



# **COMPARING THE IMMEDIATE EFFECT OF CHANDRA ANULOMA VILOMA PRANAYAMA IN HYPERTENSIVE AND NORMOTENSIVE INDIVIDUALS ON CARDIOPULMONARY FUNCTIONS**

By

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## **ABSTRACT**

### **BACKGROUND:**

Hypertension (HTN) is one of the most common medical disorder and is associated with increased risk of cardiovascular diseases. Yogic practices which include pranayama are known to affect the cardiopulmonary functions. Chandra anuloma viloma pranayama refers to unilateral left nostril breathing which corresponds to the parasympathetic arousal. The present study was conducted to compare the immediate effect of chandra anuloma viloma pranayama in hypertensive and normotensive individuals on cardiopulmonary functions.

### **AIM:**

To compare the immediate effect of Chandra anuloma viloma pranayama in hypertensive and normotensive individuals on cardiopulmonary functions.

**OBJECTIVES:**

To study the effect of Chandra anuloma viloma (CAV) pranayama on cardio-pulmonary functions like blood pressure, oxygen saturation and pulse rate in hypertensive and normotensive individuals.

**MATERIALS &METHODS:****Participants:**

In this two group pre-post study, 32 participants were selected from 2 hospitals such as arogyadhama (Svyasa University) and Sparsha naturopathy hospital. They were assigned into two groups (hypertensive, n=16) & (normotensive, n=16) based on inclusion and exclusion criteria. Both the groups were asked to practice Chandra anuloma viloma (left nostril breathing) for 5 minutes and assessments were taken before and after the intervention.

**Design:**

This study is a 2 group pre - post study design

**ASSESSMENTS:**

- Blood pressure (BP)
- Pulse rate (PR)
- Saturation of oxygen (SPO2)

**INTERVENTION:****Chandra anuloma viloma pranayama**

- The participants will be asked to sit in any comfortable meditative posture preferably sukasana with eyes closed.
- Ask to adopt chin mudra in left hand and nasikagra mudra in right hand.
- Close the right nostril in right hand and start inhalation and exhalation in left nostril only
- Continue it for 5 minutes.

**RESULTS:**

The pre-post data within each group showed significant difference in hypertensive group. In normotensive group significant changes are noted, but less significant than hypertensive group. The difference between groups showed significant changes in SBP and DBP. However no significant changes in SPO2 and PR .

**CONCLUSION:**

The results of this study suggest that CAV is an effective measure to reduce blood pressure in hypertensive individuals. Further, it is observed that there are less significant changes in cardiovascular parameters of normotensive individuals thereby implying that it brings a state of balance or homeostasis. Hence, CAV could potentially be used as an adjuvant therapy in hypertensive individuals.

**KEYWORDS:** Hypertension, pranayama, blood pressure, CAV

**1.0 INTRODUCTION:****1.1 HYPERTENSION:**

Currently hypertension (HTN) is one of the most common diseases and its prevalence is rapidly increasing day by day around the globe. Persistent HTN has been the cause for developing coronary heart disease, stroke and other cardiovascular diseases, such as heart failure. HTN is the fourth most common cause of premature death in developed countries and is the seventh in developing countries (Tiwari et al., 2019).

HTN is a common disease in industrialized countries and accounts for 6% death worldwide. The causes of hypertension are stress, less or physical activity, and unhealthy dietary habits. Criteria for normal blood pressure, pre HTN and HTN (stage1& stage2) have been laid by the National Institute of Health (NIH) US (Table 1).

**Table 1. Categories of hypertension**

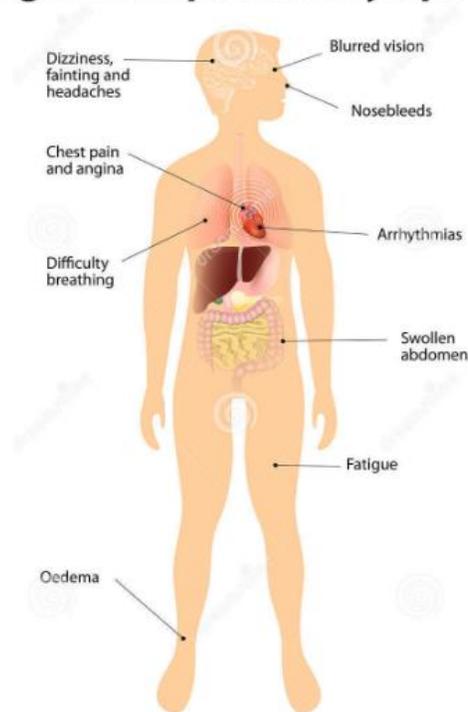
Category	Systolic(mmHg)	Diastolic(mmHg)
Normal	<120	And <80
Prehypertension	120-139	Or 80-89
HTN Stage 1	140-159	90-99
Stage 2	>160	Or >100

**HTN is generally classified into 2 types**

1. **Primary or essential HTN** in which the cause of increase in BP is unknown. Constitutes about 80-95% patients of HTN.
2. **Secondary HTN** in which increased in BP is caused by diseases of kidney, endocrines or some other organs. Constitutes about 5-20% cases of HTN.

