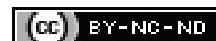


Effectiveness of Abdominal Breathing Exercise on Biological Parameters among Hypertensive Patients at Selected Tertiary Care Hospital, Mangaluru, India

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ABSTRACT

Introduction: High blood pressure, also known as Hypertension (HTN) is a long-term medical condition in which the blood pressure in the arteries remains consistently high. HTN rates in India are expected to rise. Abdominal breathing exercise activates the parasympathetic nervous system which decreases the heart rate and dilates blood vessels, reducing overall blood pressure.

Aim: To find out the effectiveness of abdominal breathing exercise on biological parameter among hypertensive patients.

Materials and Methods: This quasi-experimental time series design study was conducted at Yenepoya Medical College Hospital, Mangaluru, Karnataka, India, from February 2021 to March 2021. A total of 60 samples were selected, with 30 samples in each of the control and experimental groups. Abdominal breathing exercise was given for 5-10 minutes about 3-4 times a day for seven days after the pretest of biological parameter

assessment. Data was collected for three alternative days. The tools used were demographic proforma and clinical assessment proforma. Unpaired t-test and Chi-square test were used for statistical analysis.

Results: About 53.3% of the participants in the control group were males as compared to 66.7% in experimental group. The mean value of pretest Systolic Blood Pressure (SBP) and the Diastolic Blood Pressure (DBP) had no significant difference ($p>0.05$). However, after the abdominal exercises, there was significant difference in the mean SBP ($p=0.01$), DBP ($p=0.01$), Pulse Rate ($p=0.05$), Respiratory Rate (RR) ($p=0.01$) in experimental group when compared to control group.

Conclusion: The study concluded that abdominal breathing exercise reduced BP, HR and RR among hypertensive patients and it is an effective technique to reduce BP, PR and respiration.

Keywords: Health, Hypertension, Pulse rate, Respiration rate

INTRODUCTION

Health is the physical, social, psychological and spiritual well-being of individuals. Overall health of the population is determined by the people's income, education, employment and housing as a combination of preventive and rehabilitative approaches and services [1]. The foremost common hereditary diseases which are prevailing in Indian population are diabetes mellitus, HTN, cardiac disease, respiratory disorder, tuberculosis. Among these disease HTN is the most commonly seen [2].

The HTN is also named as silent killer because many people do not know that they are hypertensive. Varieties of safe and effective medications are available for treatment of high BP. These include older molecules like thiazide diuretics, beta-blocking agents, Calcium Channel Blockers (CCB) and newer molecules, such as, Angiotensin Converting Enzyme (ACE) inhibitors, and Angiotensin Receptor Blockers (ARB). In view of the recent clinical trials information, international guideline (World Health Organisation (WHO), International society of hypertension) counselled that CCB, ACE inhibitors or ARB (and not betablockers or diuretics) should be the initial therapy in HTN management. The former however, are much more expensive and beyond the affordability in several poor income countries [3,4]. The side-effects and cost of antihypertensive drugs have stimulated the search for a non pharmacological approach to control BP either as a first line or adjunctive treatment [5]. Complementary Therapy is proved to be one of the effective treatments for the most of the disease conditions. Complementary therapies such as yoga exercises, homeopathy, acupuncture, herbs and oils can boost the immune system, it helps to eliminate toxins, relieve pain, improve circulation, improve sleep pattern, increase

energy levels, induce deep relaxation, reduce stress and tension and restore balance to body systems [6].

Abdominal breathing exercise activates the parasympathetic nervous system which decreases HR and dilates blood vessels, reducing overall BP. Breathing deeply can help lower blood pressure, it relaxes the body and lowers the HR, reducing the chronic stress and tension that raises the BP. Deep breathing may also help the body to process the salt that contributes to high BP more effectively [3]. Diaphragmatic breathing exercise is a type of abdominal breathing exercise that helps strengthen the diaphragm, an important muscle that helps to breathe [7]. With regular practice, it helps to breathe from the abdomen most of the time, even while asleep. Breathing deeply can help to lower BP [8]. In 2005, 20.6% of Indian men and 20.9% of Indian women were diagnosed with HTN, according to a global study of data. By 2025, the proportion of Indian men and women with HTN is expected to rise to 22.9 and 23.6. Deep breathing exercise is the one of the measures which will overcome these issues in management of HTN. Regular practices of deep breathing exercise increase blood and oxygen flow to the brain to function normally [9].

