



## RESEARCH ARTICLE

### ROLE OF FAST BREATHING EXERCISES IN MODULATION OF PULMONARY FUNCTIONS

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#### ABSTRACT

**Background & Objectives:** With increased awareness and interest in health and natural remedies, breathing techniques are gaining importance and becoming increasingly acceptable to the scientific community. Breathing is the most vital function for maintenance of life. Pranayama is an art of controlling the life force of breath. It produces many systemic psycho-physical effects in the body, besides its specific effects on the respiratory functions. Pranayama helps to bring the conscious awareness in breathing to reshape breathing habits and patterns. Thus the present study was conducted to elucidate the effect of bhastrika pranayama, a fast breathing type of exercise, on various pulmonary functions.

**Methods:** The study included thirty medical students both male and female of age group 17-21 years. Students practiced bhastrika pranayama twenty five minutes daily for three months. Pulmonary Function Test (PFT) are measured before, at 6 weeks and 12 week after pranayama practice. Parameters included in the study were Vital Capacity (VC), Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV).

**Results:** There occurs a significant increase ( $p$  value  $<.01$ ) in all the parameters included in the study following practice of bhastrika pranayama for three months.

**Interpretation & Conclusion:** Bhastrika pranayama plays a significant role in improving the various ventilatory functions of lungs in pranayama practicing subjects. Thus helps in improving the quality of life.

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## INTRODUCTION

Yoga is ancient heritage of India that has given man the answers to his spiritual and holistic search for perfect health and well-being. The term "yoga" and the English word "yoke" are derived from Sanskrit root "yuj" which means union. It is an ideal way of living, providing rhythm to the body, melody to the mind, harmony to the soul and thereby symphony to life. It is an ancient Indian science which teaches man how to live in unity within himself and with those around him. (Gaur, 2014; Somwanshi *et al.*, 2013) Patanjali has described eight-limbs of yoga (ashtang yog). Role of different limbs of yoga are: The first two limbs of ashtang yoga are "Yam" and "Niyam" which are universal morality and personal discipline for the development of our moral, spiritual and social aspects. Third and fourth limbs are "Asan" and "Pranayam" which help in our

physical development and improvement of physiological functions and breath control. Fifth and sixth limbs are "Pratyahar" and "Dharna" for controlling our senses and making our mind one-pointed, calm and alert. The last two limbs are "Dhyan" and "Samadhi" which cause inner peace, ecstasy, higher level of consciousness and the ultimate union of our individual consciousness with the Universal Consciousness, resulting in God realization. (Carrico, 2007) Many physicians recommend pranayama and asanas to the patients at risk for heart diseases, as well as those with back pain, arthritis, depression and other chronic diseases<sup>4</sup>. Pranayama, the fourth limb of ashtang yoga, is a controlled and conscious breathing exercise which involves mental concentration. The word Pranayama is derived from two words i.e. "Prana" meaning vital force or life and "Ayama" meaning to control the vital force. Hence pranayama means control of the vital force by concentration and regulated breathing. (Lathadevi *et al.*, 2012; Yadav, 2015) Previously done study by Manaspure, Shankarappa, Tanwar etc. included a combination of asanas and pranayama for a shorter duration. (Shankarappa *et al.*, 2012; Manaspure *et al.*, 2011; Panwar *et al.*, 2012) Very few studies

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are available in literature that studied the effect of specific pranayama. So we planned to study the effect of bhastrika pranayama, practiced for 12 weeks, on pulmonary functions.

## MATERIALS AND METHODS

The present study was conducted in the department of Physiology at Pt. B.D.Sharma PGIMS, Rohtak on medical and para-medical students. Thirty students both male and female of 17 to 21 years of age were enrolled in the study. Students were enrolled randomly who are interested in practicing pranayama.

### Inclusion criteria

1. Healthy medical and para medical students of either sex between 17 and 21 years of age.
2. Students who have not practiced pranayama before enrollment.
3. Students who were committed to practice pranayama as taught by the instructor regularly.

### Exclusion criteria

1. History of smoking and alcohol intake
2. Subjects on long term medications or suffering from any chronic disease including neuromuscular or skeletal disorder.
3. Subjects who do not practice pranayama regularly during the study.

