



Original Research Article

A Study to Evaluate the Changes in Blood Pressure Values of Hypertensive Patients Post Aerobic and Progressive Resisted Exercise (PRE)

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ABSTRACT

Background and Objectives: The purpose of this study was to compare and evaluate the effectiveness of Aerobic and PRE in reducing blood pressure in hypertensive patients.

Method: 60 mild hypertensives were divided into two groups ie, Group A consisted of 30 individuals and Group B consisted of 30 individuals. Individuals in Group A were given 30 minutes of Aerobic exercise whereas Group B was given PRE. Blood pressure, Heart rate and Rate pressure product were assessed prior and after the exercises.

Results: Greater significance SBP (P<0.001), DBP (P<0.001), HR (P<0.001), RPP (P<0.001) were seen in those undergoing aerobic exercise.

Conclusion: The result shows Aerobic exercise is more effective in reducing Blood pressure when compared to PRE in hypertensive individuals.

Keywords: Aerobic exercise, Progressive resisted exercise, Hypertension.

INTRODUCTION

Blood pressure is the pressure exerted by the blood on the vessel walls. It is expressed by the systolic pressure and the diastolic pressure. [1]

Systolic blood pressure is the highest pressure generated by the heart during the contraction of the left ventricle at rest. Normal value 120mm/Hg, Diastolic pressure is the lowest pressure during relaxation phase of the cardiac cycle. Normal value 70-80mm/Hg. [2]

Hypertension or high blood pressure is a persistent blood pressure above 90mm of Hg between the heart beats (diastolic) or

over 140mm of Hg at the beats (systolic). The BP varies naturally in response to stress & physical work load. [3] Hypertension is directly responsible for 57% of all stroke deaths & 24% of all coronary heart disease deaths in India. The absolute number of hypertensive's in India is 31.5 million in rural population and 34 million in urban population which takes a total of 65.5 million. [4]

The causes of hypertension are: -

Genetic factors: - These are a large number of genes that are responsible for hypertension.

High sodium intake: - Excessive sodium intake is linked with high blood pressure or hypertension in some people. [2]

Age: - Commonly seen in aged individuals near about 40 years but varies from 25 to 55 years.

Regular exercise's helps to keep arteries elastic, which intern ensures a good blood flow and a normal BP.

Hypertension occurs when excessive force is exerted against artery walls as the heart pumps blood. This silent disease has no symptoms, until it has reached an advanced & dangerous stage. Diuretics Angiotensin Converting Enzyme (ACE), vasodilators, Ca⁺ Channel blockers, @ - blocking agent. E.g. prazoin, centrally acting methyl dopa, combined effects gives a reduction in BP.

Alternative therapies like Acupuncture, Herbal medicine, Homeopathy, Nutritional therapy, Yoga and Meditation etc also gives an effect on reduction of BP. [5]

Physical exercises improves cardiovascular and circulatory functions by strengthening and enlarging the heart causing greater elasticity of blood vessel, increase the O₂ consumption & lowers the blood level of cholesterol & triglyceride. Exercises are categorized in to 2 types – Aerobic and Anaerobic. Aerobic exercise consists of repetitive low resistance last over a long period of time. It involves major muscle groups such as running and brisk walking. Anaerobic exercises consist of high resistance low repetitive movement such as weight lifting last only 1-3 minutes. [6]

Aerobic exercises are those exercise wherein oxygen is used to produce energy, these are simple, moderate intensity workouts performed for a longer duration. Aerobic exercise may last for about 20 minutes, they tend to improve the overall oxygen consumption of the body and simultaneously boost body metabolism.

Aerobic exercises facilitate proper circulation of blood and oxygen in the body, these exercise help in reducing blood pressure and fat burning. On the other hand - A meta-analytic review of randomised controlled trials in older adults concludes that aerobic exercise slightly reduces resting SBP, but not DBP. [7]

Anaerobic exercises are those exercises wherein the energy requirement of the body exceeds that provided by breathing, and body is forced to work without oxygen. These exercises are only performed for shorter duration lasts for about 2- 3minutes. Anaerobic exercise on the other hand helps in improving strength and muscle mass. The endurance levels required are higher compared to endurance level of anaerobic exercise although both the forms of exercise produce energy through the process of glycolysis, the substance used to break down glucose are different. [8]

In a study conducted to analyse the effects of progressive resisted exercise on resting systolic and diastolic blood pressure in adult humans, results showed small reductions in both systolic and diastolic blood pressures. [9] Numerous sources of information states that exercise training lower the blood pressure at rest and during sub maximal exercise in normotensive and hypertensive individuals. [10] As per the available literature both the Aerobic and resistance training should considerable decreases in blood pressure in hypertensive patients.

