International Journal of Academic Research
ISSN: 2348-7666; Vol.4, Issue-12(1), December, 2017
Impact Factor: 6.023; Email: drtvramana@yahoo.co.in

Comparison of aerobic training versus resistance training in stage 1 hypertensive males

Prathiba.Satyalai, Assistant Professor, Sandhya Institute of Physiotherapy and Rehabilitation, Kakinada, AP, India.

D.Anandhi, Professor, SRM College of Physiotherapy, Chennai, TN, India.

ABSTRACT :

Background: *Hypertension is a major health problem. Cardiovascular diseases caused 2 to 3 million deaths in India in the year 1999; this is projected to double by the year 2020. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India. The objective of this paper is to compare the effectiveness of the aerobic training and resistance training in reducing the blood pressure in stage 1 hypertensive males. In this experimental comparative study, 60 males are randomly divided into 3 groups (control Group- 20, aerobic Group- 20 and resistance Group-20) and trained for 8 weeks. Systolic Blood Pressure, Diastolic Blood Pressure and Rate Pressure Product measured by digital sphygmomanometer. In the present study, the statistical value shows that the posttest 1 values are statistically significant whereas posttest 2 values shows that there are not statistically significant. The study concluded that there was a significant difference in reducing Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Rate Pressure Product (RPP) after aerobic and resistance training. This study states that medication and exercises are showing good results when compared to medications alone.*

Key Words: Hypertension,Aerobic training,Blood pressure,Resistance training,Rate Pressure Product

INTRODUCTION

Hypertension is a state which is characterized by increase in resting level of Blood Pressure, which is in range of systolic 110 to 130mm Hg, diastolic 70 to 90mm Hg. Cardiovascular diseases caused 2 to 3 million deaths in India in the year 1999; this is projected to double by the year 2020. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India. Hypertension is steadily increasing prevalence from 5% in 1960's to 12 to 15% in 1990's. Epidemiological studies show that hypertension is present in 25% urban and 10% rural subjects in India. At an underestimate, there are 31.5 million hypertensive individuals in rural and 34 million in urban populations (1).

The recent Joint National Committee (JNC) VII on Prevention, Detection, Evaluation and Treatment of the Blood pressure, recommended that normal blood pressure levels should be less than 120/80 mg Hg for resting systole and diastole respectively.

CLASSIFICATION OF BLOOD PRESSURE FOR ADULTS (JNC VII) (35, 39)

BLOODPRESSURE CLASSIFICATION	SYSTOLIC MM HG	DIASTOLIC MM HG
NORMAL	<120	<80
PRE HYPERTENSION	120-139	Or 80-89
STAGE 1 HYPERTENSION	140-159	Or 90-99
STAGE 2 HYPERTENSION	≥160	Or ≥100

Hypertension is a major risk factor for stroke, myocardial infarction (heart attacks), heart failure, aneurysms of the arteries (e.g.:- aortic aneurysm), peripheral arterial disease and a cause of chronic kidney disease(40). Physical inactivity is also recognized as a major risk factor for cardiovascular disease. Persons who are less active and less fit have 30% to 50% greater risk for High blood pressure (2, 3).

Hypertensive patients usually have low aerobic capacity and strength due to underlying cardiovascular, neurological and renal disorders. The decrease in aerobic capacity and strength not only aggravates the underlying cardio-vascular diseases but also increases the risk of decreased activities of daily living, depression and functional depends (4).

Numerous sources of information state that exercise training lowers blood pressure at rest and during sub-maximal exercise in normo-tensive and hypertensive individuals(5). Based on Oxygen utility exercise can be classified into aerobic (endurance training) or anaerobic (resistance training) (6).

Aerobic exercise refers to any exercise that uses large muscle groups continuous and rhythmic in nature like running, brisk walking and swimming. In aerobic exercise peripheral vascular resistance is reduced and systolic blood pressure progressively increases as an increase in left ventricular function and diastolic blood pressure decreases because of decreased peripheral vascular resistance.

Resistance training is also known as weight training or strength training where in effort is performed against a specific appearing force generated by resistance. Therefore, the purpose of this study was to compare the aerobic training versus resistance training in stage 1 hypertensive males.