Various researches on the effect of abdominal breathing exercise on HTN have been undertaken [6,7] and it has been discovered that exercise results in a significant reduction in BP. It was also discovered that long-term treatment leads to non compliance due to the high cost of treatment. As a result, it is critical to identify and administer a medication that is both cost-effective and successful in treating hypertension [6]. As a result, the investigator chose this topic to provide quality of care for management of HTN. The main objectives of the study were to assess the biological parameter among HTN patients, to evaluate the effectiveness of abdominal breathing

exercise on biological parameter among hypertensive patients and to find out the association between biological parameter with selected socio-demographic variables.

MATERIALS AND METHODS

This quasi-experimental time series design study conducted at Yenepoya Medical College Hospital, Mangaluru, Karnataka, India, for duration of one month from February 2021 to March 2021. Written approval for the study was obtained from the ethical committee of university. (Approval number: YEC2/467 Date 14/01/2021). Consent was obtained from all participants of the study.

Inclusion criteria: Hypertensive patients undergoing treatment, patients who were suffering with co-morbid medical conditions such as diabetes, kidney disease, cancer, cardiovascular disease were included in the study.

Exclusion criteria: Patients who had severe respiratory problems like pleural effusion, chronic obstructive pulmonary disease, haemodynamically unstable patients, patients who are already practicing abdominal breathing exercise, patients with gastrointestinal disorder were excluded from the study.

Sample size calculation: The sample size was calculated using G* statistical analysis. It was based on the 10% level of attrition $\alpha=0.01$. Power was 60% [10]. Hence, the sample size estimated was 60. The control group and experimental group had 30 samples each.

Procedure

After self-introductions, the investigator explained the purpose of the study and obtained consent from the subjects followed by an interview to obtain the demographic data and pretest biological outcomes (blood pressure by sphygmomanometer, pulse and respiration manually). The experimental group practiced abdominal breathing exercise for seven days, where the subject placed one hand on upper chest and the other hand just below the ribcage. Client breathed slowly through the nose and exhale through pursed lips [11]. This exercise was carried out 5-10 minutes about 3-4 times a day with the routine treatment and those in the control group received only routine treatment. The post-test (abdominal breathing exercise) BP, HR and RR was assessed in all 60 samples on 3rd (Post-test 1), 5th (Post-test 2) and 7th day (Post-test 3) during the intervention period.

STATISTICAL ANALYSIS

The data was analysed by using by descriptive and inferential statistics using SPSS version 16.0. Chi-square test, unpaired t-test, Mann-whitney test and Friedman rank test at 5% level of significance was used for statistical analysis. A p-value <0.05 is considered to be statistically significant.

RESULTS

Total 60 participants with age range from ≤ 30 to >51 years were divided in two groups. Each group had 30 participants, the control group consisted of 16 males and 14 females, while the experimental group had 20 males and 10 females.

Majority of the patients in the control group were above 51 years old, accounting for 9 patients (30%) whereas in the experimental group 9 patients (30%) belonged to ≤ 30 age group, while 6 (20%) were between the ages of 31 and 40. Males constituted the majority of the subjects in both the control and experimental groups. In the control group, 25 (83.3%) samples had a family history of hypertension, while in the experimental group, 21 (70%) samples had a history of hypertension [Table/Fig-1].

The pretest SBP and DBP between the experimental and control groups were comparable with $p>0.05$ [Table/Fig-2]. There was a significant decrease in the SBP post abdominal exercise in the experimental group when compared to the control group ($p=0.01$).

