IMPACT OF ISOMETRIC EXERCISE TRAINING VERSUS AEROBIC EXERCISE TRAINING ON BLOOD PRESSURE CONTROL AMONG STAGE 1 HYPERTENSION PATIENTS

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ABSTRACT:

Hypertension is the leading risk factor of cardiovascular disease death. This study aimed to screen for any significant variation in the aerobic and isometric exercise training among stage 1 hypertension patients and to compare the impact of isometric exercise training versus aerobic exercise training on blood pressure control among Stage-1 Hypertension patients.

About 30 stage 1 hypertension patients who met the inclusion criteria were selected, after obtaining concern, the patients were separated into two groups.(GROUP A:AEROBIC AND ISOMETRIC EXERCISE .GROUP B: ISOMETRIC)following detailed explanation to the patients, results is measured using Sphygmomanometer. The statistical analysis of the collected data revealed that there is significant difference among the two groups. This study concludes that aerobic exercises and isometric exercise training had considerable effect on reducing BP in stage 1 hypertension.

KEYWORDS: Stage 1 hypertension, aerobic exercise, isometric exercise, and sphygmomanometer

INTRODUCTION

Hypertension, also known as high or raised blood pressure, in which the blood vessels have raised pressure, It is both a disease and a major risk factor for other diseases. Recent Studies shows that an increasing rate of cardiovascular events such as stroke, heart attack ,congestive heart failure, atrial fibrillation and premature mortality with increasing blood pressure.

Approximately 1 in 5 adults (21%) with hypertension have it under control. Hypertension is a major cause of premature death worldwide. Prevalence of hypertension is 10.4 million death per year .In severe hypertension, according to us guideline stage 1 hypertension are systolic of 130-139mmHg or diastolic of 80-89 mmHg [1].

CLASSIFICATION OF HYPERTENSION:According to the American heart association, blood pressure is classified into four categories:

- Normal systolic less than 120 and diastolic less than 80
- Elevated systolic between 120-129 and diastolic less than 80

- Stage 1 hypertension systolic between 130-139 and diastolic between 80-89
- Stage 2 hypertension systolic of 140 or higher and diastolic of 90 or higher.

Normal hypertension- Normal blood pressure or rare blood pressure elevations and no identifiable cardiovascular disease.

Stage 1 hypertension-Occasional or intermittent blood pressure elevations and early cardiovascular disease. It is the earliest identifiable stage of hypertensive disease .This stage is often characterized by early signs of functional or structural changes in the heart or small arteries.

Stage2 hypertension- Sustained blood pressure elevations or progressive cardiovascular disease. This type of patients frequently has sustained resting BP levels ≥140/90 mm Hg, with much higher elevations induced by physiologic or psychological stressors. It indicates that progressive disease has developed as a consequence of persistent functional and structural changes in BP control mechanisms [2].

PATHOPHYSIOLOGY OF HYPERTENSION:

Sympathetic nervous system-vasomotor centre situated in medulla has lateral presser and medial depressor these are responsible for sympathetic and parasympathetic output. Stimulation of this can cause both arteriolar constriction and arteriolar dilatation, which cause excitatory effect. This effect can increase blood pressure.

1.Vascular endothelialium-endothelium is the lining of tunica intima. It plays a key role in cardiovascular regulation by producing a number of vasoactive agents like vasodilator molecule nitric oxide and the vasoconstrictor peptide endothelia. When these gets activated there will be increase in blood pressure, free radicals also cause cell damage.

2.The renin-angiotensin system-It is the most important of the endocrine systems that affect the control of blood pressure. Renin is secreted from the juxtaglomerular apparatus of the kidney. It is also released in response to stimulation from the sympathetic nervous system. Renin is responsible for converting (angiotensinogen) to angiotensin I, a physiologically inactive substance which is rapidly converted to angiotensin II in the lungs by angiotensin converting enzyme (ACE).Angiotensin II is a potent vasoconstrictor and thus causes a rise in blood pressure. In addition it stimulates the release of aldosterone from the adrenal gland, which results in a further rise in blood pressure related to sodium and water retention.

