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# YOGA AS A NON-PHARMACOLOGICAL TREATMENT MODALITY FOR PATIENTS OF COPD

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**ABSTRACT :** Chronic obstructive pulmonary disease (COPD) is a major health problem worldwide. Various non pharmacological modalities are being investigated for the management of COPD, in addition to medical and surgical treatment. Yoga training is one such adjuvant therapy. A study was hence conducted to determine the effectiveness of yoga training in patients of COPD. It was a prospective study conducted on 50 COPD patients diagnosed as per GOLD 2021 guidelines. They were divided into two groups of 25 patients each. The yoga group received adjuvant yoga therapy along with medical management. The control group received medical management only. At baseline, forced expiratory volume in first second (FEV1), forced vital capacity (FVC) and FEV1/FVC, saturation of peripheral oxygen (SpO2), modified medical research council dyspnea scale (mMRC), six-minute walk distance test (6MWD) and COPD assessment test (CAT) score was noted in both the groups and the same parameters were studied at follow-up at 1st month and 3rd month. The FEV1, FVC, 6MWD and CAT score improved significantly in both the groups from baseline to 3rd month ($p < 0.001$). The FEV1/FVC also improved significantly in both yoga ($p = 0.001$) and control group ($p = 0.012$) from baseline to 3rd month. mMRC improved in both the groups from baseline to 3rd month but the improvement was significant in the yoga group only ($p = 0.002$). No significant improvements from baseline to 3rd month were seen in SpO2 in either of the two groups. Yoga group showed statistically significant additional improvement in mMRC ($p = 0.002$), 6MWD (p value <0.001) and CAT score (p value <0.001) from baseline to 3rd month, when improvements in both the groups were compared with each other. There was no additional benefit of yoga on FEV1 (p value = 0.051), FVC (p value = 0.165), FEV1/FVC (p value = 0.167) and SpO2 (p value = 0.650). We concluded that 3 months of yoga training is an effective adjuvant to medical management in patients of COPD.

**KEY WORDS:** Yoga, Pulmonary Rehabilitation, COPD

## INTRODUCTION:

Validated non-pharmacologic approaches to combat dyspnea and exercise intolerance in patients of Chronic obstructive pulmonary disease (COPD) include pulmonary rehabilitation, smoking cessation and immunization.[1–3] Like pulmonary rehabilitation, yoga, which is a mind and body technique is being recently studied for its role in COPD as an adjuvant therapy.[4] Few studies have been conducted in India to evaluate the role of yoga in patients of COPD and have shown varied results.[4–7] The yoga practices included a prayer of 1 min duration, asanas (ardhakatichakra asana, ardh-achakra asana, shashankasana, ardha ushtra asana, bhujangasana, shalabhasana: 12 mins), breathing (shashank asana breathing and hujanga asana breathing: 12 mins), pranayam (kapalabhati, surya bhedi pranayama, ujjayi pranayama, bhramari pranayama, bhastrika pranayama, anuloma villoma: 25 mins), meditation (nadaanu sandhana and om chanting: 5 mins) and deep relaxation techniques / Quick relaxation techniques (5 mins).

This study was undertaken to assess the effectiveness of

3 months yoga training practice in COPD patients, by evaluating its effect on spirometeric parameters: (FEV1), forced vital capacity (FVC) and $FEV_1$/FVC; oxygenation status: saturation of peripheral oxygen ($SpO_2$), level of breathlessness: modified medical research council dyspnea scale (mMRC), exercise capacity: six-minute walk distance test (6MWD) and health status: COPD assessment test (CAT) score.

## MATERIALS AND METHODS

It was a prospective study carried out from July, 2021 to October, 2022. Patients of stable COPD aged more than 18 years and diagnosed as per GOLD 2021 guidelines were counselled for 3 months yoga as an adjuvant therapy. Those who agreed for the same were taken up in the yoga group and those refusing for the same were taken up in the control group, till the sample size of 25 was reached in each group. The yoga group received adjuvant yoga therapy along with medical management as per GOLD guidelines. The control group received medical management only. (Figure 1). Spirometry (performed using spirometer - EasyOne Connect, ndd Medical technologies) was used to diagnose and classify COPD as per GOLD 2021 guidelines.[8] The mMRC score, 6MWD and CAT score of all the patients was noted at baseline.[8]

