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The Effect of one-month Pranayama Breathing Training on Pulmonary Function Tests in Healthy Individuals: An Interventional Study

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Abstract:

Background and objectives: Pranayama is one of the important breathing techniques which help in relaxing the body and the mind. It also improves respiratory and cardiovascular health. The present study evaluates the effect of one-month pranayama breathing training on pulmonary functions in healthy individuals.

Methods: A total of 50 healthy male individuals were included in this study. The participants were trained in the pranayamas like nadisuddhi, kapalabhati and bhastrika breathing techniques. Pulmonary function tests were recorded before pranayama training and one week after pranayama training followed by one month after pranayama training.

Results: Pulmonary function parameters were gradually increased after one week and one month of training. Differences among Forced vital capacity (FVC), Forced expiratory volume in 1st second (FEV1), and Maximum ventilation volume (MVV) were found to be statistically highly significant (P<0.0001). FEVI/FVC% also showed significant differences (P < 0.011) in the pulmonary parameters.

Conclusion: In this study, 50 healthy male individuals were trained for nadisuddhi, kapalabhati and bhastrika pranayama for a one-month duration. The practice of pranayama increased the pulmonary function parameters like FVC, FEV1, FEV1/FVC, and MVV for a minimum periods of one week to one month.

Keyword: Yoga; Pranayama; Pulmonary function tests; Nadisuddhi; Kapalabhati; Bhastrika

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1. Introduction

Yoga is an ancient cultural practice in India. In modern days, many of us face too much stress because of our facing environment and unhealthy lifestyle that affects our body and mind. Pranayama is an important breathing technique that helps to relax physical and mental health (1). The practice of pranayama plays a role in cardiovascular functions such as regulation of rhythm, heart rate and blood pressure. In the respiratory system, it increases the strength of respiratory muscles, clears the respiratory tracts and supplies proper oxygen to the tissues. It increases cognitive function and reduces the effect of stress and strain on the body (2). The pranayama practice may decrease the physiological dead space and reduce the work of breathing. It makes diaphragm and abdominal muscles which improves pulmonary functions stronger and more efficient (3). Pranayama has positive effects on disease conditions like chronic bronchitis, asthma, rhinitis, and other diseases like obesity, diabetes, hypertension, heart attack, allergy, anxiety disorders and cancer (4).

Nadisuddhi, Kapalabhati and Bhastrika are the most commonly practiced pranayama techniques among the practitioners. Nadisuddhi or Nadi Shodana is widely

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practiced as nostril breathing. It reduces stress, improves oxygenation in the lungs and relieves respiratory symptoms. In Bhastrika, breath is exhaled forcibly and quickly and improves the respiratory system. Kapalabhati is quick exhalation and natural inhalation. It cleans the respiratory tracts and reduces diseases like asthma, respiratory troubles, allergies, sinusitis, etc. Pulmonary function test is a non-invasive, simple test that assesses, screens, and monitors respiratory function (5). This study was planned to explore the combined effect of Nadisuddhi, Kapalabhati and Bhastrika during one month of pranayama breathing training in healthy individuals.

Aim and objectives:To evaluate the effect of one-month pranayama training on pulmonary function in healthy individuals.

2. Material and method

This is an interventional study conducted in Chettinad health city in Chennai, Tamil Nadu. Institutional Human Ethical Committee approval was obtained. (Ethics clearance number:14/IEC/2014). Registry for clinical trials was not mandatory for this experiment. Written informed consent was collected. In this study, 50 healthy males were included. The study participants were recruited from training students, office & management staff working in the Chettinad health city. All fifty subjects were grouped as study group and there was no control group. The participants were chosen based on the proforma questionnaire. It contains basic details like height, weight, occupation, smoking, tobacco and alcohol use. Participants with a family history of any diseases, any complaints of tightness of chest, cough, breathlessness, chest pain, and wheezes were excluded. Also, we excluded participants with diseases like asthma, COPD, emphysema, chest deformities, chest pain, heart failure, hypertension, diabetes, smoking, and alcohol consumption, athletes and those who were doing regular gym exercise. The healthy male individuals aged between 18-35 years. The sample size calculated was based upon the FVC value by Dinesh et al (6). Estimation of mean Alpha error was 0.05 and estimated standard deviation 0.17. The estimated sample size was 45, with an attrition rate of 10%. This study was conducted between April 2014 to June 2015.