3.Endocrine system-Endocrine hypertension can be caused when glands produce too much or not enough hormone, or when they are affected by tumours. PrimaryAldosterone's-it is called as cons syndrome. The most common form of endocrine hypertension. Excessive aldosterone production by the adrenal glands leads to fluid retention, loss of potassium and hypertension. Cushing's Syndrome- occurs when too much cortisol is produced by the adrenal glands. People with Cushing's syndrome often have other endocrine-related disorders. It is a stress hormone, which cause vasospasm of artery.Phenochromocytoma-it is a rare syndrome caused by tumours of the adrenal glands. Thesetumours are non-cancerous, it produce excessive amounts of adrenaline, catecholamines. Patients with a pheochromocytoma may have episodic or sustained hypertension [3].

AIM OF THE STUDY:

To compare the impact of isometric exercise training versus aerobic exercise training on blood pressure control among Stage-1 Hypertension patients.

OBJECTIVES OF THE STUDY:

- To find out the effects of aerobic exercise and isometric resistance exercise on blood pressure among stage-1 Hypertension patients.
- To find the effects of isometric resistance exercise on blood pressure among stage-1 Hypertension patients.
- To compare the effects between aerobic exercise and isometric resistance exercise on blood pressure among stage-1 Hypertension patients

BACKGROUND OF THE STUDY:

Hypertension is a common risk factor and the prevalence of hypertension rises sharply with age. Its common risk factors in myocardial infarction, stroke, varicose vain. Many studies have done for finding the alone and combined efficacy of aerobic exercise and isometric resistance exercise but very few studies compared both. There are many studies supporting the effectiveness of aerobic exercise training and isometric resistance exercise training is achieving normal blood pressure in hypertensive patient.

There by this study is an attempt to investigate the impact of isometric exercise training versus aerobic exercise training on blood pressure among stage 1 hypertension patients.

NEED OF THE STUDY:

The need of the study is to compare the effectiveness of isometric exercise training and aerobic exercise training in controlling blood pressure among patients with Stage 1 Hypertension.

It helps identify which exercise method provides better cardiovascular benefits, improves fitness

HYPOTHESIS

NULL HYPOTHESIS:

There is no significant difference between aerobic exercise and isometric resistance exercise on blood pressure in stage-1 Hypertension patients.

ALTERNATE HYPOTHESIS:

There is a significant difference between aerobic exercises and isometric resistance exercise on blood pressure among stage-1 Hypertension patients.

REVIEW OF LITERATURE

1. **Hossein, Rastegar, etal (2024)**

States that Exercise has been suggested to manage hypertension by inducing sweating and the corresponding loss of sodium and water from the body, the decrease in sodium and water content in the body associated with sweating may result in a reduction in blood volume and thus a decrease in blood pressure. Moreover, the reduction in peripheral resistance is thought to be mediated by the activation of the nitric oxide syntheses

pathway and the release of vasodilators such as prostacyclin and bradykinin, which lead to vasodilation and, thus, a reduction in blood pressure.

2. **Mehrnoosh Esmailiyan, et al (2023)**

The study shows that Hypertension was considered the leading cause of more than 494,873 death in the United States in 2018 and is associated with the incidence of myocardial infarction (MI), stroke, heart failure, and other cardiovascular diseases. Concluded thatDifferent type of physical activity including aerobic and resistant, combined aerobic and resistant, circuit training, heated water-based exercise, and isometric exercise training, and has been effective in terms of lowering blood pressure in different groups of the population

3. **Alexander M.lehnen, et al (2022)**

Have done a study on effect of isometric exercise on blood pressure in pre hypertensive and hypertensive individual, states that good number studies have reported beneficial effect of ISE handgrip exercise on blood pressure, and also states that it reduce blood pressure among hypertensive patients

4. **Stephen A.Maris, et al (2021)**

Have done a study on a review of hypothesized mechanisms and protocol application in person with hypertension, states that incorporation of isometric exercise training provides meaningful reduction in blood pressure. IET program of 12-20 minutes per day, 3 times per week could improve blood pressure reduction in hypertension patients

5. **Annalisa Mancusa, etal (2021)**

Have done a study on effect of aerobic versus resistance exercise on hypertension patients, concluded that bpdecreasedsignificant between two groups compared with baseline, without significance between group differences.

