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# To study the effect of pranayama technique (breathing exercise) on lung function test of healthy volunteers

**Amit Mujumdar[1], Hemangini Waghulade[2], Sudarshan Hande[3]**
[1] Associate Professor, Department of Kriya Sharir, DY Patil Deemed to be University School of Ayurveda, Nerul, Navi Mumbai, and Maharashtra, India
[2] Professor, HOD, Department of Kriya Sharir, DY Patil Deemed to be University School of Ayurveda, Nerul, Navi Mumbai. Maharashtra, India
[3] Associate Professor Department of Sanskrit Samhita Siddhant, DY Patil Deemed to be University School of Ayurveda, DY Patil Deemed to be University School of Ayurveda, Nerul, Navi Mumbai. Maharashtra, India

**Abstract**
"Pranayama is control of Breath". "*Prana*" is Breath or vital energy in the body. On subtle levels *Prana* represents the energy responsible for life or life force, and "*Ayama*" means control. So *Pranayama* is "Control of Breath"**[1].** In today's era of industrialization due to air pollution, sedentary lifestyles respiratory strength of individual is affected. So in our society there is increase in demand for special Technique which will look after respiratory health. *Pranayam*a a part of *Yoga* has ability to improve respiratory function. FVC, PEFR etc. are parameters which indicate functional ability of respiratory system. The study is conducted to evaluate whether *Pranayama* plays any role in improving lung capacity.

**Keywords:** pranayama, *FVC, PEFR*

## Introduction
Air pollution is a global health threat and causes millions of human deaths annually. The late onset of respiratory diseases in children and adults due to prenatal or post natal exposure to air pollutants is emerging as a critical concern in human health [2]. The new respiratory diseases are emerging like COVID-19, swine flu; put dangers in front of society. So it becomes important to strengthen Respiratory system and prevent such diseases & maintain normal lung function by best possible way.

*Pranayama* is important part of *Yoga* which has been practiced for centuries by students of *Yoga* in remote *Ashrams* & has been preserved for us through many generations both in practice and in handwritten books. Until science of Yogic breathing was almost unknown to common man like many other ancient Indian Arts. Those who knew it used to be very reluctant to share their knowledge and experiences with any one, unless students prove this by different tests world can't accept its importance.

*Pranayama* has considerable effect on respiratory function. *Pranayama* includes the control over the natural process of inspiration & expiration. The purpose of *Pranayama* is to make the respiratory system function at its best. This automatically improves the circulatory system, without which the process of digestion and elimination would suffer. Toxins would accumulate, disease spread through body and ill health become habitual. The respiratory system is gate way to purifying the body, mind and intellect. The key to this is *Pranayama* [3].

*Pranayama* is accepted as best breathing Technique. So it is important to explain *Pranayama* using objective parameters in today's world of science & technology.

## Materials and methods
### Aims and objectives
- To study the effect of Eight weeks of *Pranayama* Technique on Lung Function Test of normal volunteers

### Materials and Methods
During the study effect of *Pranayama* on respiratory system of randomly selected 30 healthy volunteers was studied. The following materials were used,
Thermometer, Weighing Machine, Stop watch, BP apparatus, Stethoscope, Measuring tape, computerized Spirometer.

### Inclusion criteria
Normal healthy volunteers aged between 20 to 50 yrs.

### Exclusion Criteria
1. Pregnancy
2. Volunteers having habit of tobacco chewing, smoking & alcoholics were avoided
3. Volunteers having diseases of respiratory system e.g., Bronchial Asthma, URTI etc. were avoided
4. Volunteers performing *Pranayama* regularly, sports persons, athletes were not included in study.
5. Lung function test (LFT) was recorded by breeze suite
6. A computerized spirometer. The parameters of PFT included in the study were

a. FVC- Forced Vital Capacity
b. PEFR- Peak Expiratory Flow Rate

### Methods of *Pranayama*
30 Volunteers were randomly selected and all volunteers were considered as experimental group. Volunteers were

first explained the whole *Pranayama* procedure as explained in AYUSH Protocol [4].

**1. Invocation:- 3 Minutes**
Yogic Practice shall start with a prayer or prayerful mood to enhance the benefits of practice.

**2. Loosening practices:- 10 Minutes**
The loosening practices help to increase microcirculation. These practices can be done while standing and sitting. Neck, Shoulder, Trunk and Knee movements.

**3. *Anulom Vilom Pranayama* (Alternate Nostril Breathing)**
The main characteristic feature of this *Pranayama* is alternate breathing through the left and right nostrils.