Recent epidemiological studies have reported that HTN is present in 25–30% of urban and 10–20% of rural population in India (Gupta & Xavier, 2018) and its prevalence is higher in men ( 34.6 % ) than in women ( 30.8%). Worldwide there are 15% of uncontrolled hypertensive patients in India. HTN is a medical condition in which the pressure of the blood pushing against the blood vessels (arteries) walls is persistently high than normal. The heart works harder to pump blood throughout the body due to high BP. When BP is high for prolonged periods, there will be hardening of the arteries, heart failure, and other ailments can be developed. BP is measured in millimetres of mercury (mm Hg) using two numbers, for example 120/80 mmHg. The above number is defined as the SBP and it represents the pressure in your blood vessels when your heart beats. The below number is defined as the DBP and it represents the pressure in your blood vessels when your heart rests between the beats. Raised DBP is considered to be more serious than the raised SBP as it has more serious long-term ill effects. The health ministry program defines high BP as a reading of more than 140/90mmHg. The normal BP is considered as less than 120mmHg as SBP and less than 80mm Hg as DBP (Tiwari et al., 2019) .

### High blood pressure symptoms



*Figure 1: Symptoms of HTN*

## 1.2 HYPERTENSION AND CARDIOVASCULAR DISEASES

HTN, a "psychological classical silent killer" is the hallmark of various cardiovascular disorders (CVD) (Naik et al., 2012). It is one of the most common medical disorders and is associated with an increased incidence of cardiovascular disease (CVD) mortality. The positive relationship between CVD risk and BP occurs when the BP is as low as 115/75 mm Hg and doubles for each 20/10-mm Hg increase. Even a person with normal BP at the age of 55 has a 90% lifetime risk of developing HTN ("Exercise and Hypertension," 2004) .

A 2007 review in the Postgraduate Medical Journal shows that older individuals with the systolic hypertension are at a greater risk of mortality due to heart disease.(Writes, 2017)

Cardiovascular risk factors can be broadly divided into four groups- social determinants, lifestyle factors, biochemical factors and genetic factors. Hundreds of risk factors within these four classes have been identified. There are no prospective epidemiological studies from India that have evaluated relative importance of various CVD risk factors in cardiovascular diseases. Accordingly eight common risk factors are responsible for incident acute coronary disease in South Asians: high apolipoprotein B/apolipoprotein A1 ratio, hypertension, diabetes, abdominal obesity, smoking, sedentary lifestyle, low fruit and vegetable intake and psychosocial stress. HTN management and control is crucial to prevent its vascular complications. There is a previous study which shows strong clinical trial and meta-analytical evidence that SBP > 140 mmHg is harmful and prompt initiation and titration of therapy to achieve and maintain SBP < 140 mmHg in all these patients is recommended. Strong evidence also exists from randomized clinical trials that SBP < 130 mmHg and DBP < 90 mmHg is associated with decreased adverse vascular complications and risks (Gupta & Xavier, 2018) .

More recently, Framingham Heart Study investigators (263) reported that participants with high normal BP (SBP 130–139 and DBP 85–89 mm Hg) had higher rates of cardiovascular risks as compared with those with optimal levels (SBP <120 and DBP < 80 mm Hg) (“Exercise and Hypertension,” 2004) so it is necessary to maintain our BP at optimal levels .

Medical treatment to cure HTN is not always enough to control their BP to target level of (140/90) mmHg. Yoga the traditional practice from Indian culture has been used effectively in various health disorder issues and can be used as a supplementary medicine. Pranayama or regulation of breath has been greatly emphasized in Yoga and has drawn special attention from the scientific community worldwide in this modern era. Uninostril and alternate nostril breathing has been the special significance in Yoga, since the nostrils are said to represent the subtle energy channels known as Nadis. Right nostril corresponds to Pingala Nadi, and the left nostril corresponds to Ida, respectively. Breathing through a single specific nostril is said to have effects on the human system differently (Tiwari et al., 2019) .HTN is an important and growing public health challenge worldwide and it would become a greater global burden in the next 15 - 20 years. If one believes that 'old is gold', then yoga is quite effective and widely believed to reduce BP in hypertensive's and as well as normotensives which includes some varieties of pranayama that requires the practitioner to inhale and exhale through one specific nostril selectively (Naik et al., 2012) .