6.**Gonzalo Saco-Ledo, et al (2020)**

Study shows that Chronic exercise reduces clinic and ambulatory blood pressure (BP), but the short-term effects of an acute exercise bout on ambulatory BP have not been studied widely,concludedthata single acute bout of aerobic exercise reduces subsequent 24-hour, daytime, and nighttime ABP in patients with hypertension, with the magnitude of BP reduction similar in medicated and unmedicated individuals. Furthermore, aerobic exercise of vigorous intensity tends to be to be most effective for producing the largest short-term reductions in daytime and nightime ABP .

METHODOLOGY:

STUDY DESIGN: experimental study
STUDY SETTING: Sri Isari Velan Mission hospital,thalambur
pink fitness centre, pallikarani, Chennai
SAMPLE SIZE: 30 subjects
SAMPLING METHOD: simple random sampling
STUDY DURATION: 4 weeks

INCLUSION CRITERIA:

- Subjects who are willing to participate in the study
- Subjects with Stage -1 Hypertension.
- Both Male and female subjects.
- Subjects with age group of 45 to 55 years.
- Subjects who are under anti-hypertensive medications.

EXCLUSION CRITERIA:

- Subjects who are not willing to participate in the study
- Subjects of age above 60 years are excluded in the study
- Any comorbidities or disabilities other than diabetes mellitus are excluded from the study
- Any severe ortho and neuro conditions(visual,hearing,seizures disorders)
- Any psychiatry or psychological illness

OUTCOME MEASURE:-Sphygmomanometer

PROCEDURE:

Thirty subjects who fulfilled the inclusion and exclusion criteria were selected for the study; informed consent was obtained from the selected subjects and randomly divided into 2 groups. Group A and Group B. Each group consist of 15 subjects. After completion of initial assessment both the groups were assessed by sphygmomanometer. Safety and security of the treatment was explained to all subjects.

GROUP A received aerobic and isometric exercise

PROGESSION:30mintues with moderate intensity 60% -65% of maximum heart with Frequency is 5times a week.

TECHNIQUE:

1. Aerobic exercise:
   - First-warm-up is done for 10min for major muscle of upper and Lowe limb include: stretching of biceps,triceps,pectoralis,lateral flexors,quadriceps,hamstring,calf muscles
   - Second -treadmill training
   - Third -cool down period is done for 10min for major muscle of upper and lower limb include: stretching of biceps,triceps,pectoralis,lateral flexors,quadriceps,hamstring,calf muscles

2.Isometric Exercise:

- isometric neck exercise-in supine lying patient applies downward force on pillow with back of the head
- isometric back exercise-in hook lying patient applies downward force in lower back on the towel roll placed under lower back
- isometric hip extensor- in supine lying patients applies downward force with both the heels of the leg onto the towel placed under the heels
- isometric knee exercise-in long sitting patient applies a downward force on the towel roll placed under both the knees
- 10 repetition, 3days per week totally 4 weeks,30mintues.

GROUP B Received isometric exercise

PROGESSION 10 repetition, 3days per week totally 4 weeks, 30mintues.

TECHNIQUE:

1. Isometric Exercise consist of:
   - isometric neck exercise-in supine lying patient applies downward force on pillow with back of the head
   - isometric back exercise-in hook lying patient applies downward force with lower back on the towel roll placed under lower back

- isometric hip extensor- in supine lying patients applies downward force with both the heels of the leg onto the towel placed under the heels
- isometric knee exercise-in long sitting patient applies a downward force on the towel roll placed under both the knees

DATA ANALYSIS:

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24.0. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test was adopted to find the statistical difference between the groups.

