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Effectiveness of Buteyko Breathing Technique versus Slow Deep Breathing Technique Along With Aerobic Exercise on Blood Pressure and Functional Capacity among Essential Hypertensive Subjects - A Comparative Study

Mahima Manivannan[1], Mythili Ramesh[2], Preetha Jeevabharathi[3], Sivakumar Chinnusamy[4], Pradeepa Mani[5]

[1]MPT Student, PPG College of Physiotherapy (Affiliated to the Tamil Nadu Dr. MGR Medical University) Chennai - 600032
[2]Lecturer Ppg College of nursing (Affiliated to the Tamil Nadu Dr. MGR Medical University) Chennai - 600032
[3]Professor, PPG College of physiotherapy (Affiliated to the Tamil Nadu Dr. MGR Medical University) Chennai - 600032
[4]Principal, PPG College of physiotherapy (Affiliated to the Tamil Nadu Dr. MGR Medical University) Chennai - 600032
[5]Vice Principal, PPG College of physiotherapy (Affiliated to the Tamil Nadu Dr. MGR Medical University) Chennai – 600032

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ABSTRACT:

Background: Hypertension is a leading modifiable risk factor for cardiovascular and cerebrovascular disease. Of more than 1.3 billion people with hypertension globally, 82% live in low- and middle-income countries, and India alone is home to an estimated 220 million people with hypertension. A number of factors increase Hypertension, including Obesity, Insulin resistance, High alcohol intake, High salt intake, Aging, sedentary lifestyle, stress, Low potassium intake and low calcium intake. This can lead to increase blood pressure levels and slow down our daily activities of our capacity.

Objectives: The study's primary objective was to evaluate the effectiveness of Buteyko breathing technique and slow deep breathing technique along with Aerobic exercise on blood pressure and functional capacity among essential hypertensive subjects.

Subjects and methods: 40 Subjects with Essential hypertension were selected for this study based on the selection criteria. Group A consisting of 20 subjects and they were treated with Buteyko breathing technique along with Aerobic exercise. Group B consisting of 20 subjects and they were treated with slow deep breathing along with Aerobic exercise. The objective and the aim of the study were clearly explained to the ethical committee of PPG COLLEGE OF PHYSIOTHERAPY and permission was obtained. Both the groups received intervention and the Aerobic exercise increases progressively for each 2 weeks, 6 days a week for 6 weeks. The pre and the post test score values on blood pressure and Functional capacity were measured by using Sphygmomanometer and Incremental Shuttle Walk test (ISWT) test and the values were recorded.

Results: Thus, the resultant of the study shows that in paired‘t’ test, the obtained result was 2.093 greater than observed calculated probability. In unpaired‘t’ test post- post comparison results was 2.7, 2.1 in ISWT 9.1 greater than observed‘t’ value was 2.024. It showed that there was significant improvement on Blood pressure and Functional capacity. Eventually, alternate hypothesis is accepted.

Conclusion: it concluded that Blood pressure readings and functional capacity among essential hypertensive patients after the application of Buteyko breathing technique along with Aerobic exercise for Group A and Slow Deep Breathing technique along with Aerobic exercise for Group B for a period of 6 months. But, Buteyko breathing is effective in reducing Blood pressure and improving Functional Capacity when it was compared with Group B.

Clinical Implications: Buteyko breathing technique along with Aerobic reducing Blood pressure and improving Functional Capacity in essential hypertensive subjects.

Keywords: Buteyko Breathing Technique, Slow Deep Breathing, Incremental Shuttle Walk Test, Blood Pressure, Essential Hypertension, Aerobic exercises.