METHODS

Sixty male between the ages of 25 – 55 years were recuited for this study. All the participants were diagnosed by physician as stage 1 hypertension, Non-smokers, who did not participate in any kind of regular exercise programme for a minimum of 12 months and those who satisfied Physical Activity Readiness Questionnaire (PAR-Q). Individuals with any positive history of cardiovascular

disease / complications like unstable angina, myocardial infarction or cerebrovascular accidents, any significant orthopedic conditions and with history of Diabetes mellitus were excluded from this study. All methods and procedures were approved by Institutional Review Boards of SRM College of physiotherapy.

PROCEDURE

Sixty stage 1 hypertensive subjects were selected depending on the inclusion and exclusion criteria and randomly divided into three groups. Informed consent was obtained before starting the intervention. Baseline measurements (Heart Rate and Blood Pressure) had been taken before starting the intervention by Digital sphygmomanometer. To initiate the 8 week exercise programmme, the subjects underwent a supervised orientation, after which they exercised on their own. The subjects were reviewed for progression in intensity periodically. Post test 1 was taken at the end of week 4 and Post test 2 was taken at the end of week 8. All blood pressure measurements were conducted during the morning hours. Arterial blood pressure was measured using digital sphygmomanometer, after subjects rested in the sitting position for at least 5 minutes. Three readings were taken at 2 minutes interval, and best of three was used in statistical analysis (2).

GROUPS:

Three Groups:

Group 1: Control group

Group 2: Aerobic training

Group 3: Resistance training

All groups had received life style modifications, patient education tool and medications.

AEROBIC TRAINING (36)

Exercise Type: Aerobic includes treadmill, stationary bike.

Frequency: 3 days / week.

Intensity: 50-80% of max HR.

Duration: 30-60 minutes.

AEROBIC TRAINING PROTOCOL

WEEKS	DURATION	INTENSITY
1st,2nd,3rd	30 minutes/day	50-60%
4th,5th,6th	30-45 minutes/day	70%
7th,8th	60 minutes/day	80%

RESISTANCE TRAINING (36)

Exercise Type: Resistance training.

Frequency: 8-12reps (1 set) 1 set – 8 exercises.

Intensity: 50% of 1 RM.

Duration: 30-50 minutes alternate days. (3 days/week)

Exercises are: Leg extension, Leg curl, Leg press, Bench press, Lat pull down, Chest press, Biceps curl and Triceps extension.

LIFESTYLE CHANGES FOR HYPERTENSION

- Reduce excess body weight.
- Reduce dietary sodium to ≤ 2.4 grams/day.
- Maintain adequate dietary intake of potassium, calcium and magnesium.
- Limit daily alcohol consumption.
- Exercise moderately each day.
- Engage in meditation or relaxation daily.
- Cessation of smoking

DATA ANALYSIS

The collected data were recorded and tabulated. The data was analyzed using statistical package for social science (SPSS) to present the finding of the study.

Table 1: Comparison Of Post Test Values Of Systolic Blood Pressure, Diastolic Blood Pressure, Rate Pressure Product Among Group 1(Control),Group 2(Aerobic) Andgroup 3(Resistance Groups).

Dependent Variable	(I) GROUP	(J) GROUP	Mean Difference (I-J)	Sig.
SBPPOST1	Control	Aerobic	-8.2463289*	.000
		Resistance	-10.1104521*	.000
	Aerobic	Control	8.2463289*	.000
		Resistance	-1.8641232	.623
	Resistance	Control	10.1104521*	.000
		Aerobic	1.8641232	.623
DBPPOST1	Control	Aerobic	-3.8579776	.250
		Resistance	-7.4957175*	.008
	Aerobic	Control	3.8579776	.250
		Resistance	-3.6377399	.290
	Resistance	Control	7.4957175*	.008
		Aerobic	3.6377399	.290
RPPPOST1	Control	Aerobic	-16.4035917*	.002
		Resistance	-16.2834710*	.002
	Aerobic	Control	16.4035917*	.002
		Resistance	.1201206	1.000
	Resistance	Control	16.2834710*	.002
		Aerobic	-.1201206	1.000

RESULTS

The statistical package for social sciences (SPSS) version 17.0 was used for data analysis. The statistical tool used in this study was POST HOC TEST.

