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Original Research Article

Role of regular yoga practice in improvement of various pulmonary parameters in first year medical students

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ABSTRACT

Background: tress at any stage of life virtually produces several respiratory limitations and reduces tolerance to physical efforts, sometimes leading to pulmonary diseases in individuals. Various yoga and Pranayama like Kapalbhati and Nadi-sodhan involves powerful strokes of exhalation, which trains the subject to make full use of diaphragm and abdominal muscles.
Methods: This study is performed on 1st yr. medical students whose stress level is in higher side due to academic burden. 55 medical students were selected as participants through counseling and were divided into Yoga group (n= 27) and control group (n=28). Pulmonary functions of subjects were tested using Pony FX advanced desktop spirometer manufactured by Cosmed. Yoga is performed 1 hr/day for 6 days /week for 12 weeks by yoga group.
Results: Pulmonary functions tested in Yoga and control group were FVC, $FEV_{1,}$ PEF and $FVC/FEV_{1.}$ There were significant improvements in pulmonary functions in yoga group. In Yoga group (FVC- 5.8% increases, FEV_1- 5.2% increase, PEF- 34% increase and FVC/FEV_1- 3.15% increase). In control group also, all parameters increased but P value was not significant.
Conclusions: This study concludes that practicing Yoga has shown a significant improvement on pulmonary functions in 1st year medical students.

Keywords: Medical students, Pulmonary functions, Stress, Yoga

INTRODUCTION

Sedentery lifestyle and professional burden in millennials have lead to development of various lifestyle diseases, including depression and altered social welfare. Stress at any stage of life virtually produces several respiratory limitations and reduces tolerance to physical efforts, sometimes leading to pulmonary diseases in individuals. Yoga is a mind-body technique which involves relaxation, meditation and a set of physical exercises performed in association with breathing.[1] 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 to get maximum benefits.) and meditation. It produces consistent physiological changes and has sound scientific basis.[2] Due to sedentary lifestyle, fat accumulation in thoracic and abdominal cavities arise changes in respiratory function including sluggish thoracic movements and pulmonary compliance in thoracic cavity, reduced inspiratory capacity and falling of diaphragm.[3] Various Yoga and pranayam like Kapalbhati and Nadi-sodhan involves powerful strokes of exhalation, which trains the subject to make full use of diaphragm and abdominal muscles. There is a steady and progressive improvement in pulmonary functions, the changes being statistically significant in case of forced expiratory volume in first second (FEV1) and peak

expiratory flow rate after 12 weeks of yoga as compared with the corresponding baseline value.[4] Involvement in daily physical activity or sports preferably yoga can help in achieving better pulmonary function and hence increases quality of life.[5] Increased Cortisol is a marker of stress, and DHEAS is an anti-cortisol hormone. Dehydroepiandrosterone (DHEA) improves pulmonary hypertension in chronic obstructive pulmonary disease (COPD).[6]

DHEA modulates endothelial function, reduces inflammation, improves insulin sensitivity, blood flow, cellular immunity, body composition, bone metabolism, sexual function, and physical strength in frailty and provides neuroprotection, improves cognitive function, and memory enhancement. Glucocorticoids are toxic to hippocampal neurons. It is reported that dehydroepiandrosterone protects neurons of primary hippocampal cultures against the toxic effects of corticosterone. Basal level of DHEAS declines with advancing age and is reported as anti-aging hormones. Nonpharmachological replacement of these hormones by natural stimulus like yoga may be a strategy for reducing stress and improving pulmonary functions.[7] Yoga and Pranayam improved ventilatory functions in the form of lowered respiratory rate (RR), and increases in the forced vital capacity (FVC), forced expiratory volume at the end of 1st second (FEV1%), maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR-lit/sec), and prolongation of breath holding time.[8] Not only in healthy individuals but yoga training can improve pulmonary functions in patients with muscular dystrophy.

There is evidence that breathing exercises can improve respiratory function in patients with DMD. Hatha yoga is a broad philosophy that encompasses a series of breathing exercises aimed at improving the health of its practitioners. The objective of the present study was to determine whether a 10-month program of yoga breathing exercises that recruit inspiratory and expiratory muscles is safe for children with DMD and can improve their respiratory function.[9]

Buffalo health study concluded that pulmonary function is a long-term predictor for overall survival rates. It is essential to be involved in physical activity or sports which help in achieving better lung function. Yogis and athletes had similar lung functions except for better PEFR amongst yogis. Involvement in daily physical activity or sport preferably yoga can help in achieving better pulmonary function.[10]

METHODS

This study was conducted in yoga lab in Dept. of physiology, B.R.D. Medical College, Gorakhpur, for a period of 12 weeks, where Yoga was practiced 6 days/week. Duration of yoga was 60 mins divided into 10 mins for meditation, 15 mins for pranayam and 35 mins for Asanas.

