

A Hospital Based Study to Evaluate the Effects of Simple Yogic Exercises on Pulmonary Function Tests in Adults: A Case-Control Study**Rashmi Sharma¹, Abhishek Kumar², Akash Bharadwaj³, Rita Kumari⁴**¹Tutor, Department of Physiology, Nalanda Medical College, Patna, Bihar, India²Tutor, Department of Physiology, Nalanda Medical College, Patna, Bihar, India³Tutor, Department of Physiology, Nalanda Medical College, Patna, Bihar, India⁴Professor and HOD, Department of Physiology, Nalanda Medical College, Patna, Bihar, India

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Abstract**Aim:** The aim of the present study was to find the effects of simple yogic exercises on Pulmonary Function Tests in healthy adults.**Methods:** The present study was conducted in the Pulmonary Function Test (PFT) Laboratory, Department of Physiology, Informed (written) consent was taken from each subject before the study. 100 healthy subjects, including both male and female of age group of 40 to 60 years, with no respiratory, cardiovascular or other medical ailments, were selected for the study.**Results:** The mean age, mean weight and mean height was 64.26 + 6.34 years, 72.48 + 13.47 kgs and 166.74 + 8.32 cms. The pulmonary parameters with respect to FVC % Predicted and MVV % Predicted showed highly significant results.**Conclusion:** The study revealed that after undergoing six weeks of regular yoga training in healthy individuals, definite improvement in pulmonary function parameters like FVC and MVV is seen. This may be due to regular slow and forceful inspiration and expiration during yogasanas leading to strengthening of respiratory muscles and increased release of surfactant too.**Keywords:** FVC, MVV, Elderly individuals, Simple Yogic Exercises

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Introduction

Yoga is a mind and body practice with historical origins in ancient Indian philosophy. It is the science of simple living that balances all aspects of life – the physical, mental, emotional, psychic and spiritual. By the practice of asana, pranayama, mudra, bandha, shuddhi kriyas and meditation yoga, helps balance and harmonize the body, mind and emotions. [1] Classical literature on yoga indicates that it is of great value as a method of preservation of health and treatment of various diseases. Yoga practice consists of the five-principle including proper relaxation, proper exercise, proper breathing, proper diet and positive thinking and meditation. Yoga respiration consists of very slow, deep breaths with sustained breath hold after each inspiration. Practicing yoga contributes in the improvement of pulmonary ventilation and gas exchange. It also helps in the prevention, cure and rehabilitation of patients with respiratory illnesses by improving ventilatory functions. [2,3] It is a popular form of exercise in India since ancient times and yoga's effects on

pulmonary function have been investigated previously.

Pulmonary function tests (PFT) serve as a tool of health assessment and also to some extent as a predictor of survival rate. PFT tend to have a relationship with life-style such as regular exercise and non-exercise. [4,5] Spirometry is pivotal to the screening, diagnosis and monitoring of respiratory diseases and is increasingly advocated in primary care practice. Due to regular yogic exercise, yoga practitioners tend to have an increase in pulmonary capacity when compared with no yoga practitioners. Pulmonary functions are generally determined by the strength of respiratory muscles, compliance of the thoracic cavity, airway resistance and elastic recoil of the lungs. [6] PFT provide qualitative and quantitative assessment of pulmonary function in patients with obstructive and restrictive lung diseases. The tests used to describe pulmonary function are the lung volumes and lung capacities. It is well-known that pulmonary functions may vary

according to the physical characteristics including age, height, body weight and altitude. The practice of yoga is accompanied by a number of beneficial physiological effects in the body. Regular practice of yoga is known to improve overall performance and working capacity. [7] Current evidence suggests that following regular practice of yoga there is an improvement in cardiovascular and pulmonary functions. [8]

The pulmonary function capacities of normal sedentary individuals have been studied extensively in India [9-11] but less in the context of comparison with yogic population practicing yoga. Furthermore, such comparative studies have not been done in this part of the country.

The aim of the present study was to find the effects of simple yogic exercises on Pulmonary Function Tests in healthy adults.

Materials and Methods

The present study was conducted in the Pulmonary Function Test (PFT) Laboratory, Department of Physiology, Nalanda Medical College, Patna, Bihar, India. Informed (written) consent was taken from each subject before the study. 100 healthy subjects, including both male and female of age group of 40 to 60 years, with no respiratory, cardiovascular or other medical ailments, were selected for the study. Pulmonary function test was performed on all the subjects before the beginning of yogic exercises. Then they were made to perform yogic exercises for 6 weeks. Again at the end of 6 weeks, pulmonary function parameters were recorded again.