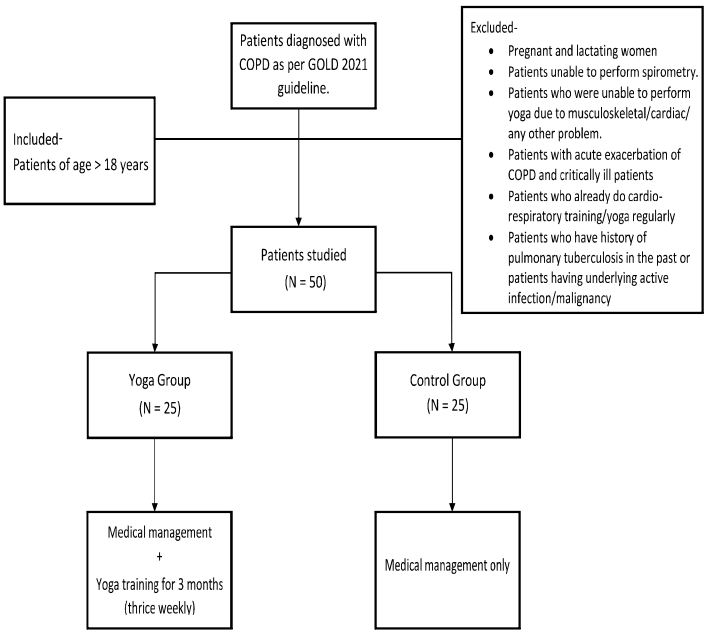



**Figure 1: Patient enrolment criteria. COPD, Chronic obstructive pulmonary disease; GOLD, Global initiative for chronic obstructive lung disease.**

The yoga group was taught yoga exercises by the yoga instructor/candidate. The total duration of yoga practice was 60 minutes for 3 days/week for a period of 3 months. The patients did yoga under the supervision of yoga instructor/candidate for three days/week during the first two weeks. After that the patients practiced yoga at their home. The patients were given a yoga record sheet to keep a record of their yoga sessions, symptoms, hospitalization, and medications. All patients were asked to visit the outpatient department after one month and then after three months to report about their health status and for reassessment of their study parameters. The changes in $FEV_1$, FVC, $FEV_1$/FVC, $SpO_2$, mMRC, 6MWD and CAT score were noted at both the follow ups in both the groups. Patients who had an exacerbation during the study period or who left yoga training in between were excluded, and additional patients were recruited to reach the desired sample of 25 patients in each of the two groups.

**Exclusion criteria:** Pregnant and lactating women, patients who were unable to perform yoga due to musculoskeletal/ cardiac/any other problems, had recently undergone surgery, patients who were already doing cardio-respiratory training/yoga, patients who had history of pulmonary tuberculosis in the past and patients having underlying active infection/malignancy were excluded.

The study was approved by the institutional ethical committee.

**Statistical analysis:** Normality of quantitative data were checked by measures of Kolmogorov Smirnov tests of normality. Normally distributed quantitative data was given as mean ± SD and range, and Student t-test was applied to compare two groups. Non -normally distributed (skewed) was represented as median and interquartile range; comparisons for the two groups were made by Mann-Whitney U test. For time related variables of different timings Wilcoxon Signed rank test was carried out for comparison of events at different timings. Changes were calculated by subtracting value of each subject T0 (baseline) - T1 ($1^{st}$ and $3^{rd}$ month) and then its mean/medians were calculated. Comparisons for two groups were made by Mann-Whitney U test. Spearman correlation coefficient were calculated to see relation between variables. A p value $<0.05$ was considered significant. Analysis was conducted using IBM SPSS STATISTICS (version 22.0).

