

# EXPLORING THE POTENTIAL ROLE OF PRANAYAMA IN RESPIRATORY SYSTEM DISEASES

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**Abstract-** In the world, respiratory diseases are the most common cause of disability and death. Long-term exposure to contaminants, irritants, foreign particles, and smoking are the most common causes of infection. Some may experience difficulty in breathing due to inflammation of air-passage and other may experience tissue damage to respiratory failure. Asthma, chronic obstructive pulmonary disease (COPD), pneumonia, tuberculosis, pulmonary edema, pulmonary embolism and lung cancer are among these respiratory diseases. Pranayamas (Breathing- exercises) play an important role in strengthening the corresponding muscles that are actively involved in respiration and also improves various pulmonary parameters. Pranayama is an important limb in the tradition of yoga. Pranayama, in the Ashtanga yoga of Maharishi Patanjali, comes after asana and takes the fourth position. Its main goal is to cleanse the nadis, which are the channels through which the different pranas or life forces move through our body. In Hatha yoga texts, there are various types of pranayamas and their benefits to respiratory health are unlimited. The most common forms of pranayama include Bhastrika, Bhramari, Ujjayi and Nadishodhan pranayama. Along with the physical benefits, pranayama practice connects the body, mind and soul and brings full awareness towards awakening the energy of consciousness.

**Material and Methods:** The data used in the current investigation was gathered through a variety of databases, including Google Scholar, PubMed/MEDLINE, Cochrane databases and Directory of open access journals. The search criteria include randomized clinical trials published in English from 2009 to 2023 that employ pranayama as an intervention for respiratory health related outcomes and/or demonstrated a significant impact on various respiratory diseases. A total of eight articles met the inclusion criteria were reviewed. The results of this study show that pranayama may boost respiratory health by removing various diseases of the respiratory system.

**Keywords:** Inflammation, COPD, Edema, Embolism, Pranayama,

## INTRODUCTION:

The respiratory system is a biological system made up of various organs and tissues, including air passages, pulmonary vessels, lungs and breathing muscles that work together for bringing air into the lungs (inhalation) and releasing waste gases like CO<sub>2</sub> to the atmosphere (exhalation).<sup>[1]</sup> Long-term exposure to pollutants and irritants in the environment, infection from foreign particles (Microflora), and sometimes physiological abnormalities make the respiratory tract susceptible to a wide range of disorders. The respiratory diseases cause an immense burden to global health industry ranging from Asthma, COPD, Tuberculosis, Pulmonary edema (abnormal buildup of fluid in the lungs), Pneumonia and Lung cancer. In contrast to only 18% of the world's population, India accounts for 32% of the worldwide burden of respiratory disorders, according to the Global Burden of Disease Study.<sup>[2]</sup> The hope for today and the promise for the future is to make pranayama practice a daily habit for the management and prevention of respiratory disorders. In several research studies, it is recommended that pranayama be practiced to enhance pulmonary functions in both healthy people and those who are afflicted with respiratory disorders, hence preventing respiratory ailments in the future. Traditional methods, such as Yoga, Ayurveda, Siddha and/or etc, of restoring and maintaining health claims to treat diseases for which modern allopathy does not offer a cure. With a growing body of research towards popularizing yoga as a holistic approach to health developed several thousand years ago. Yoga therapy is a natural way of treating various health issues and can also work as an adjunct to Ayurveda to restore health and wellbeing. In a Hatha yoga tradition like Ayurveda the treatment of any disease starts with internal purification which includes six cleansing processes as mentioned in Gheranda samhita followed by Asana, Pranayama, Mudra, Bandhas and Meditation.<sup>[3]</sup> Practicing yoga has been shown to increase vitality by removing the signs of illness. Yoga also encourages a sattvic diet and certain restrictions on eating.<sup>[3, 4, 5]</sup> The single most important technique to treat various respiratory diseases is a breath control mentioned in many yoga texts under the name of pranayama. Researchers describe the importance of pranayama to improve pulmonary functions in order to prevent respiratory diseases.<sup>[6, 7, 8, 9, 10, 11, 12, 13]</sup> In Hatha yoga texts pranayama is considered one of the major limbs of yoga. Thus, in order to reach a higher state of consciousness, they explained a variety of pranayamas. Ultimately pranayama with its key role in managing and preventing respiratory diseases by improving pulmonary parameters as evidenced by several scientific studies is best suited for intervention when a modern approach is not feasible. Hence in the present study various types of pranayama practices are taken to improve multiple aspects of physical health especially to improve quality of breath.

