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Effect of Short-Term Yoga Practices on Pulmonary Function Tests in Medical Students

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Abstract

Yoga is one of the best ancient philosophies of life for the prevention and management of various psychosomatic ailments especially in the present scenario of stress whether physical or mental. Medical students are future doctors; and they should be fit physically and mentally in order to make others physically and mentally fit. Incorporating yoga in one's own life is an important step towards that. Keeping this objective in mind, the present study was conducted on medical students to make them aware what yoga is and to encourage them to incorporate yoga in their life. *Aim:* To study the effect of short term yoga practices on pulmonary function tests FVC, FEV_1, PEFR, and MEF 25-75%. *Material and Methods:* The study was conducted on healthy medical students of M.B.B.S. 1st year (21 males and 15 females) of age group 17-21 years in the department of physiology, M.G.M. Medical College, and M.Y. Hospital, Indore. After obtaining an informed consent; and satisfying the inclusion and exclusion criteria the pulmonary function tests were performed on Ganshorn Power-Cube LF8 Beta System before subjecting the students to yoga training. The parameters taken were FEV_1 and PEFR. Then the students were trained by experts from Yoga Center. The students performed the yoga practices in the morning for one hour, six days in a week, for four weeks under expert's observation. The yoga practices consisted of Prayer, Omkar recitation, asana, Pranayama, and breathing exercises. Pulmonary function parameters were also tested after four-week yoga session. Data thus collected before and after performing yoga were compiled, tabulated and analyzed by using students' 't' test. *Result:* There was significant improvement in FEV_1 and PEFR as denoted by p value of <.05. *Conclusion:* A Marked improvement can occur in various respiratory parameters after short-term yoga practices. By extending these results, we suggest that yoga practice may be applied as an alternative therapy or as an adjunct to conventional therapy for the prevention as well as management of respiratory diseases like bronchial asthma.

Keywords: Yoga; Pulmonary Function Tests; FVC; FEV_1; PEFR; MEF; Students' 't' Test.

Introduction

For centuries, Hindu devotees have talked about the miraculous effects of Yoga. In the last century, the world has woken up to Yoga and its many benefits. Today, we talk about how yoga helps us stay young and healthy. Ever since the dawn of the 21st century, the health industry has been growing in leaps and bounds. The markets are flooded with various health products of all brands and composition. Doctors around the world have echoed that Yoga can relieve a number of potential life threatening diseases and become a life saving tool. Yoga is an ancient Indian science and way of life which includes the practice of specific postures, regulated breathing, and meditation [1]. Thus yoga is not only curative but also a preventive and promotive science of health and wellbeing [2].

Respiratory functions are the major components of physical well being. Any derangement in respiratory functions can lead to physical disability. Air pollution and sedentary life styles may be one of the important factors for the decline in the respiratory performance. Therefore, pulmonary

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function assessment has achieved a lot of importance in recent years owing to a steep rise in air pollution. Pulmonary function tests have become an accepted part of respiratory system studies and screening programmes.

Medical students of today are the physicians of tomorrow and a good physician must be fit and mentally alert. Sound health and physical fitness are positively associated with good mental health and well being. That is why this study was done on medical students to make them aware and know what yoga is and how it is helpful in improving one's own health. Buffalo health study [3] concluded that pulmonary function is the long term predictor for overall survival rates in both genders and could be used as a tool in general health assessment. Spirometry is the most commonly used lung function test. Pulmonary function tests by simple spirometry if used routinely help us to assess the pulmonary status in health as well as in disease.

Material and Methods

Subjects

The study is based on the data collected on 36 (21 males and 15 females) young healthy medical students of Mahatma Gandhi Memorial Medical College, Indore, age ranging from 17-21 years who were interested in attending the yoga programme. After obtaining the informed consent and taking care of inclusion and exclusion criteria, initially 60 subjects recruited for the study, but due to some or other reasons 24 subjects could not complete the study.

Study Design

This was a prospective study with purposive sampling. The pulmonary function tests were performed on the subjects on the first (day 1) and the last day (28th day) of the yoga programme. The data thus obtained were compiled, tabulated, and analyzed by using Student's t-test.

Yoga Schedule

The students were briefed about the programme and made comfortable oriented for initial 2 days then the programme was administered. The students performed the yoga practices in the morning for one hour, six days in a week, for four weeks under expert's observation. The yoga practices consisted of Prayer, Omkar recitation, asana, Pranayama, and breathing exercises. The course started with prayer followed by Omkar recitation. After this the subjects performed various stretching exercises, asana, Pranayama, and meditation.

