Effect of Physical Activities in Lowering Blood Pressure in Hypertensive Patients: The Case of Haramaya University Main Campus Employee, Ethiopia

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Abstract- Background: A variety of lifestyle modifications including weight loss in the overweight and regular aerobic physical activities have been shown in clinical trials to lower blood pressure in hypertensive patients. This study aims to investigate the effect of physical activities in lowering blood pressure in hypertensive patients subjected to consecutive physical activities training sessions. **Method:** A sample of 12 female hypertensive patients diagnosed with hypertension for more than one year were purposively selected from those hypertensive patients visited the primary care center for their regular follow up. A laboratory experiment was conducted in April, 2012 at Haramaya University Health Center. Patients whose systolic blood pressure reading < 180 mmHg, and diastolic blood pressure reading < 110 mmHg and heart rate reading <100 b/m were included in the study. Hematological and biochemical tests and systolic and diastolic blood pressure reading was employed for data collection. Data analysis was made using SPSS Version 15.0. **Result:** Physical activities training induced significant net weighted reductions in blood pressure readings by 17.00/11.08 mmHg (P<.0001), and resting heart rate by 15.58 b/m (P<.0001), and RBC count by 2.6 ml/cm^3 (P<.0001), body weight and BMI by 9.5 kg and 3.65 (P<.0001), respectively. In addition, training induced significant net weighted reductions in uric acid by 2.9 mg/dl (P<.0001), sodium by 30.67 mmol/l (P<.0001), potassium by 3.92 mmol/l (P<.0001), creatine by 0.57 mg/dl (P<.0001) and triglyceride by 71.98 mg/dl (P<.0001). Furthermore, physical activities training induced significant net weighted increment of hemoglobin by 3.43 g/d (P<.0001), WBC by 2.16 ml/cm^3 (P<.0057), platelet by 113.92 ml/cm^3 (P<.0001) and albumin by 0.38 g/l (P>0.05).

Conclusion: This study revealed that training from 3 – 5 times per week with an average of 4 times per week during 20 – 60 minutes per session with a mean session length of 40 minutes at intensity of 40% – 60% with a mean of 50% of net maximal oxygen uptake (VO_2max) physical activities training performance is recommended to lower blood pressure in hypertensive patients.

Index Terms- Blood pressure, aerobic physical activity, VO2max.

I. Introduction

Hypertension remains a major public health challenge in both economically developing and developed countries (1). 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 (2). It is the most widely recognized risk factor for cardiovascular disease (CVD), cerebrovascular disease and end-stage renal disease. The importance of treating this "silent killer" lies in its associated risk to cardiovascular disease, which is one of the cause of death in both economically developing and developed countries as well as other maladies including renal disease, stroke, heart failure, and peripheral artery disease (3).

Many studies have reported a significant relationship between hypertension and risk factors such as age, body mass index, smoking and physical inactivity (4). Physical inactivity may be responsible for various chronic disease conditions including hypertension. Hypertension therapy and medications are available that can control blood pressure with minimal side effects. Yet inadequate blood pressure control remains too common, contributing to excess cardiovascular morbidity and mortality. Prevention of hypertension by lifestyle modifications may be one of the ways to decrease the cardiovascular disease (CVD) population risk attributed to hypertension (5). A variety of lifestyle modifications such as weight loss in the overweight, increased physical activity, eating a diet with increased fresh fruits and vegetables and reduced saturated fat content, and reduction of dietary sodium intake plays a great role in lowering blood pressure in hypertensive patients (6). A prospective study from Finland in 2005 showed that overweight and obese subjects were associated with an increased risk of hypertension and the protective effect of physical activity was consistent in both overweight and normal weight subjects (7). There is no longer any question concerning the role of aerobic physical activity in controlling or lowering blood pressure in hypertensive patients (8). Health workers agree that regular aerobic physical activity is an important aspect of a healthy living beyond high blood pressure concerns. It makes the heart and blood vessels more flexible and efficient and prevents possible onset of high blood pressure for people who currently are not hypertensive. Thus, the flexibility of blood vessels and efficiency of the heart are at the center of blood pressure control, management and treatment (8). As pertains to which physical activity in particular, it is true that

not all types of physical activities are beneficial to lower blood pressure. Hypertensive patients need to focus on particular activities that benefit the heart and blood vessels. However, aerobic physical activities are what are recommended for hypertensive patients (9)**.** At the present time, most hypertensive patients are laden with overweight because of physical inactivity. Having overweight body particularly causes strain on an individual's heart which has the net effect of raising blood pressure. It therefore, follows that losing weight will lower blood pressure for people who are already hypertensive and prevents possible onset of high blood pressure for people who currently are not hypertensive (10)**.** The main aim of this study was to determine the effect of physical activities in lowering blood pressure in hypertensive patients subjected to consecutive physical activities training sessions.

