Original Research Article

Study of effect of slow and deep breathing exercise on blood pressure among the patients with essential hypertension

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Abstract

Background: Normal function of cardiovascular system is an important for healthy and fruitful life. With a prevalence rising to over 30 % in India, hypertension is recognized as a major health problem throughout the world leading to a wide range of life threatening cardiovascular diseases. Hypertension can be treated by pharmacological and non-pharmacological methods. Non-pharmacological methods are more affordable in the developing countries because they offer the prospect of addressing the underlying problem rather than just the symptoms. Deep breathing exercise is one of the exercise and relaxation technique which helps to decrease the blood pressure to maintain the health in optimal state. **Method and Materials:** The purpose of this study is to determine the effectiveness of deep breathing exercise on blood pressure among patients with essential hypertension. A research design adopted for this study was randomized control trial. The sample size was 50 in study group and control group each. Subjects were distributed randomly in both the groups. Slow and deep breathing exercise was done by the study group for one month. The control group received the routine care. Their blood pressure was measured by automated Sphygmomanometer before as well as after the study duration in both the groups. **Results:** Data were analyzed by using descriptive and inferential statistics. Deep breathing exercise was found to be effective in reducing both systolic and diastolic blood pressure at the level of $p<0.05$. The study findings concluded that the breathing exercise reduces the blood pressure and improve the quality of life of the patient. Continuously practicing deep breathing exercise can also reduce medicine usage there by it can be used routinely as a complementary method of treatment for hypertension. **Conclusion:** Practicing slow deep breathing exercise decreases the systolic and diastolic blood pressure of the patients with essential hypertension.

Key Words: Blood pressure, essential hypertension, slow and deep breathing exercise, hypertensive patients.

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INTRODUCTION

Hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated.[1] High blood pressure typically does not cause symptoms. Hypertension is a widespread health problem and is called the "silent killer" because it often has no warning signs or symptoms, and many people don't realize they have it.[2,3] It has been estimated that hypertension accounts 6% of deaths worldwide. Long-term high blood pressure, however, is a major risk factor for coronary artery disease, stroke, heart failure, atrial fibrillation, peripheral vascular disease, vision

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loss, chronic kidney disease and dementia.[4,5,6] Classification of hypertension for adults ages 18 and older has been provided by the Seventh Report of the Joint National Committee of High Blood Pressure (JNC 7 Classification, 2013), patients with sustained rise in blood pressure above 140/90 mmHg.[1] Essential hypertension is the most prevalent type, affecting 90-95% of hypertensive patients. [7] With this type of hypertension, there is no single identifiable cause; its pathogenesis is multifactorial can trigger risk as genetic factors which play an important role. Environmental factors such as sedentary lifestyle, stress, high salt (sodium) intake, smoking, high alcohol intake, obesity, insulin resistance and ageing, are also significant.[8,9] Secondary hypertension is a less common, affects about 5 to 10 percent of hypertension cases, results from various conditions and medications. [10] Pharmacological therapy is recommended to the patients whose blood pressure is ≥140/90 mmHg. It includes variety of antihypertensive drugs such as diuretics, beta blocker, alpha antagonist, and sympatholytics. Non-pharmacological intervention includes salt restriction, dietary modification, fat restriction, yoga, exercise and relaxation technique and avoidance of caffeine, smoking and alcohol. Deep breathing exercise is one of the exercise and relaxation technique which increases blood and oxygen flow to the brain to function in its optimal state. During deep breathing exercise on inhalation the abdomen, lower ribcage and lower back all expand thus drawing the diaphragm down deeper into the abdomen and retract on exhalation, allowing the diaphragm to move fully upward toward the heart and also while the diaphragm moves downward it massages the liver, stomach and other organs and tissues below it, and upward to massage the heart. Combined with the outward and inward movements of abdomen, ribcage and lower back help to promote blood flow and peristalsis and pump the lymph more efficiently through our lymphatic system. [11] Slow and deep breathing improves vagal activity and therefore decreases baseline heart rate and blood pressure. This is associated by improving vagal tone and by decreasing sympathetic discharge. Improvement in both sympathetic and parasympathetic reactivity may be the mechanism that is associated in those practicing the slow breathing exercises. [12] Deep breathing increases blood and oxygen flow to the brain causing it to function in its optimal state. It creates a connection between mind and body that can lead to greater self-awareness, mindfulness and clear thinking, improves circulation, which improves heart efficiency, energy levels and helps the body eliminate toxins, as well as reduces stress. [13] Hence, practicing deep breathing exercise influence autonomic functions and has therapeutic benefit to hypertensive patients. By considering the mentioned benefits of breathing exercise on hypertension, we studied the effectiveness of it on patients of essential hypertension as a non-pharmacological complementary approach to treat essential hypertensive patients.

