Effect of Yoga as an Adjunctive Therapy on the Respiratory Function of COPD Patients with mild to Severe Grades of Severity in a Tertiary Care Centre in Kerala

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) being a major public health problem, pulmonary rehabilitation along with pharmacotherapy can give better results while managing COPD. Almost no studies have been done to assess the relationship between effect of yoga as an adjunctive therapy on respiratory function in COPD patients especially in south India. This study was an attempt to know the effect of selected Yogic practices on improving respiratory function.

Material and methods: A total of 30 cases of mild, moderate and severe grades of COPD defined as per Global Initiative for obstructive lung disease (GOLD) guidelines were recruited in this study. The sample size was taken as 30. All selected subjects were assessed for spirometric evaluation, Maximum inspiratory pressure MIP (or PImax) and Maximal expiratory pressure MEP (or PEmax). Patients were taught selected yoga exercises for 1 hour, thrice a week for one month by a certified yoga therapist. Thereafter, patients were asked to practice at home in the morning for two months.

Statistical analysis was performed using a statistical software package SPSS version 20.0. Comparison of pre-yoga and post-yoga assessment of respiratory function at the end of each month for two months was done. Continuous variables were expressed as Mean±SD. Effect of yoga on selected parameters at different interval of time were assessed by paired t test. $P<0.05$ was taken to be statistically significant.

Results: FEV1%, PEFR, FVC, FEV1/FVC, showed an increasing trend over time from pre-yoga to 1 month and pre-yoga to 2 month, among which FEV1% and FEV1/FVC was statistically significant at $p <0.05$. Likewise, variables PEFR also showed a significant increase from pre- yoga to end of 2nd month ($p<0.05$).

Conclusion: yoga practices is suggestive of improving respiratory function in COPD patients when used adjunctively with standard pharmacological treatment.

Keywords: Yoga, COPD and Yoga, Respiratory Static Pressures , Spirometry after Yoga Therapy.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major public health problem. By 2020, it is predicted to rank as the third leading cause of death worldwide.[1-3]

Recent evidence-based clinical practice guidelines and statements have shown that pulmonary rehabilitation is accepted as the most effective non-pharmacotherapy in the management of COPD.[4] Hence the concept of introducing yoga and or relaxation techniques came into being.

Yoga originated in ancient India, and denotes the union between the individual self and the transcendental self.

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. There are several facts supporting the physiological changes that can occur following yoga therapy.[5]

Increasing incidence of illness in modern times as a result of several factors like pollution and stressful life has triggered studies of how yoga can help in handling this problem. As far as the respiratory system is concerned, it helps to relieve the bronco-constriction, strengthens the lungs, and improves the lung capacity and thus effectively used in the management of respiratory disorders.

Yogic exercises have been shown to have positive effects on people with many diseases like asthma[6,7], cardiac diseases[8], diabetes[9], tuberculosis[10], depressive disorders[11], and pleural effusion.[12]

But there are no studies done to assess the relationship between effect of yoga as an adjunctive therapy on respiratory function and respiratory muscle strength in COPD patients especially in south India. This study was an attempt to know the effect of selected Yogic practices on the respiratory function and respiratory muscle strength in COPD patients in Kerala.

MATERIAL AND METHODS

A total of 30 cases of mild to severe grades of severity as defined in the Global Initiative for obstructive lung disease (GOLD) guidelines[13], were recruited who attended outpatient

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unit in department of the Respiratory medicine at Govt. T D Medical College Hospital, Alappuzha. All the cases were non-practitioners of yoga. The study was explained to all subjects and their written informed consent was obtained. The sample size was determined based on a previous study[14] by Comparison of Two Mean $N= 2(Z\alpha +Z\beta)^2 \sigma^2/ \Delta^2$; Where $Z_\infty = 1.96$ for $\infty = 0.05$; $Z_\beta = 0.84$ for $\beta = 0.20$; $\Delta = \mu_T - \mu_C$ (difference in mean); σ = Standard deviation. In the present study,[14] Pooled standard deviation for PEFR (σ) = 0.85, Difference in mean PEFR between yoga group and normal group (Δ) = 0.7; $N= \{2(1.96+0.84)^2 \times 0.85^2\}/(0.7)^2 =24$; Minimum sample required is 24. The sample size in our study is rounded off to 30, anticipating drop outs during the study. The study protocol was approved by the institutional ethical committee at Govt. T D Medical College Hospital, Alappuzha. The subjects were recruited by the following criteria;

