
Effect of ten weeks yoga practice on pulmonary function tests

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Abstract

Background: The present work was planned to find effects of 10 weeks Yoga practice on some pulmonary function tests.

Methods: The present study was conducted on 40 subjects (30 males and 10 females) who came voluntarily as subjects for the project with written and informed consent. It was a prospective study on healthy volunteers from both sex of age between 20 to 65 years. Various Pulmonary function tests (PFTs) were measured. The instrument used was Medspiror.

Results: Forced Vital Capacity (FVC), Forced Expiratory Volume during 1st second (FEV₁), Peak Expiratory Flow Rate (PEFR) and Maximum Expiratory Pressure (MEP) were found to be increased in all subjects.

Conclusion: From this study we conclude that yoga practice can be advocated to improve respiratory efficiency for healthy individuals as well as an alternative therapy or as adjunct to conventional therapy in respiratory diseases.

Keywords: Yoga, FVC, FEV₁, PEFR, MEP

1. Introduction

Yoga is an ancient Indian philosophical and religious tradition discipline designed to bring balance and health to the physical, mental, emotional, and spiritual dimensions of the individual. "Yoga" means union of our individual consciousness with the Universal Divine Consciousness in a super-conscious state known as Samadhi. [1] Yoga is popular all over the world nowadays. It increases longevity and has therapeutic and rehabilitative effects. [2]

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) and meditation. It produces consistent physiological changes and have sound scientific basis. [3]

Yoga have been shown to increase timed vital capacity, maximal voluntary ventilation, breath holding time, maximal inspiratory pressure and maximal expiratory pressure.[4]

Pranayama is an important component of yoga training. Pranayama (controlled breathing exercise) improves the airway reactivity in the

asthmatic individuals. It was noted that high frequency breathing exercise resulted in more than 10 fold increase in expired minute ventilation. [5]

Many reports supported the beneficial effect of long- term yoga training on pulmonary functions. [3,6] It has been reported that yoga practice an hour per day, for 12 weeks resulted significant increment in the forced vital capacity (FVC), forced expiratory volume during 1st second (FEV₁) and peak expiratory flow rate (PEFR). [7] In a study with subjects between the ages of 40 to 60 years with no previous yoga experience, 80 % showed improvement in breath holding time after the completion of an intensive yoga program. [8]

Urbanization and resultant environmental pollution affects the respiratory system also. With great advances in technology in recent years in medical instrumentation, the pulmonary function tests have come to assume a central place in pulmonary medicine. Pulmonary function tests permits an accurate and reproducible assessment of the functional state of respiratory system.

Effect of yogic practices on respiratory function has been an important area of research for decades. Practicing yoga, in addition to its contribution in the improvement of pulmonary ventilation and gas exchange, helps in the prevention, cure and rehabilitation of many respiratory illnesses by improving ventilatory function. [7, 9]

2. Material and Methods

Ethical clearance for the study protocol was obtained from Institute Ethics Committee (Reg. No. ecr/6/inst/guj/2013), prior to study.

40 healthy subjects, 30 males and 10 females of age group 20-65 years were selected randomly from a group of participants visiting the Yoga center at Amusement park, Jamnagar who had not yet started practicing yoga but were keen on learning. The same subjects were chosen as both study as well as control group in order to minimize the confounding factors and make the study more reproducible.

Healthy non-smoker subject with no cardio-respiratory diseases, not doing any other type of exercise from both the sex between ages of 20-65 years were included in our study.

Subjects with history of active sports training, previous experience of yoga, with history of major respiratory, cardiac illness or neurological disorders or with history of major surgery in the recent past, smoking, alcohol consumption, and pregnant females were excluded from our study.

History of the subjects was noted in brief. The health of the subject was assessed by noting the present, past, family and personal history and also by a brief general and systemic examination.