The set of asana and Pranayama included in the programme is as follows:

1. Prayer and Omkar recitation meditative postures - Padmasana/Sukhasana (Easy pose)
2. Loosening or stretching exercises–Warm ups: starting from the head working towards the toes. Neck rotation, shoulder rotation, arm rotation, elbow movements, wrist movements, finger movements, waist movements, knee rotation, ankle rotation, and toe movements.
3. Quick relaxation in Shavasana (Corpse Pose)
4. Asanas

Standing Yogic Postures

Tadasan

Tiryak Tadasan

Trikonasana

Pawanmuktasana

Katichakrasana

Padhastasana

Sitting Yogic Postures

Shshankasana

Padangusthan

Bhunamanasana

Janushirasana

Paschimuttanasana Utthit Padmasana

Surya Namaskar

5. Deep relaxation in Shavasana (Corpse Pose)
6. Pranayama (Breathing Exercises)
   - Kapalbhati (forceful exhalation)
   - Nadi shuddhi (alternate nostril breathing)
   - Bhramari (Honeybee sound during expiration)
7. Omkar recitation in Padmasana/Sukhasana (Easy Pose)

Measurement of Pulmonary function tests: After performing initial general examination with respiration rate, pulse rate, and blood pressure measurement; the pulmonary function tests were evaluated with the help of Ganshorn Power-Cube

LF8 Beta system. It was done in calm and comfortable environment in Pulmonary Function Test Laboratory in the Maharaja Yashwantrao Hospital, Indore. Spirometry is a physiological test that measures how an individual inhales or exhales volumes of air as a function of time. It includes measurement of tidal volume, inspiratory reserve volume, expiratory reserve volume, inspiratory capacity, and vital capacity. The three spirometric indices in the dynamic test are Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1) and the ratio of FEV_1/FVC. Test quality depends on achieving a maximal inhalation, nearly maximal effort during the initial few seconds of exhalation and a reasonable duration of exhalation. A plateau in the volume-time tracing of a minimum expiratory time of 6 seconds indicates a reasonable duration of exhalation. FVC and FEV1 were measured from a series of at least 3 forced expiratory curves that had an acceptable start of test and were free from artefacts; and were reproducible. The largest FVC and the largest FEV1 were taken after examining the data from all the usable curves, even if they do not come from the same curve.

Measures taken prior to the test procedure

- The study subjects undergoing the tests were well informed about the instrument and the technique of the test by demonstration of the procedure
- Anthropometric measurements like height and weight of each subject were measured before the test procedure.
- Due care was taken while measuring the height and weight of the subject following the protocol for their measurement.
- It was ensured that the subject is not wearing items of apparel that are tight or restrictive like: neck tie, tight shirt collar, tight belt etc.

Test Procedure

1. Pulmonary Functions of the subjects were evaluated on Computerized Ganshorn Power Cube LF8 Beta System.
2. Clean and new disposable mouth piece with filter was used for each subject.
3. Test was performed in sitting position.
4. Clear and simple instructions about the technique of the maneuver were given to the subject followed by demonstration.
5. Nose was closed with the nose clip during the maneuvers.
6. The subject was asked to perform the maneuver to his/her best ability.
7. The test was repeated three times to get reproducibility according to American Thoracic Society (ATS) criteria [4,5,6].
8. Coaching and motivation during the test helped the subject to give his/her best performance.

Precautions taken during the test procedure

- The subjects were instructed to assure the correct sitting posture with head slightly elevated and back straight.
- The nose clip was kept in position throughout the manoeuvre.
- Mouth piece was kept in the mouth with tight and close approximation of lips around the mouth piece to ensure airtight seal.
- The Subjects were instructed to exhale rapidly, forcibly, and completely like a 'blast' until no more air can be expelled while maintaining the upright position.
- Instructions were repeated as and when necessary.
- Manoeuvre was repeated three times on each subject with a pause of 5 minutes between each manoeuvre.

Statistical Analysis

The observations thus obtained were tabulated and analyzed using Student's t-test. The values data obtained before (first day) and after Yoga (last day) were compared by Student's t-test. Differences were considered significant with $p<0.05$.

Result

The values of various pulmonary function parameters before and after yoga course are given in table 1 and figure 1. At the end of the course, pulmonary function parameters showed variable response. Some showed an increase, some showed reduction, and some showed no change. The changes were also found gnederwise. The changes were statistically significant in some while not significant in others.