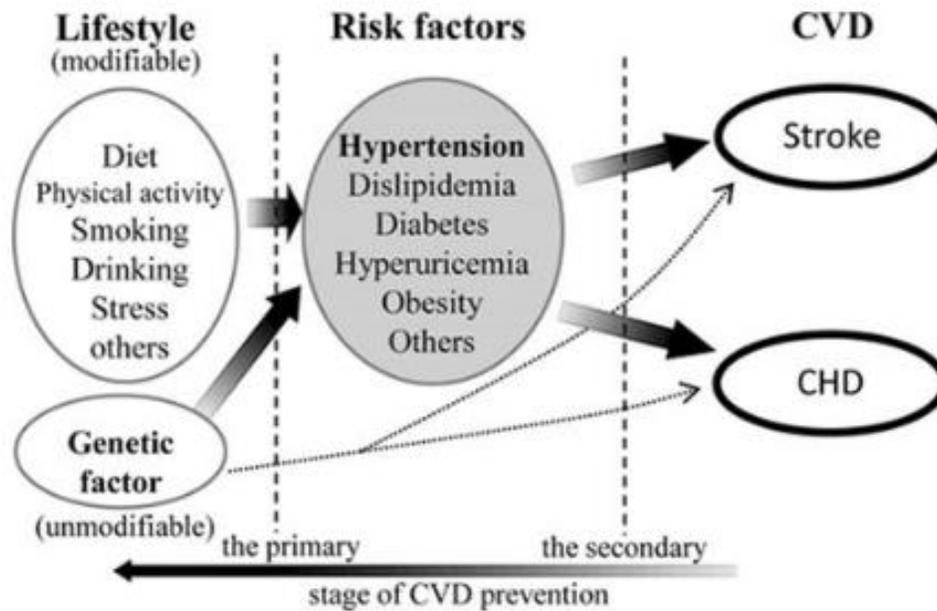


Figure 2: complications of HTN

### 1.3 PRANAYAMA EFFECTS ON HYPERTENSION

The ancient Indian science of yoga makes use of voluntary regulation of the breathing to make respiration rhythmic and calm the mind, this practice is called pranayama (Malhotra & Takkella, 2020). Pranayama is the art of prolongation and control of breath (Singh et al., 2009). It helps in reshaping of breathing habits and patterns in our daily life (Chitnis et al., 2019). Pranayama is the fourth limb of the classical Asthanga Yoga and it includes different breathing techniques. It was used as important lifestyle techniques by ancient yogis. Now a day's such techniques are being used as therapy and is becoming popular day by day so it's is no longer just the practices of ancient yogis and Monk. There are a multitude of yogic breathing techniques and it is traditionally taught that each of them has different psycho-physiological benefits and is known to modify CVS functions, baroreflex sensitivity and autonomic responses (Saoji et al., 2018).

Pranayamas and breathing exercises have been reported to affect the ANS in different ways depending on the breathing technique, duration of practice and the period of recording of the autonomic parameters (Prakash S, 2015). It has been observed that pranayamas improves autonomic functions thus benefits in promoting the health (Raj, 2016). Yoga favours diffusion and oxygenation processes in tissues, and has shown benefits in the control and management of autonomic nervous system alterations, HTN and oxidative stress management (Benavides-Pinzon & Torres, 2017).

Yogic practices are being used as therapy and are prescribed by medical practitioners to treat various physical and psychological ailments in present days so this study was executed to implement left nostril breathing in hypertensives. Pranayamic breathing practiced exclusively via either nostril has opposite effects. It is based on the

belief that right nostril dominance corresponds to sympathetic arousal and the left nostril breathing (LNB) corresponds to parasympathetic arousal (Dhandayutham et al., 2015). In the yogic system of breathing, the right nostril dominance corresponds to the activation of 'Pingala' nadi, the subtle energy channel of yoga, which is related to sympathetic arousal and the left nostril dominance to 'Ida' nadi, which is the representative of parasympathetic activation (Pal et al., 2014).

Unilateral Left nostril breathing is called as Chandra Nadisuddhi Pranayama or Chandra anuloma viloma Pranayama (CAV) in which the respiratory cycle of inhalation and exhalation is completed through left nostril alone and it is expected to have cooling down or parasympathetic effect in the body (Prakash S, 2015). The findings of the previous study provide evidence that the practice of left nostril breathing may alleviate stress in medical students and reduce their CVS risks (Pal et al., 2014). Moreover, pranayamas practice is cost effective and does not require any specific equipment and places, which may increase its applicability. Improvement in the baroreceptor sensitivity helps to change the autonomic balance with an increase in the parasympathetic and decrease in sympathetic modulation is the main mechanism for its lowering effect on BP (Brandani et al., 2017).

Very few researches are carried out on CAV as per the best of our knowledge. The present study was aimed to determine immediate effects on 5 minutes practice of unilateral left nostril breathing on BP, SPO2 and PR on hypertensive and normotensive individuals.

## **2.0 REVIEW OF SCIENTIFIC LITERATURE**

### **2.1 Effectiveness of yoga in hypertension**

### **2.2 Pranayama**

Numerous studies have been reported that the practice of pranayama improves lung functions by strengthening the inspiratory and expiratory muscles (Shyam Karthik et al., 2014). It is prescribed as a complementary therapy to relieve stress (Hepburn & McMahon, 2017) which even helps to normalize the BP. Previous studies showed that it improves cardiopulmonary functions as there was significant increase in VC, Peak expiratory flow rate, TV, breath holding time and plays a major role in combating stress (Sharma et al., 2013). In previous study alternate nostril breathing for 5 minutes followed for 6 weeks showed improvement in parasympathetic tone (Sinha et al., 2013).

### 2.3 CAV

A pilot study was conducted with sample size of 22; there was an immediate decrease in HR, SBP and pulse pressure. Male participants evidenced significantly decrease in HR and SBP whereas in females only HR decreased significantly after 27 rounds of CAV (Bhavanani et al., 2012) . There was fall in PR, respiratory rate, SBP and DBP after 12 rounds of CAV Pranayama in each session for 24 days in both Naïves and Yoga practitioners. But the significant drop was observed in SBP only (at  $p < 0.05$ ) among Naïves and in all parameters except respiratory rate among Yoga Practitioners(Prakash S, 2015).There was decrease in SBP and DBP after 60 minutes of yoga practice which included 12 minutes of pranayama practice for 6 weeks (Tiwari et al., 2019) .