According to Table I, the mean difference of systolic blood pressure between Group 1 (control) and Group 2 (aerobic) is 8.2463289, between Group 1 (control) and Group 3 (resistance) is 10.1104521, the p value is <0.0001 and statistically significant. Whereas between Group 2 (aerobic) and Group 3 (resistance) is 1.8641232, the p value is >0.0001 and statistically not significant. Hence the reduction of systolic blood pressure is greater in Group 2 (aerobic) and Group 3 (resistance) than Group 1 (control), but there was not much difference between Group 2 (aerobic) and Group 3 (resistance).

According to Table I, the mean difference of diastolic blood pressure between Group 1 (control) and Group 2 (aerobic) is 3.8579776, between Group 2 (aerobic) and Group 3 (resistance) is 3.6377399, the p value is >0.0001 hence statistically not significant. Whereas between Group 1 (control) and Group 3 (resistance) is 7.4957175, the p value is <0.0001 and statistically significant. Hence the reduction of diastolic blood pressure is greater in Group 3 (resistance) than Group 1 (control) and Group 2 (aerobic).

According to Table I, the mean difference of rate pressure product between Group 1 (control) and Group 2 (aerobic) is 16.4035917, between Group 1 (control) and Group 3 (resistance) is 16.2834710, the p value is <0.0001 and statistically significant. Whereas between Group 2 (aerobic) and Group 3 (resistance) is 0.1201206, the p value is >0.0001 and statistically not significant. Hence the reduction of rate pressure product is greater in Group 2 (aerobic) and Group 3 (resistance) than Group 1 (control), but there was not much difference between Group 2 (aerobic) and Group 3 (resistance).

DISCUSSION

This study focused on comparing the effects of aerobic exercise and resistance exercise in stage 1 hypertensive males. The results show that both aerobic training and resistance training showed greater influence in hypertensive males as assessed by digital sphygmomanometer. These results shows that the regular practice of both aerobic and resistance training has a positive impact on reducing blood pressure in stage 1 hypertensive males.

According to the results, reduction in systolic blood pressure is greater in Group 2 (aerobic) and Group 3 (resistance) than Group 1 (control) whereas the mean difference of diastolic blood pressure between Group 1 (control) and Group 2 (aerobic) is 3.8579776, between Group 2 (aerobic) and Group 3 (resistance) is 3.6377399, the p value is >0.0001 hence statistically not significant. Whereas between Group 1 (control) and Group 3 (resistance) is 7.4957175, the p value is <0.0001 and statistically significant. Hence the reduction of diastolic blood pressure is greater in Group 3 (resistance) than Group 1 (control) and Group 2 (aerobic)

During rhythmic aerobic muscular activity, vasodilatation in the active muscles reduces total peripheral resistance to enhance blood flow through large portions of the peripheral vasculature. Alternate muscle contraction

and relaxation also provide an effective force to propel blood through the vascular circuit and return it to the heart. Increased blood flow during rhythmic, steady rate exercise rapidly increase systolic pressure during the first few minutes of exercise. As exercise continues, systolic pressure gradually declines because the arterioles in the active muscles continue to dilate, further reducing peripheral resistance to blood flow. Diastolic blood pressure remains unchanged throughout exercise (37, 38).

Resistance exercises, particularly the concentric (shortening) and or static phase of muscle actions, mechanically compress the peripheral arterial vessels that supply active muscles. Arterial vascular compression dramatically increase total peripheral resistance and reduces muscle perfusion. Muscle blood flow decreases proportionally to the percentage of maximum force capacity exerted. In an attempt to restore muscle blood flow, substantial increases occur in sympathetic nervous system activity, cardiac output and mean arterial pressure. The magnitude of the hypertensive response relates directly to the intensity of effort and quantity of muscle mass activated. Whereas in the dynamic, low to moderate resistance, high-repetition, isotonic routines are ideally performed two to three times a week. Since the blood pressure response is related to the percentage of maximal voluntary contraction, any increase in strength will result in a lower blood pressure response to any given sub maximal work load. Thus the individual will be able to perform strength tasks with less strain on the heart following such training (37, 38).

This result is supported by M.A.Mughal et.al.,Stated that the aerobic exercises cause small reduction in resting systolic and diastolic blood pressure with stage 1 or 2 hypertension (2).

Michele M. Fisher et.al, Stated that the resistance exercise invoke a systolic hypotensive response during recovery in normotensive and borderline hypertensive women (18).