2.1. Pranayama Breathing techniques

All the participants were assembled at a specific time in the morning between 11 to 12 AM or evening between 4 to 5 PM. Before the procedure, subjects were instructed to wear a loose dress and avoid heavy foods. Pranayama procedures were taught to all subjects. The participants underwent the pranayama breathing training under the supervision of a certified yoga trainer. After completion of warm-up training, they proceeded to pranayama breathing. The training continued till the completion of the study.

2.1.1. Nadi Shuddhi Pranayama (Alternate nostril breathing) instruction: (5 minutes)

Close the right nostril with the right thumb and inhale slowly through the left nostril and inhale air to fill your lungs. After inhalation, close the left nostril with the ring finger of the right hand. Open the right nostril, and exhale slowly. After complete exhalation, again inhale through the right nostril and close it with the right thumb. Open the left nostril, and breathe out slowly.

2.1.2. Kapalbhati: (2 – 5 minutes)

Kapalabhati was done in a sitting posture. In Kapalabhati quick exhalation and natural inhalation are intended. Exhale and simultaneously contract the abdomen muscles with each exhalation. Normally exhalation takes 1/4 of the time of inhalation.

2.1.3. Bhastrika: (5 minutes)

In this, emphasis is given to thoracic not abdominal breathing activity. Subjects were asked to take a deep inspiration followed by rapid expulsion of breath following one another in rapid succession. This is called as “bellow” type of breathing. Each round consisted of 10 such “bellows.” After 10 expulsions, the final expulsion is followed by the deepest possible inhalation. Breath is suspended as long as it can be done with comfort. The deepest possible exhalation is done very slowly. This completes one round of bhastrika (6).

2.2. Evaluation of lung function

The assessment of the pulmonary function was tested using the EASY ONE PRO”(Medcoid Systems Pvt. Ltd., Chandigarh) digital spirometer. The participants were requested to avoid drinking beverages and perform a vigorous exercise 30 min before recording of parameters. In the standing posture, a nose clip was attached, a mouthpiece was placed in the mouth and closed the lips around the mouthpiece and asked the subject to breathe normally. Participants were asked to Inspire completely and rapidly with a pause of <2 seconds at total lung capacity. They had to expire with maximal effort until no more air can be expelled while maintaining an upright posture. They were to repeat for a minimum of three times, usually not more than eight for adults. FEV1 and FVC were checked (ATS & ERS guideline) (7).

- **Phase -0** - Before starting the pranayama training.
- **Phase -1** - The assessment phase during the study was done on the 8th day of the pranayama training.
- **Phase - 2** - The outcome assessment phase end of the study was made on the 30th day of the pranayama training.

2.3. Statistical analysis of data

The pulmonary function parameters were obtained from study participants. The one-way repeated ANOVA test was used to compare the parameters. The p-value < 0.05 indicates a significance.

3. Result

These baseline characteristics shows the participants’

height and weight BMI, blood pressure, pulse rate and SPO $_2$ were within the normal range (Table 1).

The pulmonary functions test was recorded from the participants. Forced vital capacity (FVC) before pranayama training (3.15±0.5), after one week of training (3.3±0.43) and following one month of training (3.72±0.40) showed a gradually increase in FVC value shown as statistically highly significant (P< 0.0001). Forced expiratory volume in 1st second (FEV1) showed an increased value, before training (2.74±0.5) and one week of training (2.85±0.46) followed by one month of pranayama training (3.33±0.41). FEV1 value was found highly significant (p < 0.0001). Forced expiratory volume in 1st second / forced vital capacity % (FEV1/FVC%) was before pranayama training (84.8±5.0) and after one week of training (84.3±6.6) and at the end of one-month pranayama training (89.8±10.7). FEV1/FVC was statistically significant (P< 0.011). Peak Expiratory Flow Rate (PEFR%) value was increased after one week and after one month of training. Yet it was no statistical significance (P<0.097). Mid maximum Expiratory flow 25 -75 (MEF 25 -75) value showed no statistically significant differences (P< 0.923). Forced expiratory flow 75% (FEF75%), forced expiratory flow 50% (FEF50%), and Forced expiratory flow 25% (FEF25%), values were not statistically significance (P< 0.701), (P< 0.418), (P< 0.88), respectively. Maximum ventilation volume (MVV%) values before training (88.2 ± 6.4) and one week after training (100.8 ± 5.8) followed by one month of training (111.3±14.4)) showed a gradually increase in MVV value shown as statistically highly significant (P< 0.0001)(Table 2).