Hence the purpose of the study is to compare the effectiveness of aerobic exercise and progressive resisted exercises in reducing blood pressure in hypertensive patients.

METHODOLOGY

Study design: Experimental design

Sampling technique: Block randomization

Population: Hypertensive patients of 30-55 years of age group of both sexes.

Inclusion criteria: -

- 1) Age group selected 30-55 years
- 2) Individuals with borderline hypertension who are not on medication.

Exclusion criteria: -

- 1) Blood pressure with peripheral vascular disease.
- 2) Pregnant women.
- 3) Individuals with diabetes.
- 4) Individuals with congenital & acquired heart disease.

Outcome measures:

- Blood pressure
- Heart rate
- Rate pressure product

Group A:

The 30 individuals of group A were asked to do aerobic exercise for 30 minutes which include 5 minutes warm up, 20 minutes brisk walking, 5 minutes cool down.

Group B:

The 30 individuals of group B were asked to do progressive resisted exercise in the

Physiotherapy dept. Progressive resisted exercise with 10-15 contractions for each muscle groups of lower extremity (i.e.: glutei, quadriceps, hamstrings, calf muscles and ankle dorsi flexors by using various resisted devices like weight cuff, thera band etc. A period of 5 minutes warm up, and period of 5 min cool down are included.

Study Duration: 6 weeks

Ethical Consideration: Procedures followed were in accordance with the ethical standards of Helsinki Declaration of 1975, as revised in 2000. [11]

RESULTS

Blood pressure, Heart rate, Rate Pressure Product, was assessed as the outcome measures on the first day and fourth day of week 1, week 3 and week 6. The scores were tabulated and subjected to statistical analysis. Group A and B is done by students paired t- test , pre to post comparison is done by students unpaired t- test and intra group comparison is done by mann-whitney test.

Table 1.1 Descriptive Statistics Of Age

	Group	Mean	Std. Deviation	t v alue	p
Age	Aerobic	42.85	6.475	.908	.370
	Progressiv e resisted	40.95	6.763		NS

Table 1.1 shows the descriptive statistics of age distribution of the subjects in both Group A and Group B .The mean age and SD of 30 individuals in Group A is 42.85± 6.47 and the mean age and SD in Group B is 40.95±6.76. There is no significant difference between Group A and Group B with respect to age (t=.98,p=.370,NS)

Table 1.2: Gender Wise Distribution Of Subjects In Group A And Group B

		Group		Total
		Aerobic	Progressive resisted	
Sex	F	9	11	20
		30.0%	36.6%	33.4%
	M	21	19	40
		70.0%	63.3%	66.6%
Total		30	30	60
		100.0%	100.0%	100.0%

$\chi^2 = 0.114, p=0.736, NS.$

TABLE 1.2 shows the gender distribution 40 individuals who participated in the study Group A had 9 females (30.0%) and 21 males (70.0%). Group B had 11 females (36.6%) and 19 males (63.3%)

Table 1.3: Sbp Difference Between The Groups

	Group	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mann-Whitney Test Z value	p value
SBP diff . Week -1	Aerobic exercise	30	-6	4	-1.90	2.673	-2.00	2.33	.020 sig
	Progressive resisted exercise	30	-2	0	-1.15	.587	-1.00		
SBP diff . Week -3	Aerobic exercise	30	1	4	2.40	.754	2.00	5.42	p<0.001 HS
	Progressive resisted exercise	30	1	2	1.05	.224	1.00		
SBP diff . Week -6	Aerobic exercise	30	2	4	3.35	.933	4.00	4.76	p<0.001 HS
	Progressive resisted exercise	30	1	2	1.60	.503	2.00		

TABLE 1.3 Shows SBP difference in both the Groups mean value in Aerobic exercise, week 1 was -1.90 ± 2.67 ($p=.020, sig$), week 3 , $2.40 \pm .754$ ($p=0.001, HS$), week 6 , $3.35 \pm .933$ ($p=0.001, HS$) in Group B week 1 was $-1.15 \pm .587$ ($p=.020, HS$), week 3 mean was $1.05 \pm .224$ ($p<0.001, HS$), week 6 mean was $1.60 \pm .503$ ($p<0.001, HS$).

Table 1.4 DBP Difference Between The Groups.

	Group	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mann-Whitney Test Z value	p value
DBP dif f. Week -1	Aerobic exercise	30	-6	8	-1.00	3.403	-2.00	1.34	.179 sig
	Progressive resisted exercise	30	-2	0	-1.00	.562	-1.00		
DBP dif f. Week -3	Aerobic exercise	30	2	5	2.35	.745	2.00	4.79	p<0.001 HS
	Progressive resisted exercise	30	-1	6	1.15	1.348	1.00		
DBP dif f. Week -6	Aerobic exercise	30	0	4	2.00	.649	2.00	1.57	.117 sig
	Progressive resisted exercise	30	1	2	1.80	.410	2.00		

This shows DBP difference in both the groups. During the 1st, 3rd, 6th week the mean std.deviation are as follows: in the aerobic group -1.00 ± 3.4 ; $2.35 \pm .745$; $2.00 \pm .649$. In the PRE group $-1.00 \pm .562$; 1.15 ± 1.34 ; $1.80 \pm .410$ ($p=.17, Sig$) ($p<0.001, HS$); ($p=.11, Sig$).