Tidal volume, inspiratory capacity, and slow vital capacity, FEV_1 and PEFR did show an increase

Table 1: Pulmonary Function Tests

S. No.	Pulmonary function test variables (liters)	Mean ± SD Before Yoga	Mean ± SD After Yoga	P Value	Significant (S) / Non Significant (NS)
1	Respiratory Rate/minute	16.86±2.153	14.472±1.275	0.000	S
2	Tidal Volume (TV)	0.438±0.165	0.525±0.193	0.010	S
3	Inspiratory Capacity (IC)	2.016±0.491	2.084±0.587	0.158	NS
4	Forced Vital Capacity (FVC)	3.353±0.755	3.378±0.745	0.363	NS
5	Forced Expiratory Volume in 1st second (L) (FEV_1)	3.052±0.642	3.102±0.650	0.036	S
6	FEV_1 / FVC %	91.47±5.223	92.22±5.281	0.152	NS
7	Slow Vital Capacity (SVC)	3.372±0.755	3.389±0.750	0.551	NS
8	MEF 25-75%	4.023=1.002	4.081±0.952	0.37	NS
9	Peak Expiratory Flow Rate (PEFR)	7.013±1.461	7.426±1.475	0.012	S

Mean with Standard Deviation and P value

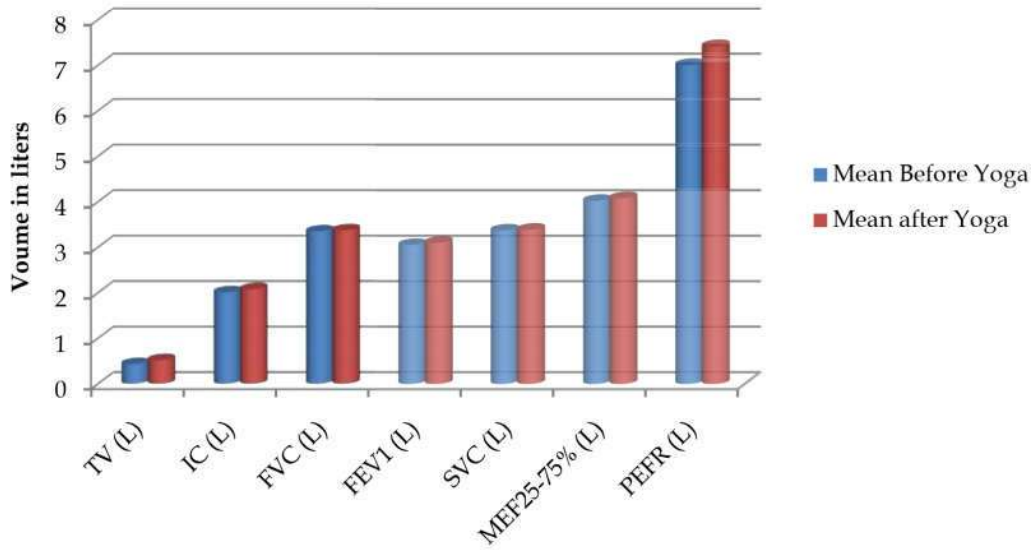

Fig. 1: Mean values of Pulmonary Function Tests before and after Yoga

while inspiratory reserve volume, expiratory reserves volume; Forced vital capacity did not show any significant change.

Discussion

The present study shows that measureable improvement in the various spirometric parameters occurs with 4-week yoga course which includes various asana and pranayama, and relaxation techniques (Shavasana and Meditation) [7]. At the end of the course tidal volume, inspiratory capacity, slow vital capacity, FEV_1 and PEFR showed remarkable improvement. A trend towards an increase in inspiratory capacity and slow vital capacity indicates that there could be a change in the compliance of the lung. An increase in expiratory parameters like FEV_1 and PEFR indicates a decrease in airway resistance [8]. The increase in Tidal Volume, FEV_1 and PEFR is statistically significant as indicated by $p < 0.05$. The other parameters also revealed an increase but not statistically significant as shown by $p > 0.05$. A significant improvement was also observed in general well being suggesting that the participants felt more interested in lives and perceived it as functioning smoothly and joyfully. Prior studies have also reported the beneficial effects of Yoga on pulmonary function parameters [9,10]. One of the previous studies also reported a significant improvement in various pulmonary function parameters after yoga with no such increase occurred after training in physiotherapy. In another previous study the beneficial effects of yoga were observed in college students [11]. The improvement in pulmonary function parameters was also observed after short-term yoga programme [12,13]. The effects of yoga on vital capacity was compared with the effect of exercise and revealed an improvement with yoga and not with exercise [14]. Yoga is also helpful in reducing

clinical symptoms, reduce the need for medication and increase the PEFR, FEV_1 and FVC in asthma patients [15-19].

Various respiratory patterns and maneuvers can provide striking influences on the autonomic nervous system and may exacerbate or reduce adverse responses to stressors [20,21]. For example, increased breathing rate is a typical response to stressful situations. Yoga is helpful in relieving stress by way of reducing breathing rate which decreases sympathetic activity and improves parasympathetic activity [22]. The increase in various lung function parameters indicate that a long term practice might improve it further, as has already been documented in literature.

In conclusion, Yogic practices even for short-term (four weeks) duration seem to be beneficial for the lung functions in health as well as diseased conditions. Further studies are needed to confirm the possible mechanism (s) responsible for such an effect.

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