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YOGA-BASED PULMONARY REHABILITATION FOR THE MANAGEMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity, mortality, and health care use. COPD -Chronic obstructive pulmonary Disease (COPD), a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to the noxious particles or gases. **Objectives:** To evaluate the effectiveness of Yoga Therapy in the management of dyspnea and fatigue in patients with COPD. **Inclusion criteria:** 1. Age > 18 years. 2. History, examination and PFT consistent with COPD as per GOLD guidelines. PFT showing: -FEV1/FVC < 0.70 -irreversible bronchial obstructions (<12% and /or <200ml increase in FEV1 or FVC, 20 minutes after the administration of 200µg of inhaled salbutamol). **Exclusion criteria:** 1. History of acute respiratory tract infection in the past 4 weeks prior to study. 2. History of medication with antibiotics and /or steroids (oral, injection or inhalation) in the previous 4 weeks prior to study. 3. Patients with cardiovascular disease, diabetes mellitus, Neuro -masculo-skeletal deficits, tuberculosis, hepatic or renal diseases. 4. Pregnant and lactating females. 5. History of thyroid disorders, parathyroid disorder and thyroidectomy. **Materials and methods:** A randomised controlled trial at New Delhi India hospital a Tertiary care unit:Sixty COPD patients (18 to 60years) ,both male and female were recruited. The yoga group received an intervention **Yoga** module for COPD that included asanas, loosening practices, breathing practices, pranayama, meditation, yogic counseling and lectures 45 min/day, 3days/weeks on alternate days for 12 weeks. **Primary and secondary outcomes:** Measurements of dyspnea and fatigue on the spirometry, exercise capacity by the 6 min walk test, COPD QUESTIONNAIRE, and C -Reactive protein (CRP) for inflammatory response were made before and after the intervention.**Results:** Statistically significant within group reductions in dyspnea (P <0.001), COPD questionnaire (P <0.001) scores, CRP (P <0.001), and 6 min walk distance (P <0.001) were observed in the yoga group; all except the last were significant compared to controls (P <0.001). **Conclusions:** Findings indicate that yoga benefits patients with COPD. Yoga can now be included as an adjunct to conventional therapy for pulmonary rehabilitation to most cases of COPD can be prevented by **Yoga** programs for COPD patients.

Keywords: Chronic obstructive pulmonary disease, Dyspnea, Yoga.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity, mortality, and health care use . COPD - Chronic obstructive pulmonary Disease (COPD),a common preventable and treatable disease, is characterized by

persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to the noxious particles or gases. Exacerbation and comorbidities contribute to the overall severity in individual patient. COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing. About 3 million die due to COPD every year. In India median prevalence of COPD is 5% in men and 2.7% in women and about half a million people die due reducing exposure to risk factors. This includes decreasing rates of smoking and improving indoor and outdoor air quality. While treatment can slow worsening, there is no cure. COPD treatments include stopping smoking, vaccinations, respiratory rehabilitation,

and often inhaled bronchodilators and steroids. Some people may benefit from long term oxygen therapy or lung transplantation. In those who have periods of acute worsening, increased use of medications and hospitalization may be needed. As of 2015 COPD affects about 174.5 million (2.4%) of the global population. It typically occurs in people over the age of 40. Males and females are affected equally commonly. In 2015 it resulted in 3.2 million deaths, up from 2.4 million deaths in 1990. Pulmonary rehabilitation is a comprehensive intervention that includes exercise training, education, and behavior modification, designed to improve the physical and psychological condition of people with COPD . The evidence is increasing for the efficacy of several kinds of exercise training as part of pulmonary rehabilitation aimed at reducing dyspnea and fatigue, as well as improving health-related quality of life and exercise capacity in individuals with COPD . Yoga has been included as a component of exercises prescribed for many pulmonary rehabilitation programs. Studies of short term yoga practices have reported improved lung function parameters, increased diffusion capacity , decreased dyspnea-related distress and improved health- related quality of life . Yoga therapy program includes asanas; pranayama; relaxation techniques; meditation; yogic counseling for stress management; chanting; and lectures on yogic lifestyle and philosophy . Limited studies on COPD using other yoga systems have assessed its efficacy in an adjunctive role. Here we report a randomized controlled study of COPD, evaluating the effects of yoga. We hypothesized that these parameters would improve in yoga group as compared to a control group.