TABLE - 1

COMPARISON OF SYSTOLIC BLOOD PRESSURE LEVEL BETWEEN GROUP – A AND GROUP – B IN PRE TEST ANDPOST TEST

SYSTOLIC BLOOD PRESSURE	GROUP A		GROUP B		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	135.07	2.31	134.53	2.72	0.578	.568*
POST TEST	125.13	2.50	126.87	1.92	2.127	.042**

(*- P > 0.05, **- P ≤ 0.05)

The above table reveals the Mean, Standard Deviation (S.D), t-test and p- value of the Systolic Blood Pressure between (Group A) & (Group B) in pre test and post test.
This table shows that there is no significant difference in pre test values of the Systolic Blood Pressure between Group A & Group B (*P > 0.05).

This table shows that there is a significant difference in post test values of the Systolic Blood Pressure score between Group A & Group B (**P ≤ 0.001).

Both the group shows significant decrease in the post-test means but (GROUP-A) which has the lesser mean value is more effective than (GROUP-B).

GRAPH - 1

COMPARISON OF SYSTOLIC BLOOD PRESSURE LEVEL BETWEEN GROUP – A AND GROUP – B IN PRE TEST ANDPOST TEST

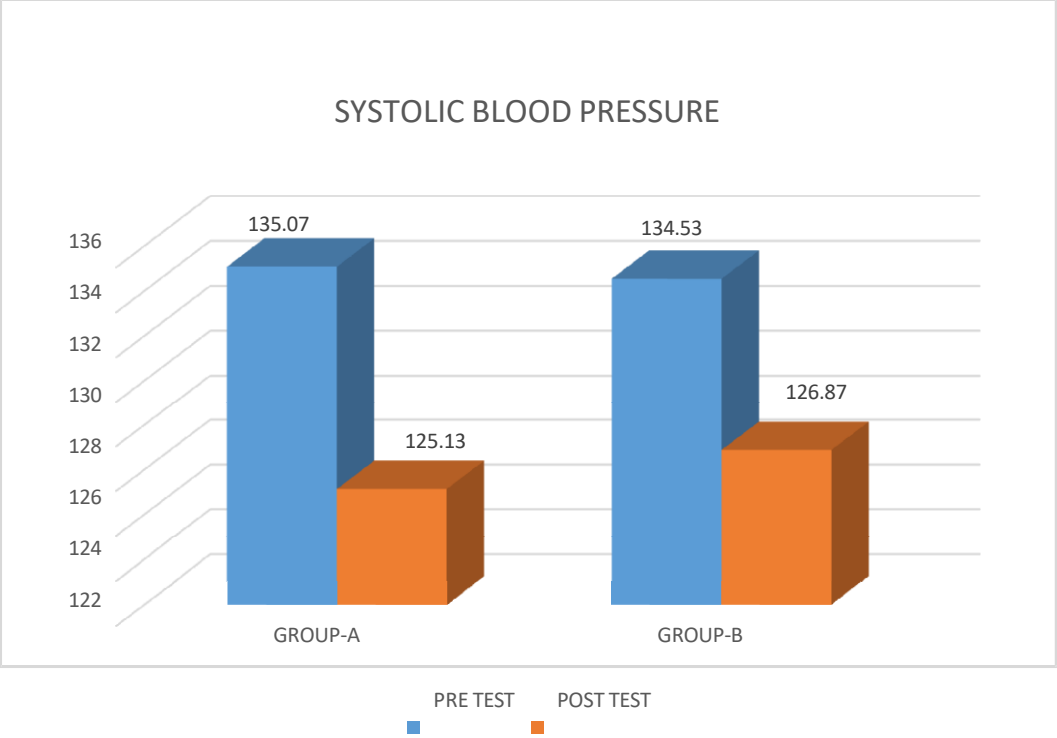


TABLE - 2

COMPARISON OF DIASTOLIC BLOOD PRESSURE LEVEL BETWEEN GROUP – A AND GROUP – B IN PRE TEST ANDPOST TEST

DIASTOLIC BLOOD PRESSURE	GROUP A		GROUP B		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	85.07	2.28	84.67	2.63	0.444	.660*
POST TEST	76.33	1.54	77.73	1.62	2.420	.022*

