



## Effect of moderate physical activity on blood pressure in hypertensive patients

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Article published on August 24, 2013

**Key words:** Physical activity, blood pressure, hypertensive patients.

### Abstract

The purpose of this study was to measure the effects of moderate physical activity (60% of maximal heart rate-MHR) on the reduction of 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 12th session (mid-test) and final session (24th session), 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.

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**Introduction**

Hypertension is an important public health challenge in both economically developing and developed countries (Kearney *et al.*, 2004). Worldwide prevalence estimates for hypertension may be as much as 1 billion individuals, and approximately 7.1 million deaths per year may be attributable to hypertension. Many studies have reported a significant relationship between hypertension and risk factors such as age, body mass index, smoking and physical inactivity. Physical inactivity may be responsible for various chronic disease conditions including hypertension (Booth *et al.*, 2000). Hypertension is undoubtedly a multifactorial 'disease' and it is very unlikely that only one causal factor is involved. Its pathogenesis is based on the interaction between genetic and environmental/lifestyle factors. Genetic variance has been shown in family and twin studies, but the exact nature of the postulated genetic defect remains largely unknown. Environmental and lifestyle factors that have been invoked to explain an elevated blood pressure include sodium, alcohol and caloric intake, stress and physical inactivity. Many epidemiological studies have analysed the relationship between habitual physical activity or physical fitness and blood pressure, but the results are not quite consistent (Fagard *et al.*, 2000). A variety of lifestyle modifications have been shown in clinical trials to lower blood pressure. These include weight loss in the overweight (Leiter *et al.*, 1999), physical activity (Hagberg *et al.*, 2000), a diet with increased fresh fruits and vegetables and reduced saturated fat content (Sacks *et al.*, 2001), and reduction of dietary sodium intake (Sacks *et al.*, 2001; Whelton *et al.*, 1998). Regular physical activity is considered a cornerstone in the prevention and management of hypertension. (Chobanian *et al.*, 2003; European Society of Hypertension, 2003; Pescatello *et al.*, 2004) 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 (Pescatello *et al.*,

2004). 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 (Haskell, 2007). 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, the higher the risk of cardiovascular events. 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 1). A BP of 180 over 110 (or higher for either pressure) is classed as severe hypertension (grade 3).

**Table 1.** Classification of blood pressure for adults age 18 and older.

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

1997 JNC VI Classification of Blood Pressure

\*Not taking antihypertensive drugs and not acutely ill. When systolic and diastolic blood pressures fall into different categories, the higher category should be selected to classify the individual's blood pressure status. For example, 160/92 mm Hg should be classified as stage 2 hypertension, and 174/120 mm Hg should be classified as stage 3 hypertension. Isolated systolic hypertension is defined as SBP of 140 mm Hg or greater and DBP below 90 mm Hg and staged appropriately (e.g., 170/82 mm Hg is defined as stage 2 isolated systolic hypertension). In addition to classifying stages of hypertension on the basis of average blood pressure levels, clinicians should specify presence or absence of target organ disease

and additional risk factors. This specificity is important for risk classification and treatment.

†Optimal blood pressure with respect to cardiovascular risk is below 120/80 mm Hg. However, unusually low readings should be evaluated for clinical significance.

‡Based on the average of two or more readings taken at each of two or more visits after an initial screening. Quite often, a person's BP is higher when measured by a doctor than if measured at home, so called white coat hypertension. This effect is probably caused by anxiety associated with having BP measured by a doctor. For this reason, some experts recommend that the BP recorded by doctors should not be the only measurement used to manage patients with hypertension (Pickering, 2005). Usually, BP rises and falls as people go about their daily activities. During aerobic exercise (i.e. exercise for heart and lung fitness), systolic BP increases as the exercise intensity increases the heart works harder to pump more oxygenated blood to the muscles. At the same time, diastolic BP remains relatively stable and may even decrease slightly. On average, men have higher BP than women during aerobic exercise. Some people have an abnormal, extremely high spike in BP when they exercise (exercise hypertension), which is probably an early indicator of poorly controlled BP and, therefore, a higher risk of future problems. This should not be interpreted as 'exercise is bad for you', because this is definitely not true. Low BP during exercise may also signal serious heart disease and requires investigation. Regular physical activity is the first treatment recommended to lower BP and improve cardiovascular health, both in the general population and in those people with hypertension (National Heart Foundation of Australia, 2008; Sharman, 2008). Importantly, exercise is usually safe and beneficial whether or not BP-lowering (antihypertensive) medication is used. However, chest discomfort, irregular heart rhythm or abnormal breathlessness when exercising can indicate underlying heart disease and should be further

investigated. Also, people with a resting systolic BP of 180mmHg or more, or arresting diastolic BP of 110mmHg or more, should postpone their exercise program and seek medical advice.