## RESULTS

The study subjects in the two groups were uniformly

**Table-1**
**BMI, body mass index; GOLD, global initiative for chronic obstructive lung disease**
**Baseline patient characteristics**

| Parameter | Yoga group (n=25) | Control group (n=25) | p value |
|---|---|---|---|
| **Age (years)** | 58.92 ± 11.79 | 61.04 ± 9.43 | 0.486 |
| **Gender** | | | |
| **Male (n)** | 23 | 24 | 0.552 |
| **Female (n)** | 2 | 1 | |
| **Weight (kg)** | 60.20 ± 16.19 | 56.64 ± 11.97 | 0.381 |
| **Height (cm)** | 165.20 ± 9.31 | 165.88 ± 7.45 | 0.777 |
| **Mean BMI (kg/m$^2$)** | 21.98 ± 5.26 | 20.56 ± 3.89 | 0.790 |
| **GOLD Grade** | | | |
| **GOLD Grade 1 (n)** | 0 | 1 | |
| **GOLD Grade 2 (n)** | 6 | 7 | 0.414 |
| **GOLD Grade 3 (n)** | 14 | 9 | |
| **GOLD Grade 4 (n)** | 5 | 8 | |
| **ABCD Group** | | | |
| **A (n)** | 3 | 2 | |
| **B (n)** | 12 | 17 | 0.494 |
| **C (n)** | 2 | 2 | |
| **D (n)** | 8 | 4 | |

distributed in terms of demographic factors like age, gender, weight, height, BMI, locality, occupation, GOLD grade and ABCD grouping at the baseline (p>0.05). (Table 1)

In both the groups, the $FEV_1$, FVC, 6MWD and CAT score improved significantly at 1$^{st}$ month and 3$^{rd}$ month as compared to baseline (p value < 0.001). At 3$^{rd}$ month $FEV_1$/FVC improved significantly in the yoga group (p value <0.001) and control group (p value = 0.012) as compared to baseline. The mMRC improved significantly only in the yoga group at the end of 3 months (p value = 0.002) as compared to baseline. (Table 2)

At the end of 3 months, it was seen that yoga had an additional significant benefit, as seen by the improvement in mMRC (p =0.002), 6MWD and CAT score (p <0.001), in the yoga group, when improvements in both the groups were compared. Yoga didn't have any additional significant benefit on $FEV_1$, FVC, $FEV_1$/FVC and $SpO_2$. (Table 3).

No patient developed any adverse effect because of yoga sessions.

**DISCUSSION**

The pharmacotherapy has been established to influence the various lung function parameters. In a developing and resource limited country like India, the most common reason for non-compliance to inhaled

**Table-2**
**Patient Characteristics at baseline, one month and three months in yoga group and control group**

| | Yoga Group | | | | | | Control Group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Baseline** | **1$^{st}$ month** | **3$^{rd}$ month** | **p value** | | | **Baseline** | **1$^{st}$ month** | **3$^{rd}$ month** | **p value** | | |
| | | | | **B - 1** | **B - 3** | **1 - 3** | | | | **B - 1** | **B - 3** | **1 - 3** |
| **$FEV_1$ (L)** | 1.16 ± 0.43 | 1.32 ± 0.48 | 1.52 ± 0.56 | <0.001* | <0.001* | <0.001* | 1.27 ± 0.63 | 1.42 ± 0.68 | 1.52 ± 0.70 | <0.001* | <0.001* | 0.001* |
| **FVC (L)** | 2.21 ± 0.67 | 2.37 ± 0.65 | 2.60 ± 0.69 | <0.001* | <0.001* | <0.001* | 2.32 ± 0.81 | 2.53 ± 0.84 | 2.62 ± 0.81 | <0.001* | <0.001* | 0.005* |
| **$FEV_1$/FVC** | 0.51 ± 0.08 | 0.54 ± 0.08 | 0.57 ± 0.10 | <0.001* | <0.001* | 0.024 | 0.52 ± 0.09 | 0.54 ± 0.09 | 0.55 ± 0.08 | 0.185 | 0.012* | 0.053 |
| **$SpO_2$(%)** | 95.92 ± 0.95 | 96.00 ± 0.70 | 96.20 ± 0.57 | 0.593 | 0.166 | 0.166 | 95.84 ± 0.89 | 95.92 ± 0.95 | 96.00 ± 0.81 | 0.564 | 0.346 | 0.617 |
| **mMRC score** | 2.12 ± 0.72 | 2.08 ± 0.81 | 1.72 ± 0.93 | 0.317 | 0.002* | 0.003* | 2.04 ± 0.61 | 2.04 ± 0.61 | 2.00 ± 0.57 | 1.00 | 0.317 | 0.317 |
| **6MWD (m)** | 283.36 ± 45.03 | 324.64 ± 59.11 | 373.68 ± 67.77 | <0.001* | <0.001* | <0.001* | 282.68 ± 40.54 | 299.80 ± 41.84 | 311.92 ± 43.65 | <0.001* | <0.001* | <0.001* |
| **CAT score** | 22.16 ± 7.57 | 18.48 ± 7.13 | 14.92 ± 6.06 | <0.001* | <0.001* | <0.001* | 23.68 ± 7.62 | 21.56 ± 6.75 | 19.28 ± 6.59 | <0.001* | <0.001* | <0.001* |