II. METHODS

A laboratory experiment was conducted in April, 2012 at Haramaya University Health Center to investigate the effect of physical activities in lowering blood pressure in hypertensive patients subjected to consecutive aerobic physical activities training sessions. A sample of 12 female hypertensive patients were selected using purposive technique from those hypertensive patients visited the primary care center for their regular follow up. A laboratory experiment for hematological and biochemical tests and systolic and diastolic blood pressure and heart rate reading was employed for data collection. The physical activities mode for the treatment of hypertension was cardiovascular mode, for duration length of 20 - 60 minutes, frequency of 3 - 5 days per week, at intensity of 40 - 60% of net maximal oxygen uptake physical activity performance (VO_2max). Data analysis was made using SPSS Version 15.0. Ethical clearance was approved by Haramaya University Ethical Board. Client consent was taken and confidentiality was maintained.

III. OPERATIONAL DEFINITION

- **Blood pressure**: refers to the force exerted on the wall of the blood vessels by the blood as a result of contraction of the heart (systole) or relaxation of the heart (diastole).
- **Aerobic physical activity**: an activity performed by using oxygen.
- **VO_2max**: the largest amount of oxygen an individual use during physical activities.

IV. RESULT

A total of 12 female hypertensive patient of Haramaya University were participated. The response rate was 100%. Age of the study samples ranges from 45 to 60 years. All of the study samples were married 12 (100%). Physical activities training induced significant net weighted reductions in blood pressure readings by 17.00/11.08 mmHg (P<.0001), and resting heart rate by 15.58 b/m (P<.0001).

The results of the current study revealed that, participation of regular aerobic physical activities training resulted in weighted net decrease of body weight by 9.5 kg and body mass index (BMI) by 3.65 which had a major contribution in lowering blood pressure in hypertensive patients. Similarly, systolic, diastolic and heart rate readings resulted in average net reduction by 17.00 mmHg, 11.08 mmHg, and 16.58 b/m, respectively.

Furthermore, the results obtained clearly indicated that participation of moderate to high intensity (40% - 60% of net maximal oxygen uptake physical activity performance (VO_2max) with a mean of 50% VO_2max, frequency ranged from 3 – 5 times per week with an average of 4 times per week and duration per session varied from 20 – 60 minutes with a mean session length of 40 minutes) of regular aerobic physical activity training resulted in weighted net reduction of red blood cells (RBC) by 2.6 ml/cm^3, uric acid by 2.9 mg/dl, sodium by 30.67 mmol/l, potassium by 3.92mmol/l, Creatine by 0.57 mg/dl, triglyceride by 71.98 mg/dl, and weighted net increment of white blood cells (WBC) by 2.16 ml/cm^3, platelet by 113.92 ml/cm^3 and hemoglobin by 3.43 g/d and no significance difference (P>0.05) was observed on the level of albumin. The patient's hemoglobin count was significantly increased by 3.43 g/d (25.13%) within population normative range (12 - 17.4 g/d) throughout the whole study period. The patient's platelet count was significantly increased by 113.92 ml/cm^3 (44.97%) within population normative (150 - 400 ml/cm^3) throughout the whole study period.

Table 1. Mean effect of physical activities on changes of weight and BMI of hypertensive patients, HU, Eastern Ethiopia, 2012.

Parameters	Experiments			F Value	Pr > F
	Before	Between	After		
Weight (kg)	78.00	72.6 7	68.50	146.30	<.0001
Height (m)	1.61	1.61	1.61	6.09	<.0001
BMI	30.31	28.24	26.65	480.12	<.0001

HU = Haramaya University

Table 2. Mean effect of physical activities on changes of HB, RBC, WBC and platelets of hypertensive patients, HU, Eastern Ethiopia, 2012.

1. Parameters	2. Experiments			3. F Value	4. Pr > F
5.	6. Before	7. Between	8. After	9.	10.
11. HB (g/d)	12. 13.65	13. 15.89	14. 17.08	15. 1.90	16. 0.0963
17. RBC (ml/cm^3)	18. 7.07	19. 5.19	20. 4.47	21. 2.05	22. 0.0728
23. WBC (ml/cm^3)	24. 5.76	25. 7.27	26. 7.92	27. 2.08	28. 0.0686
29. Plt (ml/cm^3)	30. 253.33	31. 307.83	32. 367.25	33. 1.35	34. 0.2640

HU = Haramaya University

Table 3. Mean effect of physical activities on changes of blood pressure and heart rate readings of hypertensive patients, HU, Eastern Ethiopia, 2012.