Signs and Symptoms

Wheezing the sound of wheezing as heard with a stethoscope.

The most common symptoms of COPD are sputum production, shortness of breath, and a productive cough. These symptoms are present for a prolonged period of time and typically worsen over time. It is unclear if different types of COPD exist. While previously divided into emphysema and chronic bronchitis, emphysema is only a description of lung changes rather than a disease itself, and chronic bronchitis is simply a descriptor of symptoms that may or may not occur with COPD. Chronic cough is often the first symptom to develop. When it persists for more than three months each year for at least two years, in combination with sputum production and without another explanation, there is by definition chronic bronchitis. This condition can occur before COPD fully develops. The amount of sputum produced can change over hours to days. In some cases, the cough may not be present or may only occur occasionally and may not be productive. Some people with COPD attribute the symptoms to a "smoker's cough". Sputum may be swallowed or spat out, depending often on social and

cultural factors. Vigorous coughing may lead to rib fractures or a brief loss of consciousness. Those with COPD often have a history of "common colds" that last a long time.

Shortness of breath Shortness of breath is often the symptom that most bothers people. Typically the shortness of breath is worse on exertion of a prolonged duration and worsens over time. In the advanced stages, it occurs during rest and may be always present. It is a source of both anxiety and a poor quality of life in those with COPD. Many people with more advanced COPD breathe through pursed lips and this action can improve shortness of breath in some. Other features In COPD, it may take longer to breathe out than to breathe in. Those with obstructed airflow may have wheezing or decreased sounds with air entry on examination of the chest with a stethoscope. Advanced COPD leads to high pressure on the lung arteries, which strains the right ventricle of the heart. This situation is referred to as cor pulmonale, and leads to symptoms of leg swelling and bulging neck veins. COPD is more common than any other lung disease as a cause of cor pulmonale. Cor pulmonale has become less common since the use of supplemental oxygen. COPD often occurs along with a number of other conditions, due in part to shared risk factors.

Exacerbation An acute exacerbation of COPD is defined as increased shortness of breath, increased sputum production, a change in the color of the sputum from clear to green or yellow, or an increase in cough in someone with COPD. This may present with signs of increased work of breathing such as fast breathing, a fast heart rate, sweating, active use of muscles in the neck, a bluish tinge to the skin, and confusion or combative behaviour in very severe exacerbations. Crackles may also be heard over the lungs on examination with a stethoscope. Cause The primary cause of COPD is tobacco smoke, with occupational exposure and pollution from indoor fires being significant causes in some countries. Typically these exposures must occur over several decades before symptoms develop. A person's genetic makeup also affects the risk.

1.3 Diagnostic Method



A person blowing into a spirometer. The diagnosis of COPD should be considered in anyone over the age of 35 to 40 who has shortness of breath, a chronic cough, sputum production, or frequent winter colds and a history of exposure to risk factors for the disease. Spirometry is then

used to confirm the diagnosis. Screening those without symptoms is not recommended. Spirometry measures the amount of airflow obstruction present and is generally carried out after the use of a bronchodilator, a medication to open up the airways. Two main components are measured to make the diagnosis: the forced expiratory volume in one second (FEV1), which is the greatest volume of air that can be breathed out in the first second of a breath, and the forced vital capacity (FVC), which is the greatest volume of air that can be breathed out in a single large breath. Normally, 75–80% of the FVC comes out in the first second and a FEV1/FVC ratio of less than 70% in someone with symptoms of COPD defines a person as having the disease. Based on these measurements, spirometry

would lead to over-diagnosis of COPD in the elderly. The National Institute for Health and Care Excellence criteria additionally require a FEV1 of less than 80% of predicted. Evidence for using spirometry among those without symptoms in an effort to diagnose the condition earlier is of uncertain effect and is therefore currently not recommended. A peak expiratory flow (the maximum speed of expiration), commonly used in asthma, is not sufficient for the diagnosis of COPD.

