

## Effect of Adjuvant Yoga Therapy on Pulmonary Function and Quality of Life Among Patients with Chronic Obstructive Pulmonary Disease : A Randomized Control Trial

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### ABSTRACT

**Background and Objectives:** Previous studies have suggested that yoga positively impacts lung function and quality of life (QoL). The present prospective two-arm, single-blinded and controlled study evaluated the effect of adjuvant yoga therapy on pulmonary function and QoL in patients of Chronic Obstructive Pulmonary Disease (COPD).

**Material and Methods:** Seventy two COPD patients were recruited and randomized to yoga group who received adjuvant yoga therapy in addition to standard medical management and control group who received only medical management. Yoga therapy protocol included loosening exercises, postures, breathing techniques and relaxation. Forced vital capacity (FVC), forced expiratory volume in first second (FEV1) and FEV1/FVC were measured using computerized pulmonary function test 'Trueflow (nidd)'. Saint George Respiratory Questionnaire (SGRQ) was used to assess QoL. Changes in parameters were correlated with symptoms, activity, impacts and quality scores. Intra-group comparisons were done using Student's paired 't' test and intergroup comparisons using unpaired 't' test.

**Results:** There was significant improvement ( $p < 0.001$ ) in FVC and FEV1 after four weeks of adjuvant yoga therapy while controls showed decline in all parameters. QoL scores, namely: symptoms, activity, impacts and quality improved significantly in yoga group with no significant changes in controls. Significant correlation was found between pulmonary function and QoL in Yoga group.

**Conclusion:** Significant improvements of lung function with adjuvant yoga therapy can be attributed to comprehensive yoga therapy package administered to participants resulting in decreased airway resistance and better lung compliance attributed to nonspecific broncho-protective / broncho-relaxing effect. Significant improvement in QoL scores can be attributed to improved vital capacity as well as enhanced self-confidence /self-reliance. We conclude that there is a positive and additive role of adjuvant therapy with standard medical management of COPD.

### Keywords:

Lung function, Saint George Respiratory Questionnaire, yoga therapy

### INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is an important cause of morbidity and mortality and it is a major public health problem.<sup>1</sup> The condition is characterized by irreversible airflow obstruction, a gradual decline in lung function, loss of lung tissue, reduced quality of life, and high rate of mortality.

By 2020, COPD is predicted to rank as third leading cause of death

worldwide, whereas its social burden will rank fifth.<sup>2</sup> The Global Initiative for Chronic Obstructive Lung Disease (GOLD) management includes a reduction in symptoms, complications, and exacerbations, improved exercise tolerance, improved health status and reduced mortality.<sup>3</sup> Dyspnea, the hallmark symptom of COPD is the reason for which most patients seek medical attention and is a major cause of disability and anxiety associated with the disease.<sup>4</sup>

Prana, the life force, promotes mind-body harmony. Yoga practices, especially pranayama help in restoring the harmony thereby promoting health and well being.<sup>5</sup> Prana vitalizes organs responsible for respiration. Asthma, COPD and airway restrictions are the most troublesome chronic diseases for lifetime. Drug therapy alone does not work because it does not deal with the problem.<sup>6</sup> Yoga helps to maintain the state of equilibrium whereby the health and strength of body and mind are acquired by enhanced prana.

Yoga therapy has a positive impact on lung function and exercise capacity and can be used as an adjunct pulmonary rehabilitation program for COPD patients which are a known cause to increase the level of stress, emotional vulnerability and physical inactivity. A comprehensive yoga program can have a salutary effect on general health and respiratory health increasing a person's ability to perform activities.

