

## Effect of yoga on pulmonary function test in chronic obstructive lung diseases and COPD patients

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**Abstract:** Background- COPD & asthma are major health problems and worldwide number of patients with these diseases continue to rise. Lung function test get impaired in asthma and COPD.

Objective- The study was conducted to observe the beneficial effect of yoga on pulmonary function in asthma & COPD patients.

Method- Thirty diagnosed patients of moderate asthma (n=15) as well as COPD (n= 15) in the age group 18-60 years of either sex were selected from medicine outpatient department of GTB hospital, Delhi. Subjects performed pranayama for 21 days at an average 30 minutes daily. Pulmonary function tests of all the subjects were evaluated prior to yoga training (pranayama and meditation) and after 2 month of yoga. The pulmonary function parameters recorded by using computerized medisoft instrument (HYPAIR compact) were compared and statistically analyzed.

Results- Pulmonary functions FVC, FEV<sub>1</sub>, FEV<sub>1</sub>%, SVC, PEF, MVV, FEF<sub>25-75%</sub> and TLCO showed a statistically significant improvement after 2 months of yoga training. Quality of life also increased in asthma patients after Pranayama and meditation.

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### I. Introduction

COPD & asthma are major health problems and worldwide number of patients with these diseases continue to rise [1]. Asthma is a varied immune response leading onto picture of chronic inflammation of bronchioles, which is due to local release of inflammatory mediators from mast cells, eosinophils and other cells. Chronic inflammation causes an associated increase in airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing [2].

Chronic obstructive pulmonary disease (COPD) is disease with some significant extrapulmonary effects that contribute to severity in patients; its pulmonary component is characterized by airflow limitation that is not fully reversible. COPD symptoms include excessive coughing, breathing difficulty, mucos production and wheezing.

Pulmonary function tests are group of test that measure how well the lungs take in & release air. These tests are used to check for conditions like asthma, COPD. Lung function tests are impaired in asthma and COPD [3].

Bronchial asthma besides being chronic inflammatory disease of airways also has psychosomatic imbalance [4]. In spite of advancement in medical technology conventional medicine has proved ineffective in tackling many disorders which have psychosomatic origin. The new millennium has heralded an unprecedented increase in such disorders and appropriate preventive measures are needed to be taken.

Yoga originated in ancient India, and denotes the union between the individual self and the transcendental self. Yoga practice mainly consists of Asana (Posture- a particular position of the body which contributes to steadiness of body and mind), Pranayama (to control the breathing in a superior and extra-ordinary way to get maximum benefits.) and Meditation. There are several facts supporting the physiological changes that can occur following yoga therapy [5]. Increasing incidence of illness in modern times as a result of several factors like pollution and stressful life has triggered studies of how yoga can help in handling this problem. As far as the respiratory system is concerned, it helps to relieve the broncho-constriction, strengthens the lungs, and improves the lung capacity and thus effectively used in the management of respiratory disorders. Yogic exercises have been shown to have positive effects on people with many diseases like asthma [6,7,] cardiac diseases [8] , diabetes [9] , tuberculosis [10], depressive disorders [11]. Pranayama has been shown to improve the resting respiratory rate, vital capacity, maximum voluntary ventilation, breath-holding time, and maximal inspiratory and expiratory pressures. It reduces the dead-space ventilation (the volume of air that is inhaled but does not take part in the gas exchange), and it aerates the whole lung, in contrast to regular shallow breathing that ventilates only the bases of the lung. This full aeration has beneficial effects on exercise performance and quality of life. When individuals with COPD have been specifically trained to perform pranayama, the strength of both the inspiratory and expiratory muscles increased.

## **II. Material and methods**

The study was conducted in the department of physiology and medicine, University College of medical sciences and Guru Teg Bahadur hospital, Delhi.

Selection of subjects- Thirty diagnosed patients of asthma (n=15) as well as COPD (n=5) in the age group 18-60 years of either sex were selected from medicine outpatient department of GTB hospital, Delhi. Ethical clearance was taken from ethical committee.

Inclusion criteria- duration of symptom at least one year, socioeconomic status low & middle class, patients willing for yoga, moderate asthmatics & COPD patients.