Severity

MRC shortness of breath scale

Grade Activity affected

1. Only strenuous activity
2. Vigorous walking
3. With normal walking
4. After a few minutes of walking
5. With changing clothing

GOLD grade

Severity FEV1 % predicted

Mild (GOLD 1) ≥ 80

Moderate (GOLD 2) 50–79

Severe (GOLD 3) 30–49

Very severe (GOLD 4) < 30

There are a number of methods to determine how much COPD is affecting a given individual. The modified British Medical Research Council questionnaire (mMRC) or the COPD assessment test (CAT) are simple questionnaires that may be used to determine the severity of symptoms. Scores on CAT range from 0–40 with the higher the score, the more severe the disease. Spirometry may help to determine the severity of airflow limitation. This is typically based on the FEV1 expressed as a percentage of the predicted "normal" for the person's age, gender, height and weight. Both the American and European guidelines recommended partly basing treatment recommendations on the FEV1. The GOLD guidelines suggest dividing people into four categories based on symptoms assessment and airflow limitation. Weight loss and muscle weakness, as well as the presence of other diseases, should also be taken into account. Other tests A chest X-ray and complete blood count may be useful to exclude other conditions at the time of diagnosis. Characteristic signs on X-ray are

overexpanded lungs, a flattened diaphragm, increased retrosternal airspace, and bullae while it can help exclude other lung diseases, such as pneumonia, pulmonary edema or a pneumothorax. A high-resolution computed tomography scan of the chest may show the distribution of emphysema throughout the lungs and can also be useful to exclude other lung diseases. Unless surgery is planned, however, this rarely affects management. An analysis of arterial blood is used to determine the need for oxygen; this is recommended in those with an FEV1 less than 35% predicted, those with a peripheral oxygen saturation of less than 92% and those with symptoms of congestive heart failure. In areas of the world where alpha-1 antitrypsin deficiency is common, people with COPD (particularly those below the age of 45 and with emphysema affecting the lower parts of the lungs) should be considered for testing. Yoga therapy is a type of therapy that uses yoga postures, breathing exercises, meditation, and guided imagery to improve mental and physical health. The holistic focus of yoga therapy encourages the integration of mind, body, and spirit. Modern yoga therapy covers a broad range of therapeutic modalities, incorporating elements from both physical therapy and psychotherapy. Practice and Benefits of Yoga Therapy Yoga therapy is practiced in a wide range of formats. Physical therapists, for example, often implement yoga techniques in their delivery of massage and other treatments. Yoga therapy practice can resemble physical therapy, rehabilitative therapy, and/or psychotherapy. Unlike a standard yoga class, yoga therapy sessions are typically conducted in one-on-one or small group settings. Yoga therapy can be provided as an adjunct therapy to complement other forms of treatment, or it can be used to directly treat a specific issue. Yoga techniques range from simple to advanced, and can be enjoyed by people of all ages. Potential benefits from yoga therapy include stress reduction, psychological well-being, improved diet, and efficient functioning of bodily systems. A 2011 qualitative study from Inkanyiso: Journal of Humanities and Social Sciences examined the effects of yoga therapy on anxiety. The findings not only indicated that yoga therapy effectively reduced subjects' anxiety, but improvement across several dimensions of physical and mental health including physicality, relaxation, and mindfulness.

Effects of Yoga Therapy

Yogic practices enhance muscular strength and body flexibility, promote and improve respiratory and cardiovascular function, promote recovery from and treatment of addiction, reduce stress, anxiety, depression, and chronic pain, improve sleep patterns, and enhance overall well-being ...

Objectives of the Study

To determine the prevalence of ascertain factors related to COPD in and around Delhi, India. ☐ To Evaluate the following parameters in patients of COPD:

- a) High Sensitivity C Reactive Protein (hsCRP)
- b) PFT

- c) Six minutes walk test
 - d) COPD questioners
2. To Evaluate the correlation of these parameters with severity of disease and the rate of acute exacerbations of COPD

DESCRIPTION OF YOGA PRACTICE

TABLE IV LIST OF ASANAS

POSITION	NAME OF THE YOGIC PRACTICE
Shatkarma	Jalnetikapalbhati
Suryanamaskar	Suryanamaskar
Standing	TadasanaArdhachakrasanakatichakrasana
Supine	Savasana, Pawanmuktasana
Prone	Bhujangasana, SalabhasanaVajrasanaUttanmandukasanaGomukhasanaVakrasana
pranayama	NadishodhanBhastrika Bhramari
Meditation	Om chanting



Materials and Methods

1 PARTICIPANTS The COPDpatients of Shanti Devi Charitable Trust Ashok Vihar,Delhi,Indiawererecruited as study participants. The study sample consisted of 60 (male &female) patients in the age range 18 to 60 years.