Vedanthan observed that one of the most important aspects of yoga for asthma and COPD patients is that they develop an increased capacity to relax and control their breathing, which is more effective with regular practice.<sup>7</sup> Brain's cortico-limbic-hypothalamic systems get modulated by pranayama, asana and meditation, which enhances the autonomic, endocrine and somatic responses correlated with homeostatic response to negate the undesirable effects of stress.<sup>7</sup> Yoga therapy improves Quality of life (QoL) and lung function even on a short-term basis.<sup>8</sup> Donesky and colleagues also reported an improvement in health related QoL and psychological well-being after yoga therapy.<sup>9</sup>

Though a few studies have been done on yoga and COPD, the novelty of the present study is that it throws light on improvements in QoL of the patients and correlates it with the changes in lung function through adjuvant yoga therapy.

## MATERIAL AND METHODS

This prospective two-arm, single-blinded and controlled study was undertaken as an interdisciplinary collaborative work between the Centre for Yoga Therapy, Education and Research (CYTER) and the department of Pulmonary Medicine, Mahatma Gandhi Medical College and Research Institute (MGMC&RI), Puducherry. Approval was obtained from Institutional Research Council and Institutional Human Ethics Committee of Sri Balaji Vidyapeeth (P.G Dissertation/2017/05/77, 04/05/2017). The study

was also registered on the Clinical Trial Registry-India (CTRI: ctri/2017/11/010597).

Inclusion and exclusion criteria: COPD patients with lung function less than 70% of predicted values and who were willing to participate and able to perform techniques given in the protocol (Table 1) were recruited for the study after obtaining their informed consent. Those with active infection of lungs especially pulmonary tuberculosis and evidence of complications were excluded.

**Table 1:** Components of yoga therapy protocol for COPD

S. No.	Name of practice	Duration
1	Prayer	3 min
2	Loosening exercises	7 min
3	Matsyasana	3 min
4	Shashahasana	3 min
5	Mahamudra	3 min
6	Chiri kriya	3 min
7	Sharabhasana	3 min
8	Vibhaga pranayama	5 min
9	Bhastrika pranayama	5 min
10	Bhramari pranayama	5 min
11	Kaya kriya	3 min
12	Spanda nishpanda	2 min
13	Makarasana	3 min
14	Shavasana	10 min
15	Prayer	2 min
<b>Practice duration</b>		60 min

A total of 100 COPD patients were assessed for eligibility and then 72 patients (mean  $\pm$  SD age, 53.04  $\pm$  9.71 years) who satisfied inclusion criteria were allocated to two groups by random selection and block allocation (blocks of 4)/ Zelen's design. Thirty six patients were allocated to yoga group (22M and 14F with mean age of 52.12  $\pm$  9.89 years) and received adjuvant yoga therapy in addition to medical management while 36 were allocated to control group (20M and 16F with mean age of 53.97  $\pm$  9.53 years) and received only medical management with no yoga therapy.

In yoga group, four dropped out during study period due to inconvenience and age factor and 32 of them completed the four week yoga therapy. The study parameters were recorded in all the subjects before and after intervention of both groups.

**Table 2:** Anthropometric parameters in yoga and control groups before (pre) and after (post) four weeks study period.

Anthropometric Parameters	Yoga (n=32)		Control (n=36)	
	Pre	Post	Pre	Post
Height (cm)	158.62 ± 8.82	158.59 ± 8.79	161.50 ± 10.11	161.52 ± 10.10
Weight (kg)	63.66 ± 11.73	63.13 ± 11.43	62.72 ± 10.65	62.91 ± 10.87
BMI	25.43 ± 4.94	25.22 ± 4.79	24.06 ± 3.53	24.12 ± 3.56

Values are mean ± SD.

Anthropometric: BMI was calculated by Quetelet's index, which is weight (kg)/height (m)<sup>2</sup>.

Pulmonary Function: Forced vital capacity (FVC), forced expiratory volume in first second (FEV<sub>1</sub>) and ratio of forced expiratory volume in first second to forced vital capacity (FEV<sub>1</sub>/FVC) were measured using a standard computerized pulmonary function test 'Trueflow (nidd)'. The calibration is factory set and is not affected by temperature change, pressure change and condensation.<sup>10</sup>

Subject was seated comfortably in upright position with an erect spine, without bending forward. They were then instructed to take the disposable mouthpiece inside their mouth with lips closed over it to avoid leakage of air while blowing. It was repeated thrice with gap of 5 minute between each attempt subject encouraged to perform at their optimum level applying maximal effort. The value of the best effort was then considered for data analysis.

