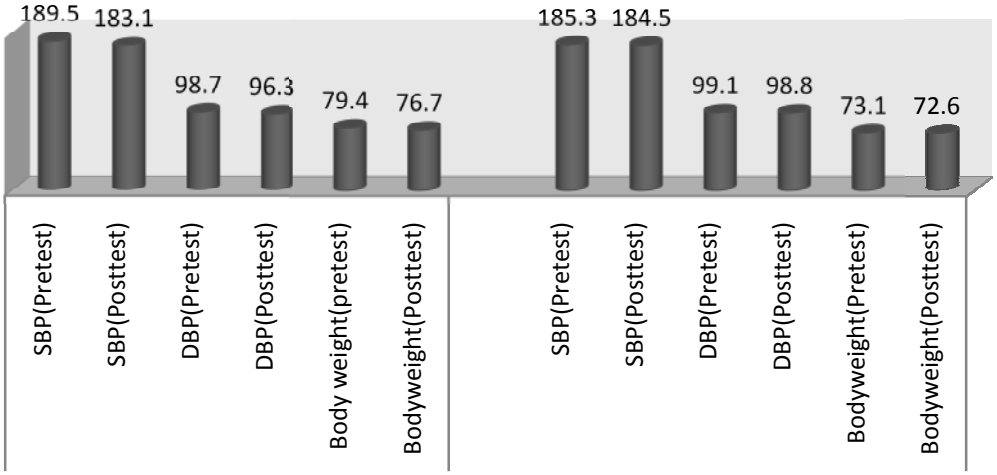

Fig. 1. The mean of blood pressure and body weight changes before and after exercise among EG and CG.

Our finding in this study showed that the aerobic exercise is of paramount importance as a strategy for prevention and treatment hypertension and its complications. It is now the time to consider physical activity as a therapy, and physicians should be trained to being capable of prescribing the appropriate dose of exercise, in terms of type, intensity and frequency, as if it were the dosage of a drug. Public health policies are mandatory to identify ways to enhance exercise prescription by physicians and adherence to training programs by patients. It is well known that aerobic exercise decreases blood pressure, mainly in the daytime. These blood pressure-lowering effects are more pronounced in hypertensive patients [27-30].

Therefore, the reduction of blood pressure by moderate- to low-intensity exercise intensities is particularly important for hypertensive patients. When compared to high intensity exercise, low-intensity exercise carries a lower risk for cardiac event [31].This important factor considered along with the low-cost, lack of pharmacological side effects, and additional cardiovascular benefits associated with exercise [32], are likely to increase patients' participation in exercise programs and lead to a better control of hypertension. Physical activity is considered as a natural, inexpensive, feasible, and effective means of control for hypertension and is a primary life style measure required to lower blood pressure in hypertensive patients. The present study suggests that exercise is associated with modest BP reductions, independent of weight loss, and patients achieve significant exercise-related BP reductions. Indeed, while changes in aerobic fitness were correlated with changes in and DBP, weight loss was even more highly correlated with SBP and DBP changes. These BP reductions are not only statistically significant but are clinically meaningful. In summary, the present findings suggest that exercise training alone is effective in reducing BP (SBP & DBP) also the exercise training can play a important role to weight loss. Our subjects of individuals with an elevated BP was relatively middle age (mean age, 49.7 years), educated (65% obtained a college degree), employed and receptive to nonpharmacological approaches to reduce BP. Those who affected by hypertension if set exercise to their daily program and 3 days in a week with the intensity of 60% - 70% of maximum heart rate with at least 45 minutes in each session do the aerobic exercise, their blood pressure efficiently reduce .Combining a program of exercise and weight loss is recommended for the management of overweight individuals with an elevated BP. Physical activity is considered as a natural, inexpensive, feasible, and effective means of control for hypertension and is a primary life style measure required to lower blood pressure in hypertensive patients. Finally, aerobic exercise is able to reduce in hypertensive patients [33]. Previous studies showed that patients with hypertension managed to reduce their blood pressure by about 6-10 mmHg through physical activity [34]. These results are similar to the reductions achieved in the current study. Applications of this study are simple and useful for prevention and treatment of hypertension. Further studies are clearly needed to better define the mechanisms involved in the blood pressure-lowering effect of exercise as well as to best define the more appropriate dose of exercise on an individual basis.

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