Inclusion criteria for the study are as follows - COPD patients with mild, moderate and severe grades of severity, Enrolled for yogic exercise for the first time under the supervision of yoga experts. No history of concomitant severe or chronic medical illness (hepatic failure, chronic renal failure, diabetes mellitus, etc.) and any surgery.

Exclusion criteria: Exclusion of 'very severe' COPD groups of severity as per GOLD staging, Smoker, Patients with severe anemia, electrolyte imbalance, tuberculosis, diabetes, coronary arteries disease. Patients who do exercises regularly, or indulged in exercises within six months before intervention.

COPD Patients recruited for the study were informed about the benefits of yoga while attending the OP clinic of department of Pulmonary Medicine. Those willing to participate were grouped according to their severity of disease, as per the GOLD staging of the disease.

Mild COPD - $FEV_1/FVC<70\%$ and FEV_1 <80% predicted

Moderate COPD - $FEV_1/FVC<70\%$ and FEV_1=50-79% predicted,

Severe COPD- $FEV_1/FVC<70\%$ and FEV_1=30-49% predicted, (Table- 1)

All selected subjects were assessed for the following parameters of respiratory system**.**

Spirometry- FVC (L), FEV1 (L), PEFR (L/sec). FEV1/FVC ratio (%) using an electronic portable PC based spirometer with printer (SPIROPALM 6MWT comply with ATS/ERS guidelines) was used. The COPD patients with post-bronchodilator (20 min after inhalation of 2 puffs of salbutamol given via a metered dose inhaler through a spacer) FEV_1 less than 80% of the predicted value along with an $FEV_1/FVC\%$ not more than 70% were taken into the study.

Maximum inspiratory pressure, MIP (or PImax) and Maximal expiratory pressure, MEP (or PEmax), a non-invasive procedure to asses inspiratory and expiratory muscle strength was done using portable digital peak respiratory pressure (DPRP).[15] Maximum inspiratory pressure (MIP) is the maximum negative pressure that can be generated from one inspiratory effort starting from functional residual capacity or residual volume to maximal inspiration after a slow and deep expiration. Maximal expiratory pressure (MEP) measures the maximum positive pressure that can be generated from one expiratory effort starting from total lung capacity to maximal expiration after a slow and deep inspiration. These tests are simple ways to gauge inspiratory and expiratory muscle strength.[16] The device DPRP works on the principle of pressure transducer converting the pressure in the mouth piece into voltage. Voltage is calibrated as 1mm Hg = 10 mV.

Yoga practices- Patients were taught selected yoga exercises including breathing exercises, meditation, and yoga postures for 1 hour, thrice a week for one month by a certified yoga therapist in Shivananda yoga, in a well spacious hall in the department of pulmonary medicine at the medical college hospital itself for ease of conveyance for the patients. All patients were instructed to continue on their prescribed medical treatment for COPD during the study**.**

All the parameters aforementioned were assessed again at the end of one month. Thereafter, patients were asked to practice at home in the morning for two months. They were instructed to visit the principal investigator once a week to give report about their health status. Patients were told to keep nutritious eating regime, sleep enough (7-8 hours/day). Patient's bystanders were instructed to keep a diary about their daily yoga practices and the duration of time. Patients were also instructed to keep a record about their symptoms, hospitalization other than the regular checkup and the medications other than the usual dose, taken for the disease COPD. They were strictly instructed to abstain from yoga practice during any acute exacerbation of their respiratory symptoms. The medication for COPD were kept the same throughout the study period for all the groups.