The subjects were explained about the importance and procedure of the study. An informed and written consent was obtained from all the members. The subjects were asked not to change their lifestyle during the study and were instructed not to perform any other physical exercises if they were not doing the same regularly.

All the data were collected at a fixed time of the day between 5pm to 8pm to minimize any diurnal variation. Data on physical characteristics such as age, height, weight and body mass index (BMI) was obtained. A baseline record (which served as control) of respiratory rate (RR/min), Pulse rate (PR/min),

Arterial blood pressure (mmHg) were recorded within first 5 days of starting Yoga.

Subjects were explained and demonstrated about the procedure to be performed and made acquainted with "MEDSPIROR, an instrument for recording pulmonary function tests with Pneumotach sensor" (manufactured by Medicare Systems Pvt. Ltd. Chandigarh), a computerized spirometer self-calibrating and fulfils the criteria for standardized lung function tests and is designed as a low cost high performance instrument capable of giving highly accurate repeatable test results. Three such readings were taken in sitting position on the Medspiror and then highest reading of these was taken for data processing. [8]

All the subjects were received same yoga training under the guidance of well trained Yoga instructor for a period of 10 weeks for 1hour daily, 6 days a week between 6:00 am to 7:00 am. The yoga practice schedule consisted of Pranayama and Asanas, which was concluded by prayer as: Mild worm up exercise, Surya Namaskar, Pranayamas (anulom-vilom, bhramari, bhastrika, kapalbhati, and bahya pranayama), Asanas (shavasana, mandukasana, halasana, dhanurasana, and pavanmuktasana), Aumkar citation and prayer.

At the end of 10 weeks of above mentioned Yogic practice, once again all the data of 40 subjects were assessed and recorded as done before the start of Yoga practice.

3. Results

This study was conducted with the purpose of finding out the outcomes of Yoga practice on pulmonary functions in healthy volunteers. The collected data were analysed by paired "t" test using IBM SPSS Statistics v20 – 64 bit and the values were expressed as Mean±SD (standard deviation). Probability (p) value of <0.05 was considered statistically significant, p<0.01 considered as highly significant.

The age of the participants ranged from 20 to 65 years, the mean age of the subjects in the present study was 47.65±12.19 years. The mean height (cm) was 166.05±6.66, the mean weight (kg) was 68.30±8.765 and the mean BMI (kg/m²) was 24.845±3.369 at the start of study.

Table-1: PFTs of the all participants before and after Yoga training (N=40)

Parameters	Before Yoga (Basal value)	After ten weeks Yoga	P value
FVC (L)	2.25±.69	3.03±.76	<0.001
FEV ₁ (L)	1.99±.65	2.53±.64	<0.001
PEFR (L/sec)	6.50±2.33	8.02±2.20	<0.001
MEP (mmHg)	77.95±27.51	99.65±31.29	<0.001

Table-2: PFTs of male participants before and after Yoga training (N=30)

Parameters	Before Yoga (Basal value)	After ten weeks Yoga	P value
FVC (L)	2.41±.70	3.30±.67	<0.001
FEV ₁ (L)	2.13±.66	2.73±.61	<0.001
PEFR (L/sec)	7.14± 2.25	8.77±1.93	<0.001
MEP (mmHg)	89.20±21.21	114.00±20.82	<0.001

Table-3: PFTs of female participants before and after Yoga training (N=10)

Parameters	Before Yoga (Basal value)	After ten weeks Yoga	P value
FVC (L)	1.76±.30	2.21±.25	<0.001
FEV ₁ (L)	1.55±.41	1.93±.30	<0.001
PEFR (L/sec)	4.58±1.29	5.77±1.24	.002
MEP (mmHg)	44.20±11.94	56.60±10.07	<0.001

4. Discussion

Patanjali, first exponent of yoga, described Pranayama as the gradual unforced cessation breathing and Asanas as different physical postures that makes muscles more strong and flexible. [10]. Yoga practice causes betterment of pulmonary functions.