Each subject performed bhastrika pranayama as instructed by a certified yoga teacher and detailed below. For performing bhastrika pranayama subjects were asked to sit in vajrasana keeping the back, neck and head straight. Arms were folded at the elbows and kept on either side of the body with medial side of each arm touching the chest; fists were closed and pointed upwards. Keeping the mouth closed a deep inhalation was taken through nose along with raising the arms parallel to each other above the head and opening the fist. After the inhalation the subjects were instructed to exhale fully and forcibly through nose along with pulling the arms down to the same initial position. One inhalation and exhalation completes one cycle of bhastrika. One set consist of twenty such cycles. The subjects performed two such sets with an interval of four minutes. Between the sets the subjects were asked to sit in vajrasana with eyes closed and hands resting on thighs palms facing towards the sky. Completing both the sets took approximately 25 minutes. (Swami, 2008) The pranayamic breathing was practiced early in the morning after a warm up for ten minutes by jumping and jogging on the spot.

Subjects practiced pranayama with empty stomach or if required only a glass of water was allowed 30 minutes before starting pranayama. Subjects were required to wear light & comfortable clothing.

### Pulmonary Function Tests

The following parameters were recorded on RMS MEDSPIROR Platform WIN 98 version- 1.0 supplied by RMS Chandigarh:

- (1) Vital Capacity in liters.
- (2) Peak Expiratory Flow Rate in liters/min.
- (3) Maximum Ventilatory Volume in liters/min.

### Procedure for VC and PEFR

The subject was asked to apply the mouthpiece and close the lips above it so that no air escapes. A nose clip was applied on the nose to close both the nostrils and then subject was instructed to breathe in and out normally through the mouth. After a few tidal breaths the subject was asked to inhale deeply and then exhale as fast and as completely as possible into the mouthpiece. The subject was asked to repeat it three times and the best attempt was selected for analysis.

### Procedure for MVV

The subject was asked to apply the mouthpiece and close the lips above it so that no air escapes. A nose clip was applied on the nose to close both the nostrils. The subject was then instructed to inhale and exhale as quickly and as deeply as possible into the mouthpiece for a period of 15 seconds. The subject was advised to stop the maneuver if he/she feels uncomfortable during the procedure. All the tests were done at 7:00 am on empty stomach, in the department of physiology. Three sets of recordings were done, one before the start of study, second after six week and third after twelve weeks of pranayamic practice.

### Statistical analysis of data

For interpretation of the results, repeated measure ANOVA was used for analysing the data. Significance of results was predicted based on p value. p value > 0.05 was taken as nonsignificant, p value < 0.05 was taken as significant and p value <0.01 was taken as highly significant.

## RESULTS

The present study was conducted in the department of Physiology at Pt. B.D.Sharma PGIMS, Rohtak on medical and para-medical students. The study was carried out on 30 students of 17-21 years of age of either sex. Their PFT was recorded at basal, 6 weeks and 12 weeks. The observations and results of our study are presented in graphical and tabular forms in the following section:

**Table 1. Effect of Bhastrika pranayama on PEFR (L/min.)**

PEFR	N	Mean	S.D.
Basal	30	389.520	± 83.237
6 week	30	406.360	± 84.270
12 week	30	422.880	± 81.392

p value <.05, repeated measure ANOVA

Table 1 shows the effect of fast breathing pranayama on PEFR with time. There was an increase in mean PEFR from basal 389.520±83.237 l/min. to 406.360 ± 84.270 l/min.

at 6 weeks and 422.880 ± 81.392 l/min. at 12 weeks. Increase in PEFR was found to be statistically significant with p value <.05.

**Table 2. Effect of Bhastrika pranayama on MVV (L/min.)**

MVV	N	Mean	S.D.
BASAL	30	130.533	± 28.064
6 WEEK	30	134.500	± 28.319
12 WEEK	30	139.600	± 28.390

p value <.05, repeated measure ANOVA

Table 2 shows the effect of fast breathing pranayama on MVV in relation with time. There was an increase in mean MVV from basal 130.533 ± 28.064 l/min. to 134.500 ± 28.319 l/min. at 6 weeks and 139.600 ± 28.390 l/min. at 12 weeks. Data observed after practicing 12 week of pranayama was found to be statistically significant with p value <.05.