The training in yoga: The yoga practice given to COPD patients (for 3 months) included pranayama and asanas. Yoga includes initial relaxation of external body 5 min, pranayama (25min), asanas (15min), shavasana final relaxation (5 min), meditation (5 min) along with life style changes.[17]

Pranayama (breathing exercises)

Bhastrika:**,** Anulom vilom:**,** Kapalbhati:**,** Bhramari:

Asanas (postures)

Surya Namaskar, Tadasana (mountain pose), Sukhasana, Paschimotaasana, padahasthasanam, bhavanamuthasanam, vrikshasanam, bhujangasanam, matsyaasanam, shalabhasanam, makarasanam, butterfly, Vajrasanam. (different sets of asanas per session considering the flexibility and safety of patients.)

Shavasana: 5min

Patients were given a videotape or pamphlets of yoga asanas and were strongly encouraged to practice daily at home. They were asked to document the number of sessions and number of minutes of home practice since the last yoga class during each yoga class session.

Safety and feasibility: Before putting the patients on yoga regimen, they were clinically examined to rule out any physical ailments. Safety of the yoga program were assessed by measuring heart rate, oxygen saturation (SpO2), and dyspnea (MMRC) before and after each yoga session. Feasibility was assessed by interviewing the participants for perceived difficulty of the yoga class, and level of enjoyment after each session. Patients were given ample time to get comfortable with the yoga regimen. Patients were asked about their satisfaction and experiences with the program during individual exit interviews, which was conducted by the principal investigator.

STATISTICAL ANALYSIS

Statistical analysis was done to compare pre-yoga and post-yoga assessment of respiratory function and respiratory muscle strength at the end of each month. In this study, the COPD subjects were assessed at the end of each month for two months following pre-yoga assessment. Continuous variables were expressed as Mean±SD. Effect of yoga on selected parameters at different interval of time were assessed by paired t test. P<0.05 was considered the threshold for statistical significance. Statistical analysis was performed using a statistical software package SPSS version 20.0.

RESULT

From Table-2, among the 50 patients recruited for the study, 41 patients had regularly attended yoga training and successfully completed the study by attending regular follow up for post yoga assessment at the end of first month(1m) and second month (2 m).

Statistical analysis was done to compare groups at pre-yoga (baseline) and post-yoga at the end of first month(1m) and second month (2 m), between and within the groups.

The variables expressing the respiratory function, FEV1%, PEFR, FVC, FEV1/FVC, showed an increasing trend over time from pre-yoga to 1 month and pre- yoga to 2 month, among which FEV1% and FEV1/FVC showed a significant increase both at the end of 1 month and at the end of 2nd month from the pre-yoga level which was statistically significant at P<0.05. Likewise, variables PEFR also showed a significant increase from pre- yoga to end of 2nd month (P<0.05).

Static respiratory pressures MIP (or PImax) and MEP (or PEmax) also showed a significant increase in its values from pre -yoga to the end of 1 month and 2 months (P<0.001).

DISCUSSION

COPD is a progressive and debilitating ailment which is one of the leading causes of morbidity and mortality across the world especially in India. As the disease progresses, impairment of lung function decreases the physical inactivity of the patient. One of the reasons for COPD being a debilitating condition is the inactivity leading to further deterioration of disease by weakening the body musculature.[18]

Hence, in this scenario yoga practice can be a help to improve the quality of life and lung function. This is because with proper breathing exercises more oxygen is available for the exchange at tissue level. And continuous stretching postures relieves broncho constriction, increases respiratory stamina, relaxation of the chest muscles, expansion of lungs, raising energy levels and calming the body.[19]

In our study, we have included Pranayama, Asanas and Meditation. Asanas leads to steadiness of body and mind, Pranayama improves breathing and Meditation brings peace within and a feeling of well-being.

We got a positive result indicating improvement in respiratory function as observed by increasing FEV1%, PEFR, FVC, FEV1/FVC following yoga therapy within a duration of one month itself.

In a study conducted by Behera D, it was observed that lung function parameters, forced vital capacity (FVC), forced expiratory volume in first second (FEV_1) and peak expiratory flow rate (PEFR) improved after the practice of yoga in COPD.[20]

We also noticed a remarkable improvement in static respiratory pressures MIP (or PImax) and MEP (or PEmax).

