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A Comparative Study to Find the Effect of Aerobic Exercise Training Versus Resistance Exercise Training in Adults with Pre-Hypertension

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Abstract

Background and Objectives: In 2003, the Seventh Report of the Joint National Committee (JNC 7) defined prehypertension as a systolic blood pressure (BP) of 120–139 mmHg or a diastolic BP of 80–89 mmHg in adults 18 years and older. Prehypertension seems indeed to be a precursor of hypertension, associated with many adverse outcomes. The conversion rate of prehypertension to hypertension over 4 years was 30%. Many studies have focused also on the predictors of progression from prehypertension to hypertension. However, the results were controversial, and Therefore, we performed this study in order to find out and compare the effect of aerobic and resistance exercise training in adults with prehypertension.

Method: This study was done on 40 subjects who were randomly divided into two groups, Group A (N=20) with mean age 49.45 (SD±5.586) and Group B (N=20) with mean age 45.25 (SD±4.375) where Group A was given aerobic exercise and Group B was given resistance exercise. The outcome measure was taken as BP. Exercise session for both group was for 5 days (40minute/day) per week for 4 weeks.

Result: Statistical analysis was done using SPSS version. The paired 't' test was used to find the effect of aerobic and resistance exercise in prehypertension. Result showed significant reduction in blood pressure in both group. in aerobic group the pre and post effect of aerobic exercise is mean=2.30,SD=1.658 since the significance value for changes in all measurement are less then 0.05(p=0.00) and the average difference in 3.25 per subject in aerobic group and in resistance group the pre and post effect of resistance exercise is mean=2.50,SD=1.638 since the significance value for changes in all measurement are less then 0.05(p=0.00) and the average difference of 2.95 per subject in resistance group. These result showed significant reduction in BP ($p<0.05$) in both aerobic and resistance group.

Conclusion: The study concluded that the aerobic exercise and resistance exercise both were effective in prehypertension. And these results also suggest that there are no significant comparative difference between aerobic and resistance group.

Key Words: Blood pressure, Prehypertension, Aerobic exercise, Resistance exercise.

Introduction

Blood pressure (BP) is the pressure exerted by circulating blood upon the walls of blood vessels.(1) "Prehypertension" is defined as systolic BP 120 to 139 or diastolic BP 80 to 89 mm Hg, based on "2 or more properly measured seated BP

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readings on each of 2 or more visits.[1] Hypertension, sometimes called arterial hypertension, is a chronic medical condition in which the blood pressure in the arteries is elevated**.** It is summarised by two measurements systolic and diastolic.[2]

Hypertension is classified as either primary (essential) hypertension or secondary hypertension. About 90–95% of cases are categorized as primary hypertension, defined as high blood pressure with no obvious underlying cause. The remaining 5–10% of cases are categorized as secondary hypertension, defined as hypertension due to an identifiable cause, such as chronic kidney disease, narrowing of the aorta or kidney arteries, or an endocrine disorder such as excess aldosterone, cortisol, or catecholamines.[3]

Life style modification can help reduce symptoms in prehypertension and hypertension patients. Lifestyle modification includes increasing physical activity, and reducing sodium intake to<6g of sodium chloride daily, low alcohol intake,. Patients who were randomly assigned to a low salt diet/ sodium<1800mg/24hour had a 25% risk reduction in cardiovascular disease.[13]

Based on the high number of exercise related benefit, It is recommended that the exercise as a part of initial treatment strategy for individual with high blood pressure.[14]Regular physical exercise has been recommended for prevention and treatment of hypertension. Physical exercise can be divided into 2 broad categories namely aerobic exercise training and resistance exercise training.[15]

Intervention studies have shown that regular aerobic activity can reduce systolic and diastolic blood pressure by approximately 10 mmHg. Four weeks of chronic aerobic exercise can lower resting BP by 10/6 mm Hg, and the reduction can persist for a period of 7 days.[16] Chronic exercise training significant reduction in resting BP (SBP = 7.0 To 1.4 mm Hg/DBP = 5.2 To1.2 mm Hg), typical of values reported for this age group (45–60 yr old).[17] Also, resistance exercise tends to produce greater decreases in blood pressure.[18]

Need Of Study:

Hypertension is a common risk factor and the prevalence of hypertension rises sharply with age. Prehypertension is more common in adults due to sedentary life style, high sodium diet intake, low physical activity ,and cigarette smoking. Prehypertensive are at a higher risk of developing hypertension.[19]

So, our study is to find and compare the effectiveness of aerobic exercise versus resistance exercise in prehypertension.

OBJECTIVES

- To find the effectiveness of aerobic exercise training in pre hypertension.
- To find the effectiveness of resistance exercise training in prehypertension.
- To compare the effect of aerobic exercise training versus resistance exercise training in prehypertension.

Research Methodology

Study Design: Experimental design comparative in nature

Source Of Data Collection: Choithram Hospital and Research Center Indore M.P.

