DETERMINATION OF EFFECT OF YOGA (PRANAYAMA) IN TERMS OF SEVERAL LUNG PARAMETERS AND CAT SCORE ON MILD TO MODERATE COPD PATIENTS FOR SHORT DURATION OF TIME (3 MONTHS)

Physiology

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ABSTRACT

Medicines become the lifeline for the treatment of COPD which is becoming one amongst the alarming factors of death throughout the globe. Patients plagued by COPD experience deterioration in their pulmonary function test. On the contrary, the beneficial effects of pranayama on respiration are reported since the traditional time in India. Aim of the current study was to explore the potentiality of short term pranayama to enhance the pulmonary function parameters both subjective and objective of mild to moderate COPD patients. 100 mild to moderate COPD patients were selected by the exclusion and inclusion criteria. Before starting pranayama each patient was observed for various lung parameters like FVC, FEV₁, FEV₁/FVC, PEFR, FEF, MVV and CAT score and (visit 1). Each patient was further studied for the identical parameters one month (visit 2) and three months (visit 3) after starting pranayama. Visit 1 was taken as control group and was compared with visit 2 and visit 3. Result showed significant positive co-relation between pranayama and lung function parameters with CAT score. Lung parameter values prior and after starting pranayama showed significant differences ($P < 0.01$). So, the study revealed the fact that additive effect of pranayama along with medicines is way stronger than that of single effect of medicines. It can be incorporated into daily life as life style modification as well as adjuvant therapy for medical condition like COPD.

KEYWORDS

Pranayama, COPD, FEV₁, FVC, FEF, MVV, PEFR, CAT.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is defined as a disease state characterized by airflow limitation that's not fully reversible. COPD includes emphysema and chronic bronchitis. Yoga on the other hand is a psycho-somatic and spiritual discipline for achieving union and harmony between our mind, body and soul and also the union of our individual consciousness with the universal consciousness. Estimates suggest that COPD will rise from the sixth to the third commonest explanation for death worldwide by 2020¹ and medications are the foremost stay of treatment always long. Pulmonary function tests are usually deranged in COPD patients. On the contrary, pranayama from the older time in India found to possess beneficial effects on respiration. In recent time many studies have shown that pranayama improves pulmonary function parameters.²⁻⁸

Yoga has been recommended to encourage relaxation, reduce stress and improve some medical conditions. Yoga is taken into consideration to be a low-impact activity which can provide the identical benefits as any well-designed exercise program, increasing general health and stamina, reducing stress, and improving those conditions caused by sedentary lifestyles. It is particularly promoted as a routine therapy and as a regimen to strengthen and balance all parts of the body.⁹

Yoga exercises usually recommended for ladies with premenstrual syndrome because it absolutely was found to alleviate emotional, physical and behavioral symptoms related to the disease.¹⁰ Yoga may improve psychological health during cancer treatment.¹¹ It can also be used as complementary intervention for cancer patients to decrease depression, insomnia, pain, and fatigue and to extend anxiety control; although more evidence is required to substantiate this possible benefit. Other researches indicated that yoga is a useful adjuvant additionally to other treatments in schizophrenia,^{12,13} depression¹⁴ and other neuropsychiatric disorders¹⁵. Yoga may additionally be effective for low back pain both in short-term and long-term basis.¹⁶ Yoga combined with health education may cause improvements in quality of life outcomes among adults with for metabolic syndrome over conventional standardized group health education.¹⁷ It's claimed that yoga might be a beautiful training for teens and adolescents, both as a form of workout and for breathing, focus, mindfulness, and stress relief; many faculties have considered incorporating yoga into their teaching programs. Regular yoga practice increases FVC, FEV₁, PEFR, FEF and breath holding time significantly in young healthy adults. Yoga exercises and pranayama done regularly on regular basis

improve pulmonary function test in middle aged men. Targeted practice of pranayama improves FVC, FEV₁, double product and lactate production capacity in sedentary adults at intermediate altitude.¹⁸

While kind of the community regards the results of yoga research as significant, others point to several flaws which undermine results. Much of the research on yoga has taken the shape of preliminary studies or clinical trials of low methodological quality, including small sample sizes, lack of randomization, and high risk of bias. Hence this study will be undertaken to research the effect of yoga (pranayama) on Pulmonary Function Tests in healthy subjects and patients of COPD considering of these flaws mentioned.