In this study one of the outcome measures is rate pressure product (RPP). It is an estimation of myocardial oxygen demand. Myocardial oxygen supply depends on the delivery of oxygenated blood through the coronary arteries, the oxygen carrying capacity of arterial blood and the ability of the myocardial cells to extract oxygen from the arterial blood (38).

Rate Pressure Product relates closely to directly measured myocardial oxygen consumption and coronary blood flow in healthy subjects over a wide range of exercise intensities, Rate Pressure Product computes as

$$RPP = SBP * HR$$

Where, RPP is rate pressure product,

SBP is systolic blood pressure

HR is heart rate

Typical values for Rate Pressure Product ranges from 6000 at rest (Heart Rate=50 beats/min, Systolic Blood Pressure =120mmHg) to 40,000 (Heart Rate=200 beats/min, Systolic Blood Pressure= 200 mmHg) or above depending on the intensity and exercise mode. Rate Pressure Product provides an objective yard stick to evaluate the effects on cardiac performance of various clinical, surgical or exercise interventions. The well documented lowering of exercise heart rate and Systolic Blood Pressure

with training helps to explain the improved exercise capacity of cardiac patients following exercise training(37).

The results of this study goes in hand with Ali Vasheghani Farahani et.al.,proved that water aerobic exercise markedly reduced the systolic blood pressure and mean arterial blood pressure and is especially recommended for the obese and the elderly who have orthopedic problems or bronchospasm (8).

Ferdinando lellamo et.al., Stated that exercise training are capable of reducing blood pressure up to 11 and 8 mmHg for systolic and diastolic pressure with respectively in approximately 75% of hypertensive individuals of both genders (3)

In this current study both aerobic training and resistance training are equally effective in reducing blood pressure in hypertensive males. When compared to pretest to post test1 values are statistically significant where as when compared to pretest to post test2. This may be because of lack of continuity in doing exercise protocols after post test 1.

CONCLUSION

There was significant reduction of Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Rate Pressure Product (RPP) after aerobic and resistance training.

REFERENCES

JOURNALS:

1. Gupta R- Trends in hypertension epidemiology in India, Journal of human Hypertension 2004; 18,73-78.
2. Mughal M.A., Alvi I.A ; Akhund I.A.; Ansari A. K. The effects of aerobic exercise training on resting blood pressure in hypertensive patients. Journal of the Pakistan medical association 2001,vol.51;222-226.
3. Ferdinando lellamo. Effects of exercise training in essential arterial hypertension. Rev Bras hipertens 2010,vol. 17(2): 68-71.
4. Chadra sekaran B. Resistance exercise training for hypertension. Cochrane Collabration 2010, Issue 11.
5. Seals, Douglas R.; Hagberg, JamesM. The effect of exercise training on human hypertension: a review, Medicine & science in sports & exercise. 16(3):207-215,june 1984.
6. Nagameka,Biju Cherian,Rohith R Arora-Endurance exercise and resistance training in cardiovascular disease,Therapeutic Advances in Cardiovascular Disease 2008;2(2):115-121
7. Sedigheh Hosseinpour Delavar. Effect of different concurrent training methods on post exercise hypotension in borderline hypertension women. Middle –East Journal of Scientific research.2011, 9 (4),456-461.
8. Ali Vasheghani farahani. The effects of a 10 week water aerobic exercise on the resting blood pressure in patients with essential hypertension. Asian Journal of sports medicine, 2010 vol 1 (no 3) : 159-167
9. Crivaldo Gomes Cardoso Jr. Acute and chronic effects of aerobic and resistance on ambulatory blood pressure. Clinics 2010, 65 (3) : 317-325.
10. James A. Blumenthal. Exercise and Weight loss reduces blood pressure in men and women with mild hypertension. Arch Intern Med. 2010,Vol 160: 1947-1958.