(*- P > 0.05, **- P ≤ 0.05)

The above table reveals the Mean, Standard Deviation (S.D), t-test and p- value of the Diastolic Blood Pressure between (Group A) & (Group B) in pre test and post test.

This table shows that there is no significant difference in pre test values of the Diastolic Blood Pressure between Group A & Group B (*P > 0.05).

This table shows that there is a significant difference in post test values of the Diastolic Blood Pressure between Group A & Group B (**P ≤ 0.001).

Both the group shows significant decrease in the post-test means but (GROUP-A) which has the lesser mean value is more effective than (GROUP-B).

GRAPH – 2

COMPARISON OF DIASTOLIC BLOOD PRESSURE LEVEL BETWEEN GROUP – A AND GROUP – B IN PRE TEST ANDPOST TEST

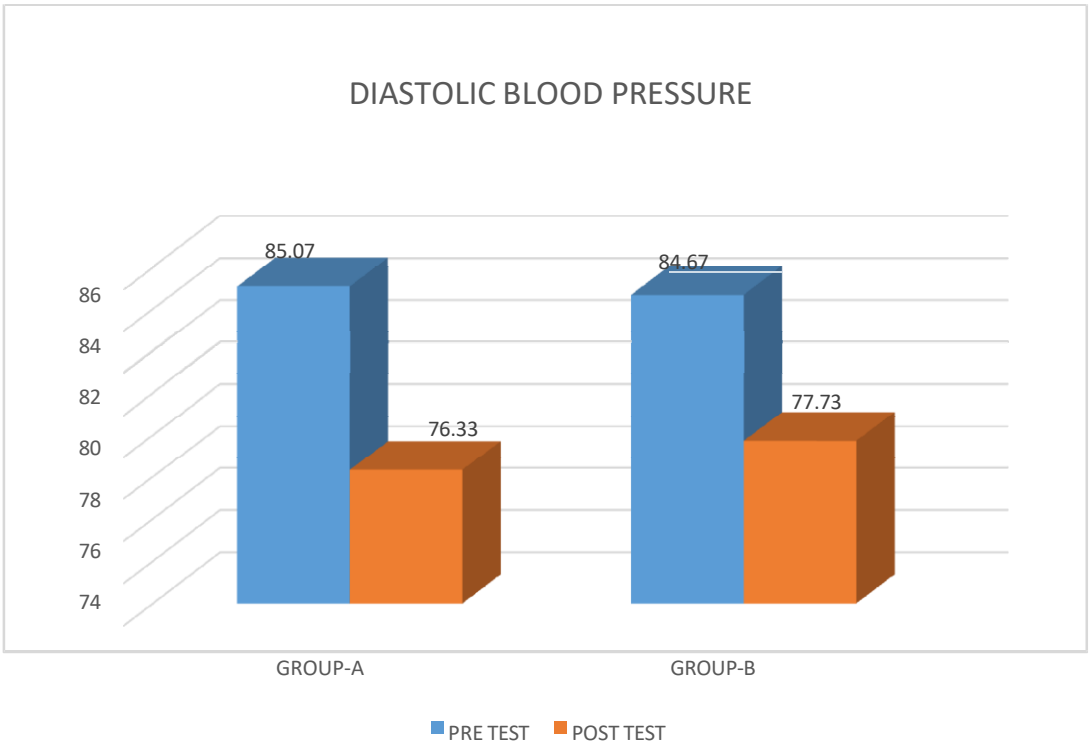


TABLE – 3 COMPARISON OF BLOOD PRESSURE BETWEEN PRE TEST AND POST TEST WITHIN GROUP – A

GROUP – A	PRE TEST		POST TEST		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
SYSTOLIC BP	135.07	2.31	125.13	2.50	18.751	.000*
DIASTOLIC BP	85.07	2.28	76.33	1.54	22.053	.000*

(*- P ≤ 0.001)

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A.