Subjects were selected from 1st yr M.B.B.S. Students and are put into two groups, yoga group (n = 27) and control group (n = 28). Following materials were part of study-

- Yoga lab
- Yoga instructor
- Medical students
- Desktop Spirometer
- Lab. Technicians.

Inclusion criterion

- Willing to participate and to continue Yoga practice
- Subject should be physically fit
- Normal personal and family health status.

Exclusion criterion

- Previous history of Yoga Practice
- Any history of major illness like stroke, seizure, vertigo, hypertension, coronary artery disease, congenital heart disease, history of status asthmaticus, peptic ulcer disease, spondilytis, joint pain, prolapsed disc, csom, hernia, physical inability to practice yoga or any other disease condition which may exaggerate discomfort.
- Any addiction.

First year medical students were councelled and motivated for taking part in study. Informed and written consents were taken before their participation. All first year students were interviewed personally and their personal and family history were taken. Their personal history included their Daily routines, dietery habit, exercise habit etc. The participants (N = 55, including males and females) were randomized into two groups (Yoga group and control group) by computer generated list of random numbers. Randomization were done by independent assistant with councelment. There were 27 (15 males and 12 females) in yoga group and 28 (20 males and 08 females) in control group.

All 55 eligible participants were assessed for their pulmonary functions. Pulmonary functions of subjects were tested using Pony FX advanced desktop spirometer manufactured by Cosmed. Subjects were explained about the procedure and the precautions which was to be taken during spirometry.

Pulmonary functions which were measured are FCV, FEV1, PEF and FEV1/FVC. Both Yoga group and Control group were instructed one day before the procedure to visit Human Lab.at about 7.00 A.M. Data of pulmonary function was recorded on Desktop and a print out of recording was taken and preserved as pre-study Data.

Yoga instructor instructed Yoga group, a specific yoga module 1hr/day, six days a week, for twelve weeks. Control group was not given any such type of instruction,

but was kept in touch with, till twelve weeks for final evaluation. Following yoga, all PFT were repeated and the results were finally evaluated.

RESULTS

Pulmonary function is assessed under four different categories in both Yoga and control group. These are as follow:

Influence of yoga on forced vital capacity (FVC).

Both groups were assessed and compared before and after study.

Table 1: Pre- and post study FVC in yoga group.

Yoga group	Pre-study (mean ±SD)	Post-study (mean ±SD)	% Change
Total sample (N= 27)	3.26±0.65	3.45±0.63	5.8% increase
Increased (N =22)	3.17±0.87	3.65±1.31	15.1% increase
Decreased (N =5)	3.36±0.98	2.97±1.09	18% decrease

Table 2: Pre- and post study FVC in control group.

Control group	Pre- study (Mean±SD)	Post study (Mean±SD)	% Change
Total sample (N= 28)	3.09±0.64	3.17±0.68	2.5 % increase
Increasing pattern (N=15)	3.17±0.71	3.28±0.63	3.4 % increase
Decreasing pattern (N=13)	3.04±1.04	2.96±0.89	2.6 % decrease

Table 3: Comparison of FVC in yoga and control group.

	Yoga group	Control group
Sample size	27 participants	28 participants
Increasing pattern	81% participants (N=22)	54% participants (N= 15)
Decreasing pattern	19% participants (N=5)	46% decreasing (N=13)
Overall change in FVC	5.8% increase (P value= 0.0316)	2.5% increase (P value= 0.262)

Table 2 represents pre- and post study FVC in control group (n= 28) where 54% (N=15) participants have shown increasing pattern and rest 46.4% (N=13) have shown decreasing pattern.

Table 3 shows Forced Vital capacity in yoga and control group participants. There were more participants (81%) in yoga group whose FVC has increased in comparison to control group participants (54%).

Influence of yoga on FEV1 (forced expiratory volume in 1 sec

Table 4 shows pre- and post study fluctuations in yoga group (N=27) where 67% participants have shown marked increase in FEV_1 whereas only 33% have shown slight decrease in FEV_1.

Table 4: Pre- and post study FEV1 in yoga group.