QoL: Saint George Respiratory Questionnaire (SGRQ) used for assessing COPD patients' quality of life, as it is a disease-specific designed to measure impact on overall health, daily life, and perceived well-being in patients with obstructive airways disease.<sup>11</sup> An excel-based scoring calculator was used for scoring QoL variable symptoms score, activity score, impacts score and QoL score. Changes in pulmonary function parameters were recorded and correlated with QoL (symptoms, activity, impacts and quality) scores of SGRQ.

Statistical Analysis: All data passed normality testing by Kolmogorov-Smirnov test. Hence intra-group comparisons of pre and post study data was done using Student's paired 't' test while intergroup comparisons between groups was done using Student's unpaired 't' test. Relationships between baseline characteristics

and the outcome variables were determined with correlations. P value less than 0.05 were considered to indicate significant differences between the means.

## RESULTS

The anthropometric parameters of study participants before and after yoga therapy are given in Table 2. Both groups were comparable at baseline with respect to anthropometric parameters, pulmonary functions and QoL.

Intra-group comparisons (Table 3): Changes in pulmonary functions showed significantly better improvement of both FVC and FEV<sub>1</sub> (p<0.001) among yoga group subjects after four weeks of yoga therapy. There were significant negative changes in FVC and FEV<sub>1</sub> (p<0.001) among control group subjects after four weeks. However there was no significant change in FEV<sub>1</sub>/FVC in both the groups. In yoga group, the percentage of changes were highly significant in FVC and FEV<sub>1</sub> (p<0.001).

Changes in SGRQ showed significantly better improvement in all the QoL scores, namely symptoms score (p<0.001) and activity score (p<0.05), impacts score (p<0.01) and quality score (p<0.001) among yoga group subjects after four weeks of yoga therapy. There was no significant change in QoL score among control group subjects after four weeks.

Intergroup comparisons (Table 3): There was highly significant changes in both FVC and FEV<sub>1</sub> (p<0.001) in yoga group. FEV<sub>1</sub>/FVC showed no change between the groups. The % change showed highly significant change in both FVC and FEV<sub>1</sub> (p<0.001) in yoga group.

QoL score showed highly significant changes (p<0.001) in all the scores of yoga group when compared between groups. In yoga group, the % change was

**Table 3:** Pulmonary function and quality of life parameters in yoga and control groups before (pre) and after(post) four weeks study period. FVC: forced vital capacity, FEV<sub>1</sub>: forced expiratory volume in first second.

Parameters	Yoga group (n=32)			Control group (n=36)		
	Pre	Post	% change	Pre	Post	% change
<b>Pulmonary function</b>						
FVC (L)	1.99 ± 0.64	2.21 ± 0.50 *** <sup>a</sup>	17.80 ± 30.75 <sup>a</sup>	1.96 ± 0.50	1.80 ± 0.51 ***	-8.45 ± 12.90
FEV <sub>1</sub> (L)	1.35 ± 0.49	1.61 ± 0.53 *** <sup>a</sup>	24.75 ± 33.93 <sup>a</sup>	1.30 ± 0.51	1.18 ± 0.43 ***	-6.47 ± 14.31
FEV <sub>1</sub> /FVC	0.66 ± 0.10	0.68 ± 0.12	2.82 ± 9.91	0.65 ± 0.15	0.66 ± 0.14	3.64 ± 22.63
<b>QoL scores of SGRQ</b>						
Symptoms score	51.74 ± 9.04	29.72 ± 6.86 *** <sup>a</sup>	-41.27 ± 14.50 <sup>a</sup>	49.74 ± 8.72	46.92 ± 6.00	-3.14 ± 19.71
Activity score	26.92 ± 9.26	22.43 ± 6.85 ** <sup>a</sup>	-6.67 ± 43.41 <sup>a</sup>	24.79 ± 8.90	26.90 ± 4.29	19.68 ± 38.30
Impacts score	25.44 ± 9.24	21.37 ± 5.61 ** <sup>a</sup>	-8.53 ± 32.88 <sup>a</sup>	29.65 ± 9.58	31.44 ± 7.65	11.15 ± 27.09
Quality score	26.73 ± 4.18	21.12 ± 5.96 *** <sup>a</sup>	-19.05 ± 26.16 <sup>a</sup>	24.09 ± 8.74	26.13 ± 6.18	15.12 ± 29.35

