

Research Article

Effect of Yoga on pulmonary function tests

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ABSTRACT

Background: Yoga is considered to be a very good exercise for maintaining proper health. 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.

Results: Respiratory rate was decreased while Breath Holding Time (BHT) and Maximum Ventilatory Volume (MVV) were found to be increased in both male and female subjects.

Conclusions: 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, Respiratory rate, BHT, MVV

INTRODUCTION

All the orthodox systems of Indian Philosophy have one goal in view, the liberation of the soul through perfection. The method is by Yoga - Swami Vivekananda.¹

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. It is long popular practice in India that has become increasingly more common in Western society. "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 consist 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. It produces consistent physiological changes and has sound scientific basis.³

Yogic Asanas and Pranayama have been shown to reduce the resting respiratory rate. Furthermore, they increase timed vital capacity, and 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 air way 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 regular Yoga practice resulted in decrease in resting respiratory rate.⁷ It has also been reported that short term Yoga practice resulted in significant

improvement in BHT^{8,9} and MVV.¹⁰ 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.¹¹

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.^{12,13}

METHODS

Ethical clearance for the study protocol was obtained from institute ethics committee 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 centre 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 5 pm to 8 pm to minimize any diurnal variation.

Data on physical characteristics such as age, height, weight and Body Mass Index (BMI) was obtained.

Subjects were explained and demonstrated about the procedure to be performed. 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.

Respiratory rate was recorded by observing abdominal wall movement in sitting position after sufficient rest.

Breath holding time was measured in seconds from the time of holding breath after quit expiration till the breaking point of the held breath by using a stop watch in comfortable sitting position in which subjects were asked to hold breath by closing both nostril voluntarily by pinching nose between his/her thumb and index finger and closed mouth.

The subjects were instructed about procedure for recording MVV 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 then highest reading of these was taken as final one.¹¹

All the subjects were received same Yoga training under the guidance of well-trained Yoga instructor for a period of 10 weeks for 1 hour 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 follows;

Mild worm up exercise, Surya Namaskar, Pranayama (Anulom vilom, Bhramari, Bhastrika, Kapalbhati, Bahya Pranayam), Aumkar, prayer, Asanas (Shavasana, Mandukasana, Halasana, Dhanurasana, Bhujangasana, and Pavanmuktasana).

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.

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 analyzed by paired 't' test using IBM SPSS Statistics v20 - 64bit and the values were expressed as Mean \pm 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/m^2) was 24.845 ± 3.369 at the start of study.

Table 1 shows Mean \pm SD of various spirometric parameters of all participants before starting Yoga and after 10 weeks of Yoga practice. All taken spirometric parameters were found to be highly significant after Yoga practice.

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

Parameters	Before Yoga	After Yoga	t	P value
RR /min	17.83 \pm 2.81	16.18 \pm 2.01	6.13	<0.001
BHT (sec.)	27.05 \pm 7.59	34.70 \pm 8.38	-8.58	<0.001
MVV (L)	110.52 \pm 28.32	120.35 \pm 26.90	-8.21	<0.001

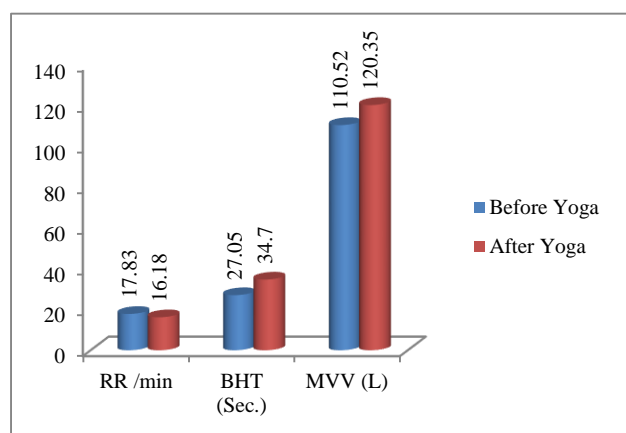


Figure 1: PFTs before Yoga and after 10 weeks of Yoga.

DISCUSSION

Patanjali, first exponent of yoga, described Pranayama as the gradual unforced cessation of breathing and Asanas as different physical postures that makes muscles more strong and flexible.¹⁴ 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 almost all the pulmonary function parameters as shown in Table 1. In present study there was significant increase in BHT and MVV with decrease in respiratory rate after Yoga practice.

Effect of yoga on respiratory rate

Table 1 of present study shows decrease in RR after Yoga practice. It shows highly significant improvement in all.

K. Upadhyay Dhungel et al. (2008)¹⁵ found decrease in respiratory rate after four weeks of Pranayama (alternate nostril breathing) and Vinayak P. Doijad, Anil D. Surdi (2012)⁷ also found significant decrease in respiratory rate after 12 weeks of Yoga practice. Yoga especially Pranayama provides the concentration and removes attention from worldly worries and “de-stress” the person. This may decrease release of adrenaline i.e. decrease sympathetic activity and hence decrease in heart rate, blood pressure etc. including respiratory rate. During daily practice of Pranayama the basic activity of bulbopontine complex is modified in such a way as to slow down its rhythm by voluntarily prolonging the phases of inspiration and expiration by stretching to their fullest extent. Thus making the lungs to work to their maximal extent to take O₂ and expire CO₂ maximally.¹⁶ Thus by practicing Pranayama for few weeks, the bulbopontine complex is adjusted to a new pattern of breathing which is slower than its basal rhythm leading to decrease in respiratory rate.

Effect of yoga on BHT

Table 1 shows a significant increase in BHT in all. Ankad Roopa B et al. (2011)⁸ found similar improvement in BHT after practicing short term Pranayama and meditation in healthy individuals and study of Lata M. Mullur et al. (2012)⁹ also found significant increase in BHT after short term Yoga practice. Improvement in BHT may be due to practice of Yoga which makes stretch receptors to withstand more stretching. Also the sensitivity of the respiratory center to carbon dioxide is reduced. Hence respiratory center can withstand higher carbon dioxide concentrations in the alveoli and the blood. With training subject can exercise voluntary control on the respiratory muscles overriding the excitatory stimuli to respiratory centres. In addition there is gradual acclimatization of receptors to the increased concentrations of carbon dioxide.¹⁷

Effect of yoga on MVV

Table 1 shows significant increase in MVV after Yoga practice in all groups of subjects. Significant increase in MVV, observed in our study, might be due to increased strength and/or endurance of respiratory muscles.¹⁸ MVV was improved by the likely integrated interaction of various components of the respiratory system like respiratory muscles, chest wall, alveoli and airways - probably mediated by increased lung compliance; which in turn, could be a result of enhanced release of lung surfactants and prostaglandins.^{19,20} Other studies Vinayak P. Doijad, Anil D. Surdi (2012),¹⁰ Kaushik Halder et al. (2012)²¹ also observed significant increase in MVV after Yoga practice.

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.²² 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.¹⁶
- 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 and raises the diaphragm at higher level helping in efficient movement of diaphragm.²³

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.

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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