1. Introduction

Hypertension is a high systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg in a state of rest or calm. Hypertension is a leading modifiable risk factor for cardiovascular and cerebrovascular disease and it leads to several pathological conditions including renal failure, congestive heart failure, stroke and myocardial infarction. While hypertension is largely caused by a range of genetic, lifestyle modifications and environmental risk factors. [(1)] Hypertension is associated with 12.8% of all deaths globally. Many countries have implemented large-scale programs to diagnose and manage hypertension and other chronic diseases, with varying success.[(2)] Of more than 1.3 billion people with hypertension globally, 82% live in low- and middle-income countries, and India alone is home to an estimated 220 million people with hypertension.[(3).] In order to meet the global and national target of 25% relative reduction in the prevalence of Hypertension by 2025[(4).] He causes of essential hypertension are not known, this is only partially true, because we have little information on genetic variations or genes that are over expressed or under expressed as well as the intermediary phenotypes that they regulate to cause high BP. It's classified by European Society of Hypertension (ESH) and European Society of Cardiology (ESC) Hypertension guidelines. There are various mechanisms described for the development of hypertension, which include increased salt absorption resulting in volume expansion, an impaired response of the renin-angiotensin-aldosterone system (RAAS), and increased activation of the sympathetic nervous system. These changes lead to the development of increased total peripheral resistance and increased after load, which in turn leads to the development of hypertension. Pressure natriuresis can result from impaired renal function, inappropriate activation of hormones that regulate salt and water excretion by the kidney (such as those in the renin- angiotensin-aldosterone system), or excessive activation of the sympathetic nervous system. Symptoms include Severe headaches, Chest pain, dizziness, Vomiting, Blurred vision and anxiety are most severe factors involved in Essential Hypertension.[(5).] Diagnosed with Blood workup including complete blood count, ESR, creatinine, GFR, electrolytes, HbA1c, thyroid profile, blood cholesterol levels, and serum uric acid, Urine albumin to creatinine ratio, Ankle-brachial pressure index – ABI. Buteyko breathing technique and Slow Deep Breathing exercises along with aerobic exercise are very useful in controlling blood pressure and improving the daily functional activities. Buteyko breathing technique is supposed to lower pulmonary airflow which increases carbon dioxide level causes an increase in oxygen partial pressure forcing oxygen to be released from hemoglobin (Bohr Effect). Slow Deep breathing technique decreases Parasympathetic activity and improves Cardio vascular and respiratory functions. It will increase the baroreflex sensitivity and reduce chemo reflex activation. Aerobic exercises is a useful adjunctive therapy in treating hypertension. It reduces systolic blood pressure, diastolic blood pressure and improves the capacity of the cardiovascular system to uptake and transport oxygen. [(6).]

2. Methodology

Study design: A comparative study design, pre-test, post-test evaluation was used with two different intervention groups to assess the effectiveness of Buteyko breathing technique and slow deep breathing technique along with Aerobic exercise on blood pressure and functional capacity among essential hypertensive subjects.

Subjects: Those subjects with medical history of Essential Hypertension. 40 subjects were randomly allocated into two groups by using lot method. This study was conducted in the Department of Cardio respiratory physiotherapy, Ashwin Multispecialty Hospital, Coimbatore. The treatment duration was for 12 weeks. The inclusion criteria for this study

are Patient clinically diagnosed with Primary Hypertension, Patients who have undergone Anti-hypertensive drugs for 1 year, Patients with Age group 30-45 years, Patient with Systolic blood pressure ≥ 140 mmHg, Patient with Diastolic blood pressure ≥ 90 mmHg, Patient without Obesity (BMI ≤ 30, Willingness to participate in this study. The exclusion criteria are Patients with Other Chronic respiratory disease New or current Smoker and Alcoholic, Patients with Respiratory tract infection, Diabetes, Kidney failure, Seizures, Chronic renal failure, Asthma, Cardiac diseases, Pregnant woman is excluded, Patients with Severe hypertension**.** Treatment procedure was clearly explained to the patient and the inform consent form was received from the patient prior to the study. Both the groups received intervention and the Aerobic exercise increases progressively for each 2 weeks, 6 days a week for 6 weeks. The pre and the post test score values on blood pressure and Functional capacity were measured by using Sphygmomanometer and Incremental Shuttle Walk test (ISWT) test and the values were recorded.