Values are mean ± SD. \*\*\*p< 0.001, \*\* p< 0.01, \* p<0.05 by Student's paired 't' test for intra group comparison and <sup>a</sup>p<0.001by Student's unpaired 't' test for intergroup comparison.

highly significant in all the QoL scores (p<0.001), namely symptoms score, quality score, activity score, impacts score and quality score.

Correlation of pulmonary function and QoL (Table 4): Significant correlation was found between pulmonary function and QoL in yoga group. FVC correlated with symptoms score (r= -0.418, p<0.001), activity score (r= -0.257, p<0.05), and quality score (r= -0.304, p<0.01). FEV<sub>1</sub> correlated with FVC (r=0.882, p<0.001), symptoms score (r= -0.442, p<0.001), quality score (r= -0.326, p<0.01), weight (r= -0.367, p<0.01) and BMI (r= -0.308, p<0.05).

## DISCUSSION

In the present study there was a marginal reduction in body weight and body mass index of yoga group, with a marginal increase in control group. This may be attributed to the practices utilizing excess fat deposited peripherally and is in line with other studies attributing improved metabolic function.<sup>12</sup> It is also well known that an increase in BMI is associated with decreased pulmonary function and decline in FEV<sub>1</sub>.<sup>13</sup> Hence the trend towards reduction of BMI shows a healthy

trend in adjuvant yoga therapy. Such findings could become more significant and marked if the therapy was continued for a longer duration.

The improvement in lung function coupled with decreased need for regular and rescue medicinal usage has been established using yoga as an adjunct therapy in COPD.<sup>14,15</sup>

At baseline, both groups were comparable and after study period there was significant improvement in FVC and FEV<sub>1</sub> in yoga group. Reduction in FEV<sub>1</sub> is directly correlated with impaired lung function.<sup>16</sup> FEV<sub>1</sub> increased significantly in yoga group and can be attributed to the comprehensive yoga therapy package administered to the participants that may have produced marked improvement.

In this study we found that FVC increased significantly in yoga group but reduced in control group as found in previous reports.<sup>2</sup> NICE guidelines state that an increase of FEV<sub>1</sub>>1.5 L and in FVC >2.0 L is correlated with greater changes in arterial blood gases.<sup>17</sup> Improvement in FEV<sub>1</sub> and FVC may be correlated with decreased airway resistance and better

**Table 4:** Correlation of FVC with FEV<sub>1</sub>, symptoms, activity, impacts and quality scores of SGRQ in yoga (n=32) and control (n=36) groups after four weeks study period.

Parameters	FEV <sub>1</sub>	FVC	SS	AS	IS	QS	Wt	BMI
<b>FVC</b>	<b>0.822 ***</b>	-	<b>-0.418 ***</b>	<b>-0.257 *</b>	<b>-0.133</b>	<b>-0.304 **</b>	<b>-0.167</b>	<b>-0.150</b>
<b>FEV<sub>1</sub></b>	-	<b>0.822 ***</b>	<b>-0.442 ***</b>	<b>-0.151</b>	<b>-0.184</b>	<b>-0.326 **</b>	<b>-0.367 **</b>	<b>-0.308 *</b>

Correlation is significant at \*p<0.05, \*\* p<0.01, \*\*\* p< 0.001 level (2-tailed).