Yoga group	Pre-study (Mean±SD)	Post-study (Mean±SD)	% Change
Total sample (N=27)	2.69±0.63	2.83±0.62	5.2% increase
Increasing pattern (N=18)	2.76±0.60	3.11±0.65	12.6% increase
Decreasing pattern (N=9)	3.07± 0.91	2.72 ± 0.97	11.4% decrease

Table 5: Pre- and post study FEV1 in control group.

Control group	Pre-study (Mean±SD)	Post-study (Mean±SD)	% Change
Total sample (N=28)	2.63±0.61	2.71±0.63	3.04 % increase
Increasing pattern (N=17)	2.97±0.88	3.09±0.67	4 % increase
Decreasing pattern (N=11)	2.84±1.02	2.78±0.99	2.11 % decrease

Table 6: Pre-and post study FEV1 in yoga and control group.

	Yoga group	Control group
Sample Size (N)	27	28
Increasing pattern	67% participants	61% participants
Decreasing pattern	33% participants	39% participants
Over-all FEV_1	5.2% increase (P value= 0.09)	3.04% increase (P value= 0.329)

Table 5 shows increasing and decreasing pattern of control group (N=28) where 61% (N=17) have shown increasing pattern and 39% (n= 11) have shown decreasing pattern. Table 6 compares pre- and post study FEV_1 of yoga and control group. 67% (N=18) have shown increasing pattern in comparison to control group (61%, N=17) participants. Overall increase was more for yoga group.

Effect of yoga on peak expiratory flow (PEF)

Table 7 shows that there is an overall increase in PEF by 34% in yoga group participants (N=27). 78% (N=21) participants have shown an increasing pattern whereas 22% (N=6) have shown decreasing pattern. Table 8 shows change in Peak expiratory flow rate in control group participants (N=28). 61% (N=19) participants have shown increasing pattern whereas 39% (N= 11) have shown decreasing pattern.

Table 7: Pre- and post study effect of yoga on PEF.

Yoga group	Pre- study (Mean±SD)	Post-study (Mean ±SD)	% Change
Total sample (N= 27)	2.84±0.7	3.81±0.62	34% increase
Increased Pattern (N= 21)	2.95±0.96	4.03±0.71	37% increase
Decrease pattern (N=6)	3.62±0.84	3.49±0.72	4% decrease

Table 8: Pre- and post study PEF in control group.

Control group	Pre- study (Mean±SD)	Post-study (Mean ±SD)	% Change
Total sample (N= 28)	2.45±0.91	2.49±0.65	1.6% Increase
Increased Pattern (N= 17)	2.54±0.89	2.95±0.71	15.7% increase
Decrease pattern (N=11)	2.80±0.66	2.38±0.71	15% decrease

Table 9: Comparison of PEF in yoga & control group.

	Yoga group	Control group
Sample size	27 Participants	28 Participants
Increasing pattern	78% participants	61% participants
Decreasing pattern	22% participants	39% participants
Over-all change	34% Increase (P value < 0.005)	1.6 % Increase (P value = 0.216)

Table 9 shows 34% increase in PEF in yoga group (P value <0.05) whereas 1.6% increase in PEF in control group (P Value=0.216).

Effect of yoga on FEV1/FVC

Figure 1 represents FEV_1/FVC ratio in both group participants in which Post study increase was more for yoga group in comparison to control group.

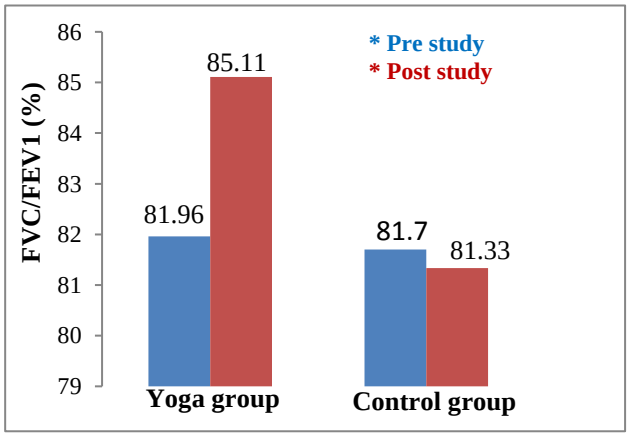

Figure 1: Pre-and poststudy FEV1/FVCIN yoga and control participants.

