Efficiency of short term Yoga practice on Pulmonary Function Tests in Healthy Young Females : A Randomized Control Trial

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Abstract— *During recent years, a bit attention is given toward holistic therapy along with allopathic medicine in comprehensive care. The present study was undertaken to assess the effects of yogic practice on few pulmonary functions. Ninety healthy young female of age group 17-25 yrs subjects were selected for this study after excluding pregnant and chronic diseased females. These 90 females were randomized through chit box method into two groups i.e. one group was instructed for doing yogic practice daily for about one hour for 6 weeks and other one was called upon after six week after recording desired information. The PFT observations were recorded by RMS HELIOS 701, in the form of FVC, FEV-l and PEFR on day-1 and at the end of 6 weeks in both the group. There was significant increase in FVC, FEV-l, FEV1/FVC and PEFR at the end of 6 weeks was found in females of group doing yogic exercise than who had not done exercises. So exercises should be promoted to increase lung capacity especially in asthmatic cases and cases with other lung diseases.*

Key words*:* ***Yogic exercises, Pulmonary Function Tests (PFTs), Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR) and Forced Expiratory Volume (FEV1)***

1. Introduction

Yoga is a science which has been practiced in India from over thousands of years. Besides its spiritual achievements, the practice of yoga is accompanied by a number of beneficial physiological effects in the body. Yogic techniques, which aim at physical and mental self culture, have convincing scientific basis and produce consistent physiological changes[1,2,3] .It has been reported that yogis are capable of remarkable feats of endurance [4-5] and controlling their autonomic functions [6-7]. There is evidence that the practice of yoga improves cardio-respiratory efficiency and performance quotient 8.Medical science tries to achieve an optimum physical and mental health of individual through preventive, curative and promotive means[14]. In yogic practices the stress is mainly on the promotive aspects, although some yogic methods are prescribed for curative method as well. In the recent years a lot of research work has been done to improve the beneficial effect of yogic training. *Yogasanas* help in prevention, control and rehabilitation of many respiratory diseases[4].

Numerous studies have been done to know the effect of yogic practices on pulmonary functions. Udupa et al[1] studied the effects of some breathing exercises (*Pranayama*) in normal persons. Nayar et al[2] documented the effects of yogic exercises on human physical efficiency. In other study oxygen consumption during 3 yoga breathing patterns was shown by Miles Wales[3]. All three of the yoga breathing patterns examined, when individually continued for 20 min or more and compared with previous relaxed quiet breathing, were found to demand an increased oxygen consumption of a mere 12–35% above basal need. The relaxed breathing that immediately followed a yoga pattern gave little or no indication that the subject had been exerting himself. In a related work Makwana et al[4] studied the effects of short term yoga practice on pulmonary function tests[4]. The present study has been done exclusively on young healthy females to add more data in the field of yoga and pulmonary functions. This study has been designed to explain and

ascertain the promotive aspects of health and yoga. Researchers and physicians all over the world now recommend a yogic lifestyle. It keeps a person physically, mentally and spiritually healthy. Breathing is considered to be a regulator of the autonomic nervous system and consequently of mental processes as Swami Rama stated "controlling the breath and thus calming the nerves is a prerequisite to controlling the mind and the body".

2. **Methodology**

This study was carried out in the Department of Physiology, SMS Medical College, Jaipur. Young healthy females of age 17 years to 25 years were identified from the institute who has given written informed consent to be included in study. Out of these females pregnant females and females suffering from diabetes, hypertension and chronic respiratory problems like asthma, tuberculosis were excluded from this study. Thus finally ninety healthy young females were selected as subjects for this study.

These females were interrogated to gather information about socio-demographic data; age was recorded in years to nearest birthday, height is recoded in centimeters while standing (reading was taken nearest to half cm) and weight was recorded in kilograms (reading was taken nearest to half Kg) with calibrating weighing machine time to time.

These females were further divided randomly through chit box method in 2 groups i.e. one group practicing yoga and another group not practicing yoga.

The pulmonary function tests were done by computerized spirometer RMS HELIOS 701. The parameters included in the study for outcomes were and FEV1/FVC ratio. Value of these outcome variables were also recorded as baseline outcome for both the groups.

Then the females identified for no intervention were told to come after 6 weeks and the females identified for yogic exercise (intervention) were instructed that they should follow instructions and do regular yogic exercises (at least 5 days a week) for 6 weeks to find out the effect of yogic exercises.