MATERIALS AND METHODS

Study Design

Our study was longitudinal, observational and analytical type.

Place of Study

Study was conducted yoga laboratory in the Department of Physiology of IPGME&R, Kolkata.

Period of Study

One and half year (January 2019 to June 2020)

Study Population

Patients suffering from mild or moderate COPD as registered at the respiratory clinic at IPGME&R, Kolkata.

Sample Size

Assuming that there would be a 15 % change in FEV₁/FVC following a yoga treatment and 80 % power and delta of 15 % we would need 85 evaluable subjects considering an attrition rate of about 10 to 15 % we proposed to enroll 100 patients suffering from mild or moderate COPD (diagnosed and registered at the respiratory clinic at IPGME&R) selected depending on the inclusion and exclusion criteria. (Sample size was calculated using n Master 2.0). Though total 130 patients participated in the study but out of 130, 100 patients completed three visits perfectly. So, 30 patients who did not completed all three visits, were removed from the study.

INCLUSION CRITERIA

- Mild to moderate COPD patients (according to GOLD guidelines)

- who had noacute exacerbation in last 6 months continuing medications of COPD
- Not on any systemic steroid for 6 months or not hospitalized in last 6 months.
 - Nonsmoker or ex-smoker (Left > 6 month).
 - Age group -20 to 60 years, both male and female.
 - Devoid of any major respiratory (except COPD), cardiac (e.g. DCM, IHD,MI), renal disease (CKD), neurological illness (e.g. CVA) or malignancy.
 - Not doing any yoga practice previously but able to perform pranayama daily for 30 minutes in two phases for three months

EXCLUSION CRITERIA

- Previous experience of yoga training or experience of active sports training.
- Severe anemia (Hb < 6 gm %).
- History of major surgery or hospital admission < 6 months.
- Active Tuberculosis, Active smoker, Chest deformities like kyphosis, scoliosis

Study outcome variables

- CAT score (COPD assessment test score)
- Forced Expiratory Volume (FEV₁ %)
- Forced Vital Capacity (FVC %)
- FEV₁/FVC
- Forced Expiratory Flow 25-75 % (FEF 25-75 %),
- Peak Expiratory FlowRate (PEFR %),
- Maximum Voluntary Ventilation (MVV %)

(All parameters except CAT score were measured by Electronic spirometer-SpiroWin)

Study procedure

Mild to moderate COPD patients studied for all parameters before starting pranayama (visit 1) and one and three months follow up (visit 2 and visit 3 respectively) in same cases after starting pranayama. Patients were given four pranayamas to perform regularly for one hour in two divided sessions preferably in outdoor. Pranayamas were Bhastrika, Lom - anulom - vilom, Kapalbhati and Bhramari pranayama.

STATISTICAL ANALYSIS

Statistical analysis was performed with the help of the software SPSS 17. Descriptive statistical analysis was performed to calculate means with the corresponding standard deviation (SD). Paired sample t test was performed to compare the mean values and t denoted the value of paired sample t test. P<0.05 was taken to be statistically significant and P<0.01 was considered to be statistically highly significant

RESULT

100 mild to moderate COPD patients were monitored at 0 month i.e. before starting pranayama (visit 1) and 1 month (visit 2) and 3 months (visit 3) interval after practicing pranayama regularly.

Table 1: Comparison of Mean Values of different Selected Parameters CAT Score, FEV₁ %, FVC %, FEV₁/FVC, FEF(25-75 %), PEFR %, MVV % in Visit 1, 2 and 3 Respectively

	Visit 1 Mean ± SD n=100	Visit 2 Mean ± SD n=100	Visit 3 Mean ± SD n=100
CAT SCORE	22.03±3.02	18.14±2.77	13.27±2.24
FEV ₁ (%)	51.04±17.73	61.31±17.50	72.80±18.06
FVC (%)	67.77±15.62	73.52±15.15	80.29±15.21
FEV ₁ /FVC	59.96±12.05	67.13±11.39	73.22±9.42
FEF (25 - 75 %)	27.02±14.97	35.41±16.28	46.29±18.49
PEFR (%)	39.14±16.39	46.65±16.52	56.52±18.20
MVV (%)	37.21±15.79	47.30±15.04	59.68±18.96