DISCUSSION

Pulmonary functions tested in yoga and control group were FVC, FEV1, PEF and FVC/FEV1. Pre- and post study FVC in yoga group were 3.26±0.65 and 3.45±0.63 (P value = 0.031, (5.8% increase) whereas in control group pre and post study record were 3.09±0.64 to 3.17±0.68 (P value =0.26). So, overall increase in FVC were more for yoga group. Desuza CD and collugues studied the effect of yoga training and detraining on respiratory muscle strength in pre-pubertal children. A total of 100 participants were recruited from a school in Bangalore. After baseline assessments, the participants were randomly allocated to either yoga or physical activity group. Intervention was given for 3 months, and measures of pulmonary function and pulmonary pressures were determined immediately post-intervention and at 3-months follow-up. There was significant improvement in all pulmonary functions especially FVC and FEV1.[11]

Pre and Post study FEV1 in yoga group were 2.69±0.63 and 2.83±0.62 respectively (P value=0.09, 5.2% increase). Whereas in control group pre and post study Data were 2.63±0.61 and 2.71±0.63 (P value=0.329, 3.04% increase). Yoga group participants have shown sharp increase in FEV1 in comparison to control group. Previous study have shown that depression and anxiety worsens pulmonary functions in asthmatic individuals. Krommydas GC and collegues worked on thirty-eight adult asthmatic patients who underwent psychometric evaluation with the DSSI/SAD questionnaire, filled in an asthma questionnaire and underwent spirometry. The majority of patients suffered from mild-persistent asthma. Twenty-six reported symptoms of anxiety and 25 reported symptoms of depression. A statistically significant reduction in FEV1 values was observed in asthmatic patients with symptoms of depression. The mean value of FEV1 was 81.84±20.83) in patients without symptoms and 63.73±17.99 in patients with symptoms of depression.[12] Along with improvement in respiratory muscle flexibility, Yoga training reduces depression and anxiety in youngers and hence potentiates lung parameters to its maximum.

PEF before and after study in Yoga group were 2.84±0.7 and 3.81±0.62 respectively (34% increase, P value <0.005) whereas in control group it was 2.45±0.91 and 2.49±0.65 respectively (1.6% increase, P value = 0.216). Wassermann K and collegues studied lung function changes and exercise-induced ventilatory responses to external resistive loads in normal subjects. The aim of this study was to assess the value of common lung function variables in the follow-up of patients with obstructive lesions of the larynx and trachea and to study the respiratory response to progressive upper airway stenosis at rest and during respiratory exercises. They observed that among all conventional lung function values, PEF and, to a certain degree, PIF, seem to be the best suitable follow-up parameters to assess airway

mechanics before and after study. PEF and PIF significantly improved in exercise group.[13]

FEV1/FVC ratio were also analyzed for both groups and pre and post study data for yoga group were 81.96±0.96 and 85.11±1.30 respectively whereas for control group it was 81.7±1.07 and 81.33±2.40 respectively. Post study FEV1/FVC ratio is increased in Yoga group whereas decreased in control group. Vedala SR and collegues compared the pulmonary function test among the yogic and sedentary groups. This study was conducted on 50 subjects practicing yoga and 50 sedentary subjects in the age group of 20-40 years. They were assessed for pulmonary function test in which sedentary group acted as controls. They finally concluded that along with other pulmonary functions FEV1/FVC increased significantly in yoga group irrespective of their age.[14]

CONCLUSION

Yoga has significantly improved pulmonary functions in yoga participants. Pre and post study FVC data in yoga group (N= 27) have shown increasing pattern from 3.26±0.65 to 3.45±0.63 (P value= 0.03, overall 5.8% increase) whereas pre- and post study FVC in control group (n= 28) increases from 3.09±0.64 to 3.17±0.68 (overall 2.5% increase, P value= 0.26). FEV1 increases in yoga group from 2.69±0.63 to 2.83±0.62 (overall increase by 5.2%, P value=0.09) whereas control group have shown an increase from 2.63±0.61 to 2.71±0.63 (Overall increase by 3.04%, P Value= 0.39). PEF significantly increased in yoga group from 2.84±0.7 to 3.81±0.62 (overall 34% rise, P value <0.005) whereas control group have shown an increase from 2.45±0.91 to 2.49±0.65 (overall 1.6 % increase, P value = 0.216). FEV1/FVC in yoga group increases by 3.8% whereas ratio decreased by 0.4% in control group.

Hence yoga has played beneficial role in improving all types of pulmonary parameters in even young individuals also.

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