Exclusion criteria- acute attack, respiratory infection, pregnant & lactating women, hypertension, diabetes, severe asthma & COPD cases were excluded

Patients of asthma & COPD were randomized into 2 groups

Group 1- Asthma patients before and after yoga

Group 2- COPD patients before and after yoga

Patients were called to yoga centre in the department of Physiology, UCMS, Delhi for 5-6 days initially, for getting proper yoga training by a yoga expert. They were tested after giving instruction & followed up in cardiopulmonary laboratory of physiology department. Thereafter they were practicing yoga for an average of 40-50 min daily at home for 2 months. In between this period they were called to the yoga centre regularly after every 7 days to see as to whether they were doing the yogic exercises properly. Yoga group were explained about yoga & lifestyle modification. Lifestyle modification was assessed by giving them proper diet chart to follow, in which they were instructed to take more fruits & vegetables, avoid drinking alcohol and smoking, proper sleeping of 7 hours. Subjects were asked to keep their daily records of yogic breathing exercises and meditation, medication used and asthma symptom severity during day and night, and activity limitations due to asthma. All the patients received same yoga training.

Parameter- Pulmonary function tests were assessed prior to yoga training and after 2 month of yoga. The recorded parameters were compared statistically analyzed then conclusion was drawn.

Assessed parameters-

Anthropometric parameters- Height, weight, BMI

After signing informed consent, the patients were tested for pulmonary functions. Pulmonary function tests were carried out on each stable subject using computerized Medisoft Expair (HYPAIR compact). The patients were acclimatized to the laboratory for 10 min. The level of mouth piece was adjusted so that the patient was comfortable. Adequate demonstration was given till subject has comprehended the instructions. Pulmonary function tests were carried out in the morning between 9:30 am to 11 am. Patients were then subjected to pulmonary function tests including Forced vital capacity (FVC), Forced expiratory volume in first second (FEV1), FEV1/FVC, Forced expiratory flow between 25 to 75 percent (FEF25-75%), Peak expiratory flow rate (PEFR), Maximum voluntary ventilation (MVV), Transfer factor of lung for carbon monoxide (TLCO). A total of tests were carried out and the best of the three fulfilling the criteria of reproducibility and vitality were considered for analysis

Quality of life was measured by using a self administered Asthma quality of life questionnaire- (AQLQ) which is available in bilingual form i.e. English and Hindi. AQLQ is a 32-item disease specific questionnaire that has been validated to measure the problems that adult patients with asthma experience in their daily lives (13). Questionnaire has 3 items in four sub domains: symptoms (12 items), activity limitation (11 items), emotional function (5 items) and environmental stimuli (4 items). The response options for each of the 2 items are on 7 point scale, where 1 indicates maximal impairment and 7 indicates no impairment. At each visit, patients were asked to recall what impairment they would have experienced during the previous 2 week and to respond using 7-point response option. The response was recorded. For each of the 32 items in the AQLQ, patients were asked to recall what impairment they had experienced during the previous 2 week and to respond using 7-point response options. The score for each sub-domain was also calculated as the mean score for items pertaining to that sub-domain.

Pranayama – Bhastrika (5 min), Anulomvilom (15 min), Kapalbhathi (10 min), Bahaya pranayama (5 min), Bhramri (5 times) , Om ucharan (5times)

Statistical analysis was analysed using repeated measures ANOVA followed by Turkey’s Kramer post hoc test with  $p < 0.05$  as a significant.

Result- 30 subjects of stable asthma & COPD patients showed significant reduction in weight, BSA and BMI after 2 months of yoga as shown in table 1. The mean  $\pm$  SD of pulmonary function tests were analyzed using repeated measures analysis of variance (ANOVA), followed by Tukey’s test with  $p < 0.05$  as a significant shown in table 2. There was significant improvement in pulmonary function tests of asthma & COPD patients after 2 months of pranayama & meditation. Quality of life also increased in asthma patients after pranayama and meditation

**Table 1:** Anthropometric variables in yoga group of moderate Asthma (n=15)

	Weight (Kg)	Body surface area (m <sup>2</sup> )	BMI(Kg/m <sup>2</sup> )	Height(cm)
Before Yoga (Asthma Patients)	55.33±13.11	1.55±0.19	21.95±4.48	158.33±8.89
After yoga	54.07±12.87*	1.54±0.18*	21.47±4.53*	158.33±8.89

**Table 2 :** Showed intragroup comparison of pulmonary function test in Asthma patients

	FVC(l)	FEV <sub>1</sub> (l)	FEV <sub>1</sub> %	FEV <sub>1</sub> /FVC	MVV	SVC	PEFR	FEF <sub>25-75%</sub>	TLCO
Baseline	2.64±0.50	2.04±0.41	68.81±5.60	77.27±0.40	60.50±21.28	2.64±0.45	4.54±1.29	2.41±.607	19.20±3.94
After yoga	3.10±0.54	2.48±0.45	83.25±5.45	80±0.44	74.60±19.73	3.03±0.44	5.96±1.30	2.96±0.54	22.75±3.70
p-value	<0.001	<0.001	<0.001	>0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Data presented are mean ± SD. Analysis of data was done by one way ANOVA and post hoc by Tukey- Kramer test. It depicts pre yoga group comparison with post yoga group. p<0.001 depicts the level of significance