**Position: Any comfortable posture**.
Technique - Sit in any comfortable posture. Keep the spine and head straight with eyes closed. Relax the body with few deep breaths. Keep the left palm on the left knee called as *Dnyan Mudra* and the right palm should be in *Nasagra Mudra* (places the middle finger and forefinger at the point between the eyebrows.) Place the ring and small fingers on the left nostril. Place the right thumb on the right nostril. Open the left nostril, breathe in from the left nostril, close the left nostril with the small and ring fingers and release the thumb from the right nostril; exhale through the right nostril. Next, inhale through the right nostril. At the end of inhalation, close the right nostril, open the left nostril and exhale through it. This completes one round of the Anuloma Viloma *Pranayama*. Repeat for another 4 rounds in first week, 8 rounds in second week, and 12 rounds in third and fourth week and 16 rounds from fifth week to Eight week. *Anulom Vilom Pranayam* for 20-30 Minutes duration.

**Data collection**
All volunteers were examined on 1st day & lung function test was done. Then daily early in morning 6:00 am to 6:45 am *Pranayama* practice done. After 8 weeks of *Pranayama* procedure above all volunteers were again examined. Case record form was prepared to note observations of volunteers at specific interval. Observations obtained on day 1st & on 8th week were analyzed by paired‘t’ test.

**Examination of Volunteers**
1. General Examination – Weight, Pulse, B.P., Temperature are examined
2. Examination regarding Respiratory system –
3. Lung Function Test
4. Lung function test (LFT) was recorded by Breeze Suite 3 a computerized spirometer. The Parameters included in this study,

1. FVC – Forced vital capacity
2. PEFR – Peak expiratory flow rate

For LFT the subjects were explained the whole procedure & were demonstrated the same. Before starting procedure, make sure that the volunteer is comfortable & fully understood the maneuvers necessary to complete the test.

**FVC**: FVC measures the maximum volume of gas that can be expired as forcefully & rapidly as possible after a maximal inspiration to lung capacity.
First switch on the instrument. By clicking FVC tab initiate the procedure. After clicking space bar to begin the test, instruct the volunteers to make normal relaxed breaths. Instruct the patients to inhale fully, then exhale as rapidly, forcefully & completely as possible (Try to have volunteer exhale until the yellow indicator box turns green, indicating end of test criteria). Then inhale fully. After stopping the test by pressing space bar, the completed test results appear in Data table. Breeze software automatically performs the calculations.

**PEFR**: (Peak expiratory flow rate) the maximum rate at which the air can be expired after a deep inspiration is known as peak expiratory flow rate [8].
PEFR was determined by computerized Breeze suite spirometer while determining FVC test.

**Results and Discussion**
**Result**
The present study has demonstrated a significant (paired‘t’ test) improvement in the FVC, PEFR with 8 wks daily *Pranayama* Technique. Along with that it is found that Calming effect on mind.

**Discussion**
The exact mode of action of *Anulom Vilom Pranayama* on Lung function is not yet known but various factors mentioned below may be responsible for improvement
1. The improvement in the lung function test may be due to increased in development of respiratory musculature incidental to regular practice of *Pranayama*. By the practice the respiratory apparatus emptied & filled more completely & efficiently which is recorded in terms of FVC. During the normal inspiration or expiration volume of Air is Tidal volume & it is about 500ml. We directly try to stretch our basic respiratory unit i.e. Alveoli with the *Pranayama*.
2. Emptying & filling of respiratory apparatus more efficiently may be due to efficient use of diaphragmatic & abdominal muscles.
3. Its common misconception that breathing is automatic and it is beyond our active control. This is not true. In Pranayama by arduous training of Lungs and Nervous system, breathing can be made more efficient by changing its rate, depth and quality. The lung capacity of great athletes, mountain climbers, and Yogis is far greater than that of ordinary man, allowing them to perform extraordinary feats. Better breathing means a better and healthier life [5].