FVC – forced vital capacity; FEV<sub>1</sub> – forced expiratory volume in first second; SS - symptoms score; AS - activity score; IS – impact score; QS – quality score; Wt – weight.

lung compliance and such enhancing effects in yoga group may be attributed to the nonspecific broncho-protective or broncho-relaxing effect of yoga training as postulated by Singh, along with the improved exercise tolerance reported by Tandon following yoga therapy in patients of COPD.<sup>18,19</sup> This can also be correlated to the reports that well-performed slow yogic breathing maintains better blood oxygenation without increasing ventilation, reduces sympathetic activation during altitude-induced hypoxia and decreased chemoreflex sensitivity to hypoxia and hypercapnia.<sup>20,21</sup>

Asthmatic patients showed a statistically significant improvement in many lung parameters including FVC, FEV<sub>1</sub> and QoL after 2 months of yoga practices and Singh *et al* concluded that pranayama and yoga postures can be used to increase respiratory stamina, relax the chest muscles, expand the lungs, raise energy levels, and calm the body.<sup>22</sup>

In the yoga group there was a significant improvement in activity score which implies that patients were able to participate in more of the activities than earlier, which may be attributed to the improved vital capacity as well as enhanced self-confidence and self-reliance. Yogic counselling included dietary change and life style modification which may improved significantly in impact score of yoga group and the practice of pranayama resulted in overall improvement in QoL. Yoga group showed significant improvement in total quality score which is similar to earlier reports that yogic breathing had an overall positive effect on patients with moderate-to-severe COPD.<sup>23,24</sup>

Pulmonary functions in COPD patients are compromised. Yoga therapy improved pulmonary function and quality of life by various mechanisms which include long time housework, carrying things upstairs, going out for entertainment and recreation

and improved exercise tolerance. Our results are consistent with other studies which reported related changes after yoga therapy in healthy volunteers as well as in those suffering from different conditions.<sup>25,26</sup> Our findings provide evidence for the scientific basis of using yoga as an adjunct therapy in COPD with significant improvement in pulmonary function and QoL indices.

We conclude that yoga has a positive and additive role as an adjuvant therapy along with standard medical management of COPD. Results of this study reaffirm that addition of such a complementary therapy improve physical condition by reducing weight and BMI while enhancing pulmonary function through parameters such as FVC and FEV<sub>1</sub>. It retarded the decline of pulmonary function that was seen in control group only receiving medical management.

It is to be noted that adjuvant yoga therapy also significantly improved the qualitative aspects of the patient's life through symptoms score, activity score, impacts score and total QoL score. As a form of therapy, yoga is cost effective, relatively simple and carries minimal risk and we recommend that it can be advocated as an adjunct, complementary therapy in our search for an integrated system of medicine capable of producing health and well being in all. It is expected that the results of this RCT will provide momentum for further in-depth research in evaluating the efficacy of yoga in COPD patients. We recommend that yoga therapy can be safely advocated as an adjunct, complementary therapy in our search for an integrated system of medicine capable of producing health and well being in all.

The limitation of the study is that this has been done on limited number of patients for only few weeks. More such studies with larger numbers of COPD patients and for a longer period of time may be done in future to further validate such short term studies.

## CONFLICTS OF INTEREST

None

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## Pill reverses Type 2 diabetes

Researchers have engineered a material that temporarily coats the small intestine and reduces the amount of glucose that enters the bloodstream during digestion. Scientists 'envision a pill' that 'mimics surgery' for people with diabetes.

When they tested the material, which is called Luminal Coating of the Intestine (LuCI) on rats, they found that it reduced "glucose response" by almost half. The research team developed the material because they want to find a non-invasive treatment for reversing type 2 diabetes that is as effective as surgery. The intention is that once swallowed, LuCI forms a temporary coating in the gut and then dissolves harmlessly a few hours later. The material acted as a partial barrier to nutrient absorption, and prevented blood sugar "spikes" following a meal.

*Source: Nature Materials. 2018 Jun 11:1*