Inclusion Criteria

- 1. Age > 18 years
- 2. History, examination and PFT consistent with COPD as per GOLD guidelines. PFT showing : -FEV1/FVC < 0.70 - irreversible bronchial obstructions (<12% and /or <200ml increase in FEV1 or FVC, 20 minutes after the administration of 200µg of inhaled salbutamol).

Exclusion Criteria

- 1. History of acute respiratory tract infection in the past 4 weeks prior to study
- 2. History of medication with antibiotics and /or steroids (oral, injection or inhalation) in the previous 4 weeks prior to study.

- 3. Patients with cardiovascular disease, diabetes mellitus, Neuro -masculo-skeletal deficits, tuberculosis, hepatic or renal diseases.
- 4. Pregnant and lactating females.
- 5. History of thyroid disorders, parathyroid disorder and thyroidectomy

The baseline value of the following parameters will be measured before including the subjects into the study:

- 1. Pulmonary function test (PFT). a) Force vital capacity (FVC) b) Force expiratory volume in 1 second (FEV1) c) FEV1 / FVC% d) FEF 25 -75
 - 2. High sensitive C-reactive protein (hs CRP) [mg /l]
- All subjects will be classified as per GOLD stage i.e. patients having FEV1/FVC <0.70 and:FEV1 ≥ 80% predicted GOLD Stage 1-mild 50% ≤FEV1<80% predicted GOLD stage 2 modreate. 30%≤FEV1<50% GOLD stage 3severe. FEV1<30% predicated GOLD stage 4-Very severe.

All subjects will be evaluated with CCQ (clinical COPD questionnaire).6 min walk test and BODE index will be assessed. After measuring the baseline value of the above parameters subjects will be divided into two groups randomly (group A & B).All the subjects of the both groups will receive standard inhalational therapy as per the GOLD guidelines. Group B subjects will additionally receive yoga therapy. Subjects will be followed up at monthly intervals for 6 months. Subject will report if exacerbations occurs which is define as per GOLD criteria. The number of exacerbations will be recorded. All subjects will be assessed at each visit with the CCQ (Clinical COPD questionnaire). Subjects will fill CCQ at weekly intervals for prompt identification of exacerbations and this will be reviewed at each visit.

Exit from The Study

- 1. Patients request
- 2. Non compliance with study protocol.

Ethical clearance and informed consent

The study protocol was passed by TNPESU Institutional Ethical Committee. All procedures were performed according to the Declaration of Helsinki research ethics. Each participant received detailed information about the study and provided written informed consent before the trial commenced.

Experimental Design

The experimental design used for this study was pre and post test random group design involving sixty subjects, who were divided at random into two groups of thirty each. This study consisted of two experimental groups. Group I underwent medicinal management and Group II underwent yogic practice. All the subjects were tested prior to and after the yoga training on selected variables.

Assessments

- Six minute walk distance (6MWD),
- PFT
- COPD questionnaire
- And CRP were measured in both groups pre-and post-intervention.
- 1.Six minute walk test

This was performed according to the American Thoracic Society guidelines . As an objective measurement of true functional capacity, the 6MWT is usually better than self-reports or questionnaires to overcome over- or under-estimation. For patients with COPD it is a good indicator of exercise capacity and also reflects an individual's sub maximal level of functional capacity to perform activities of daily living. Participants were asked to walk back and forth at their own pace in a flat, straight, hard surfaced 35 m corridor, and to try and cover as much distance as possible in the time allotted. Rest stops were permitted during the test, but they were instructed to resume walking as soon as possible. Standardized phrases were used at each minute (e.g., "You are doing fine. Five minutes to go," "Keep up the rhythm. Four minutes to go," "You are doing fine. You are halfway to the end," "Keep up the rhythm. Only 2 min to go," "You are doing fine. Only 1 min to go"). Total distance covered was recorded.