Table 1.5 heart rate difference between the groups.

	Group	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mann-Whitney Test Z value	p value
HR diff . Week-1	Aerobic exercise	30	-16	0	-8.80	4.073	-10.00	5.51	p<0.001 HS
	Progressive resisted Exercise	30	0	2	1.50	.889	2.00		
HR diff . Week-3	Aerobic exercise	30	-2	4	1.30	1.490	2.00	2.91	.004 HS
	Progressive resisted exercise	30	-6	4	-1.20	3.002	.00		
HR diff . Week -6	Aerobic exercise	30	2	2	2.00	.000	2.00	.67	.504 sig
	Progressive resisted exercise	30	-8	8	1.30	3.629	2.00		

This shows heart rate difference in both the groups during the 1st, 3rd and 6th week. The mean and std.deviation are as follows: in the aerobic group -8.80 ± 4.07 ; 1.30 ± 1.49 ; 2.00 ± 0.0 ; in PRE group $1.50 \pm .889$; -1.20 ± 3.00 ; 1.30 ± 3.62 ($p < 0.001$, HS); ($p = .004$, HS); ($p = .504$; Sig).

Table 1.6 RPP Difference Between The Groups

	Group	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mann-Whitney Test Z value	p value
RPP diff. Week -1	Aerobic exercise	30	-2756	2184	-1006.40	1262.148	-1206.00	3.79	p<0.001 HS
	Progressive resisted exercise	30	-140	284	135.80	144.253	213.00		
RPP diff. Week -3	Aerobic exercise	30	-32	700	335.40	200.675	385.00	3.54	p<0.001 HS
	Progressive resisted exercise	30	-806	672	-84.30	420.678	68.00		
RPP diff. Week -6	Aerobic exercise	30	392	576	498.65	69.862	536.00	1.90	.058 sig
	Progressive resisted exercise	30	-1040	1256	292.70	507.287	385.00		

This shows RPP difference in both the groups .During the 1st, 3rd and 6th week the mean and std. deviations are as follows : in the aerobic group -1006.40 ± 1262.18 ; 335.40 ± 200.67 ; 498.65 ± 69.86 ; in PRE group 135.80 ± 144.25 ; -84.30 ± 420.67 ; 292.70 ± 507.28 ($p < 0.001$; HS); ($p < 0.001$, HS); ($p = .058$, Sig)

DISCUSSION

Blood pressure is the pressure exerted by the blood on the vessel walls

Hypertension is a state which is characterized by increase in resting level of blood pressure, which is in the range of Systolic 110-130mm Hg, Diastolic 70-90mmHg.

The study was conducted to compare whether Aerobic exercise or PRE is more effective in reducing blood pressure in hypertensive individuals .The study was done on 60 patients with mild hypertension, and is divided in to 2 groups(Group A & Group B), consisting of 30 individuals in each group. Group A was given Aerobic exercise and Group B was given PRE for duration of 6 weeks. The result demonstrated that a considerable reduction in SBP, DBP, HR and RPP in the Aerobic group, PRE group also showed variation in the following parameters but was as significant as aerobic group.

The analysis of data was done by students paired t test, students unpaired t test and comparisons by mann-whitney test.

In aerobic group, the result shows a significant reduction in SBP ($P < 0.001$), HR ($P < 0.001$) and RPP ($P < 0.001$). A randomized control trial on the effect of Aerobic exercise on BP, proved to be associated with significant reductions in BP in both hypertensive and normotensive patients. [12]

In PRE group, the result shows significant reduction in SBP ($P < 0.001$), DBP ($P < 0.001$) and RPP ($P < 0.001$), but HR did not show any significant change. The Meta analytic approach to examine the effects of PRE exercise on resting SBP and DBP concluded that PRE is efficacious for reducing systolic and diastolic BP. [13]

Thus we can say that both aerobic and PRE are effective in reducing BP in hypertensive individuals, but aerobic exercise is a better choice in reducing BP than PRE.

CONCLUSION

The research demonstrated that there is a significant reduction in BP, HR and RPP in aerobic exercise group when compared to progressive resisted exercise group. So we can conclude that aerobic exercise is a better tool than progressive resisted exercise in reduction of blood pressure of patients with hypertension.

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Conflict of interest – None

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