A RCT study with sample size 45 showed significant decrease in SBP after 90 rounds of CAV for 15 minutes in healthy individuals (Raj, 2016) . A pilot study showed decrease in SBP and DBP but increase in PR after 10 minutes slow pace CAV with breath retention (Raj, 2017). A study with sample size 40 was conducted to compare the effects of left and right nostril breathing , LNB for 15 minutes showed significant reduction in SBP, DBP, respiratory rate and pulse but no significant changes was observed in galvanic skin resistance. There was significant increase in peak expiratory flow rate, this study suggests that CAV improves the cardiopulmonary functions (Jain et al., 2005)

It has been observed that health promotion effects of pranayama are mediated mainly through improvement of autonomic functions(Pal et al., 2014). Recently many previous studies conducted on long duration with unilateral nostril breathing have proven that it has specific autonomic functions (Raj, 2016).

AUTHOR/YEAR	SAMPLE SIZE	STUDY DESIGN	INTERVENTION	ASSESSMENTS	RESULTS
Ananda Balayogi Bhavanani, et al.	Total -22 Male- 12 Female- 10	Pilot study	27 rounds of CAV 6 breaths/minute	HR , BP	Immediate decrease in HR , systolic pressure, pulse pressure.  Male participants evidenced significantly decrease in HR and SP and insignificantly decrease in DBP  In females only HR decreased significantly with an insignificantly decrease in SP.
Baljinder Singh Bal, 2015	Total -32 Experimental	RCT Retrospective cross-	CAV for 4 weeks 9 rounds × 1set	TV,ERV, IRV, VC, inspiratory capacity(IC)	Significant decrease in TV and IC in experimental group and

	Group - 16 Control Group-16	sectional study	9 rounds ×2 sets 9 rounds ×3 sets 9 rounds ×4 sets		insignificant between group difference in ERV, IRV and VC.  No significant changes in control group.
S Prakash , et al., 2011	36 Yoga practitioners - 26 Naive- 10	pilot study	12 rounds of CAV for 24 days twice a day	PR,RR,SBP,DBP	Decreased in both group but significantly drop in SBP only among naive.
Pallavi Tiwari,et al. 2019	30	pilot study	60 minutes - yoga for 12 weeks  (12 minutes pranayama )	BP	Decrease in SBP and DBP.
Puthige Raghuraj, Shirley Telles, 2008	21	pilot study	30 - 40 minutes of breathing practice	HRV , skin conductance, finger plethysmogram amplitude, breath rate, BP	systolic and mean pressure we're lower after CAV
Jennifer Z Brandani et al. 2017	13	Systemic review	Pranayama	BP	Decrease in BP

R. Jain Raj et al. ,2017	30	pilot study	10 minutes slow pace CA V with breath retention  1:1:1 ratio  50 cycles / minute	BP, PR	Decrease in SBP and DBP but increase in PR.
Varun Malhotra , et al., 2012	30	pilot study	pranayama	BP , PR	Chandranadi practice decreased BP in hypertensive.
R . Jain Raj , et al. ,2016	45	RCT	90 rounds of  CAV for 15 minutes  6 breaths/ minute	BP ,HR	significant decrease of SBP in ULNB
Changjun Li, et al.	120	RCT	16 breaths /minute	BP, respiratory peak , HRV	Decreased BP ,  Shifted respiratory peak towards left.

					Increased baroreflex sensitivity in hypertensive.
Naik et al.,2012	30	Pre post study	ULNB for 5 minutes	BP , PR	Decrease in PR,SBP and DBP
Jain N et al., 2005	40	2 group Pre post study	LNB for 15 minutes for 8 weeks	SBP,DBP,Respiratory Rate, PR, Peak expiratory flow rate, galvanic skin resistance	SBP, DBP, Respiratory rate , PR decreased Peak expiratory flow rate increased No significant change in galvanic skin resistance
Shyam karthik et al.,2014	50	Pre – post study	Yoga for 30 minutes for 2 months	VC, Peak expiratory flow rate, TV, breath holding time	VC, Peak expiratory flow rate, TV, breath holding time increased significantly

### **3.0 AIM AND OBJECTIVES**

#### **3.1 AIM OF THE STUDY:**

To compare the immediate effect of Chandra anuloma viloma pranayama in hypertensive and normotensive on cardiopulmonary functions

#### **3.2 OBJECTIVES OF THE STUDY**

To assess the effect of CAV on cardio-pulmonary functions like SBP, DBP, SPO2 and PR. To compare the immediate physiological effects of CAV on hypertensive and normotensive individuals.

#### **3.3 JUSTIFICATION OF THE STUDY:**

There are no studies conducted to compare the immediate effect of Chandra anuloma viloma pranayama in hypertensive and normotensive on cardiopulmonary functions. Hence, the following study was conducted to the best of our knowledge.

#### **3.4 HYPOTHESIS:**

Chandra anuloma viloma pranayama is more effective on cardiopulmonary functions in hypertensive than normotensive.

#### **3.5 NULL HYPOTHESIS:**

Chandra anuloma viloma pranayama has same effect on cardiopulmonary functions in hypertensive and normotensive.

### **4.0 METHODOLOGY**

#### **4.1 PARTICIPANTS**

Participants were literate male and female volunteers recruited from different states of India.

##### **4.1.1 SAMPLE SIZE**

A sample size of 32 subjects were selected based on the criteria both inclusion and exclusion criteria.

##### **4.1.2 SELECTION & SOURCE OF PARTICIPANTS**

We considered volunteers who were in the age group of 20 to 70 years, who were in self-reported good health.

### 4.1.3 INCLUSION CRITERIA

1. Subjects diagnosed with HTN from past 2 - 10 years in the hypertensive group.
2. Subjects under HTN medication in the hypertensive group.
3. In the age range of 20-70 years.

