Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713

THE STUDY OF EFFECT OF DIAPHRAGMATIC BREATHING EXERCISE AND ACTIVE CYCLE BREATHING TECHNIQUE ON HYPERTENSIVE PATIENT

Dr. Mohita Singh ¹, Shaillendra Kumar², Amit Kumar², Utkarsh Dubey², Priyanka Singh², Ajay Kumar²

¹Assistant Professor, Saaii College of Medical Science and Technology, Kanpur, India. ²BPT Students, Saaii College of Medical Science and Technology, Kanpur, India.

Abstract: The effect of diaphragmatic breathing exercise and active cycle breathing technique on hypertensive patient. **Subject and method**: 30 subject were included in this study they were assigned into two groups by inclusion and exclusion criteria (n= 15 per group) group A (experimental group) in this group included diaphragmatic breathing exercise and group (experimental group) in this group included active cycle of breathing exercise. **Result:** The study demonstrated score among two groups. Represents the comparison between mean of Pre-exercise MAP 112.33 (±4.64), and 4thwk MAP 105.73 (±4.51)after DBE, also compare the mean (±SD) of Pre-exercise MAP114.67 (±4.42), and 4thwk MAP 109.0(±4.67)after ACBT, it also compare the effectiveness of both group and found no significant betterment in DBE & ACBT. **Conclusion:** Hence we concluded that practicing breathing exercises enhances parasympathetic activity, vagal tone and decreases the sympathetic excitability, thereby effectively reducing the blood pressure, it can be emphasized as a non-pharmacological adjunct in hypertensive patients along with drug treatment but there is no significant difference in between types of exercises, as DBE & ACBT both shows significant effects on hypertensive patients but don't shows any significant difference in types of exercises selected, so p-value <0.33 hence null hypothesis accepted &alternative hypothesis rejected.

Keyword: ACBT- Active cycle breathing technique.

INTRODUCTION:

Our blood pressure is the pressure within your blood vessels. Hypertension is a condition where the pressure within your arteries is consistently too high.² This pressure is generated by the contraction of the heart and counteracted by the resistance of the small arteries.³BP is essential to life. It keeps the blood flowing through your body and provides oxygen and energy to your organs.4 According to the World Health Organization (WHO)-There's been a 67% increase in hypertension from 1990 to 2010 in Sub-Saharan Africa, and 40% of all adults are affected. In Africa, 18% of all deaths are related to hypertension, resulting in half a million deaths and 10 million years of lost life in 2010.5Blood pressure is the pressure exerted on the walls of the arteries. It is also named as silent killer because many of the people don't know they are hypertensive. 6 There are many risk factors for essential hypertension such as advance in age, sex and history of hypertension, atherosclerosis.⁷ A number of safe and effective medications are available for treatment of high blood pressure.8 These include older molecules such as thiazide diuretics, beta-blocking agents, Calcium channel blockers (CCB) and newer molecules, Such as, angiotensin converting enzyme (ACE) inhibitors, and angiotensin receptor blockers (ARB).8

In view of the recent clinical trials data, some international guidelines suggest that CCB, ACE inhibitors or ARB and not beta blockers or diuretics should be the

initial therapy in hypertension management. The former however, are much more expensive and beyond the affordability in many poor income countries. ¹⁰ In an analysis of worldwide data for the global burden of HTN, 20.6% of Indian men and 20.9% of Indian women were suffering from HTN in 2005. The rates for HTN in percentage are projected to go up to 22.9 and 23.6 for Indian men and women, respectively by 2025. ¹¹

Breathing exercise are fundamental intervention for the prevention or comprehensive management of acute and chronic pulmonary disorder. ¹²Breathing exercise are use in pt. suffering from chronic bronchitis, emphysema, asthma, & gastricfibrosis & in pt. with high spinal cord lesion. ¹³Pt who have under gone thoracic and abdomen surgery are at high risk for acute pulmonary complication& in pt who must remain in bed for an extended period for time. ¹⁴

Diaphragm control breathing at an in voluntory level. Pt in copd can be taught breathing control by optimal use of diaphragm and relaxation of accessory muscle. Control expiration 4 or 5 times. Diaphragmatic breathing exercise design to improve the efficiency of ventilation and also use to mobilize lungs secreation during postural drainage.