Table 2: Comparative Study of CAT Score in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
CAT score (visit 1 vs visit 2)	27.521	<0.00	HS
CAT score (visit 2 vs visit 3)	37.918	<0.00	HS
CAT score (visit 1 vs visit 3)	54.450	<0.00	HS

t-value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of CAT score (visit 1) and CAT score (visit 2), CAT score (visit 2) and CAT score (visit 3), CAT score (visit 1) and CAT score (visit 3).

CAT score impact level: <10 = low; 10-20 = medium; 21-30 = high; and >30 = very high. (GlaxoSmithKline)

Table 3: Comparative Study of FEV₁ % in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
FEV ₁ % (visit 1 vs visit 2)	-10.724	<0.00	HS
FEV ₁ % (visit 2 vs visit 3)	-14.385	<0.00	HS
FEV ₁ % (visit 1 vs visit 3)	-17.595	<0.00	HS

t value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of FEV₁ % (visit 1) and FEV₁ % (visit 2), FEV₁ % (visit 2) and FEV₁ % (visit 3), FEV₁ % (visit 1) and FEV₁ % (visit 3).

Table 4: Comparative Study of FVC % in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
FVC % (visit 1 vs visit 2)	-6.860	<0.00	HS
FVC % (visit 2 vs visit 3)	-8.845	<0.00	HS
FVC % (visit 1 vs visit 3)	-11.996	0<0.00	HS

t value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of FVC % (visit 1) and FVC % (visit 2), FVC % (visit 2) and FVC % (visit 3), FVC % (visit 1) and FVC % (visit 3).

Table 5: Comparative Study of FEV₁/FVC in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
FEV ₁ /FVC (visit 1 vs visit 2)	-7.683	<0.00	HS
FEV ₁ /FVC (visit 2 vs visit 3)	-10.948	<0.00	HS
FEV ₁ /FVC (visit 1 vs visit 3)	-14.506	<0.00	HS

t value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of FEV₁/FVC (visit 1) and FEV₁/FVC (visit 2), FEV₁/FVC (visit 2) and FEV₁/FVC (visit 3), FEV₁/FVC (visit 1) and FEV₁/FVC (visit 3).

Table 6: Comparative Study of FEF(25-75 %) in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
FEF (25-75 %) (visit 1 vs visit 2)	-6.569	<0.00	HS
FEF (25-75 %) (visit 2 vs visit 3)	-12.305	<0.00	HS
FEF (25-75 %) (visit 1 vs visit 3)	-13.045	<0.00	HS

t value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of FEF (25-75 %) (visit 1) and FEF (25-75 %) (visit 2), FEF (25-75 %) (visit 2) and FEF (25-75 %) (visit 3), FEF (25-75 %) (visit 1) and FEF (25-75 %) (visit 3).

Table 7: Comparative Study of PEFR (%) in COPD Patients During Pre and Post 'Pranayama'

	t-value	P value	Significance
PEFR (%) (visit 1 vs visit 2)	-6.895	<0.00	HS
PEFR (%) (visit 2 vs visit 3)	-8.861	<0.00	HS
PEFR (%) (visit 1 vs visit 3)	-12.849	<0.00	HS

t value of paired sample t-test denotes that there is highly significant (HS) difference (P<0.00) between the values of PEFR % (visit 1) and PEFR % (visit 2), PEFR % (visit 2) and PEFR % (visit 3), PEFR % (visit 1) and PEFR % (visit 3).

In Comparative study of MVV(%) also t value of paired sample t-test denoted that there was highly significant (HS) difference (P<0.00) between the values of MVV% (visit 1) and MVV% (visit 2), MVV% (visit 2) and MVV% (visit 3), MVV% (visit 1) and MVV% (visit 3).