Variables	Control group		Experimental group		p-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Age in years					
≤ 30	7	23.3	9	30.0	0.22
31-40	7	23.3	6	20.0	
41-50	7	23.3	8	26.7	
>51	9	30.0	7	23.3	
Gender					
Male	16	53.3	20	66.7	0.28
Female	14	46.7	10	33.3	
Education					
No formal education	5	16.7	5	16.7	0.55
Primary	5	16.7	6	20.0	
High school	10	33.3	7	23.3	
Preuniversity college	8	26.7	10	33.3	
Degree and above	2	6.6	2	6.7	
Occupation					
Unemployed	16	53.3	12	40.0	0.12
Private sector	6	20.0	7	23.3	
Government sector	2	6.7	1	3.3	
Self employed	6	20.0	10	33.3	
Type of family					
Nuclear	17	56.7	17	56.7	0.33
Joint	13	43.3	13	43.3	
Diet					
Vegetarian	3	10.0	3	10.0	0.50
Non vegetarian	27	90.0	27	90.0	
Family history of hypertension					
Yes	25	83.3	21	70.0	0.15
No	5	16.7	9	30.0	
Habits					
Smoking	6	20.0	12	40.0	0.03
Drinking alcohol	6	20.0	7	23.3	
Chewing tobacco	2	6.7	2	6.7	
Duration since diagnosis of hypertension (yrs)					
≤ 3	10	33.3	8	26.7	0.09
4-6	8	26.7	12	40.0	
7-9	7	23.3	8	26.7	
≥ 10	5	16.7	2	6.6	

[Table/Fig-1]: Frequency and percentage distribution of sample characteristics. Chi-square test; $p<0.05$ level of significance

In experimental group post-test 3 IQR (10.0) was much less than the control group (12.50) and Z value was -5.39 and the obtained p-values was <0.05 hence there was a difference in SBP. In experimental group DBP on post-test 3 was 85.0 mmHg and in control group it was 96.0 mmHg with Z value -5.13 and the obtained p-value was <0.05 [Table/Fig-3].

Parameters (mmHg)	Control	Experimental	t-value	p-value
	Mean \pm SD	Mean \pm SD		
SBP pretest1	149.0 \pm 15.16	154.3 \pm 15.24	1.35	0.180
DBP pretest1	94.33 \pm 6.78	97.66 \pm 6.26	1.97	0.053

[Table/Fig-2]: Comparison between the mean pretest of the blood pressure in experimental and control group. n=30+30; Mann Whitney test; $p<0.05$ level of significance

Parameters (mmHg)	Control		Experimental		Z-value	p-value
	Mean	IQR	Mean	IQR		
SBP post-test 1	146.0	10.0	145.3	10.0	-0.30	0.76
SBP post-test 2	148.6	10.0	139.3	12.50	-4.34	0.01*
SBP post-test 3	150.3	12.50	133.3	10.0	-5.39	0.01*
DBP post-test 1	94.33	10.0	89.66	2.50	-2.74	0.06
DBP post-test 2	95.33	10.0	86.33	10.0	-4.73	0.01*
DBP post-test 3	96.00	10.0	85.0	10.0	-5.13	0.01*

[Table/Fig-3]: Difference between the mean post-test of the blood pressure in experimental and control group.
n=30+30; Mann-Whitney test; p<0.05 level of significance; *Significance

The pretest pulse rate between the experimental and control groups were comparable with $p>0.05$ [Table/Fig-4]. In post-test 3, the Z value was -2.78 and the obtained p-values was 0.05, hence there was significant difference in PR [Table/Fig-5].

Parameters (bpm)	Control		Experimental		t-value	p-value
	Mean±SD		Mean±SD			
Pulse Rate pretest1	76.4±9.43		77.4±10.0		0.37	0.71

[Table/Fig-4]: Comparison between the mean pretest of the pulse rate in experimental and control group.
n=30+30; Mann-Whitney test; p<0.05 level of significance

Parameters (bpm)	Control		Experimental		z-value	p-value
	Mean	IQR	Mean	IQR		
PR post-test 1	76.9	14.0	76.1	14.0	-0.37	0.70
PR post-test 2	77.0	13.0	74.0	16.50	-0.91	0.36
PR post-test 3	79.8	14.50	72.8	14.50	-2.78	0.05*

[Table/Fig-5]: Difference between the mean post-test of Pulse rate in experimental and control group.
n=30+30; Mann-Whitney test; p<0.05 level of significance; *Significant

There was no significant difference ($p=0.39$) in the pretest values of RR between both the groups [Table/Fig-6]. In experimental group for post-test 3 IQR (4.50) was much less than the control group (6.0), Z-value was -4.0 and the obtained p-value was <0.05 hence there was significant difference in RR [Table/Fig-7].