There is a statistically highly significant difference between the pre test and post test values of Blood Pressure within Group - A (*- P ≤ 0.001).

GRAPH – 3

COMPARISON OF BLOOD PRESSURE BETWEEN PRE TEST AND POST TEST WITHIN GROUP – A

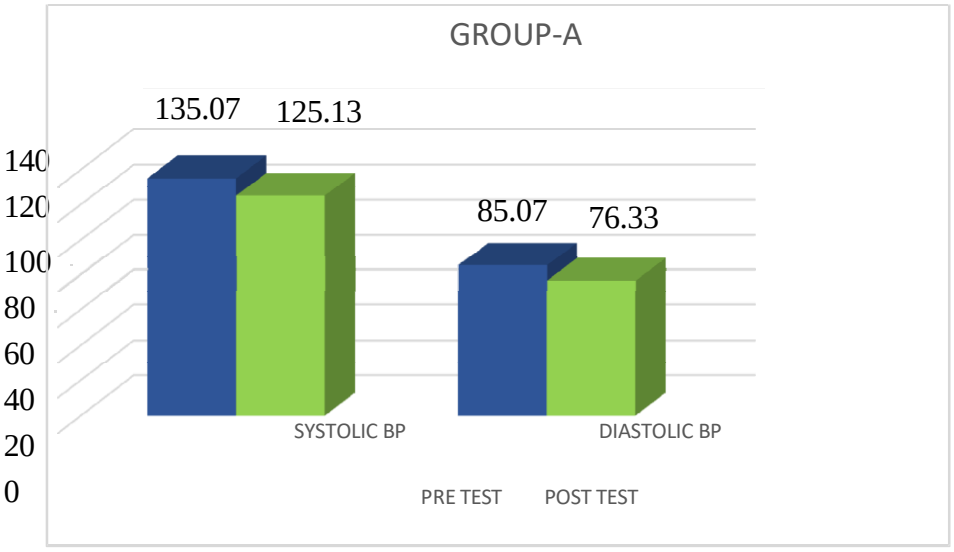


TABLE – 4

COMPARISON OF BLOOD PRESSURE BETWEEN PRE TEST AND POST TEST WITHIN GROUP – B

GROUP – B	PRE TEST		POST TEST		t-TEST	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
SYSTOLIC BP	134.53	2.72	126.87	1.92	11.888	.000*
DIASTOLIC BP	84.67	2.63	77.73	1.62	9.539	.000*

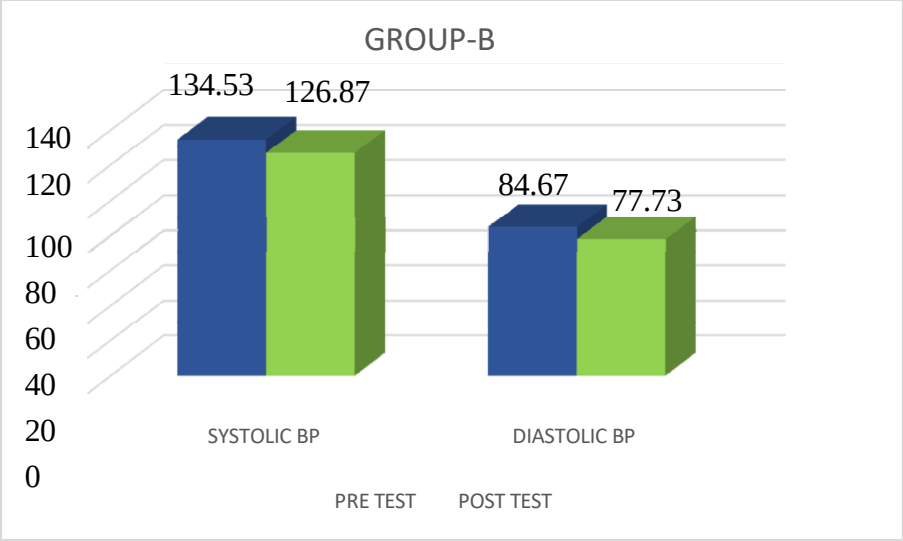
(*- P ≤ 0.001)