REVIEW OF LITERATURE

Eman Elsayed Hussien Mohammad et.al. (2018) in their study "A study to assess the effectiveness of breathing exercise on hypertensive patients. A comparative study"

Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713

Concluded and evaluated the immediate effects of diaphragmatic breathing exercise, active cycle of breathing technique in subjects with hypertension.

- G. Vasuki, LM Sweety et.al. (2017) in their study "A study of usefulness of diaphragmatic breathing exercise on blood pressure in pre hypertensive and hypertensive patients" to evaluate the effectiveness of diaphragmatic breathing exercise on hypertensive patients Regular practice of diaphragmatic breathing exercise is usefull for redusing systolic and diastolic blood pressure.
- Dr. E. Premila et.al. (2017) in their study "A study to assess the effectiveness of deep breathing exercise on blood pressure among patients with hypertension" diet and exercise are basic elements to maintain blood pressure. Although many alternative therapies are promoted for the management of hypertension. Few are truly therapeutic. Deep breathing exercise intervention on the reduction of blood pressure.
- E Grossman, MH Schein, R Zimlichman and B Gavish et.al. (2000) in their study "A study to assess the breathing control lowers blood pressure" concluded that breathing exercises are control and reduce the blood pressure of hypertensive patients.
- Dr. X. S. Blessing Nimma Sajai, Dr. Selvia Arokia Mary et.al. (2018) in their study "A study to assess the effect of segmental breathing exercise in lowering high blood pressure among hypertensive patients at general hospitals" Concluded and evaluated the immediate effects of diaphragmatic breathing exercise, active cycle of breathing technique in subjects with hypertension
- Mr. Preethin R et.al. (2017) in their study "A study to assess the effectiveness of active cycle of breathing technique along patients with hypertensive" Concluded and evaluated the immediate effects of active cycle of breathing technique in subjects with hypertension.

HYPOTHESIS:

Null Hypothesis:

It state that there will be no significance difference in effectiveness to diaphragmatic breathing exercise and active cycle of breathing technique on hypertensive patients.

Alternate Hypothesis:

It state that there will be a significant_difference in effectiveness of diaphragmatic breathing exercise and active cycle of breathing technique on hypertensive patients.

Aim of the Study:

To compare the effects of two different breathing exercises in improving breathing pattern and functional status on hypertensive patients.

OBJECTIVE OF THE STUDY:

To determine the study of effect of diaphragmatic breathing exercise and active cycle breathing technique on hypertensive patient.

METHODOLOGY:

Design of the Study: Randomised controle trail

Sampling: Systematic random sampling.

Study Population: Will be taken from (kalyanpur, panki, bithoor, chaubeypur, mandhana) Kanpur nagar.

Sample Size: 30 individuals.

Place of the Study: Saaii College of medical science and technology chaubeypur, kanpur

Selection Criteria:

Inclusion Criteria:

- Clinically diagnosed cases of hypertension
- Both genders male and female taken
- Those who were willing to participate in the study and willing to take exercise for 4
- Weeks.
- Age group (45-65)

Exclusion Criteria:

- No history of rib fracturs
- Previous surgical history
- Subjects with neurological disorders
- Avoid COPD patients
- No chest pain occurred
- No any kind of medicine taken

Variables:

Dependent:

Stethoscope

Sphygmomanometer

Diaphragmatic breathing exercise

Active cycle of breathing technique

Independent:

Diaphragmatic breathing exercise

Active cycle of breathing technique

Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713

Tools:

Couch/treatment table/chairs

Subjects/patients

Therapist

Stethoscope

Sphygmomanometer

Procedure:

Subjects who fulfill the inclusion and exclusion criteria will be included in the study and an informed consent will be taken from each of the subjects prior to participation. This was followed by subjective as well as objective assessment of the involvement of hypertension (high blood pressure). Instructions are given to the subjects about the subjects about techniques performed. After this participants were randomly allocated to two groups, Group A, Group B. for this purpose randomization is done by allocating subjects with number of experimental group.