Stage I	Mild COPD	FEV1/FVC<0.70	FEV_1≥ 80% normal
Stage II	Moderate COPD	FEV1/FVC<0.70	FEV_1 50-79% normal
Stage III	Severe COPD	FEV1/FVC<0.70	FEV_1 30-49% normal
Stage IV	Very Severe COPD	FEV1/FVC<0.70	FEV_1 <30% normal, or <50% normal with chronic respiratory failure present*

Table-1: Classification of severity of airflow limitation in COPD (based on post bronchodilator FEV1) Gold staging

	Pre Yoga	After 1 Month	After 2 Month	Pre Vs Post1	Pre Vs Post2
				P value	P value
FEV1 (%)	43 ± 10.3	45.3 ± 10	51.8 ± 11.3	0.029*	0.000*
PEFR (L/MIN)	34.5 ± 16.2	34.7 ± 12.6	39.1 ± 14.9	0.937	0.018*
FVC (L)	69.8 ± 12.9	68.7 ± 13.3	72.5 ± 15.1	0.586	0.244
FEV1/FVC (%)	0.6 ± 0.1	0.7 ± 0.1	0.7 ± 0.1	0.000*	0.000*
MIP Pressure (mm Hg)	33.1 ± 12	44.2 ± 7.4	51.1 ± 8.1	0.000*	0.000*
MEP pressure (mm Hg)	23.7 ± 12.6	36 ± 13.9	46.4 ± 17.4	0.000*	0.000*
*Significant at p<0.05, Continuous variables were expressed as MeanSD. Effect of yoga on selected parameters at different interval of time were assessed by paired t test.					

Table-2: Effect of yoga on various parameters at different interval of time-

Besides, MIP is more sensitive parameter than vital capacity during respiratory muscle weakness[16]

There are very few studies on effect of yoga on static respiratory pressures. And almost none in India especially in Kerala.

Mechanisms to account for the beneficial effects of yoga training are complex and need to be studied extensively. There are several factors contributing to the beneficial effects of yoga practice.

Yoga as mentioned above represents mind-body fitness. Regular practice improves blood circulation, tones up the musculature and enhances energy levels.[21]

Regular yoga practice corrects breathing and reduces muscle tension in both inspiratory and expiratory muscles.[22] Also this would widen bronchioles improving its perfusion.[23]

The exercises help open blocked airways caused by bronchitis or emphysema, which are linked to COPD, and improve the function of air circulation.

From an article published in journal of Rehabilitation research and development, it clearly mentions pranayama stretches lung tissue, alleviating symptoms like dyspnea, enhances respiratory muscles' strength and endurance, and also optimizes thoracoabdominal patterns of breathing.[24]

Apart from what has been mentioned above, it's a well-known fact that Yoga practice is more into slow breathing patterns which involves shoulder, thoracic, and abdominal muscles. While performing asanas controlled breathing is observed, which can ease anxiety, achieve relaxation, and provide more oxygen to the blood stream.

From a different study,[25] it was evident that parasympathetic modulation and regulation of chemoreceptive sensitivity occurs with such practices. Modifications in efferent vagal activity affect the calibre of airways reducing dyspnoea.

By doing asanas which includes stretching of muscles leads to muscle conditioning. It helps in improving oxidative capacity and strength of skeletal muscles, in turn improving physical performance, correction of postures and increasing walking pace and stride length.[26]

Relaxation techniques following yoga asanas have shown to improve cardiopulmonary endurance, evident as improved lung capacity and increased oxygen delivery.

Hence, regular yoga practices can modulate the breathing pattern and improve respiratory symptoms, when used as an adjunct therapy to the conventional pharmacological treatment.

This also directs our attention to the need of rehabilitation centres in the hospital, be it of any sector.

There are few limitations in our study, as we could not perform diffusion capacity, blood gas analysis and 6 MWD.

CONCLUSION

We conclude that yoga practices when used adjunctively with standard pharmacological treatment, can significantly improve the lung function and respiratory muscle strength in mild to moderate and severe grades of COPD.

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