Description of Experimental Intervention

Buteyko Breathing Technique

The patient should be sit in a relaxed position and the spine to stay upright. Relax the respiratory muscles and breathe normally for a few minutes. Therapist is standing beside the patient. The patient was asked to take a deep breath. After taking the deep breath, the patient was asked to hold the breath. After that should be use of index finger and thumb to connect the nose. The patient was asked to Keep the air as long as possible, until reached the level of moderate discomfort, should be pull. It may involve the non-engaging movement of the diaphragm, and then exhale. The Patient should be breathing normally for at least 10 seconds. The Patient should be repeat for 15 minutes. Hold period – Maximal pause as long as possible. Rest Period – 10 seconds

AEROBIC EXERCISES: After Buteyko breathing technique was performed, Aerobic exercises like Brisk-walking, jogging, static-cycling was performed for reducing the blood pressure and improving the functional capacity. The duration increases progressively for each 2 weeks. The rest interval for each exercise consists of 2 minutes, for every 2 weeks the blood pressure and Incremental Shuttle Walk Test (ISWT) should be recorded. Duration of exercise 1-2 weeks – 5 minutes, 2-4 weeks – 10 minutes, 4-6 weeks – 15 minutes given Brisk- Walking, Jogging, Static-cycling

5. Another group received slow deep breathing technique: The patient should be positioned in relaxed sitting position in a comfortable manner. Therapist is standing beside the patient. Ask the patient to place both the hands over the abdomen and ask them to inhale deeply through nose for 3 seconds. The patient is asked to hold their breath for 3 seconds. The Patient should feel the movement of the diaphragm. Ask the patient to pursed lips (Whistling), exhale through the mouth slowly within 6 seconds. The Patient should repeat several times for 15 minutes. Inhale-3 seconds, Hold period – 3 seconds, Exhale -6 seconds, Rest Period – 10 seconds and aerobic exercises also given.

Statistical Analysis

The result was analyzed for pre and post-test values using paired‘t’ test favored for alternate hypothesis. The statistical tools used in the study are paired t-test. The paired‘t’ test was used for within group analysis. Pre-test and post-test values were calculated using paired ‘t’ test at significant level of $p<0.05$ with t value of 2.093. In between group analysis t value was calculated by unpaired‘t’ test at 5% level of significance with table t value of 2.024

3. Results

The demographical presentation of subjects is shown in table 1. The group A consists of 8 males and 12 females. The group B consists of 9 males and 11 females. The age range of the group is 30-45 years.

Table 1: Demographic characteristics of subjects

VARIABLES	GROUP A	GROUP B
AGE	30-40 = 7 41-45 = 13	30-40 = 5 41-45 = 15
GENDER	Male = 8 Female = 12	Male = 9 Female = 11

Table 2: Both group A and B pre intervention phase

Outcome Parameter	Groups	Mean	SD	T-value*
Systolic Pressure	Group A	168.5	10.5	0.1
	Group B	170.2	11.5	
Diastolic Pressure	Group A	106.6	9.9	0.0
	Group B	107.7	7.8	
ISWT	Group A	679.4	17.2	0.0
	Group B	679.8	17.8	

*Significant at 0.05 levels (p>0.05)

The table 2 analysis showed that the calculated ‘t’ value using the unpaired ‘t’ test the pre-intervention phase and at the end of the twelve weeks of the intervention phase at 0.05 levels significance as shown in table 3.

Table 3: pre-intervention and post-intervention phase

Dependent variable	Groups	Pre-intervention stage		Post intervention stage		T-value*
		Mean	SD	Mean	SD	
Systolic Pressure	Group A	168.5	10.5	143.9	13.3	33.1
	Group B	170.2	3.09	154.6	1.9	31.2
Diastolic Pressure	Group A	106.6	9.9	92.3	5.7	12.1
	Group B	107.7	7.8	101.6	8.2	8.4
ISWT	Group A	679.4	17.2	780.9	20	17.97
	Group B	679.8	17.8	717	13.2	10.8

*Significant at 0.05 levels (p<0.05)

Further, a significant difference is observed between the two groups while analysing the effect therapeutic intervention on the three dependent variables such as systolic pressure, diastolic

pressure and ISWT. Furthermore, while considering the mean score of all the outcome variables, group A is better than the Group B (Table 4).

Table 4: Both Group A and Group B during the post intervention stage

Outcome Parameter	**Groups**	**Mean**	**SD**	**T-value***
Systolic Pressure	Group A	143.9	13.3	2.7
	Group B	154.6	1.9	
Diastolic Pressure	Group A	92.3	5.7	2.1
	Group B	101.6	8.2	
ISWT	Group A	780.9	20	9.1
	Group B	717	13.2	

*Significant at 0.05 levels ($p<0.05$)

From table 4, it is inferred that the group A, which was greater than the Group B, at 0.05 levels of significance.