MATERIALS AND METHODS

The study design is Randomized Control Trial carried out in the tertiary care centre. The study subjects were selected from medicine outpatient department. Hundred known patients with essential hypertension and age between 31 to 60 years of both sexes, with mean duration of disease 0 to 10 years were selected (n=100). The systolic blood pressure range (140 - 160 mm Hg) and diastolic blood pressure range (80 - 100 mm Hg) with no change in medications for at least 2 months preceding the study. Patients were assigned into two groups randomly i.e. Study group and Control group comprising of 50 patients each. Patients with history of ischemic heart disease, congestive heart failure, chronic atrial fibrillation, renal failure, diabetes mellitus, previous stroke, major organ failure, respiratory diseases, psychiatric disorders and any other secondary causes of hypertension were excluded from this study.Both groups were volunteer patients. All of the participants were signed an informed consent form prior to the commencement of the study. The study was reviewed and approved by Ethics Committee of our institute.

Inclusion criteria-

(a) Age between 30 to 60 years,
(b) Patients diagnosed with essential hypertension, taking anti-hypertensive medication,
(c) Duration of hypertension upto 10 years,
(d) No past history of any chronic illness like chronic renal failure, liver disease, angina, diabetes mellitus etc,
(e) Ready to participate in the study.

Exclusion criteria-

(a) Uncontrolled hypertension cases,
(b) Duration of hypertension more than 10 years,
(c) Excluded smokers and women taking oral contraceptives and women during menstrual and premenstrual phases,
(d) Patients with secondary causes of hypertension.

RESULTS

The present study was done in 100 participants of which 50 were in study group and 50 were control group. (Study group- n=50, Control group n=50). The mean value and standard deviation were calculated for the parameters to be studied in both the groups. 'T test' was applied to see whether the differences in means were statistically significant or not. P value less than 0.05 ($P < 0.05$) was considered to be statistically significant. P value of less than 0.001 ($P < 0.001$) was considered to be statistically

highly significant. The results of the present study are as follows.1) Table A shows that more than two thirds of the study sample their age ranged from 51- 60 years (76% and 82% study and control group respectively) which indicates that essential hypertension increases with age. Most of the participant patients were males (86% and 82% males in study and control group respectively). More than half of the subjects were from residing in urban areas. Most of patients had a university education i.e. 58% and 54% in study and control group respectively. 2) From the Table B it is clear that, the average systolic blood pressure of the study group before the exercise intervention was 152.94±3.89 mmHg. The average systolic blood pressure after the exercise intervention was 145.66±4.35 mmHg. The test statistics value of the paired t test was 19.31 with the p value 0.000. Here p value less than 0.001, shows that there is highly significant difference in the systolic blood pressure. In the study group, the average diastolic blood pressure before and after the exercise intervention was 84.76±1.97 mmHg and 79.58 ±2.57 mmHg respectively. The test statistics value of the paired t test was 27.43 with the p value 0.000. Here p value less than 0.001, shows that there is highly significant difference in the diastolic blood pressure.3) From the Table C it is clear that, the average systolic blood pressure of the control group before and after the study duration were 152.08±3.88 mmHg and 151.62±3.86 mmHg respectively. The test statistics value of the paired t test was 3.93 with the p value 0.068. Here p value more than 0.05, shows that there is no significant difference in the systolic blood pressure. In the control group, the values for diastolic blood pressure before and after study duration were 84.24 ±1.98 mmHg and 83.92 ±2.21 mmHg respectively. The test statistics value of the paired t test was 1.45 with the p value 0.153. Here p value more than 0.05, shows that there is no significant difference in the diastolic blood pressure.4) As per Table D, the average systolic blood pressure in the study group after the exercise intervention was 145.66 mmHg with standard deviation of 4.35. The average systolic blood pressure of control group after the one month was 151.62 mmHg with standard deviation of 3.94. The test statistics value of the unpaired t test was 7.18 with the p value 0.000. Here p value less than 0.05, shows that there is significant difference in the systolic blood pressure. In the study group, the average diastolic blood pressure after the exercise intervention was 79.58 mmHg with standard deviation of 2.57. The average diastolic blood pressure of control group after one month was 83.92 mmHg with standard deviation of 2.21. The test statistics value of the unpaired t test was 9.05 with the p value 0.000. Here p value less than 0.05, shows that there is significant difference in the diastolic blood pressure.