All females identified for yogic exercise were demonstrated and put into practice of yogic exercise under the guidance of trained yoga trainer which they have to do daily for about one hour. The yogic schedule included prayer, *Asanas, Pranayama And Meditation*.

The exercise regimen include different yogic asanas (5 times each *Asana*) i.e. *Padmasana, Matsyasana, Kukkudasana, Dhanurasana, Sputa vajrasana, Gomukasana, Sarvangasana, Halasana, Bhujangasana, Mandukasana, Parvathasana, Nauli and Shavasana*.

After doing *Asanas,* they were instructed practiced *Pranayama* for 10 -15 minutes. *Pranayama* schedule include deep breathing inhalation, retention and exhalation at fixed intervals, abdominal and alternate nostril breathing.

After doing *Pranayama*, they were instructed to do meditation for 10 -15 minutes. Meditation i.e. tries to become zero minds.

These females were instructed to continue these yogic exercises for 3 months.

After three months again pulmonary function tests were done by computerized spirometer RMS HELIOS 701. The parameters included in the study for outcomes were and FEV1/FVC ratio. Value of these outcome variables were also recorded as end line outcome for both the groups.

Statistical Analysis: Significance of difference in end line and baseline outcome of PFTs in the same group were inferred by paired 't' test whereas significance of difference in change in PFTs in both the group were inferred by unpaired 't' test. For significance p values ≤ 0.05 was considered significant.

3. Results

When both the groups of this study were compared as per physical structure wise, both were found comparable with no significant (p>0.05) difference in age, height and weight. (Table 1)

Table 1

Comparison Physical Characteristics of Intervention group and Control Group

S. No.	Physical Characteristics	Intervention Group (N=45) Mean ± SD	No Intervention Control Group (N=45) Mean ± SD	P value LS (Unpaired 't' Test)
1	**Age (Yrs)**	19.20±1.02	19.27±1.08	0.775 NS
2	**Height (Cms)**	157.03±2.26	157.17±2.26	0.770 NS
3	**Weight (Kgs)**	51.07±3.25	51.40±3.50	0.644 NS

In the present study, when changes in pulmonary function tests from baseline to end line after 6 weeks of yoga was compared in females doing yogic exercise regularly it was observed that all the PFTs studied i.e. PEER, FEV1, FVC and FEV1/FVC were showing increase which was found significant in all above variables except FVC. (Table 2)

Table 2

Comparison Pulmonary Function Tests of Intervention group from Baseline to after 6 Weeks ((N=45)

S. No.	Physical Characteristics	On 1st Day Mean ± SD	After 6 Weeks of yoga Mean ± SD	P value LS (Paired 't' Test)
1	**PEFR**	4.90±0.86	5.60±0.88	<0.001 S
2	**FEV1**	2.50±0.42	2.75±0.36	0.003 S
3	**FVC**	3.25±0.48	3.42±0.42	0.077 NS
4	**FEV1/FVC**	74%±4%	78%±3%	<0.001 S

Whereas, when changes in pulmonary function tests from baseline to end line after 6 weeks was compared in females not done yogic exercise (control) it was observed that although all the PFTs studied i.e. PEER, FEV1, FVC and FEV1/FVC were showing increase but it was not found significant any of above variables. (Table 3)

Table 3

Comparison Pulmonary Function Tests of Control group from Baseline to after 6 Weeks ((N=45)

S. No.	Physical Characteristics	On 1st Day Mean ± SD	After 6 Weeks of yoga Mean ± SD	P value LS (Paired 't' Test)
1	**PEFR**	4.63±0.86	4.69±0.90	0.747 NS
2	**FEV1**	2.59±0.59	2.61±0.39	0.850 NS
3	**FVC**	3.29±0.44	3.38±0.88	0.541 NS
	FEV1/FVC	76%±4%	77%±4%	0.239 NS

In this study, when mean changes in pulmonary function tests from baseline to end line in females of both the groups (females done exercise regularly and females not done exercise) were compared it was revealed that all the PFTs studied i.e. PEER, FEV1, FVC and FEV1/FVC were showing more increase in females doing exercise regularly than females not done exercise which was found significant in all above variables except FVC. (Table 4)

Table 4

Comparison Mean Change in PFTs of Intervention group and Control Group after 6 Weeks