**Tables and Figures**
Out of Total 30 volunteers 17 were Male and 13 were Female.

**Table No 1:-** Demographic Data of Volunteers:

| **Demographic Data of Volunteers** | |
|---|---|
| Average | |
| Age (Yrs) | 36.9 |
| Weight(Kgs) | 65.23 |
| Height (Cms) | 164.03 |

**Table 2:** Values of parameters FVC and PEFR Before and after the study period.

| Sr. No | FVC (Litre) | | PEFR (ML) | |
|---|---|---|---|---|
| | Day 1 | 8 wks | Day 1 | 8 wks |
| 1 | 1.54 | 1.64 | 265.3 | 276.9 |
| 2 | 2.23 | 2.47 | 329.3 | 340.8 |
| 3 | 1.39 | 1.76 | 249.8 | 262.3 |
| 4 | 1.91 | 2.18 | 313.1 | 336.8 |
| 5 | 1.68 | 1.77 | 282.2 | 302.1 |
| 6 | 1.98 | 2.24 | 330.8 | 358.6 |
| 7 | 1.41 | 1.8 | 182.5 | 162.1 |
| 8 | 1.89 | 1.97 | 254.4 | 268.9 |
| 9 | 3.07 | 3.25 | 600.6 | 599.4 |
| 10 | 3.18 | 3.58 | 474.1 | 491.3 |
| 11 | 2.64 | 2.81 | 374.4 | 376.4 |
| 12 | 1.49 | 1.56 | 243.8 | 248.2 |
| 13 | 2.43 | 2.64 | 382.3 | 385.9 |
| 14 | 3.22 | 3.55 | 398.5 | 411.2 |
| 15 | 2.15 | 2.71 | 181.3 | 203.2 |
| 16 | 3.07 | 3.28 | 448.9 | 455.1 |
| 17 | 2.76 | 2.84 | 380.1 | 391.8 |
| 18 | 3.51 | 3.78 | 521.2 | 530.7 |
| 19 | 2.25 | 2.8 | 370.4 | 381.9 |
| 20 | 2.09 | 2.35 | 266.6 | 277.2 |
| 21 | 2.26 | 2.78 | 320.5 | 330.5 |
| 22 | 2.31 | 2.83 | 313.7 | 146.5 |
| 23 | 2.21 | 2.93 | 340.4 | 351.5 |
| 24 | 2.36 | 2.78 | 378.5 | 388.5 |
| 25 | 2.01 | 2.63 | 298.9 | 310.9 |
| 26 | 1.96 | 2.83 | 343.4 | 353.4 |
| 27 | 2.61 | 3.13 | 258.6 | 269.6 |
| 28 | 2.71 | 3.13 | 288.8 | 300.8 |
| 29 | 2.61 | 3.13 | 278.4 | 289.8 |
| 30 | 3.01 | 3.63 | 320.5 | 330.5 |

### Statistical analysis

Paired ‘t’ Test is applied to pair data of independent observations from one sample only when each individual gives a pair of observations, so Paired ‘t’ Test is applied for statistical analysis. For testing the significance of difference Mean & SD of data is calculated.

**Table No: 3** Statistical Analyses of Parameters

| Sr. No | FVC (Litre) | | PEFR (ML) | |
|---|---|---|---|---|
| | Day 1 | 8 wks | Day 1 | 8 wks |
| Mean | 2.331 | 2.693 | 333.04 | 345.76 |
| SD | 0.5693 | 0.6171 | 93.042 | 98.669 |
| SE | 0.1039 | 0.1127 | 16.805 | 18.014 |

### Effect of *Pranayama* on FVC

By using the paired‘t’ test, ‘t’ value is found to be 9.496. Expected value at 29 degree of freedom at 5% significant level 2.05, which is less than the value found so the effect is significant.

### Effect of *Pranayama* on PEFR

By using the paired‘t’ test, ‘t’ value is found to be 2.077. Expected value at 29 degree of freedom at 5% significant level 2.05, which is less than the value found so the effect is significant.

### Conclusions

In today’s fast life most persons are suffering from lack of enthusiasm & lack of concentration in their work, which is may be due to inappropriate oxygen supply to body. Proper breathing can bring more oxygen to blood & ultimately to body parts. *Pranayama* is the best breathing Technique. Therefore the “To study the effect of Eight weeks of *Pranayama* Technique (Breathing Exercise) on lung function test of normal volunteers” is the subject taken for the study.

In this study 30 healthy volunteers, irrespective of sex between 20 to 50 years were randomly selected. All volunteers are considered as experimental group. First all volunteers were explained & demonstrated the procedure of *Pranayama* which includes *Nadi Shodhan Pranayama* as explained in AYUSH protocol.

All volunteers examined on day 1 before starting *Pranayama* & the Lung Function Test is performed. Again after 8 wks of *Pranayama* LFT done & the observations are noted which further analyzed using paired‘t’ test. Parameters included in the Lung Function Test are – FVC and PEFR.

The Lung Function Test was performed with the help of Breeze suite spirometer 6.3 a computerized unit. After 8 wks of *Pranayama* significant improvement in FVC and PEFR is found.

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