2. PFT

A person blowing into a spirometer. Smaller handheld devices are available for office use. 8. The diagnosis of COPD should be considered in anyone over the age of 35 to 40 who has shortness of breath, a chronic cough, sputum production, or frequent winter colds and a history of exposure to risk factors for the disease. Spirometry is then used to confirm the diagnosis. Screening those without symptoms is not recommended. 9. Spirometry 10. Spirometry measures the amount of airflow obstruction present and is generally carried out after the use of a bronchodilator, a medication to open up the airways. Two main components are measured to make the diagnosis: the forced expiratory volume in one second (FEV1), which is the greatest volume of air that can be breathed out in the first second of a breath, and the forced vital capacity (FVC), which is the greatest

volume of air that can be breathed out in a single large



breath. Normally, 75–80% of the FVC comes out in the first second and a FEV1/FVC ratio of less than 70% in someone with symptoms of COPD defines a person as having the

disease. Based on these measurements, spirometry would lead to over-diagnosis of COPD in the elderly. The National Institute for Health and Care Excellence criteria additionally require a FEV1 of less than 80% of predicted. Evidence for using spirometry among those without symptoms in an effort to diagnose the condition earlier is of uncertain effect and is therefore currently not recommended. A peak expiratory flow (the maximum speed of expiration), commonly used in asthma, is not sufficient for the diagnosis of COPD.

3. COPD QUESTIONNAIRE

Patient number: _____
Date: _____

Clinical COPD questionnaire							
Please circle the number of the response that best describes how you have been feeling during the past week (Only one response for each question)							
On average, during the past week, how often did you feel:	never	hardly ever	a few times	several times	many times	a great many times	almost all the time
1. Short of breath at rest?	0	1	2	3	4	5	6
2. Short of breath doing physical activities?	0	1	2	3	4	5	6
3. Concerned about getting a cold or your breathing getting worse?	0	1	2	3	4	5	6
4. Depressed (down) because of your breathing problems?	0	1	2	3	4	5	6
In general, during the past week, how much of the time:	not limited at all	very slightly limited	slightly limited	moderately limited	very limited	extremely limited	totally limited or unable to do
5. Did you cough?	0	1	2	3	4	5	6
6. Did you produce phlegm?	0	1	2	3	4	5	6
7. Strenuous physical activities (such as climbing stairs, hurrying, doing sports)?	0	1	2	3	4	5	6
8. Moderate physical activities (such as walking, housework, carrying things)?	0	1	2	3	4	5	6
9. Daily activities at home (such as dressing, washing yourself)?	0	1	2	3	4	5	6
10. Social activities (such as talking, being with children, visiting friends/relatives)?	0	1	2	3	4	5	6

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Participants were asked to rate their degree of symptoms on a vertical modified COPD questionnaire scale labeled 0 to 10. The scores were noted before and after the intervention.

4. CRP C- Reactive protein

CRP is a invasive method affording a rapid measurement of Inflammation in COPD patients



Data Statement

Demographic and vital clinical data including personal, job, family, and stress history were obtained by semi structured interviews at the time of enrollment. Participants underwent physical examinations, anthropometric measurements, and assessment of lung function.

Discussion

The result of the study on COPD related variables, PFT and lipid profile reveals that the experimental group namely yogic practice groups (YPG) had significantly improved after the 12 weeks of training. Besides, the analysis of the data indicated that there was a significant difference between the PEG and YPG on all the selected dependent variables. More over YOGA training showed better results in the entire selected dependent variables than the medicinal group. The present study indicates that 12 weeks of yogic practice improve the respiratory fitness level among the COPD patients.

Statistical Analysis

Statistical analysis was performed using SPSS 18 (IBM Corporation, USA). After ascertaining normality of data, paired t-tests were used to determine the significance of variable differences before and after the intervention. Means of the both groups were compared for all variables using Student's t-test. The level of statistical significance was set at P <0.05 for all tests.