S. No.	Physical Characteristics	Intervention Group (N=45) Mean ± SD	No Intervention Control Group (N=45) Mean ± SD	P value LS (Unpaired 't' Test)
1	**PEFR**	0.7±0.87	0.03±0.86	≤0.001 S
2	**FEV1**	0.25±0.38	0.02±0.48	0.014 S
3	**FVC**	0.17±0.46	0.09±0.64	0.498 NS
4	**FEV1/FVC**	4%±4%	1%±4%	≤0.001 S

4. Discussion

In this present study, changes in pulmonary function tests in females of both the groups were found on increase level from baseline to end line but it was not found significant in females not done yogic exercise whereas it was found significant in all studied PFT variables except FVC in females doing yogic exercise regularly. Likewise, when mean changes in pulmonary function tests from baseline to end line in females of both the groups (females done exercise regularly and females not done exercise) were compared it was revealed that all the PFTs studied i.e. PEER, FEV1, FVC and FEV1/FVC were showing more increase in females doing exercise regularly than females not done exercise which was found significant in all above variables except FVC. Well comparable observations to this study were made by other authors. [5-9]

Makwana et al[5] reported significant increase in FVC following 6 weeks of yoga training. Others have recorded similar observations. The improvement in vital capacity is due in part to increased development of respiratory musculature incidental to regular practice of yogic exercise[5]. By the practice the respiratory apparatus is filled and emptied more completely which is recorded in terms of increased FVC[6]. Similar

training even in elderly subjects has been shown to improve lung volumes and capacities. Makwana et al also showed increased FEV1 after 10 weeks of yogic practice[7]. The increase in FEV1 might be due to significant increase in vital capacity. Joshi et al reported significant increase in FVC and PEFR following 6 weeks of *Pranayama* practice[8]. Because increased ventilation has been associated with an acceleration of lung surfactant turnover, we investigated the effect of fluid and air inflations on the release of surfactant into the air spaces. The above findings are consistent with the hypothesis that air inflation to total lung capacity is a major physiological stimulus to release of lung surfactant into the alveolar space. The lung lavage process itself also causes the release of surfactant[9]. All these studies have explained that, during *Pranayama* training, regular inspiration and expiration for prolonged period leads the lungs to inflate and deflate maximally and that it causes strengthening and increased endurance of the respiratory muscles4-7 This maximum inflation and deflation is an important physiological stimulus for the release of surfactants and prostaglandins into the alveolar spaces, which thereby increase the lung compliance [14-15]. The stretch receptors reflexly decrease the trachea-bronchial smooth muscle tone activity, which leads to decreased air flow resistance and increased airway caliber, which causes the dynamic parameters of the lung function test to improve. A study showed that after 2 weeks of the *Pranayama* practice, the FVC, FEV1, FEF 25-75% and the PEFR values had improved in the subjects. In our study, a greater improvement of the pulmonary parameters was observed. This study showed that the pulmonary function test values improved after short term (6 weeks) *Pranayama* practice. Either of following may be the reasons for this i.e.

- Regular, slow and forceful inspiration and expiration for a longer duration during the *Pranayama* practice, leading to strengthening of the respiratory muscles.
- *Pranayama* training causes improvement in the expiratory power and decreases the resistance to the air flow in the lungs.
- *Pranayama* training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemo-receptors to hypercapnoea[10.]

Lung inflation near to total lung capacities is a major physiological stimulus for the release of lung surfactant[9] and prostaglandins into alveolar spaces which increase lung compliance and decreases bronchial smooth muscle tone respectively[10]. The other possible mechanism for improved pulmonary function tests may be

1. Increased power of respiratory muscles that is due to the work hypertrophy of the muscles during *Pranayama* and other exercises.
2. Cleansing procedures cleans the infective nasal secretions.
3. Yogic breathing exercises train practitioners to use the diaphragmatic and abdominal muscles more efficiently and completely.
4. Yoga with its calming effect on mind can reduce and release emotional stresses thereby withdrawing the broncho constrictor effect.

Thus practice of yogic exercises seems to be beneficial for respiratory efficiency. Many authors[13,14] reported positive effect of yoga on ventilator responses, respiratory endurance and muscle strength. Bera et al[15] have studied recovery from stress by yogic relaxation posture in their recent work. In conclusion it can be stated that yogic exercises are beneficial for better main

CONCLUSIONS

As yogic exercises significantly increases FEV1, PEER and FEV1/FVC ratio after 6 weeks of exercises. Thus practice of yogic exercises seems to be beneficial for respiratory efficiency

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