Table a: The Distribution of Frequency and Percentage of Demographic Variables among Patients with Hypertension in Experimental and Control Group

Parameters		Study Group [n=50]		Control patients [n=50]	
		Frequency	Percentage	Frequency	Percentage
Age (years)	31-40	03	06	02	04
	41-50	09	18	07	14
	51-60	38	76	41	82
Sex	Male	43	86	41	82
	Female	07	14	09	18
Duration of Hypertension (years)	< 1 year	10	20	12	24
	1-5 year	27	54	26	52
	>5year	13	26	12	24
Residence (Urban or Rural)	Urban	31	62	32	64
	Rural	19	38	18	36
Marital status	Married	37	74	35	70
	Unmarried	13	26	15	30
Level of Education	Illiterate	03	06	04	08
	Secondary	18	36	19	38
	University	29	58	27	54
		Mean		Mean	
Weight (kg)		65		66	

Table b: Table Showing Blood Pressure Values of Pre and Post Breathing Exercises Intervention among the Study Group. (Paired t test)

Study Parameters	Before Exercise Intervention		After Exercise Intervention		t Value	P Value	Remark
	Mean	SD	Mean	SD			
Systolic Blood Pressure	152.94	3.89	145.66	4.35	19.31	0.000*	HS
Diastolic Blood Pressure	84.76	1.97	79.58	2.57	27.43	0.000*	HS

SD- Standard Deviation HS- Highly Significant P < 0.001* – Statistically highly significant.

Table C: Table Showing Blood Pressure Values Before and After study Duration among the Control Group. (Paired t test)

Study Parameters	At the start of study		After One Month		t Value	P Value	Remark
	Mean	SD	Mean	SD			
Systolic Blood Pressure	152.08	3.88	151.62	3.86	3.93	0.068**	Not Significant
Diastolic Blood Pressure	84.24	1.98	83.92	2.21	1.45	0.153**	Not Significant

SD- Standard Deviation P > 0.05** – Statistically not significant

Table D: Table Showing Blood Pressure Values After study Duration among the Study Group and Control Group. (Unpaired t test)

Study Parameters	Experimental		Control		t Value	P Value	Remark
	Mean	SD	Mean	SD			
Systolic Blood Pressure	145.66	4.35	151.62	3.94	7.18	0.000*	HS
Diastolic Blood Pressure	79.58	2.57	83.92	2.21	9.05	0.000*	HS

SD- Standard Deviation HS- Highly SignificantP < 0.001* – Statistically highly significant