Group A - Experimental Group:

Diaphragmatic breathing exercise

Group B - Experimental Group:

Active cycle of breathing technique

Diaphragmatic Breathing Exercise:

Prepare pt. in a relaxed position (semi fowler position). Place your hand on rectus abdominous below the anterior costal margin. After the pt. understand and is able to breath using the diaphragmatic pattern, suggest pt. that breath nose and out through mouth. Control expiration 4 or 5 times. Diaphragmatic breathing exercise design to improve the efficiency of ventilation and also use to mobilize lungs secreation during postural drainage. Diaphragmatic breathing in a verity of position:

- a. sitting
- b. standing & during activity walking.

Active Cycle of Breathing Technique:

breathing control-Breathing control is breathing gently using as little effort as possible.²³Breathing and out through nose if is breath out through mouth can be used breathing control with pulse lip breathing.¹⁷Try to let go any tension in body with each breath out .²⁴Gradually try to make breath slower. Try to close eyes may be focus on breathing and to reflux. Breathing control can also help when pt. are short of breath on feeling anxious, fearful, or panic.²⁵Breath out gently and should to 3-5 deeper breath some found it helpful to hold there breath for about 2-3sec at the end of breath in before breath out.²⁶

Thoracic expansion exercise- *Thoracic Expansion Exercises*. Try to keep your chest and shoulders relaxed. Take a long, slow and deep breath in, through your nose if you can. At the end of the breath in, hold the air in your lungs for 2-3 seconds before breathing out (this is known as an inspiratory hold)²⁷

Huffing- A huff is exhaling through and open mouth and throat instead of cuffing.²⁸ It has move sputum up air ways so that can clear it in a control way.²⁹To huff squeeze air quickly from lungs out through open mouth and throat as if were mist up a mirror or glass. 30Use abdominal muscles to squeeze the air but do not forces so much that cause wheezing or hightness in the chest .31Huffing should always is yellow by breathing control.²⁵There have two types of huff to clear sputum from different part of lung. The small long huff-This way move sputum from low down in chest take a small to medium breath in and then huff the air out until lungs fill quite aptly ³³With short huff-This moves sputum from higher up chest so use this huff when it fills ready to come out but not before take a deep breath in hand than huff the air out quickly.³⁴Position for doing ACBT-The best position for ACBT depend on medical condition of the patient.it can be done in sitting or a postural drainage position.35

Data Analysis:

Data analysis was done using IBMSPSS Statistics (software package used for statistical analysis 2015 version-Rev.) Descriptive statistics was done to determine the demographic characteristics of the subjects recruited in this study, t-test used. p-value used in hypothesis tests to help you decide whether to reject or fail to reject a null hypothesis. The p-value is the probability of obtaining a test statistic that is at least as extreme as the actual calculated value, if the null hypothesis is true. A commonly used cut-off value for the p-value is 0.05.

RESULT:

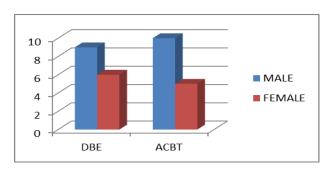
| | | Diaph | aphragmatic Breathing Exercise (DBE) on Hypertensive | | | | | | |
|-----|-----------------|-------|--|-----|-----------|-----------------|-----------|-----------|----------------|
| | | | | MEA | | | | | |
| | | | | | | | | | |
| SNo | Name | | Gender | Age | Pre-ex.BP | Post ex.BP 1 wk | 2nd wk BP | 3rd wk BP | 4th wk BP |
| 1 | Suresh char | ndra | М | 65 | 160/94 | 162/92 | 160/94 | 155/90 | 155/85 |
| 2 | Ganga devi | | F | 62 | 159/83 | 155/84 | 154/80 | 157/86 | 1 55/82 |
| 3 | Jagdeesh | | M | 60 | 145/94 | 146/82 | 144/84 | 146/82 | 142/80 |
| 4 | Suman | | F | 55 | 148/99 | 150/90 | 152/92 | 146/88 | 146/84 |
| 5 | Snehlata | | F | 62 | 166/96 | 166/94 | 162/94 | 162/92 | 160/90 |
| 6 | Ram pyari | | F | 59 | 144/88 | 146/90 | 144/88 | 142/86 | 140/80 |
| 7 | Shashi prabha | | F | 55 | 150/78 | 150/82 | 150/80 | 149/81 | 148/80 |
| 8 | Ravikant shukla | | M | 58 | 145/88 | 146/82 | 146/82 | 146/80 | 144/84 |
| 9 | Virendra kumar | | M | 50 | 144/90 | 150/74 | 148/76 | 148/80 | 142/82 |
| 10 | Suresh trip | athi | M | 63 | 155/100 | 156/98 | 156/94 | 154/90 | 152/84 |
| 11 | Prerna devi | | F | 58 | 160/100 | 158/96 | 158/98 | 156/92 | 156/90 |
| 12 | Jay ganesh | | M | 60 | 151/95 | 150/94 | 150/92 | 148/90 | 147/88 |
| 13 | Ram ratan | | M | 55 | 152/92 | 153/93 | 150/90 | 150/90 | 149/88 |
| 14 | Ram teerat | h | М | 51 | 162/100 | 162/96 | 160/98 | 160/86 | 158/88 |
| 15 | Ravi kumar | . | M | 53 | 150/90 | 150/88 | 150/86 | 148/84 | 146/82 |

Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713

Table 1: Active Cycle of Breathing Technique (ACBT) on Hypertensive Patients: Calculated MAP

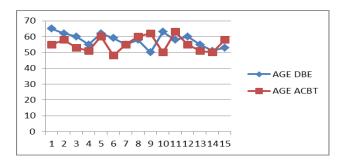
| | | Active | Cycle of Breathing Technique (ACBT) on Hypertensive Patients | | | | | | |
|------|----------------|--------|--|------|------------|------------------|------------|------------|------------|
| | | | CALCULATED MEAN ARTERIAL PRESSURE (MAP) BY MEASURED BP. | | | | | | |
| | | | | | | | | | |
| SNo. | Name | | Gender | Age | Pre-ex.MAP | Post ex.MAP 1 wk | 2nd wk MAP | 3rd wk MAP | 4th wk MAP |
| 1 | Ram ji | | М | 55 | 114 | 112 | 109 | 107 | 107 |
| 2 | Devi prasad | | М | 58 | 110 | 120 | 108 | 108 | 106 |
| 3 | Rita awasthi | | F | 53 | 124 | 121 | 120 | 117 | 114 |
| 4 | Vishuna devi | | F | 51 | 120 | 119 | 118 | 114 | 124 |
| 5 | Rahul kumar | | М | 60 | 113 | 112 | 111 | 109 | 106 |
| 6 | Rakesh kumar | | М | 48 | 111 | 110 | 111 | 108 | 105 |
| 7 | Rajesh pal | | М | 55 | 117 | 113 | 111 | 110 | 107 |
| 8 | Sumit kushwaha | | М | 60 | 107 | 106 | 107 | 104 | 102 |
| 9 | Ram dulare | | М | 62 | 118 | 116 | 114 | 109 | 108 |
| 10 | Ashish kumar | | М | 50 | 110 | 108 | 123 | 108 | 105 |
| 11 | Ram narayan | | М | 63 | 123 | 122 | 112 | 119 | 119 |
| 12 | Suman devi | | F | 55 | 116 | 113 | 112 | 113 | 109 |
| 13 | Archana pandey | | F | 51 | 105 | 108 | 104 | 105 | 105 |
| 14 | Lakshmi d | ubey | F | 50 | 113 | 111 | 11 | 108 | 108 |
| 15 | Brajmohar | 1 | М | 58 | 119 | 114 | 111 | 111 | 110 |
| | | | | 55.3 | 114.67 | 113.67 | 105.47 | 110 | 109 |