### 4.1.4 EXCLUSION CRITERIA

1. Subjects with other co-morbid conditions like chronic obstructive pulmonary disease.
2. Subjects with physical or mental disability limiting the performance of CAV.
3. Subjects with nasal polyps.

### 4.1.5 ETHICAL CONSIDERATION

The subjects recruited for the study were informed about the intervention prior to the commencement of the study. Subjects who fulfilled inclusion criteria were apprised about the purpose of study and their rights as research subjects. Adequate time was given to each participant to go through the consent form and their queries were answered. All the participants expressed their willingness to participate in the study by giving an informed consent.

### 4.2 DESIGN OF THE STUDY: Two group pre post Study

#### TRIAL PROFILE:

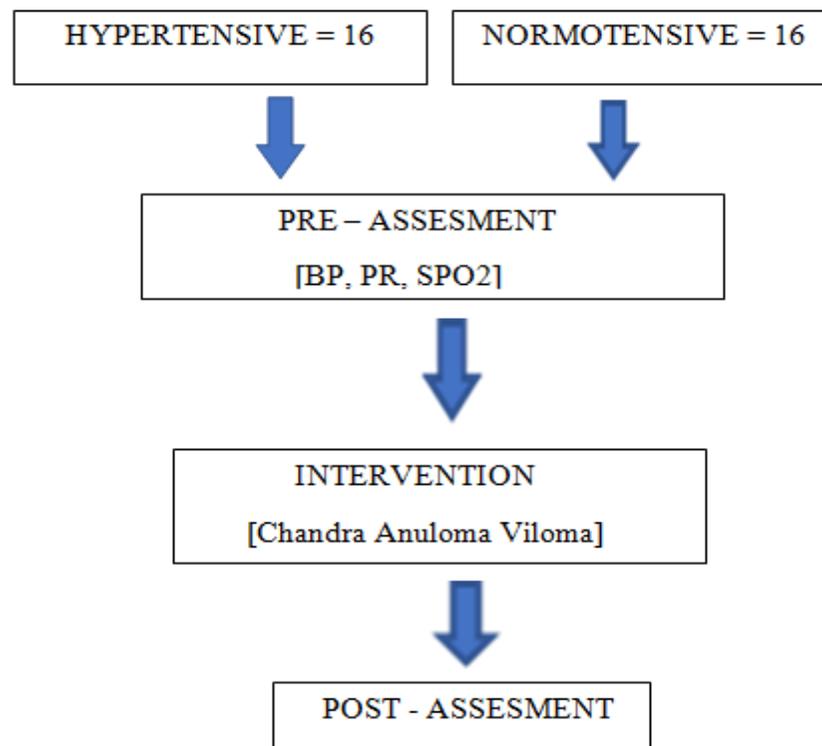


Figure 3: Trail profile

### **4.3 VARIABLES STUDIED:**

#### **4.3.1 Blood pressure**

BP is the force exerted by circulating blood against the walls of the arteries, the major blood vessels in the body. It is one of the most common non- invasive clinical practice tools used to assess the CVS status of an individual and predict the CVS risks. It was measured using a sphygmomanometer and stethoscope using the auscultatory method by medical students.

#### **4.3.2 Pulse Rate**

PR is a measurement of the heart rate that is the number of heart beats per minute. PR was measured using a pulse oxymeter.

#### **4.3.3 Oxygen saturation**

SPO2 is the amount of oxygen bound to haemoglobin in the blood, expressed as a percentage of the maximal binding capacity. SPO2 was measured by using pulse Oxymeter.

### **4.4 INTERVENTION:**

The participants were asked to observe the Chandra anuloma viloma pranayama demonstrated by BNYS intern before the intervention starts. They were asked to attain sukasana a comfortable meditative posture with closed eyes. They were instructed to adopt chin mudra in left hand and nasikagra mudra in right hand, close the right nostril in right hand and start inhalation and exhalation in left nostril only. The same practice was continued for 5 minutes with instruction. In this pattern both hypertensive and normotensive groups performed Chandra anuloma viloma pranayama for 5 minutes.



*Figure 4: CAV*

#### **4.5 DATA EXTRACTION**

Data has been collected from the participants through a data collection form (appendix 1) consisting of two sections. The first section included their demographic data and the second section contained information on their cardio-respiratory parameters.

All the data have been tabulated in an excel sheet. All the collected data has been analysed in SPSS version 23.

#### **4.6 DATA ANALYSIS**

Data was analysed using descriptive as well as inferential statistics. The data was assessed for normality distribution using the Shapiro-wilk test (a test of normality). The pre-data of hypertensive group as well as normotensive group were compared with their post - data values using a paired 't' test. The differences across the groups were assessed using an Independent t test.

## 5.0 RESULTS

Two groups (Hypertensive group and normotensive group) were assessed after the respective intervention, hypertensive group showed significant improvement. The pre-post data within each group was analyzed using a paired sample 't' test. There was a significant difference in hypertensive group ( $p < 0.01$ ). In normotensive group significant changes are noted ( $p < 0.05$ ), but less significant than hypertensive group. The difference between group was assessed using an independent sample 't' test which showed significant changes in SBP and DBP ( $p < 0.05$ ). However no significant changes were observed in SPO2 and PR.