Parameter (bpm)	Control		Experimental		t-value	p-value
	Mean	SD	Mean	SD		
Respiration rate pretest1	25.2	5.18	26.2	4.51	0.85	0.39

[Table/Fig-6]: Comparison between the mean pretest of the Respiration rate in experimental and control group.
n=30+30; Mann-Whitney test; p<0.05 level of significance

Parameters (bpm)	Control		Experimental		Z-value	p-value
	Mean	IQR	Mean	IQR		
RR post-test 1	24.8	8.50	25.4	4.50	-0.43	0.66
RR post-test 2	25.7	6.00	23.3	6.00	-2.13	0.03*
RR post-test 3	26.9	6.00	22.3	4.50	-4.0	0.01*

[Table/Fig-7]: Difference between the mean post-test in the Respiration rate in experimental and control group.
n=30+30; Mann-Whitney test; p<0.05 level of significance

The Friedman Rank test was used to assess the effectiveness of abdominal breathing exercise on biological parameter among hypertensive patients on pretest and post-test of each group. In the experimental group, the mean post-test value of systolic BP (133.3 ± 11.2) $p=0.01$ was much less than the control group (150.3 ± 8.89) $p=0.112$. The mean post-test value of diastolic blood pressure (85.0 ± 6.82) $p=0.01$ in the experimental group was much less than the control group (96.0 ± 6.21) $p=0.641$. In experimental group, the mean post-test value of HR (72.8 ± 10.1) $p=0.01$ was significantly lower than the control group (79.8 ± 8.38) $p=0.01$ and in experimental group, the mean post-test value of respiration rate (22.3 ± 4.33) $p=0.01$ was lower than the control group (26.9 ± 4.09)

$p=0.01$. This indicated the effectiveness of abdominal breathing exercise on BP, HR and RR among hypertensive patients [Table/Fig-8].

Parameter	Group	Pre test	Post-test 1	Post-test 2	Post-test 3	Mean rank	p-value
		Mean±SD	Mean±SD	Mean±SD	Mean±SD		
SBP	Control	149.0±15.16	146.0±8.55	148.6±6.28	150.3±8.89	2.82	0.112
	Exp	154.3±15.24	145.3±6.81	139.3±7.3	133.3±11.2	1.40	0.01*
DBP	Control	94.3±6.78	94.3±5.04	95.3±5.07	96.0±6.21	2.67	0.641
	Exp	97.6±6.26	89.6±6.68	86.3±6.68	85.0±6.82	1.82	0.01*
Pulse rate	Control	76.4±9.43	76.9±8.89	77.0±8.89	79.8±8.38	3.47	0.01*
	Exp	77.4±10.0	76.1±9.92	74.4±10.0	72.8±10.1	1.57	0.01*
Respiration rate	Control	25.2±5.18	24.8±4.83	25.7±4.57	26.9±4.09	3.13	0.01*
	Exp	26.2±4.51	25.4±3.71	23.3±3.65	22.3±4.33	1.53	0.01*

[Table/Fig-8]: Effectiveness of abdominal breathing exercise on biological parameter among hypertensive patients in control and experimental group.
n=30+30; Friedman Rank Test; p<0.05 [* significant] df=3

There was no significant association between the blood pressure, pulse rate, respiration rate and the demographic variables such as age, gender, education, occupation, type of family, diet, family history of HTN, duration of illness in both experimental and control group ($p>0.05$). However, increased pulse rate was associated with smoking history in experimental group with $p=0.03$.

DISCUSSION

Abdominal breathing exercise activates the parasympathetic nervous system which decreases the HR and dilates blood vessels, reducing overall BP [12]. The present study showed that post-test mean score of SBP, Sent DBP, PR and RR in the experimental group was significantly lower than that of the control group. This showed that abdominal breathing exercise was effective in reducing BP, PR and RR.

The above findings were supported by a study conducted by Samson, who discovered that abdominal breathing exercise is particularly efficient in lowering blood pressure [12]. It was also corroborated by a study by Mourya M. et al, which found that both slow and fast breathing exercises benefit individuals with hypertension, although slow breathing had a stronger effect [13].