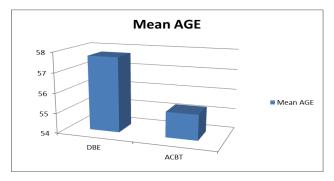
Graph-1: Represents the gender wise distribution of all study subjects. A finding shows total 15 subjects in each group (15+15=30 subjects), in group Diaphragmatic Breathing Exercise (DBE) there are 9 males & 6 female subjects while in group Active Cycle of Breathing Technique (ACBT) there are 10 male & 5 female subjects.

Table 2:

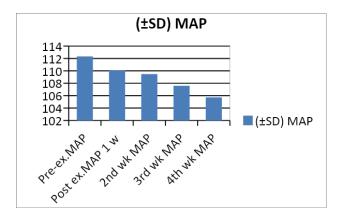
| | DBE | ACBT |
|--------|-----|------|
| MALE | 9 | 10 |
| FEMALE | 6 | 5 |



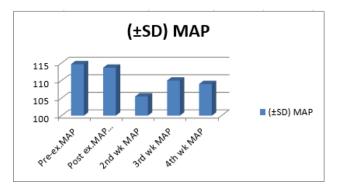
Graph-2:Represents the age of all 30 subjects which are of both group.



Graph-3: Represents the mean age $(\pm SD)$ of all 30 study subjects of both group, a finding shows mean age $(\pm SD)$ is 57.73 (± 5.64) years for group DBE & mean age $(\pm SD)$ is 55.27 (± 4.88) years for group ACBT



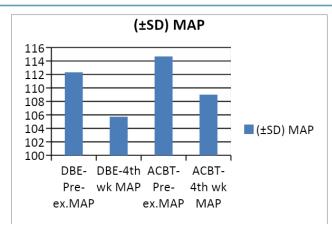
Graph-4: Represents the mean (±SD) MAP of Pre-Exercise MAP 112.33 (±4.64), post-Exercise (after 1 wk) 110.07 (±4.39), post-Exercise (after 2 wk) 109.47 (±4.31), post-Exercise (after 3 wk) 107.06(±4.44) & post-Exercise (after 4 wk) 105.73 (±4.51), which shows significant improvement in MAP after DBE.



Graph-5: Represents the mean (±SD) MAP of Pre-Exercise MAP 114.67 (±4.42), post-Exercise (after 1 wk) 113.67 (±4.49), post-Exercise (after 2 wk) 105.47 (±4.27), post-Exercise (after 3wk) 110.0 (±4.49) & post-Exercise (after 4 wk) 109.0 (±4.67), which shows significant improvement in MAP after ACBT.

Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713



Graph-6: Represents the comparison between mean of Pre-exercise MAP 112.33 (±4.64), and 4thwk MAP 105.73 (±4.51) after DBE, also compare the mean (±SD) of Pre-exercise MAP114.67 (±4.42), and 4thwk MAP 109.0(±4.67) after ACBT, it also compare the effectiveness of both group and found no significant betterment in DBE & ACBT.

DISCUSSION:

In an analysis of worldwide data for the global burden of HTN, 20.6% of Indian men and 20.9% of Indian women were suffering from HTN in 2005. The rates for HTN in percentage are projected to go up to 22.9 and 23.6 for Indian men and women, respectively by 2025.

Emanelsayedet al (2017) describes in his study that breathing exercise are fundamental intervention for the prevention or comprehensive management of acute and chronic pulmonary disorder including improvement in patients with hypertension.

In our study we selected two different breathing techniques one is Diaphragmatic breathing exercise (DBE) and Active Cycle of Breathing Technique (ACBT) respectively as two different study group & compare in-between them.