Subject with past history of major respiratory illness like Tuberculosis, pleural effusion, COPD, Asthama and Smokers were excluded from the study.

- Spirometry parameters like Forced Vital Capacity (FVC) and Maximum Voluntary Ventilation (MVV) were recorded in sitting position using spiroexcel machine (Medicaid).
- The standard protocol and precautions for the spirometry procedure were followed as per American Thoracic Society guidelines.
- Three recordings were taken and the best effort was included in the results
- All the recordings were done between 9 am to 11 am to eliminate any effect of diurnal variations.
- Percent (%) predicted values for all the parameters were taken into consideration for statistical analysis to eliminate the effect of confounding factors like Age, Sex, Height and Weight on different lung parameters.
- Paired 't' test was applied for comparison between the two groups.

The Yogic exercises allotted to the participants were 12

1. Bhastika Pranayam – duration 3 minutes
2. KapalBhati Pranayam – duration 1 min to 5 mins
3. Anulom Vilom Pranayam – duration at least 10 mins.

Results

Table 1: Baseline Characteristics

Parameters	Cases
Age (Years)	48.26 + 6.34
Weight (Kilogram)	72.48 + 13.47
Height (Centimeters)	166.74 + 8.32

The mean age, mean weight and mean height was 48.26 + 6.34 years, 72.48 + 13.47 kgs and 166.74 + 8.32 cms.

Table 2: Comparison of percent (%) predicted values of Pulmonary functions

Pulmonary parameters	Cases	Controls	P Value
	Mean±SD	Mean±SD	
FVC % Predicted	56 + 8.6	79.8 + 7.5	0.0001
MVV % Predicted	72.8 + 15.5	88.8 + 12.4	0.0001

The pulmonary parameters with respect to FVC % Predicted and MVV % Predicted showed highly significant results.

Discussion

Yoga originated in ancient India and denotes union between the individual self and the transcendental self. Prāṇāyāma is an important aspect of yoga that mainly deals with the relationship between breathing pattern and emotional states. [12] As the fourth limb

of Aṣṭāṅga yoga, it is very effective and important component of yoga training. It can assume more complex forms of breathing, but the essence of its practice remains slow and fast breathing. [13] Nāḍi śodhana, Kapālabhāti, Bhastrikā, Sītālī and Bhrāmarī are the important and most practiced types of prāṇāyāma among practitioners. Regular practice of prāṇāyāma improves cardiovascular and respiratory functions, improves cognitive function, decreases the effect of stress and strain on the body

and hence improves the physical and mental health of an individual. [14-16]

The mean age, mean weight and mean height was 48.26 + 6.34 years, 72.48 + 13.47 kgs and 166.74 + 8.32 cms. The pulmonary parameters with respect to FVC % Predicted and MVV % Predicted showed highly significant results. A compromised respiratory efficiency reduces the individuals stress tolerance which affects the quality of life in total. Yoga, specially Pranayam has beneficial effects on respiratory efficiency. It includes various respiratory exercises which involve forceful inspiration to total lung capacity (TLC) and forceful exhalation to residual volume (RV) and all manoeuvres are done through nostrils, which offer resistance by means of decreased cross sectional area and turbulences. Breathing through one nostril in Anulom – Vilom Pranayam further increases the resistance. The respiratory apparatus is emptied and filled more completely and efficiently by Yoga practice, which is recorded in terms of increased forced vital capacity (FVC). [17,18] Yogic breathing creates more negative pressures in both abdominal and thoracic cavity during inspiration and moves the diaphragm more than its normal excursions and helps in efficient movement of diaphragm, intercostals and abdominal muscles. Thus, the improvement in vital capacity is due in part to increased development of respiratory musculature incidental to regular practice of Yoga. [19]

Removal of undue tension from the skeletal muscles in yogasanas helps the thorax to relax better than before. All these practices seem to increase expiratory reserve volume (ERV) thereby increasing the vital capacity. [20] Skeletal muscles control many crucial elements of aerobic, conditioning including lung ventilation. Repeated inspirations to TLC and breath holdings as done during pranayam can lead to increase in the maximal shortening of the inspiratory muscles which has been shown to improve the lung function parameters. [21] Increase in maximum voluntary ventilation (MVV) may be due to improvement in the respiratory mechanism and strengthening of respiratory muscles due to regular practice of yogasanas and yogic breathing exercises.

Conclusion

The study revealed that after undergoing six weeks of regular yoga training in healthy individuals, definite improvement in pulmonary function parameters like FVC and MVV is seen. This may be due to regular slow and forceful inspiration and expiration during yogasanas leading to strengthening of respiratory muscles and increased release of surfactant too.

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