Method Of Data Collection: Random sampling

Sample Size: Total 40 Subjects

Study Duration: 4 weeks

Inclusion Criteria:

- Age group: 35-55 years.
- Males and females
- Clinically diagnosed with essential or primary prehypertension with in 6 months
- Person with BMI 18.5-24.9 and 25-30

Exclusion Criteria:

- Antenatal females
- Post natal females(till 1 year)
- Any other cardiac risk factor or any post cardiac surgery patient
- Orthopedic and neurological conditions(recent fracture or stroke)
- Subject not willing for follow up
- Subjects taking antihypertensive medication

Material Used For Study With Their Reliability And Validity:

- Thera band (Active band)
- Treadmill(Marathon)
- Dumbbell
- Stepper
- Sphygmomanometer(diamond)
- Stethoscope(diamond)
- Couch
- chair

Procedure and Method

Method

- 40 subjects clinically diagnosed as prehypertension were selected according to inclusion and exclusion criteria and they were divided into two groups; namely group A (Aerobic exercise group)and group B(Resistance exercise group), consisting of 20 subject in each. Both the group were informed and the purpose of the study was explained.
- A brief explanation about the treatment session was explained to both.
- Blood pressure reading were taken on first day(morning)and started exercise program for both group A and B & BP was taken regularly on daily basis before the start of exercise.

PROCEDURE

- **Exercise Prescription:**
- **Group – A: Aerobic Exercise- Duration-40 Minute/Day Intensity-5 Days/Week**

1. Aerobic exercise group was given warm up exercises for 5 minutes which includes stretching of biceps, triceps, pectorals, lateral flexors of trunk, quadriceps, hamstring and calf muscle. Stretching session included 30seconds (three sets of 10 second) of stretch for each muscle with 15 second relaxation after each muscle stretch was given.
2. Brisk walking on treadmill-for 15 minute was included warm up period for 5 minute(speed-3.5mph,steady walk) then 9minute brisk walk(4.5mph) and cool down period included 1 minute walk(3.5pmh).
3. Jumping for 2 minute(6 sets of 10 repetation,20 second for 1 repetation with 5 second rest period)
4. Stepper for 2 minute(6 sets 10 repetation with 5second rest period)
5. Static cycling for 2 minute(3 sets of 20 repetation with 10 second rest period)
6. Burpee for 2 minute(6 sets of 10 repetation with 5 second rest period)
7. Cool down for 5minute which included stretching of biceps, triceps, pectorals, lateral flexor of trunk, quadriceps, hamstring and calf muscle and rest period for 15 second after each muscle stretch include deep breathing exercise.

   All the above exercise was done regularly by the subjects for 4 weeks (5 days per week) and pre and post BP reading were statistically compared to find the effect of aerobic exercise.

Group - B: Resistance Exercise- Duration-40 Minute/ Day Intensity-5days/Week

1. Resistance exercise group was given warm up exercises for 5 minutes which includes stretching of biceps, triceps, pectorals, lateral flexors of trunk, quadriceps, hamstring and calf muscle. stretching session included 30second (three sets of 10 second) of stretch for each muscle with 15 second relaxation after each muscle stretch was given.

2. Theraband exercise was given for 21 minute (3set of 10 repetation,30second for 1 repetition and) for following muscles- trapezeus,biceps,triceps,delto id,pectorals,quadriceps,hamstring,hip adductor and abductor, calf, abdominals and spinal muscle.

3. Dumbbell exercise was given for 5 minute(2 sets of 10 repetition 20 second for 1 repetition with 10 second rest period after each repetition) included chest press, shoulder press, biceps curl ,triceps extension and abdominal crunches.

4. Squatting for 1 minute(2set of 10 repetition for 30 second and 10 second rest period after ach repetition)

5. Lunges for 1 minute(2set of 10 repetition for 30 second and 10 second rest period after each repetition)

6. Bridging for 1 minute (2set of 10 repetition for 30 second and 10 second rest period after ach repetition) Wrap a resistance band around the thighs. The elastic band should be tight and provide resistance to thigh and buttocks muscles. Tighten the muscles of abs and buttocks and hold throughout the movement.

7. Cool down for 5minute which included stretching of biceps, triceps, pectorals, lateral flexor of trunk, quadriceps, hamstring and calf muscle and rest period for 15 second after each muscle stretch include deep breathing exercise.

All the above exercise was done regularly by the subjects for 4 weeks (5 days per week) and pre and post BP reading were statistically compared to find the effect of resistance exercise.

STATISTICAL ANALYSIS- The statistical software namely SPSS 20 version was used for the analysis of data & Microsoft Word and Microsoft Excel Worksheet have been used to generate graphs, tables etc.

Result

The frequency and its percentage distribution of pre-hypertensives was according to the BP reading of day first. data represents among 20 patients of prehypertension in aerobic exercise was 1(5.0%) were having BP 130/70mmhg and 140/90mmhg, in 2(10.0%) were having BP 140/100 mmhg ,in 5(25.0%) were having BP 130/100mmhg and in 11(55.0%)were having BP 130/90mmhg.