DISCUSSION

Blood pressure is one of vital parameter for one's health. Lifestyle, Diet and exercise are fundamental elements to control blood pressure. Although many complementary therapies are promoted for the treatment of hypertension, few are truly therapeutic. The present study examined the effect of slow and deep breathing exercise intervention on the reduction of blood pressure among hypertensive patients. The current study findings showed that more than two thirds of the study sample, age ranged between 51 to 60 years and more than one fourth their age ranged between 41 to 50 years, which indicates that essential hypertension increases with age. This result is supported by studies done by Madhur *et al*(2014) that the prevalence of essential hypertension was found to increase with age.[7] Most of the study subjects were males. This coincides with the study done by Bani *et al*[14] (2011) that male subjects had a higher prevalence of hypertension than female. More than half of subjects residing in urban areas, that could explain that urban areas are more stressful than rural areas as a result of urbanization and rapid rhythm of life style; this correspond with Bani[14] (2011) that hypertension might be more prevalent in urban communities. Most of patients had a higher education. This is indicator of lifestyle attributes and sedentary lifestyle and stress leading to high Blood Pressure. The present study illustrates a significant difference in systolic as well as diastolic blood pressure before and after one month breathing exercises; this could highlight the effect of slow deep breathing exercises intervention among essential hypertensive patients. Furthermore values of systolic and diastolic BP were decreased after breathing exercises intervention, as the maximum systolic BP before starting intervention was 160 mmHg, decreased to 154 mmHg. Diastolic BP decreased from maximum 90 mmHg to 82 mmHg after one month of successful intervention. Moreover, mean systolic BP breathing exercises decreased from 152.94 mmHg to 145.66 mmHg after intervention. In addition, the mean value of diastolic BP was decreased from 84.76 mmHg to 79.58 mmHg after intervention. This is supported by another study on healthy people conducted by Tharion *et al*[15] (2012) which revealed mean SBP and DBP in volunteers decreased from 91.51 mmHg to 85.51mmHg and 85.40 mmHg to 81.46 mmHg respectively. Other studies Adhana *et al*[8] (2013), McElroy *et al* [16] (2013) and Lee *et al*[17] (2008) supported the current study results. Kaushik *et al*[18] (2006) added that slow breathing modality increased the parasympathetic tone resulting in a fall in systolic blood pressure, diastolic blood pressure and heart rate. Our results were also matched with the results of Joseph *et al* [(19)] who mentioned a significant decrease in blood pressure in essential hypertensive patients (from 149.7± 3.7 to 141.1 ± 4 mmHg and from 82.7± 3 to 77.8 ± 3.7 mm Hg, SBP and DBP respectively) by applying spontaneous and controlled breathing at slower breathing rate. They mentioned many possible explanations for their findings that slow breathing i.e. 6 cycle/min has the effect of entraining all RR interval fluctuations causing them to merge at the rate of respiration and to increase greatly in amplitude. This increase in RR interval fluctuations (relative to blood pressure changes) has the effect of enhancing the baroreflex efficiency and contributed to decrease blood pressure. [20] Slow breathing increases baroreflex sensitivity and reduces sympathetic activity and chemoreflex activation, it suggest a potentially beneficial effect in hypertension. The baroreflex is the system in the body that regulates blood pressure by controlling heart rate, strength of heart contractions, and diameter of blood vessels. Slow breathing reduces blood pressure and enhances baroreflex sensitivity in hypertensive patients. These effects appear potentially beneficial in the management of hypertension.[19,20,21] Additionally, slow breathing may reduce sympathetic activity by enhancing central inhibitory rhythms.[22] and consequently decrease the blood pressure while enhancing the baroreflex. Furthermore, the increase in tidal volume activates the Hering–Breuer reflex which in turn reduces the chemoreflex sensitivity and thus might enhance the baroreflex with an additional effect on reducing blood pressure and sympathetic activity.[23]

SUMMARY AND CONCLUSION

Based on findings of the current study, it can be concluded that, This study has proven that practicing slow deep breathing exercise daily for one month thrice a day for 30 min has significantly decreased the systolic and diastolic blood pressure of the patients diagnosed with essential hypertension. Hence it can be considered as a complementary modality and cost-effective strategy to help in treating essential hypertensive patients. Slow and deep breathing exercises are recommended as a relaxation technique and to reduce the arterial blood pressure in essential hypertensive patients. Further studies on a large number of individuals for a long duration are required to confirm the findings. Replicate the study on population with different medical diagnosis to ensure generalization of the results.

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