### Materials and methods

An important question in this research was that if doing exercise reduces blood pressure or not? The Participants In this research are the member of employees and teachers of the Islamic Azad University of Karaj. Our study was carried out from October to December 2011 at Islamic Azad University in a random sample of 65 patients as Experimental Group (EG) diagnosed with hypertension for more than one past year. Also 25 hypertensive male as Control Group (CG). The subjects mean age was 49.7. Our subjects of individuals with an elevated BP was relatively middle age, educated (65% obtained a college degree), employed and receptive to nonpharmacological approaches to reduce BP. Subjects were eligible if they were an undedicated 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, alveolar disease, severe asthma or chronic obstructive pulmonary disease, diabetes requiring insulin or hypoglycemic agents, and orthopedic problems that would preclude participation in aerobic exercise. Subjects exercised 3 times per week at a level of 60% to 70% of their initial HR reserve (Karvonen *et al.*, 1957) 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 no 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.

**Table 2.** The mean of blood pressure change before and after exercise among EG and CG.

Variable	Exercise Time	Experimental Group	Control Group	Change EG	Change CG
Systolic Blood Pressure (SBP)	Before	189.5 mmHg	185.3 mmHg	6.4	0.8
	After	183.1 mmHg	184.5 mmHg		
Systolic Blood Pressure (SBP)	Before	98.7 mmHg	99.1mmHg	2.4	0.3
	After	96.3mmHg	98.8mmHg		
Body Weight	Before	79.4 Kg	73.1	2.7	0.5
	After	78.7 kg	72.6		

**Results**

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.

Over the past decade, the prevalence of hypertension remained stable or decreased in economically developed countries and increased in economically developing countries (Kearney *et al.*, 2004). World Health organization survey reported that blood pressure control is suboptimal in between half and two thirds of hypertensive patients in the majority of countries they surveyed in MONICA Project (Antikainen *et al.*, 2006). These results contrast with those of a previous study (Blumenthal *et al.*, 1991). There were many studies in the literature that reported the effect of physical activity on controlling hypertension. 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 (Fagard *et al.*, 2007).

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 (Hagberg *et al.*, 2000). In which exercise alone was not associated with significant BP reductions after 4 months of exercise training. The reasons for this discrepancy can be attributed to important methodological differences between the 2 studies. The results of the present study are comparable generally with findings from 3 other randomized clinical trials. In a Finnish study (Kukkonen *et al.*, 1982) of 34 normotensive men and 25 hypertensive men randomized to 4 months of either exercise or observation, the exercise and control groups had similar 8–mm Hg reductions in DBP, but exercise was associated with larger decreases in SBP.

In a study of 20 Japanese men with hypertension (Urata *et al.*, 1987) subjects who exercised for 10 weeks exhibited a 12/5–mm Hg BP reduction, whereas control subjects showed no change in BP. In a third study (Martin *et al.*, 1990) of 27 hypertensive men, exercisers exhibited a BP reduction from 137/95 to 130/85 mm Hg after 10 weeks, while the control group showed no change (135/94 to 136/94 mm Hg). Another article reported that lifestyle physical activity reduces systolic blood pressure in both pre- and hypertensive adults (Padilla *et al.*, 2005). The United States National High Blood Pressure Education Program Coordinating committee has recommended six approaches with proven efficacy for the primary prevention of hypertension. These interventions include weight loss, dietary sodium reduction, increased physical activity, potassium supplementation and modification of whole diets (Chobanian *et al.*, 2003). 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. Finally, aerobic exercise is able to reduce in hypertensive patients (Cardoso *et al.*, 2010). Previous studies showed that patients with hypertension managed to reduce their blood pressure by about 6-10 mmHg through physical activity (Von Känel, 2008). 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.

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