Frequency and its percentage distribution of pre-hypertensives was according to the BP reading of day 15th.data represents among 20 patients of prehypertension in aerobic exercise in this 2(10.0%)were having BP 130/100mmhg,3(15.0%) were having BP 130/90mmhg,4(20.0%)were having BP 130/80mmhg, 5(25.0%)were having BP 120/90mmhg,6(30.0%)were having BP 120/80mmhg.

The frequency and its percentage distribution of pre-hypertensives was according to the BP reading of day 30th.data represents among 20 patients of prehypertension in aerobic exercise in this 2(10.0%) were having BP 130/80mmhg,4(20.0%)were having BP 120/90mmhg and 130/90mmhg,10(50.0%)were having BP 120/80mmhg.

The frequency and its percentage distribution of pre-hypertensives was according to the BP reading of day first .data represents among 20 patients of prehypertensioninresistanceexercisewas1(5.0%)were having BP 130/80mmhg and 140/100mmhg,7(35.0%) were having BP 130/100mmhg,11(55.0%)were having BP 130/90mmhg.

The frequency and its percentage distribution of pre- hypertensives was according to the BP reading of day 15th. Data represents among 20 patients of prehypertension in resistance exercise was 1(5.0%)was having BP 130/100mmhg,4(20.0%) were having 120/80mmhg,7(35.0%)were having 120/90mmhg,8(40.0%)were having 130/90mmhg.

The frequency and its percentage distribution of pre-hypertensives was according to the BP reading of day 30th.data represents among 20 patient's of prehypertension in resistance exercise was 1(5.0%) was having BP 130/80mmhg,5(25.0%)were having 130/90mmhg,7(35.0%)were having 120/80mmhg and 120/90mmhg.

The mean column in the paired sample t test displays the average difference between before and after 15th day training (2.6), 15th to 30th (0.65) and the base line to 30th day (3.25) changes in aerobic group.

The mean column in the paired sample t test displays the average difference between before and after 15th day training (2.25), 15th to 30th (0.7) and the base line to 30th day (2.95) changes in resistance group. The standard deviation column displays the standard deviation of the average difference in BP reading.

Discussion

High blood pressure, termed "hypertension," is a condition that afflicts almost 1 billion people worldwide and is a leading cause of morbidity and mortality.Therefore, this disease is sometimes called the "silent killer."

The management of high blood pressure is considered a priority objective in primary and secondary prevention of cardiovascular disease. An aerobic exercise is an increase in oxygen consumption and heart rate that parallels the intensity of the imposed activity and a curvilinear increase in stroke

volume while resistance training offers greater development of muscular strength, endurance and mass.

S R Collier et al. found the effect of four weeks of aerobic and resistance exercise training on arterial stiffness, blood flow and blood pressure in pre-hypertension and stage 1 hypertensive found that resistance exercise resulted in increased arterial stiffness whereas aerobic exercise training decreased arterial stiffness in individuals with pre-hypertensive to essential hypertension despite similar reductions in blood pressure.[18]

Sambhaji Gunjal et al. found that the effect of aerobic interval training on blood pressure and myocardial function in hypertensive patients and showed significant reduction in blood pressure, improvement in cardiac function, aerobic capacity and reduction of mean heart rate.[19]

Fabio T Montrezol et al. concluded that the resistance training promotes a reduction in blood pressure and an improvement in muscle strength. Resistance training increased circulating levels of adiponectin and reduced the levels of plasma Intracellular Adhesion Molecule-1.[20]

In summary, the result of our study revealed that both treatment techniques were effective in reducing systolic blood pressure, diastolic blood pressure but statically there was significant difference between both the groups at the end of 4th week. So, the result lead us to reject the null hypothesis thereby confirming that there will be significant difference between effectiveness of aerobic and resistance training in reducing blood pressure in pre-hypertensive patients.

Limitation of study:

- Sample size taken for the study was small.
- Long term effect of the maneuver was not assed in our study

Scope for further study:

Based on the outcome of the statistical analysis, it is suggested that the future studies can be modified to accommodate the following changes:

- Long term effect can be considered.
- Study with large sample size are recommended

Conclusion

The study was conducted to find out and compare the effect of aerobic exercise training and resistance exercise training in adult with prehypertension. We can conclude that with the help of independent t test and levene's test that there are no significant comparative differences between aerobic exercise and resistance exercise in prehypertension the significant value is 0.247 this is greater then 0.05 accepts the null hypothesis, we can assume that the groups (aerobic and resistance)have equal variances.

Thus, this study accepts the first statement of alternate hypothesis(H_1) i.e; there is a significant effect of aerobic exercise and resistance exercise in prehypertension. And this study also accepts the second statement of null hypothesis(H_0) i.e; there are no significant comparative difference between aerobic exercise and resistance exercise in prehypertension.

Source of funding-Self

Conflict of interest- Nil

Ethical Clearance -Taken from Institutional Ethics Committee, Choithram Hospital & Research Centre,Indore (MP)

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