*Table 1 Comparison of hypertensive group and normotensive group with respect to pre-test and post-test of SBP, DBP, SPO2 and PR*

Variables	Hypertensive group			Non - hypertensive group			Between group analysis (p value*)
	Pre	Post	p-value *	Pre	Post	p-value *	
SBP	147.63±15.61 6	138.63±14.78 2	.000	120.63 ± 6.098	117.38± 5.920	.011	.000
DBP	88.88±11.661	83.25±13.143	.000	75.75±5.698	74.25±6.017	.027	.019
SPO2	96.44±1.153	97.75±1.238	.001	97.56±1.209	98.06±1.181	.035	.471
PR	79.94±8.910	77.50±8.556	.002	85.44±9.143	80.81±9.340	.000	.304

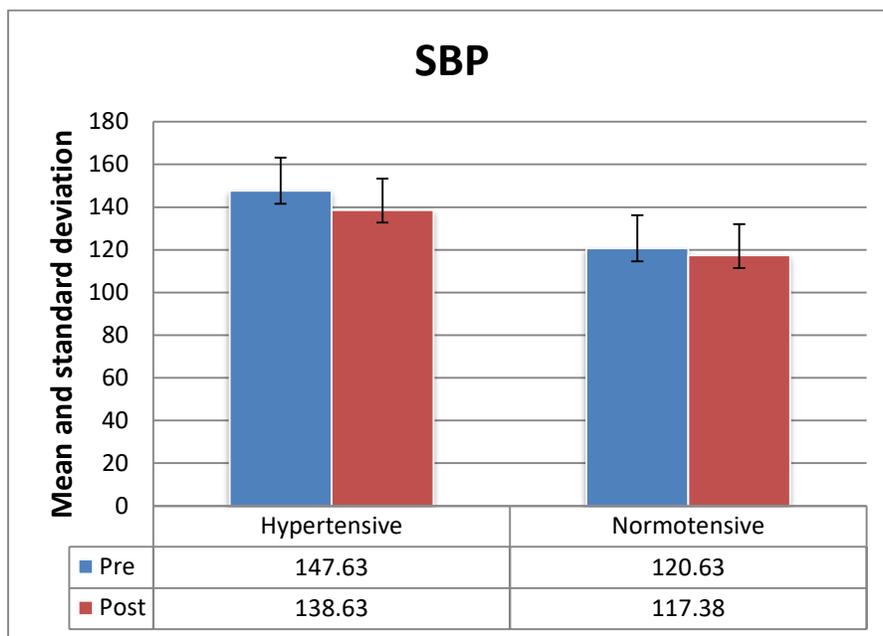


Figure 5: Comparison of hypertensive and normotensive group with respect to pre-test and post-test of SBP (Mean & Standard deviation)

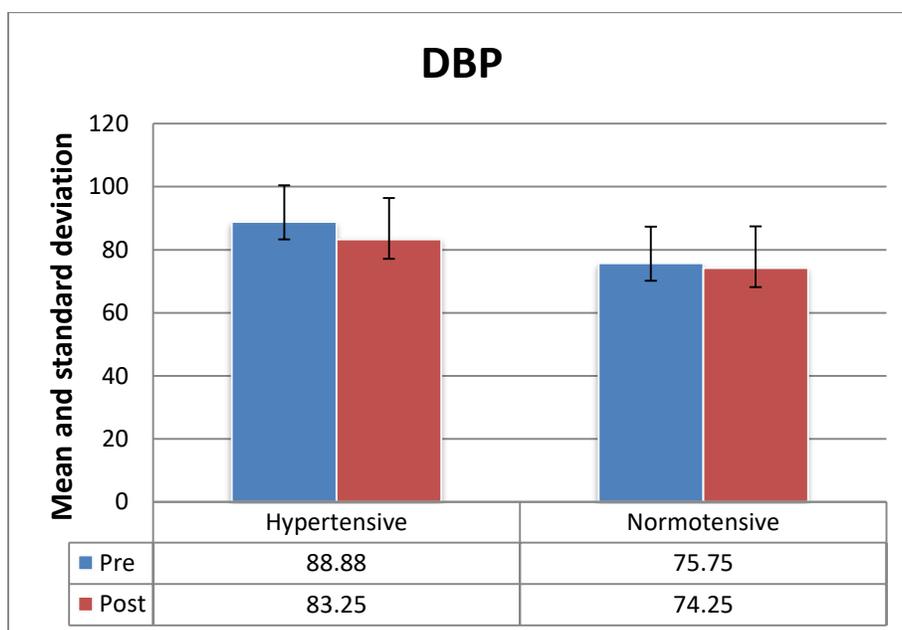


Figure 6: Comparison of hypertensive and normotensive group with respect to pre-test and post-test of Diastolic blood pressure (Mean & Standard deviation)