Table 1. baseline characteristics of the participants

baseline characteristics	Mean and SD
Age	32.7 ± 6.8
Height	165.5 ±7.2
Weight	65.6± 13.9
BMI	24.9 ±4.2
SBP	117.6 ± 9.6
DBP	78.2 ±9.5
Pulse Rate	81 ± 11.8
SPO_2	97.8 ± 1.8

4. Discussion

The current study evaluates the effect of one month pranayama training program on lung function tests. There was an increase in all the parameters like FVC, FEV1, FEV1/FVC%, PEFR, MEF 25-75, FEF25%, FEF50%, FEF75%, and MVV before training to one week of pranayama training and following one-month training. Parameters were found significant only in FVC, FEV1, FEV1 /FVC % and MVV.

In a previous study, Sivakumar et al., reported that Forced vital capacity significantly increased after 2 minutes of deep breathing exercise for a week and observed a trend towards an increase in FEV1 and PEFR. Similar results were observed in this current study. An increase in FVC could be due to a possible increase in surfactant levels, as a result of deep inhalations. Even 2 minutes of deep breathing might be good enough to bring about a significant release of surfactant, which will increase lung compliance during the Inspiratory phase of the lung (8).

The respiratory parameters FVC, FEV1, FEV1/FVC and MVV showed a significant increase in our study. Sivapriya et al had similar findings (9).

The Present study was done to assess the effect of pranayama practice on pulmonary function showed a significant increase in FVC, FEV1, FEV1/FVC and MVV, at the end of one week of training and followed by one-month training of pranayama to stimulate and balance all the systems of our body for the proper functioning of the lung functions.

Danilo et al showed a significant result on FVC and FEV1 after yoga training for a shorter period. Although elderly

Table 2. Effect of pranayama breathing before, after one week and after one month of training.

Pulmonary function Parameters	Phase (0) Before training (n = 50)	Phase (1) After one week of training (n = 50)	Phase (2) After one month of training (n = 50)	F.value	P.value
Forced vital capacity (L)	3.15±0.5	3.3± 0.43	3.72±0.40	32.8	0.0001**
Forced expiratory volume in 1st second (L)	2.74±0.5	2.85±0.46	3.33±0.41	112.1	0.0001**
FEV1/FVC%	84.8±5.0	84.3±6.6	89.8±10.7	5.33	0.011*
Peak expiratory flow rate (L/s)	6.02±1.8	6.13±1.7	6.56±1.5	7.21	0.097
Mid maximum expiratory flow 25 -75 (L/s)	3.55±1.0	3.69±0.8	3.81±0.7	2.25	0.923
Forced expiratory flow 75 (L/s)	5.44±1.8	5.44±1.7	5.53±1.5	0.36	0.701
Forced expiratory flow 50 (L/s)	4.14±1.2	4.25±1.3	4.3±1.5	0.901	0.418
Forced expiratory flow 25 (L/s)	1.9±0.6	2.00±0.6	2.08±0.6	2.66	0.88
Maximum ventilation volume %	88.2 ± 6.4	100.8 ± 5.8	111.3±14.4	24.9	0.0001**

P< 0.05* Statistically significant, P.<0.0001** Highly Significant.

subjects participated in their study, there was a significant improvement in the PE_{max} and PI_{max} which were in the normal range. In their study Bastrika, Kapalabhati and Nadi Shuddhi Pranayama were used similar to the protocol that was performed in our study. All these trainings were used especially to increase the functions of inspiration and expiration muscles. Kapalabhati helps in improving the performance of the abdominal muscles involved in expiration. Bhastrika pranayama increases both expiratory as well as inspiratory muscle performance with enhanced capacity of the thoracic compartment to create negative and positive pressures in the process of respiration (10).

Madanmohan et al reported that the yoga training group achieved a significant improvement in pulmonary function tests, due to a possible increase in maximum expiratory pressure and minimum expiratory pressure. This indicates that the yoga training group improves the strength of the expiratory as well as inspiratory muscles (11).

Future scope of the study: Pulmonary function tests along with diffusion capacity and total lung capacity need to be assessed in the pranayama breathing training.

5. Conclusion

In this study, 50 healthy male individuals were trained for nadisuddhi, kapalabhati and bhastrika pranayama for a one week and one-month follow-up. The practice of pranayama increased the pulmonary function parameters like FVC, FEV1, FEV1/FVC, and MVV for a minimum period of one week to one month.

6. Acknowledgment

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7. Conflict of interest

Authors have declared no conflict of interest.

8. Funding source

None.

9. Author contribution

Raghuvaran designed the study, data collection and manuscript writing, and Selvakumar assessed for data collection and analysis. Manikandan was involved in data analysis and wrote the final version of the paper.

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