B-1: Baseline – 1st month B-3: Baseline – 3rd month 1-3: 1st month – 3rd month

**Table - 3**
**FEV1, forced expiratory volume in first second; FVC, forced vital capacity; Sp02, saturation of peripheral oxygen; mMRC, modified medical research council dysnea scale; 6MWD, six minute walk distance; CAT, COPD assessment test**
**Mean change in characteristics after one month and three months of intervention**

| | Yoga group | | | Control group | | | p value | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter (Mean change) | B - 1 | B – 3 | 1 – 3 | B – 1 | B – 3 | 1 – 3 | B - 1 | B – 3 | 1 – 3 |
| $FEV_1$(L) | -0.16 ± 0.10 | -0.36 ± 0.21 | -0.20 ± 0.18 | - 0.15 ± 0.12 | - 0.25 ± 0.17 | -0.09 ± 0.12 | 0.705 | 0.051 | 0.217 |
| FVC(L) | -0.16 ± 0.20 | -0.39 ± 0.29 | -0.23 ± 0.21 | -0.21 ± 0.21 | -0.29 ± 0.27 | -0.08 ± 0.21 | 0.277 | 0.165 | 0.057 |
| $FEV_1$/FVC | -0.03 ± 0.02 | --0.06 ± 0.06 | -0.02 ± 0.05 | -0.01 ± 0.05 | -0.03 ± 0.06 | -0.01 ± 0.04 | 0.213 | 0.167 | 0.448 |
| $SpO_2$(%) | -0.08 ± 0.75 | -0.28 ± 0.98 | -0.20 ± 0.70 | -0.08 ± 0.70 | -0.16 ± 0.85 | -0.08 ± 0.81 | 0.983 | 0.650 | 0.495 |
| mMRC score | 0.04 ± 0.20 | 0.40 ± 0.50 | 0.36 ± 0.49 | 0.00 ± 0.00 | 0.40 ± 0.50 | 0.04 ± 0.20 | 0.317 | 0.002* | 0.005* |
| 6MWD(m) | -41.28 ± 16.79 | -90.32 ± 29.30 | -49.04 ± 16.59 | -17.12 ± 6.47 | -29.24 ± 9.99 | -12.12 ± 6.94 | <0.001* | <0.001* | <0.001* |
| CAT score | 3.68 ± 1.14 | 7.24 ± 2.04 | 3.56 ± 1.44 | 2.12 ± 1.20 | 4.40 ± 2.02 | 2.28 ± 1.48 | <0.001* | <0.001* | <0.001* |

B -1: Baseline – 1st month, B -3: Baseline – 3rd month, 1-3: 1st month – 3rd month

medications was patients belief that medications were not needed during symptom free period, followed by forgetfulness, social stigma in using inhalers, difficulty in using inhalers and inadequate instructions.[9] There have been studies in the past exploring the role of adjuvant therapies. We evaluated the role of one such adjuvant therapy i.e., yoga in patients of COPD.

In both yoga and control group, $FEV_1$ and FVC at 1st month and at 3rd month improved significantly as compared to baseline ($p < 0.001$). $FEV_1$ improved significantly in yoga and control group from baseline to 3rd month ($p<0.001$ and 0.012 respectively). It also improved from baseline to 1st month in both the groups, however the improvement was statistically significant in only yoga group ($p<0.001$). On comparing the change in mean of $FEV_1$, FVC and $FEV_1$/FVC amongst yoga and control group, there was no additional benefit of yoga over pharmacotherapy when comparison of change in $FEV_1$, FVC and $FEV_1$/FVC from baseline to 1st month, from baseline to 3rd month and from 1st month to 3rd month was done.