Results: Thus, the resultant of the study shows that in paired‘t’ test, the obtained result was 2.093 greater than observed calculated probability. In unpaired‘t’ test post- post comparison results was 2.7, 2.1 in ISWT 9.1 greater than observed‘t’ value was 2.024. It showed that there was significant improvement on Blood pressure and Functional capacity. Eventually, alternate hypothesis is accepted.

4. Discussion

Hypertension is a leading modifiable risk factor for cardiovascular and cerebrovascular disease and it leads to several pathological conditions including renal failure, congestive heart failure, stroke and myocardial infarction. While hypertension is largely caused by a range of genetic, lifestyle modifications and environmental risk factors. Gut micro bacteria (GM) dysregulation may have a role in the development of hypertension. No single factor is more important for increasing CV morbidity, mortality and overall mortality than a high blood pressure (BP) state. Coronary heart disease is three times more frequent in hypertensive than in normotensive individuals, and the clinical manifestations of this condition (angina, myocardial infarction and sudden death) are no less dependent upon elevated BP than uponelevated serum cholesterol.

The present study has demonstrated the effectiveness of Buteyko breathing technique and slow deep breathing technique along with conventional physiotherapy among subjects with Primary hypertensive patients. The sphygmomanometer is a device that helps health workers to measure a person's blood pressure. In general, a sphygmomanometer is divided into 2 types, an invasive blood pressure measurement and a non-invasive blood pressure measurement. Invasive blood pressure measurement uses a heparin solution to create pressure equal to the patient's mean arterial pressure. As a result, blood pressure measurements can be performed accurately at low pressures and can also monitor beat-by- beat blood pressure monitoring.

The Buteyko Method incorporates reduced-volume breathing as its fundamental technique, which is done by sitting in an erect posture and relaxing the muscles of respiration until one feels a slight lack of air. This sensation of slight breathlessness is then maintained by a combination of relaxation of breathing muscles, erect posture, and a little tension of the abdomen. In a formal practice session, combination of breath- holding techniques is used to perform the reduced-volume breathing, the two most important being a short breath hold called the Control Pause, and a longer breath hold called the Maximum Pause. The Buteyko breathing

is a nasal breathing pattern. At the core it focuses on breathing through the nose, breath Holding and relaxation.
Slow breathing in research has been defined as a respiratory rate less than 10 breaths a minute. Breathing at slow rates reduces psychological stress as measured by self-report. A majority of psychological studies have focused on the acute rather than long-term effects of slow breathing. The reduction in psychological stress have been attributed to slow breathing rhythms entraining neuronal activity in networks that affect emotion, cognition, and memory. Slow breathing also has been reported to reduce physiological stress as measured by changes in the autonomic nervous system with a decrease in sympathetic and increase parasympathetic tone.
In this study, 40 subjects were selected based on selection criteria. They were divided into two groups by using randomized trial by lot method. Group A consisted of 20 subjects and the received Buteyko breathing technique along with conventional aerobics. Group B consisted of 20 subjects and the received slow deep breathing technique along with aerobic exercise.
The study conducted over a period of 6 weeks. The pre-test score and post-test score before and after 6 weeks of treatment for blood pressure and functional capacity by using Sphygmomanometer and ISWT and the values were recorded.

Limitations
The study was limits to particular age group.
The study was conducted in short duration.
The study did not include a control group.
The study included Specific stage of hypertension.

Further directions of this study:
Similar study can be done on patients with secondary hypertension
Similar study can be done with more number of subjects
The study can be performed for a longer study duration
Further studies can be done with other conventional therapy as a common technique.
Having a control group is desirable.

5. Conclusion

The study concluded that, both the groups showed statistically significant reduced in Blood pressure readings and improvement in functional capacity among essential hypertensive patients after the application of Buteyko breathing technique along with Aerobic exercise for Group A and Slow Deep Breathing technique along with Aerobic exercise for Group B for a period of 6 weeks. But Group a showed significant improvement when it was compared with Group B.

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