Parameters	Experiments			F Value	Pr > F
	Before	Between	After		
SBP (mmHg)	161.67	153.33	144.67	100.41	<.0001
DBP (mmHg)	93.83	89.17	82.75	19.97	<.0001
HR (b/m)	91.00	81.58	74.42	5.43	0.0004

HU = Haramaya University

Table 4. Mean effect of physical activities on biochemical changes of hypertensive patients, HU, Eastern Ethiopia, 2012.

Parameters	Experiments			F Value	Pr > F
	Before	Between	After		
Uric acid (mg/dl)	6.28	4.83	3.38	10.31	<.0001
Albumin (g/l)	39.58	38.56	39.96	1.73	0.1320
Sodium (mmol/l)	166.76	149.78	136.09	6.23	0.0001
Potassium (mmol/l)	7.88	5.65	3.96	4.35	0.0016
Creatine (mg/dl)	1.80	1.42	1.23	7.81	<.0001
Triglyceride (mg/dl)	182.92	147.13	110.94	8.20	<.0001

HU = Haramaya University

V. DISCUSSION

The results of this study tend to indicate that regular aerobic physical activities training session significantly reduced the resting heart rate by 16.58 b/m ($P<0.05$) of the patients which is in agreement with research findings reported by Chobanian, et al**.**, 2009 as 15 - 20 b/m (12).

Systolic blood pressure reading was significantly lowered by 17.00 mmHg (11.75%) and diastolic blood pressure by 11.08 mmHg (13.39%) ($P<0.05$) for hypertensive patients throughout the whole physical activities training sessions which is in agreement with research findings reported by Padilla**,** et al, 2005) as 12/10 mmHg blood pressure readings (13) and Hagberg, *et al.*, 2000 as 5 - 25 mmHg for systolic and 3 - 25 mmHg for diastolic blood pressure with the average reduction for hypertensive patients to be 11 mmHg for systolic and 8 mmHg for diastolic blood pressure (8).

The patient's body mass index decreased by 3.65 (13.73%) throughout the whole study period and the patient's BMI changed from obese to overweight which is in agreement with research findings by Marengo, et al., 2004 (7) reported that systole and diastole reductions could be observed following weight and BMI loss, dietary modification and improvement of cardiovascular endurance, flexibility of joints, strength and efficiency of the heart and increased aerobic physical activities training. The patient's white blood cell (WBC) count was significantly increased by 2.16 ml/cm^3 (37.5%) within population normative (4 - 10 ml/cm^3) throughout aerobic physical activities training sessions which is in agreement with research findings by Seneczko, 2008 (15) reported as regular aerobic physical activities training program enhances an increase of white blood cell count that plays a major role in immune function of hypertensive patients. The patient's hemoglobin count significantly increased by 3.43 g/d (25.13%) within population

normative range (12 - 17.4 g/d) throughout the whole study period which is in agreement with research findings by Dickinson, *et al.*, 2006 (14) reported as regular aerobic physical activity enhances the amount of hemoglobin count by 1.89 g/d for hypertensive patients.

VI. CONCLUSION

The results of the current study revealed that, participation of regular aerobic physical activities training resulted in weighted net decrease of body weight by 9.5 kg and body mass index (BMI) by 3.65 which had a major contribution in lowering blood pressure in hypertensive patients. Similarly, systolic, diastolic and heart rate readings were resulted in weighted net reduction by 17.00 mmHg, 11.08 mmHg, and 16.58 b/m, respectively.

Furthermore, the results obtained clearly indicated that participation of moderate to high intensity (40% - 60% of net maximal oxygen uptake physical activity performance (VO_2max) with a mean of 50% VO_2max, frequency ranged from 3 – 5 times per week with an average of 4 times per week and duration per session varied from 20 – 60 minutes with a mean session length of 40 minutes) of regular aerobic physical activity training resulted in weighted net reduction of RBC by 2.6 ml/cm^3, uric acid by 2.9 mg/dl, sodium by 30.67 mmol/l, potassium by 3.92mmol/l, Creatine by 0.57 mg/dl, triglyceride by 71.98 mg/dl, and weighted net increment of WBC by 2.16 ml/cm^3, platelet by 113.92 ml/cm^3 and hemoglobin by 3.43 g/d and no significance difference (P>0.05) was observed on the level of albumin.

To conclude, the present study revealed that training from 3 – 5 times per week with an average of 4 times per week during 20 – 60 minutes per session with a mean session length of 40 minutes at intensity of 40% – 60% with a mean of 50% of net maximal oxygen uptake (VO_2max) physical activities training performance is recommended to lower blood pressure in hypertensive patients.

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