Clinical outcomes of participants before intervention (baseline), at end of therapy.

variable ss	Medicinal group	Yoga group	Betwe en groups	
Fev1	0.024+_0.013	0.078+_0.444	-6	<0.00001
CRP	-1	3.166+-0.77	14	<0.00001
6MWT	9.06+6.99	45.53	-6	<0.00001
COPD	-2.56+-0.91	8.13+-3.70	-7.85592	<0.00001

***P<0.00001 There result is significant as p<.05.

For the majority of patients, the intensity of dyspnea decreased after the yoga intervention;they were also able

to walk further in the stipulated 6 min time. Similar improvements were also observed between pre- and post-intervention testing in their physiological responses(PFRandCRP).

Results demographic data Of the 60COPD patients whowere recruited,(30ineachgroup) completed all assessments. The result of the study on COPD related variables, PFT reveals that the experimental group namely yogic practice groups (YPG) had significantly improved after the 12 weeks of training. Besides, the analysis of the data indicated that there was a significant difference between the PEG and YPG on all the selected dependent variables. More over YOGA training showed better results in the entire selected dependent variables than the medicinal group. The present study indicates that 12 weeks of yogic practice improve the respiratory fitness level among the COPD patients. The above findings very well be supported by observations made by the following studies conducted.

Results

USED ASSUMPTION-the base population of both medicinal management group and yoga population is same.

1. P value <0.05 for all therefore its statistically significant.
2. We reject the null hypothesis that mean value of yoga and other is same. In fact yoga mean is higher than others.

Conclusion

In the present investigation, as a result of Yoga training programmes the following improvements occurred on COPD related variables, PFT, and COPD questionnaires of COPD patients.

1. It was concluded from the results of the study that the yoga practices groups showed significant improvement in CRP,PFT,Six minute walk test and COPD questionnaires when compared with a medicinal group as well as pre test.
2. Regular practice of yoga- significantly reduced the level of CRP and prevents acute exacerbations.
3. 12 weeks of yoga practices significantly reduced the high CRP level.
4. Systematic and well planned yoga practice programs significantly improves PFT values in COPD patients.
5. Due to the influence of yoga practices significantly increased the level of distance covered in six minute walk test when compared with a medicinal group as well as pre test.
6. The yoga training has differed significantly in all the dependent variables when compared to the medicinal group.
7. YOGA training is a suitable training system to improve the COPD related fitness parameters, PFT and improve the CPR level in blood among the COPD patients.

The study's promising results, reducing dyspnoea and fatigue, and improving functional exercise capacity in COPD patients, indicate the value of using yoga in programs of pulmonary rehabilitation as an adjunct to

conventional care. More rigorously designed, larger scale research with longer follow-up should be conducted, particularly as that would also expand yoga's evidence base.

Conflict Of Interest

No conflict of interest

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Article Summary

The current limited evidence suggested that yoga training has a positive effect on improving lung function and exercise capacity and could be used as an adjunct pulmonary rehabilitation program in COPD patients. However, further studies are needed to substantiate our preliminary findings and to investigate the long-term effects of yoga training.

Strength

The findings of this study will be of significant in the following ways:

1. The findings of the study may add to the existing source of knowledge with regard to the training among COPD patients.
2. This study may help to know the increase/decrease the high sensitivity C reactive protein (hs CRP) protein levels among COPD patients due to the effect of yogic training methods.
3. The findings of this study may also help the doctors/coaches to identify the appropriate yogic methods to improve the PFR level in COPD patients.
4. The findings of the study will add to the quantum of knowledge in the level of improvement on selected criterion variables among the COPD patients.
5. The findings of the study may help the individuals to compare and contrast the changes that occur in respiratory variables before and after the yogic practices.
6. The study promotes research and growth in applying yoga in the field of Respiratory medicine.

Limitations

The following factors are the limitations of the study since the researcher could not have control over them.

1. No effort was put in order to find out the effect of environmental changes during pre and post tests and the training period. However, dry weather prevailed mostly.
2. Though the subjects were motivated verbally, no attempt was made to differentiate their motivation level during the testing and training period.
3. Since some of the subjects were non-IPD, the investigator did not take any effort to control and assess the quality and quantity of food taken by everyone. But a light diet was advised. Avoid aggravated foods, cold food, banana.
4. The quantum of physical exertion, lifestyle and physiological stress and other factors that affect the Respiratory functions were also considered as limitations.
5. Previous physical training in sports and yoga were not taken into consideration.

Figures

JalnetiKapalbhati



Nadi Shodhan pranayama



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