DISCUSSION

The aim of the present work was to focus on the magnificent effect of pranayama on mild to moderate COPD patients by a clinical trial for a period of 3 months. CAT score, FVC %, FEV₁ %, FEV₁/FVC, FEF (25-75 %), PEFR % and MVV % were selected as detecting parameters or tools for measuring the potent influences of pranayama on COPD patients. 100 patients suffering from COPD in the age group between 20 to 60 years were selected from respiratory clinic of IPGME&R and SSKM Hospital, Kolkata. They were all on their medications (mainly bronchodilators) for more than 1 year. They were monitored at an

interval of 1 month and 3 months by using the above parameters. 100 patients were marked as visit 1, visit 2, visit 3 depending on their time of monitoring. The values of lung parameters in visit 1 were considered as control value. Then the patients were trained to do pranayama for minimum 30 minutes twice daily for a period of 3 months along with their regular medications and they were told to visit again at the end of 1 month and 3 months. At the end of 1 and 3 months values of same lung parameters were recorded like visit 1.

Consistent progressive increase in their capacities indicated strong positive influence of pranayama besides medication on COPD. Statistically significant differences ($p < 0.01$) were observed in all the lung parameters between visit 1 and visit 2, visit 2 and visit 3 and visit 1 and visit 3. Significant improvement in all parameters manifested yoga in terms of pranayama more potent than single effect of medication in COPD patients.

Though we had few study limitations.

1. We monitored the patients for three months in our study. But after three months of study we could not monitor the patients for prolong period of time to know whether these changes we found in our study were persisting for longer period or not. That is, we could not monitor for long term effect of pranayama on lung parameters.
2. In our study patients were asked to perform pranayama at home for one hour in two divided sessions. They were also asked for a regular weekly visit at our yoga laboratory for better monitoring and any clarification if needed. Though we tried to communicate with the patients regularly over phone to know whether they were performing pranayama at home regularly or not, still we were not able to monitor strictly over their practice of pranayama at home.
3. The patients in this study were from different regions of West Bengal including few distant and remote areas. Few of the patients were not able to attend our department at an exact date after one month and three months for follow up. Few patients attended our department on earlier dates and few of them attended later of the scheduled date of follow up.
4. We also lost few patients who attended only one or two visits but did not complete all the three visits. In this way we had 130 patients in first visit but out of 130, 100 patients were able to complete all three visits.

CONCLUSIONS

So, it may be concluded from the study that the regular practice of pranayama may have beneficial effect on mild to moderate COPD patients. Consistent improvement in their lung capacities after practicing pranayama strongly supports the fact that pranayama may have a significant effect in the treatment of COPD along with medication. The beneficial role of yoga on the prevention of different chronic diseases has been discussed from the ancient age. Instead of that number of scientific initiatives to establish the beneficial effect of yoga on the prevention of various diseases is not enough. Besides that the number of scientific study of yoga on the treatment of diseases is not such mentionable. It is worth mentioning, scientific work on beneficial effects of pranayama, a part of yoga, hardly countable. In such condition, this interventional study may have the efficacy to highlight a new horizon in the treatment of COPD besides medications. The improvement in lung capacities of COPD patients by pranayama may be due to the following reasons which are suggested in some previous scientific literatures.

1. Stimulation of pulmonary stretch receptors by active inflation reflexly relaxes the smooth muscles of tracheo-bronchial tree. Possibly this can increase the airway caliber and decrease the airway resistance.¹⁹
2. Lung inflation near to total lung capacity as occurs in pranayama may release surfactant and prostaglandin into alveoli. That can increase lung compliance and decrease bronchial smooth muscle tone.
3. Pranayama trains to use diaphragm and abdominal muscle more efficiently.
4. It also strengthens the respiratory muscles.
5. Reducing the emotional stress factors by pranayama and its calming factor may reduce the bronchoconstrictor effect.

In our present era of science where healthy life without side effects of long term use of any medication is more precious, such findings can help to lighten the way. Therefore the present study contributes to the fact that pranayama may have potential additive

effects besides medication on COPD. Besides the capacity to prevent various chronic diseases it has the ability to treat COPD by improving lung capacities. So, to include its graceful effects it should be implicated in our daily routine as well as COPD patients. Therefore we should incorporate pranayama into our daily life as a lifestyle modification as well as adjuvant therapy for promoting health in certain medical conditions like COPD.

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