Total sample size was 30 subjects (Systematic random sampling) from Saaii College of medical science and technology chaubeypur Kanpur on the basis of inclusion criteria such as Clinically diagnosed cases of hypertension, Both genders male and female taken, Those who were willing to participate in the study and willing to take exercise for 4 weeks &Age group (45-65) and exclusion criteria such as No history of rib fractures, Previous surgical history, Subjects with neurological disorders, Avoid COPD patients, No chest pain occurred & No any kind of medicine taken.

Subjects who fulfill the inclusion and exclusion criteria will be included in the study and an informed consent will be taken from each of the subjects prior to participation. This was followed by subjective as well as objective assessment of the involvement of hypertension (high blood pressure). Instructions are given to the subjects

about the subjects about techniques performed. After this participants were randomly allocated to two groups, Group A (DBE), Group B (ACBT) for this purpose randomization is done by allocating subjects with number of experimental group.

Graph-1 represents the gender wise distribution of all study subjects. A finding shows total 15 subjects in each group (15+15=30 subjects), in group Diaphragmatic Breathing Exercise (DBE) there are 9 males & 6 female subjects while in group Active Cycle of Breathing Technique (ACBT) there are 10 male & 5 female subjects.

Graph-3 represents the mean age (±SD) of all 30 study subjects of both group, A finding shows mean age (±SD) is 57.73 (±5.64) years for group DBE & mean age (±SD) is 55.27 (±4.88) years for group ACBT.

Graph-4 represents the mean (±SD) MAP of Pre-Exercise MAP 112.33 (±4.64), post-Exercise (after 1 wk) 110.07 (±4.39), post-Exercise (after 2 wk) 109.47 (±4.31), post-Exercise (after 3 wk) 107.06 (±4.44) & post-Exercise (after 4 wk) 105.73 (±4.51), which shows significant improvement in MAP after DBE.

Graph-5 represents the mean (±SD) MAP of Pre-Exercise MAP 114.67 (±4.42), post-Exercise (after 1 wk) 113.67 (±4.49), post-Exercise (after 2 wk) 105.47 (±4.27), post-Exercise (after 3 wk) 110.0 (±4.49) & post-Exercise (after 4 wk) 109.0 (±4.67), which shows significant improvement in MAP after ACBT.

G. vasuki, LM sweety et.al. (2017) in their study "A study of usefulness of diaphragmatic breathing exercise on blood pressure in pre hypertensive and hypertensive patients" suggest that a multidisciplinary approach, comprising clinical, pharmacological treatment & non-pharmacological intervention is more effective in optimal control of blood pressure. In our study we also found the same which reflects in Graph-6 represents the comparison between mean of Pre-exercise MAP 112.33 (±4.64), and 4th Wk MAP 105.73 (±4.51) after DBE, also compare the mean (±SD) of Pre-exercise MAP 114.67 (±4.42), and 4th Wk MAP 109.0(±4.67) after ACBT, it also compare the effectiveness of both group and found no significant betterment in DBE & ACBT as p-value <0.33.

Our study it is clearly evident that there is no statically significant difference in both groups but both have significant effect on blood pressure, which reduces after exercises. It is important to highlight that respiratory & cardiovascular systems share similar control mechanisms, thus alterations in one system will modify the functioning of the other.

CONCLUSION:

Hence we concluded that practicing breathing exercises enhances parasympathetic activity, vagal tone and decreases the sympathetic excitability, thereby effectively reducing the blood pressure, it can be emphasized as a

Volume 03, Issue 09, Sep 2019

E-ISSN: 2456-6713

non-pharmacological adjunct in hypertensive patients along with drug treatment but there is no significant difference in between types of exercises, as DBE & ACBT both shows significant effects on hypertensive patients but don't shows any significant difference in types of exercises selected, so p-value <0.33 hence null hypothesis accepted & alternative hypothesis rejected.