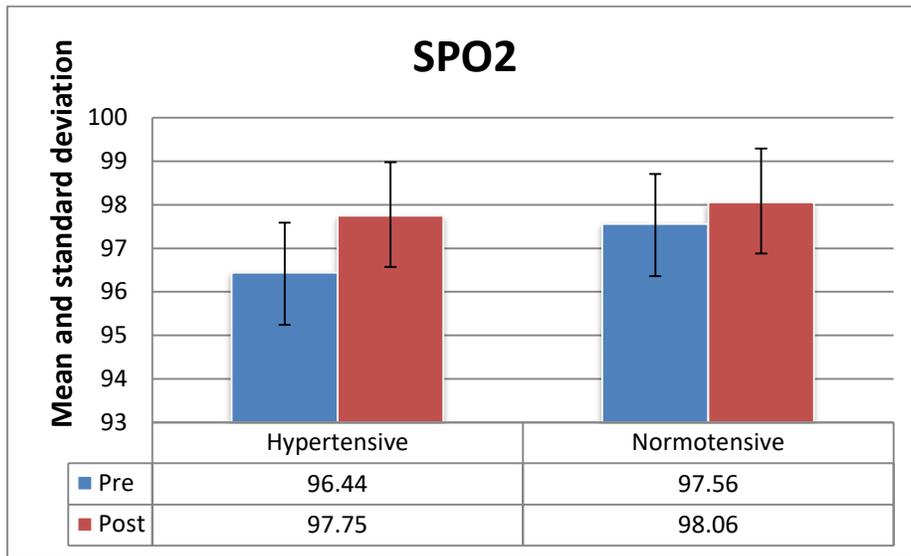


Figure 7: Comparison of hypertensive and normotensive group with respect to pre-test and post-test of oxygen saturation (Mean & Standard deviation)

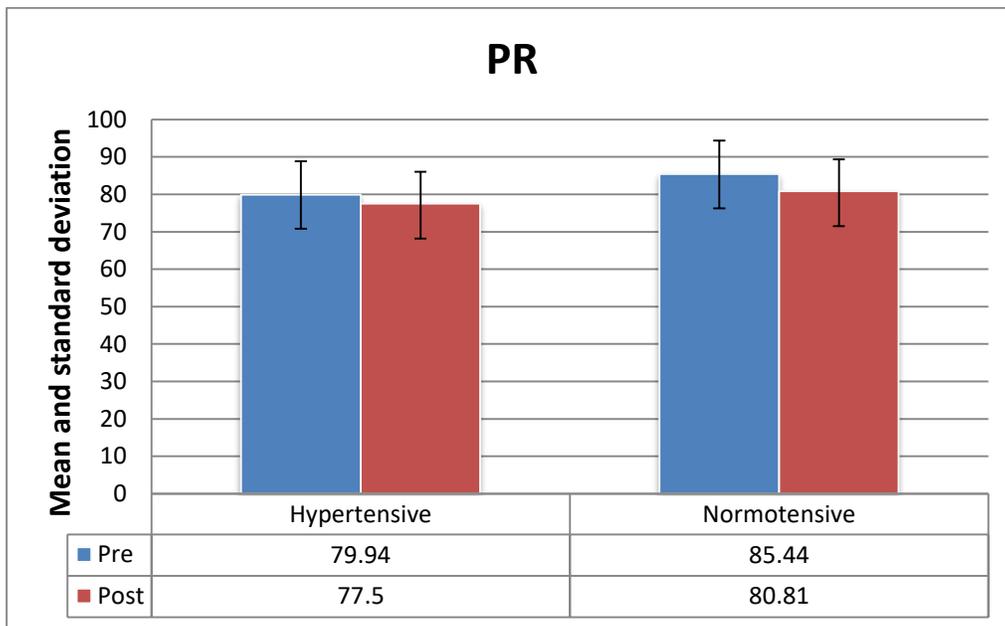


Figure 8: Comparison of hypertensive and normotensive group with respect to pre-test and post-test of pulse rate (Mean & Standard deviation)

## 6.0 DISCUSSION:

In the current study, we examined whether Chandra anuloma viloma pranayama improved cardiopulmonary functions in hypertensive and normotensive.

Patanjali ,foremost exponent of Yoga, described pranayama as “*Tasmin sati śvāsa-praśvāsyor-gati-vicchedaḥ prāṇāyāmaḥ*” which means pranayama is the gradual unforced cessation of inhalation and exhalation (Malhotra & Takkella, 2020) . The inspiration of prana-vayu is Shwasa and expiration is prashwasa and cessation of both is characteristic of pranayama. The beneficial effects of different Pranayama are well reported and has sound scientific basis to relieve stress(Bhimani et al., 2011).

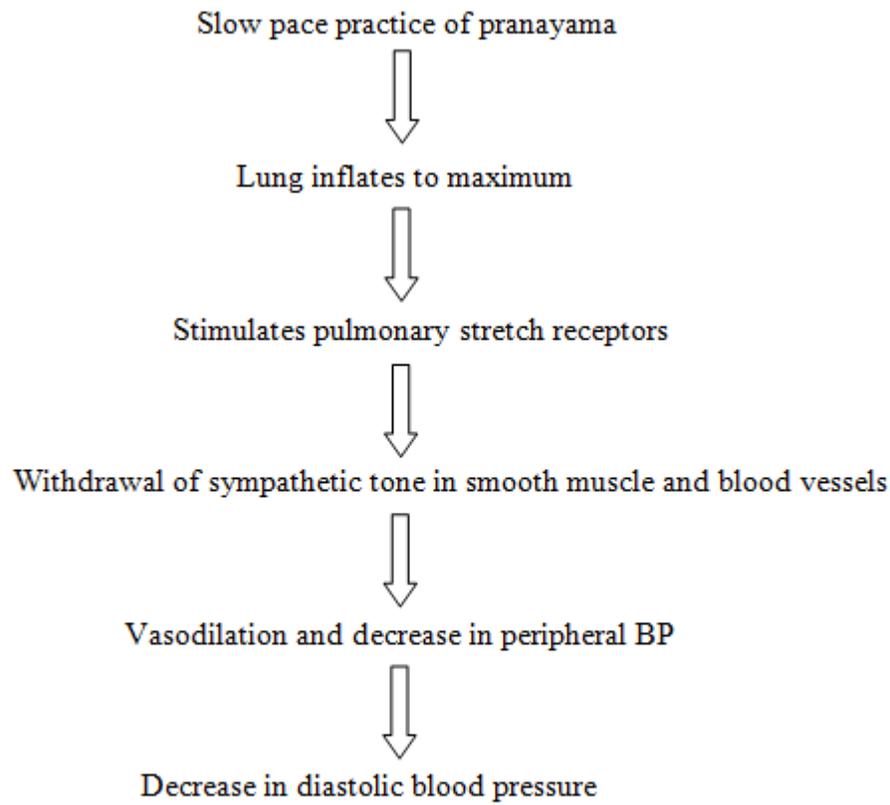
The nasal cycle was considered an ultradian rhythm during which the patency and efficiency of the right and left nostrils changed alternately with varying periodicity. It is recognized that nasal blood vessels influence nasal airflow and hence nasal airflow is regulated by autonomic and central controls (Telles, 2008).