In the present study, in experimental group 9 (30%) of the patients were under 30 years old, while in the control group, the majority of the patients were over 51 years old, 9 (30%). Another study conducted by Lovikali K, to assess the effectiveness of abdominal breathing exercise among patients with hypertension revealed that majority of the patients were over age group of 51 years [14]. Comparison of similar studies has been done in [Table/Fig-9] [12,13,15,16].

The present study showed that abdominal breathing exercise helped to decrease BP, HR and respiration rate among hypertensive patients. A similar study was conducted in Faridkot, Punjab to assess the abdominal breathing exercise on BP among hypertensive patients found that in experimental group mean value of BP (104.6 ± 3.69) was much less than the control group (116.5 ± 6.3). As per t-test there was a significant difference in BP on post-test 2 ($t=2.293$ and $p=0.02$) [16]. The experimental group's mean post-test of biological parameter reading ($p<0.05$) was significantly lower than the control group's. A similar study was conducted by Saxena T and Rajeev K, revealed that the mean value of the pretest was 116.7 ± 7.57 and mean value of post-test is 111.16 ± 7.41 . From this it is inferred that there will be a

S. No.	Author's name and publication year	Place of study	Number of subjects	Intervention given	Parameters compared	Conclusion
1.	Samson M, 2015 [12]	Mysore	60 hypertensive patients	Abdominal breathing exercise	Blood pressure	Abdominal breathing exercise was found to be effective and proved to be significant at the level of $p < 0.05$ level.
2	Mourya M et al., 2009 [13]	New Delhi	60 hypertensive patients	Slow breathing and fast breathing exercise (2 intervention group)	Blood pressure, Heart rate and Respiration rate.	Both types of breathing exercises benefit patients with hypertension.
3.	Wang SZ et al., 2010 [15]	Chennai	30 hypertensive patients	Abdominal breathing exercise	Blood pressure	It was found to be statistically significant at $p < 0.05$ level, there was a reduction in the level of blood pressure after abdominal breathing exercise.
4.	Kaur A et al., 2015 [16]	Faridkot, Punjab	60 hypertensive patients	Abdominal breathing exercise	Blood pressure	There was significant reduction in blood pressure in experimental group ($p = 0.00$), Abdominal exercise is an effective complementary therapy in reducing blood pressure among hypertensive patients.
5.	Present study, 2022	Selected tertiary care hospital Mangaluru	60 hypertensive patients	Abdominal breathing exercise	Blood pressure, Heart rate and Respiration rate	Abdominal breathing exercise was effective in lowering blood pressure, heart rate and respiration rate.

[Table/Fig-9]: Comparison of similar studies [12,13,15,16].

significant difference in the BP after doing breathing exercise, hence there was an effectiveness of abdominal breathing exercise on BP among hypertensive patients [17].

There was no significant association found between the biological parameter and demographic variables such as gender, education, family history of hypertension, habits and duration of illness in both groups except age, occupation and diet in control group. This was also supported by a study conducted by Kaur A et al., it shows that there was no significant association of BP with gender, education, occupation, duration of hypertension, habits and diet [16].

Limitation(s)

The effectiveness of the interventions was assessed for a shorter duration (one week), and the sample size was minimal (60) which imposed limits to larger generalisation.

CONCLUSION(S)

Abdominal breathing exercise was helpful in lowering BP, HR, and RR based on the findings of the study. As a result, daily abdominal breathing exercises are recommended to assist maintain a normal BP level. This study found no association between the biological parameter and demographic variables such as gender, diet, family type and family history of hypertension. In hypertensive patients, abdominal breathing exercise is an effective complementary therapy for lowering BP, HR and RR. It can be concluded that similar study can be replicated on a large sample in a different setting to strengthen the findings. A study can be conducted to assess the factors which influence in hypertension.

Acknowledgement

Authors are thankful to the authorities of Yenepoya Medical College Hospital Deemed to be University for providing all the technical and other support for the completion of this research work.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Nov 11, 2021
- Manual Googling: May 05, 2022
- iThenticate Software: Jun 02, 2022 (25%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Nov 08, 2021**

Date of Peer Review: **Jan 15, 2022**

Date of Acceptance: **May 02, 2022**

Date of Publishing: **Jul 01, 2022**