11. Mark Hamer. The effect of acute aerobic exercise on stress related blood pressure responses. A systematic review and meta analysis.2005.
12. Rakobowchuk. Effect of whole body resistance training on arterial compliancein young men. Exp. Physiol. 2005,90(4): 645-651.
13. Veronique A. Cornelissen. Effects of endurance training on blood pressure, blood pressure- regulating mechanism, and cardiovascular risk factors. Hypertension. 2005, 46: 667-675.
14. Janet P. Wallace. Exercise in Hypertension. A clinical Review. Sports Med. 2003, 33(8).
15. Jason R. Carter. Strength training reduces arterial blood pressure but not sympathetic neural activity in young normotensive subjects. J Appl Physiol. 2003,94: 2212-2216.
16. William J. Banz. Effects of resistance versus aerobic training on coronary artery disease risk. Experimental biology and medicine. 2003, 228: 434-440.
17. Seamus P. Whelton; Ashley Chin, Xue Xin, Jiang He. Effect of aerobic exercise on blood pressure :a meta analysis of randomized , controlled trials. Annals of internal medicine. 2002;136:493-503.
18. Michele M. Fisher. The effect of resistance exercise on recovery blood pressure in normotensive and borderline hypertensive women. Journal of strength and conditioning research. 2001, 15(2): 210-216.
19. George A. Kelly, Kristi Sharpe Kelly. Progressive resistance exercise and resting blood pressure: a meta-analysis of randomized controlled trials. Hypertension journal of American heart association. 2000; 35 ; 838-843.
20. George Kelly. Dynamic resistance exercise and resting blood pressure in adults: a meta analysis. J. Appl Physiol.1997,82(5): 1559-1565.
21. Athanosis J. Manolis. Exercise and Hypertension. European Society of Hypertension Scientific Newsletter.2005; 6: No. 23 Reid D.
22. Collier SR. Effects of 4 weeks of aerobic or resistance exercise training on arterial stiffness, blood flow and blood pressure in pre and stage 1 hypertensives. J Hum Hypertens.2008, 22(10) : 678-686.
23. Copeland SR, Mills ML , Lerner JL, et.al., Hemodynamic effects of aerobic vs resistance exercise. Journal of Hum Hypertensives.1996 Nov; 10(11):747-53.
24. Darren P.Casey.Arterial stiffness and aortic wave reflection progressive resistance training without volume increases. Experimental biology and medicine.2007, 232:1228- 1235.
25. Glen E. Duncan. Prescribing exercise at varied levels of intensity and frequency. A Randomized Trail. Arch Intern Med. 2005, 165: 2362-2369.
26. George Thomas- A clinical classification of hypertension, Chin Med Journal, 2006; 119(1):80-83.
27. Keese F. A Comparison of the immediate effects of resistance, aerobic and concurrent execise on post exercise hypotension. J Strength Cond Res. 2011,25(5): 1429-36.
28. Len Kravitz. Exercise and resting blood pressure. Hypertension ,35,838-843.
29. Maeda S. Effects of leg resistance training on arterial function in older men. Br J Sports med. 2006, 40: 867-869.

30. Moraes. M. R. Effect of 12 weeks of resistance exercise on post- exercise hypotension in stage 1 hypertensive individuals. J Hum Hypertens. 2012,26(9: 533-9).
31. Nabkasorn et.al. Effect of aerobic exercise on blood pressure of adults with mild hypertension in a community of Thailand. Wakayama Med Rep, vol. 40; 35-42(2000).
32. News from hypertension-Aerobic exercise controls blood pressure better than anaerobic;Week of May 19,2002,vol.1,no:11,www.medicalweek .org
33. Takanobu Okamoto, Mitsuhiko Masuhara, Komei Ikuta. Combined aerobic and resistance training and vascular function : effect of aerobic exercise before and after resistance training. Journal of applied physiology 103:1655-1661,2007.
34. Whelton SP, Chin A, Xin X, He j. Aerobic exercise reduces systolic and diastolic blood pressure in adults. Evidence based medicine 2002; 7:170.

BOOKS:

35. Internal medicine, Harrison, 18th edition,
36. Americian College of sports medicine protocol. ACSM guidelines.
37. Exercise Physiology, Katch and katch,7th edition,2010.
38. Physical Rehabilitation, Susan O Sullivan, 5th edition,2007.

WEB SEARCH:

39. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. August 2004
40. Hypertension, Wikipedia, the free encyclopedia. 1-21.
41. Smoking and hypertension, Norman M, Kaplan MD. Jan 2012.
42. www.pubmed.com
43. www.medline.com
44. Blood pressure, Wikipedia, the free encyclopedia. 1-19.
45. Super slow resistance training, Jeff Nelson, M.ed.