REFRENCES:

- Dr. Eman Elsayed Hussein Mohammad. Dr. X.S. Blessing Nimmasajai. Dr. Selvia Arokia Mary. Applied medical Science College, Alnamas University of Bisha, A study to assess the effectiveness of breathing exercise in lowering high blood preaaure among hypertensive patients...international journal of science and healthcare research.3 july-sep.2018 ISSN:2455-7585
- G. Vasuki, LM Sweety, Assistant Professor, department of Physiology, Kanyakumari Medical College, Dr. MGR Medical University, Chennai Tamil Nadu, The study of usefulness of deep breathing exercise on blood pressure in pre-hypertensive and hypertensive patients. Indian journal of clinical anatomy and physiology. July-Sept, 2017;4(3):00-03
- 3. Dr. E. Premila, chief nursing officer, school of nursing MTPG & RISH, Puducherry, India, Effectiveness of deep breathing exercise on blood pressure among on hypertensive patients, IJARILE-ISSN(0)-2395-4396:2017
- 4. https://www.physiopedia.com/Active_Cycle_of_Breathing Technique, thoracic expension exercise
- 5. Mr. Preethin R of K. G. college of physiotherapy tamil nadu, Effect of active cycle of brathing technique along with pre-hypertensive and hypertensive patients, october 2017
- 6. Patricia A. Downie. Cash's textbook of chest and vascular disorder for physiotherapist 4th Edition, diaphragmatic breathing exercise
- 7. Elaine, P. Antonio, F.B Celso, R.F.D. Effect of a physical exercise program designed to increase thoracic expension in hypertension sep/oct 2003.
- 8. The slow breathing exercise and relaxation technique [online]; 2009 from: URL:http://www.indian nursing jour.com
- 9. Mahtani KR, NunanD, Heneghan CJ. Device guided breathing exercises in the control of human blood pressure, Oxford (UK).. dept. of primary healthcare 2012 may;30(5):852-6
- Bazhenova O. V., Plonskaia O., Porges S. W. (2001).
 Vagal reactivity and affective adjustment in infants during interaction challenges. Child Dev. 72 1314–1326. 10.1111/1467-8624.00350 [PubMed] [CrossRef] [Google Scholar]
- 11. Beauchaine T. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. Dev. Psychopathol.13 183–214.

- 10.1017/S0954579401002012 [PubMed] [CrossRef] [Google Scholar]
- Becker I. (2000). Uses of yoga in psychiatry and medicine. Complement. Altern. Med. Psychiatry 19107–145. [Google Scholar]
- 13. Benson T. (1996). Timeless Healing: The Power and Biology of Belief. New York, NY: Scribner. [Google Scholar]
- Bernardi L., Spadacini G., Bellwon J., Hajric R., Roskamm H., Frey A. W. (1998). Effect of breathing rate on oxygen saturation and exercise performance in chronic heart failure. Lancet 3511308–1311. 10.1016/S0140-6736(97)10341-5 [PubMed] [CrossRef] [Google Scholar]
- Bhatia M., Kumar A., Kumar N., Pandey R. M., Kochupillai V. (2003). Electrophysiologic evaluation of Sudarshan Kriya: an EEG, BAER, P300 study. Ind. J. Physiol. Pharmacol. 47 157–163. [PubMed] [Google Scholar]
- Booth S., Burkin J., Moffat C., Spathis A. (2014).
 Breathing Techniques for Breathlessness Managing Breathlessness in Clinical Practice. Berlin: Springer; 67–112. 10.1007/978-1-4471-4754-1_5 [CrossRef] [Google Scholar]
- 17. Brown R. P., Gerbarg P. L. (2005a). Sudarshan kriya yogic breathing in the treatment of stress, anxiety, and depression: Part II—Clinical applications and guidelines. J. Altern. Complement. Med.11 711–717. 10.1089/acm.2005.11.711 [PubMed] [CrossRef] [Google Scholar]
- Brown R. P., Gerbarg P. L. (2005b). Sudarshan Kriya yogic breathing in the treatment of stress, anxiety, and depression: part I-neurophysiologic model. J. Altern. Complement. Med. 11 189–201. 10.1089/acm.2005.11.189 [PubMed] [CrossRef] [Google Scholar]