**Table 3. Effect of Bhastrika pranayama on VC (Liters)**

VC	N	Mean	S.D.
BASAL	30	3.489	± 0.513
6 WEEK	30	3.694	± 0.516
12 WEEK	30	3.957	± 0.497

p value <.05, repeated measure ANOVA

Table 3 shows the effect of 12 weeks of bhastrika pranayama on VC of subjects. There was an increase in mean VC from basal 3.489 ± 0.513 l to 3.694 ± 0.516 l at 6 weeks and 3.957 ± 0.497 l at 12 weeks. The result observed from the table were found to be statistically significant with p value <.05.

## DISCUSSION

Pranayama involves manipulation of breath movement and the breath is a dynamic bridge between the body and mind. The psychosomatic effects of different pranayama are believed to derive from differences in duration of the phases of the breathing cycle, tidal volume and other factors including the use of mouth, nostrils, and constriction of the laryngeal muscles and position of the glottis<sup>11</sup>. In the modern day scenario of cut throat competition, the prevalence of time bound project is soaring high. Every single person particularly medical and paramedical student is striving hard to stay in the world of competition and it is taking its toll in the form of negative effects like anxiety, stress, mental tension and depression. Growing population and indiscriminate use of resources has led to polluted environment which further increases the negative effects. (Manaspure *et al.*, 2011) Polluted environment affects the ventilatory functions of lungs over the time. Pranayama by its beneficial cardio-respiratory effect helps in decreasing most of the negative effects. Pranayama, the fourth limb of yoga, in conjugation with other limbs of yoga plays a significant role in mental health issues like stress management, non-psychotic mood, generalized mood disorder and in case of depression. It is a type of physiological stimuli that leads to adaption of a positive behavior on regular practice. It helps in relaxing and calming the mind. (Shankarappa *et al.*, 2012) It acts as a main adjuvant in musculo-skeletal disorder like in osteoarthritis, joint pain, rheumatoid arthritis, acute and chronic pain. Also it causes tuning and strengthening of body. (Penman *et al.*, 2012; Pagani *et al.*, 1986) In addition to other limbs of yoga along with medical therapy pranayama plays a significant role in management of pulmonary, cardiac and other disease. In various diseases like Bronchial Asthma, COPD, DM, CAD,

HT, Heart Failure, Bronchitis etc. pranayama not only controls the sign and symptoms of disease but also retards the progression of the disease. Thus it helps in improving the quality of life of the affected person. In our study we have recruited 30 medical and paramedical student. Subjects practiced fast breathing pranayama i.e. bhastrika pranayama. Their PFT was measured at the beginning, 6 weeks and 12 weeks after pranayama practice. PFT Parameters included in the study: VC, MVV and PEFR.

### Peak expiratory flow rate

Peak expiratory flow rate is the maximum amount of expiratory flow rate that occurs after full inspiration. It depends upon effort of the individual with which a person can expire. (Dikshit *et al.*, 2005) Increased PEFR signifies opening of smaller airways which are normally quiescent during normal breath. (Patil and Sawant, 2012) In our study we observed a significant increase in PEFR from basal to 12 weeks (Table 1) and it may be due to increase utilisation of physiological dead space. Patil *et al* and other researchers observed a similar effect of significant increase in PEFR following practice of nadi-shodhan pranayama. (Patil and Sawant, 2012; Dinesh *et al.*, 2013; Blessy *et al.*, 2014)

### Maximum voluntary ventilation

Maximum voluntary ventilation is the maximum amount of air that can be inhaled and exhaled with maximum effort in duration of 10-15 second. It depends upon respiratory muscle strength. (Sontakke *et al.*, 2010; Neder *et al.*, 1999) In our study we found a linear relationship between MVV and pranayama practice (Table 2). Similar to other studies conducted by Patil and other researchers, we observed a significant increase in MVV after pranayama practice. (Patil and Sawant, 2012; Dinesh *et al.*, 2013; Blessy *et al.*, 2014)

### Vital capacity

It is the maximum volume of air that can be expired when the patient exhales forcefully after a maximal inspiration. In our study we observed a significant increase in VC over the time (Table 3). Patil and other researchers also depicted a significant increase in VC after performing slow breathing pranayama. (Patil and Sawant, 2012; Dinesh *et al.*, 2013; Blessy *et al.*, 2014)

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