**Table 3:** Showed intragroup comparison of pulmonary function test in COPD patients.

	FVC	FEV <sub>1</sub>	FEV <sub>1</sub> %	FEV <sub>1</sub> /FVC	MVV	SVC	PEFR	FEF <sub>25-75%</sub>	TLCO
Baseline	2.72±0.69	1.47±0.45	49.50±8.79	53.62±6.01	44.26±18.27	2.35±0.64	2.86±0.80	1.26±.64	14.99±4.02
After yoga	2.89±0.72	1.82±0.49	62.04±8.06	64.41±6.63	50.76±22.55	2.63±0.63	3.74±1.05	1.73±0.65	17.35±3.97
p-value	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	>0.05	<0.001

Data presented are mean ± SD. Analysis of data was done by one way ANOVA and post hoc by Tukey- Kramer test. It depicts pre yoga group comparison with post yoga group. p<0.001 depicts the level of significance

**Table 4:** Showed intergroup comparison of Quality of life in asthma patients after yoga

	Symptom domain	Activity domain	Emotion domain	Environment domain
Baseline	5.18±0.83	5.04±0.87	5.03±1.02	3.95±0.81
After 2 months	6.34±0.57	6.18±0.70	6.11±0.92	4.89±0.80
P value	<0.001	<0.001	<0.001	<0.001

Data presented are mean ± SD. Analysis of data was done by one way ANOVA and post hoc by Tukey- Kramer test. It depicts pre yoga group comparison with post yoga group. p<0.001 depicts the level of significance

### III. Discussion

Yoga has been used to treat respiratory problems in Hindu cultures for centuries, but has received little attention from physicians. Several studies have claimed yoga techniques to be helpful in the treatment of asthma [12-18]. Limited studies were there showing effect of yoga on diffusion capacity in asthma & COPD patients. The mechanism by which yoga may affect diffusion capacity can be pranayama; a well regulated breathing exercise increasing the depth of breathing as compared to normal breathing. By doing so it expands the lungs more than during normal breathing and thus recruiting previously closed alveoli which results in increased surface area of respiratory membrane and air diffuses across the membrane. Due to improved breathing pattern respiratory bronchioles may be widened and perfusion of a large number of alveoli can be carried out effectively.[19].

The mechanism by which changes in respiratory functions occur are: Yoga exercises improve respiratory breathing capacity by increasing chest wall expansion & forced expiratory lung volumes [20]. Yoga improves lung capacity, a significant increase in the oxygen consumption 15 to 25% [21, 22]. It is also known that yoga appears to result in somatic muscular relaxation finally resulting in reduction in airway resistance; it also increases the compliance of lung.

Yoga asanas, which are the controlled stretching postures, aid pranayama by enhancing the strength of respiratory muscles, diaphragm and upper abdominal muscles. Previously, it was reported that yoga training for 6 months improved lung function, respiratory muscle strength & endurance in healthy Indians [23]. Our results are comparable with Nagarathana & Nagendra which showed significant increase in peak flow rate & decrease in number of asthma attack. They have suggested that yoga techniques reduce psychological over activity and emotional instability, and thereby reduce efferent vagal discharge [13].

Pulmonary functions FVC, FEV<sub>1</sub>, FEV<sub>1</sub>%, SVC, PEF, MVV, FEF<sub>25-75%</sub>, and TLCO showed a statistically significant improvement after 2 months of yoga training. Our findings indicate that yoga exercises may lead to overall improvement, as at entry point of the study, patients taking average 2 puff of  $\beta_2$  agonist a day, was reduced after 2 months of yoga. S Cooper et al suggests that Buteyko breathing technique can improve symptoms and reduce bronchodilator use in patients of asthma, but lung functions does not change significantly. [24].

Pranayama may have psychophysiological benefits by increasing the patients sense of control over stress and thus aids in reducing their autonomic arousal factors. Yoga stabilizes autonomic equilibrium with a tendency towards parasympathetic dominance rather than stress- induced sympathetic dominance. Yoga therapy readjusts the autonomic imbalance, controls the rate of breathing and relaxes the voluntary inspiratory and expiratory muscles, which results in decreased sympathetic reactivity. [25, 26].

Our results were similar to Behera D [27], who studied the effect of yoga on COPD patients and showed that lung function parameters improved after yoga practice. The study found that people who participated in yoga program had improved quality of life and needed less medicine [18]. The score of quality of life had changed significantly so they felt better, less anxious, were able to handle minor attacks much more positively. We conclude that yoga, especially the pranayamic breathing exercises when used adjunctively with standard pharmacological treatment, can significantly improve quality of life & pulmonary functions in asthma & COPD.

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