On analyzing the results of present study before and after 10 weeks of regular yoga practice, it was found that there is highly significant improvement in all the pulmonary function parameters as shown in Table-1. In present study there was significant increase in FVC, FEV₁, PEFR, and MEP after yoga practice in both male and female participants as shown in Table-2 and Table-3.

Findings of FVC and FEV₁ of present study are consistent with other studies L.N. Joshi *et al.* [11], RajKumar Yadav *et al.* [7], Madanmohan *et al.* [12] by consistently performing a variety of Asana; muscles of the thoracic cavity are constantly being recruited. This recruitment may lead to greater musculature effort and thereby result in improved FVC.

Other studies K Upadhyay Dhungel *et al.* [13], Vinayak P. Doijad *et al.* [14], Ankad Roopa B *et al.* [15], and Lata M Mullur *et al.* [16] showed the significant increase in PEFR. Increase in PEFR among our volunteers may be due to rise in thoracic-pulmonary compliances and bronchodilatation. Stimulation of pulmonary stretch receptors by inflation of the lung reflexly relaxes smooth muscles of larynx and tracheobronchial tree; probably this modulates the airways calibre and reduces airway resistance. The work of Yadav and Das attributed the increase in PEFR by yogic exercise due to following changes in respiratory dynamics: increased respiratory muscle strength by the exercises of these muscles, cleansing of airways secretions and efficient use of diaphragmatic and abdominal muscles, thereby emptying and filling the respiratory apparatus more efficiently and completely. [7]

Our findings are consistent with the study of Madanmohan *et al.* [12], Chen and Kuo [17] who have reported that respiratory muscle endurance is more in physically active than sedentary men. Pranayama like Kapalbhathi and Nadi-sodhan included in our present yoga training schedule involves powerful strokes of exhalation, which trains the subject to make full use of diaphragm and abdominal muscles. Slow, deep and full inhalation and exhalation as in Anulom-vilom and Bhastrika pranayama also improves respiratory muscle strength. Hence evaluation of respiratory muscle strength is important from physiological as well as clinical point of view. Since the highest MEP is obtained at lung volumes of more than 70% of total lung capacity (TLC), we measured MEP after full inspiration.

These all above effects can be explained in further details on the following basis-

I. Yoga postures (asanas) involve isometric contraction which is known to increase skeletal muscle strength. Yoga training improves the strength of expiratory as well as inspiratory muscles.[18] Yoga strengthens the respiratory musculature due to which chest and lungs inflate and deflate to fullest possible extent and muscles are made to work to maximal extent.[11]

II. Pranayama is characterized by slow and deep inhalation and prolonged exhalation. The stress is on more prolonged expiration and efficient use of abdominal and diaphragmatic muscles. This act trains the respiratory apparatus to get emptied and filled more completely and efficiently. [19]

Although a significant increase in all the pulmonary function parameters after the yoga practice in the present study is in accordance with the findings of other studies on effects of yoga practice in healthy individuals, the present study has some differences. The present study involved regular combined practice of Pranayama, Asana, Aumkar citation and prayer for 10 weeks, whereas many other studies reported the effects of individual pranayama, asana or meditation practice for different duration.

Very few studies have been conducted on subjects above 50 years. In the present study, an attempt was made to fill up these lacunae.

However, it remains to be assessed whether these changes persist after resuming normal respiration and whether long term practice will lead to stable modifications of respiratory control.

5. Conclusion

With this study, it is proved beyond doubt that regular practice of Yoga (pranayama and asanas) for 10 weeks is beneficial in improving the respiratory functions in healthy individuals irrespective of age and gender. The results of this study and their explanations would justify the incorporation of yoga as part of our lifestyle and as a part of course in the medical field in promoting health and thereby preventing age related respiratory diseases as well as other systemic disorders.

Research on particular set of Yogic exercises like only selected asana or pranayama is required and also further research with large sample size and for varied age groups is required for applying these results to population in general.

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