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – B.

There is a statistically highly significant difference between the pre-test and post-test values of Blood Pressure within Group - B (*- P ≤ 0.001).

GRAPH – 4

COMPARISON OF BLOOD PRESSURE BETWEEN PRE TEST AND POST TEST WITHIN GROUP – B



RESULT:

In Table 1, on comparing mean values of GROUP-And GROUP-B on Systolic Blood Pressure shows highly significant improvement in the post-test mean but GROUP-A shows (125.13) lesser mean value is more effective than GROUP-B (126.87) at P≤0.05, Hence the null hypothesis is rejected**.**

In Table 2, on comparing mean values of GROUP-And GROUP-B on Diastolic Blood pressure shows highly significant improvement in the post-test mean but GROUP-A shows (76.33) lesser mean value is more effective than GROUP-B (77.73) at P≤0.05, Hence the null hypothesis is rejected.

In Table 3 & 4, On comparing Mean Values of Blood Pressure Between pre-test and post-test within the Group-A and Group-B shows highly significant difference at p≤ 0.001.Hence the null hypothesis is rejected.

DISCUSSION:

Aim of the study was to compare the impact of isometric exercise training versus aerobic exercise training on BP control among hypertension patients Aerobic exercise is one of no pharmacological treatment methods and is recommended by European and American hypertension guidelines to reduce blood pressure. It is reported that moderate-intensity aerobic exercise is able to reduce both systolic blood pressure (SBP) and diastolic blood pressure (DBP) in both male and female patients with essential hypertension in pre- or stage 1. An isometric or static muscle contraction is defined as sustained muscle recruitment and activity with an increase in tension that is accompanied by no change in the length of the recruited muscle tissue or change in joint angle. In this study both aerobic and isometric was found to be significant and the subjects who received only isometric also showed improvement in which was not better than the subjects who has received both isometric and aerobic. In this study BP was measured by sphygmomanometer among stage 1 hyper tension. Purpose of the study was to take and in-depth look to determine the blood pressure among stage 1 hypertension in 45-55 years of age group. Exercise has been suggested to manage hypertension by inducing sweating and the corresponding loss of sodium and water from the body, the decrease in sodium and water content in the body associated with sweating may result in a reduction in blood volume and thus a decrease in blood pressure.

CONCLUSION:

The results of the study demonstrated that showed statistically significant improvements Reducing the hypertension, the study concludes that both isometric exercise training and aerobic exercise training are effective in reducing blood pressure among patients with Stage 1 Hypertension. However, aerobic exercise may provide greater overall cardiovascular and fitness benefits, while isometric exercise can be a simple and time-efficient alternative for blood pressure control. Therefore, This study concludes that aerobic exercises and isometric exercise training had considerable effect on reducing bp in stage 1 hypertension.

LIMITATION:

1. This study is limited in the age group between 45 – 55 years.
2. The sample size in this study is small. 3.Long term effects of treatment were not assessed due to short duration of time.

RECOMMEDATIONS:

1. The sample of this study design is small and it can be done on larger samples.
2. Different age groups can be considered
3. This study focuses on type-1 hypertensive patients alone which can be done Further with type-2 hypertensive patients.
4. This study can be done along with mean arterial pressure which enhances long term effect in hypertensive patients.

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