Thus, there was no additional significant benefit of yoga on the spirometry parameters of COPD patients versus control group. The duration of yoga in our study may not have been adequate to bring out spirometerically significant outcomes. Other contributing anatomical factors like bullae and emphysematous changes may have caused non-significant improvements in the spirometry parameters. Similar results were obtained in the past by some authors.[10,11] In contradiction, study by Jessy John et al, reported an improvement in $FEV_1$/FVC, whereas studies by Thokchom SK et al, Artchoudane S et al and Niu R et al, reported an improvement in $FEV_1$ only.[4, 12–14]

As seen in previous studies, the saturation of peripheral oxygen ($SpO_2$) did not show any significant improvement in any of the two groups at any of the follow-ups.[14,15]

mMRC improved significantly from baseline to 3rd month and 1st to 3rd month in yoga group only (p value 0.002 and 0.003 respectively). The improvement in mMRC in control group was non-significant at both the follow-ups. There were statistically significant additional improvements in mMRC from baseline to 3rd month ($p = 0.002$) and from 1st month to 3rd month ($p = 0.005$) in patients practicing yoga vs controls. Beneficial effect of yoga on mMRC in COPD patients was also observed in the past.[16,17] There was no statistically significant

improvement in the yoga group as compared to control group after 1 month of yoga training (p value = 0.317). In our study, significant improvement in mMRC score in the yoga group highlights that the patient has decreased perception of breathlessness at follow up. While performing yoga there is expansion and descent of the lungs that stimulates the release of surfactant and prostaglandins in the alveolar spaces which leads to expansion of the surface area of the lungs. This leads to improvement in respiratory function and decreases dyspnea.[18] One month of yoga training in our patients was found to be insufficient to decrease the perception of breathlessness, and have an impact on mMRC. However, yoga sessions of three months duration improved the mMRC significantly. Though no time limit has been specified in the past for duration of yoga practice, we suggest the patients to be motivated and persistent in their efforts and continue their yoga sessions before any clinical improvements become appreciable.

In both the groups, the 6MWD improved significantly from baseline to 1$^{st}$ month, baseline to 3$^{rd}$ month and 1$^{st}$ to 3$^{rd}$ month (p value <0.001). On comparing the change in mean 6MWD amongst yoga group and control group, there was significant additional benefit of yoga over pharmacotherapy alone when comparison of change in 6MWD from baseline to 1$^{st}$ month, baseline to 3$^{rd}$ month and 1$^{st}$ to 3$^{rd}$ month was done (p <0.001). The 6MWD is an indicator of exercise capacity. The improvement depicted that the patients practicing yoga had an improved ability to perform daily activities. The increase in 6 MWD could be due the effect of yoga on musculoskeletal and cardio-respiratory system. Yoga has been found to increase oxidative capacity, skeletal muscle strength, flexibility and endurance, and thus justifies our results.[19] Appreciable improvement in 6MWD has been observed by a number of studies in the past.[20–25] CAT score improved significantly from baseline to 1$^{st}$ month, baseline to 3$^{rd}$ month and 1$^{st}$ to 3$^{rd}$ month (p= <0.001) in both the groups. On comparing the change in mean CAT score amongst yoga and control group, there was significant additional benefit of yoga over pharmacotherapy seen at baseline to 1st month, baseline to 3$^{rd}$ month and 1$^{st}$ to 3$^{rd}$ month (p <0.001). Yoga reduces stress and anxiety through better regulation of hypothalamic-pituitary axis, suppressing sympathetic activity and balancing the autonomic nervous system responses.[20] Thus it may directly have an impact on CAT score which actually is a tool to assess symptom control, health status and wellbeing. The same has been reported by few authors in the past as well.[11,20]

## CONCLUSION

The present study showed that yoga is effective as an adjuvant to pharmacotherapy in patients with COPD. Three months of yoga training improves the perception of dyspnea, exercise capacity and health status. We hence propose that yoga as a form of pulmonary rehabilitation should be offered to patients of COPD unless contraindicated.

## LIMITATIONS OF THE STUDY

The study was conducted at a single centre and had a small sample size with a follow up period of three months only. In addition, the effect of yoga on other etio-types of COPD was not studied as all the patients has smoking related COPD. The different co-morbidities were not thoroughly evaluated. Studies with larger sample size, different etio-types of COPD and longer follow-ups are needed to explore the role of yoga in day-to-day practice.

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