When the respiratory cycle of inhalation and exhalation is completed through the left nostril alone the practice is called “Chandra Anulomaa Vilomaa Pranayam” which means a heat dissipating or cooling liberating practice(Prakash S, 2015)

There are minimal cost and side effects associated with lifestyle interventions, and they interact favorably with other CVD risk factors (“Exercise and Hypertension,” 2004) so Chandra anuloma viloma pranayama can be practiced daily as a routine lifestyle .

**Mechanism:**

- Biological evidence :



*Figure 9: mechanism of pranayama (Raj, 2017)*

The results of this study reported that Chandra anuloma viloma pranayama has more immediate effect in hypertensive than normotensive.

Further studies with large sample size are required to enable a deeper understanding of the mechanisms involved as well as determine how long such a Blood pressure lowering effect persists. We recommend that this non- invasive, simple and cost effective technique has to be added in the regular management protocol of hypertension and utilized when immediate reduction of Blood pressure is required in our day-to-day life as well as clinical situations.

## 7.0 APPRAISAL

### 7.1 SUMMARY OF FINDINGS

The present study was conducted to compare the immediate effect of Chandra anuloma viloma pranayama in hypertensive and normotensive individuals on cardiopulmonary functions. CAV helps to improve cardiopulmonary functions in both the groups but is more effective in hypertensive group. CAV hence brings homeostasis in CVS. It is also in concurrence with traditional and ancient yogic scriptures as “Samatvam Yoga Uchyate” which means yoga brings equanimity.

### 7.2 CONCLUSIONS:

The result of this study suggests that Chandra anuloma viloma pranayama helps in enhancing the cardiopulmonary functions after the intervention in both the groups. Effect on BP is more significant in hypertensive group than normotensive group. No significant changes observed in PR and SPO2 between the groups.

### 7.3 LIMITATIONS OF THE STUDY

- Sample size is relatively smaller hence generalizing the study outcome to a large population would not be definitely conclusive.
- Difference in the number of male and female participants in the study.
- The methodology could have been more rigorous and blinding may have been used in order to further minimize bias.

### 7.4 STRENGTH OF THE STUDY

- As the study was on immediate effect dropouts were less
- Non yogic background subjects were chosen
- Even though the duration of practice was short, acceptability and adherence to therapy was good.
- The assessments were objective, non invasive and cost effective.
- The intervention was non invasive and cost effective.

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## 9.0 APPENDICES

### 9.1 INFORMED CONSENT FORM: A SAMPLE COPY

A Study on the Immediate effect of Chandra anuloma viloma pranayama on hypertensive and normotensive individuals on cardiopulmonary functions.

Investigator – Kavya C T

Contact number – 9483229195

You are invited to be a part of a study aimed at comparing the immediate effect of Chandra anuloma viloma (CAV) in hypertensive and normotensive individuals on cardio-pulmonary functions. Hypertension is the most common health concern, with increased risk of cardiovascular diseases. Yoga and other mind-body medicine have been shown to have homeostatic effects. With this understanding, we intend to study the immediate effects of 1 session of CAV.

You will be required to undergo one session of CAV for a period of 5 minutes, under the instructions of a BNYS intern. Before and after this session your blood pressure, Oxygen saturation and pulse rate will be assessed by BNYS intern.

Please note that your results will be used for scientific communications and any indicator revealing your personal identity will NOT be used. The data collected from you will be maintained confidentially.

If you have any questions about the research project you may please contact the investigator:

I hereby state that there are no side effects of this intervention. The participant has all the rights to withdraw from the study at any given time with prior notification.

I give my consent to participate in the study – Yes or No

I have read the above information, or it has been read to me. I have had the opportunity to ask questions about the entire research process and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of the participant: \_\_\_\_\_

Signature of Participant \_\_\_\_\_

Date \_\_\_\_\_

Day/month/year

## 9.2 DATA COLLECTION FORM

### Data Collection Form

#### Section 1

##### Demographic data:

Name \_\_\_\_\_

Age \_\_\_\_\_

Gender \_\_\_\_\_

Female

Male

Prefer not to say

Occupation \_\_\_\_\_

Address \_\_\_\_\_

#### Section 2

##### Cardio - respiratory parameters

	Pre data	Post data
SBP		
DBP		
SPO2		
PR		