## DISEASES OF THE RESPIRATORY SYSTEM

The term respiratory diseases are a variety of pathogenic conditions that affect millions each year around the world. Types of respiratory diseases range from mild and self limiting like cold and flu to life threatening like Asthma, COPD, Tuberculosis, Pneumonia, Lung cancer and many more. Some of the most common are given below;

**Asthma:** Asthma affected an estimated 262 million people in 2019 and caused 455000 deaths worldwide. <sup>[14]</sup> According to the Global Burden of Disease (GBD) study; India has more than 30 million asthmatics, accounting for 13.09% of the global burden.

<sup>[15]</sup> Asthma is a chronic inflammatory disease of the respiratory system that affects people of all ages. The passageways of the respiratory system known as bronchial tubes are designed to allow air to enter and exit the lungs. When these passageways become narrowed and inflamed by an allergen or by certain factors like stress, extreme weather, or certain medications, it can lead to asthma.

<sup>[16]</sup> For those who have allergies, asthma is a frequent trouble characterized by bronchiolar spastic contraction, making breathing difficult. <sup>[17]</sup> In many cases, the immune system and respiratory illnesses like asthma are connected. The immune system's mast cells protect against various foreign invaders like germs and dangerous parasites. Although they are very useful, they can also cause anaphylaxis and allergic reactions. Mast cells are specialized cells responsible for allergic reactions by releasing certain “mediators” like histamine, tryptase, prostaglandins and leukotrienes, which can cause a host of symptoms in the human body. <sup>[1, 17]</sup> Mast cells play a major role in the allergic lung inflammation that results from the release of many agents, which leads to asthma. <sup>[18]</sup> The immune response to mast cell activation in the respiratory tract causes airway constriction, more mucous production, and cough. <sup>[19]</sup>

**Signs and Symptoms:** Classical signs and symptoms of asthma are wheezing, shortness of breath, chest pain and respiratory disorders. <sup>[20]</sup> The most chronic disease is more likely to occur if other family members also have asthma particularly a close relative such as a parent or sibling. <sup>[21]</sup>

➤ **Chronic Obstructive Pulmonary Disease (COPD):** Chronic Obstructive Pulmonary Disease (COPD) is an umbrella term for a number of progressive lung conditions that cause breathing difficulties and includes; **(i)** Emphysema- damage to the air sacs in the lungs, and **(ii)** Chronic bronchitis- long term inflammation of the airways. <sup>[22]</sup> The World Health Organization predicts that by 2030, chronic obstructive pulmonary disease (COPD) will rank as the third leading cause of mortality globally. <sup>[23]</sup> The causes of COPD include long-term exposure to lung irritants like smoking and air pollution that harm the lungs and airways.

**Signs and Symptoms:** <sup>[24, 25]</sup> In the early stage COPD may cause no symptoms or only mild symptoms. On progression of the disease following symptoms may occur;

- Smoker's cough, a repeated cough that produces a lot of mucus
- Shortness of breath or breathlessness, especially when engaging in vigorous activity
- Breathing that makes a whistling or wheezing sound
- Chest constriction and a frequent cold or other respiratory infection.

**Pneumonia:** Pneumonia is any inflammatory lung disease in which some or all of the alveoli are filled with fluid and blood cells, mostly caused by pneumococci. <sup>[17]</sup> In 2019, 740180 children died from pneumonia, which is 14% of all pediatric mortality. <sup>[26]</sup>

**Signs and Symptoms:** <sup>[27]</sup> The following signs and symptoms may occur;

- Coughing, which can result in mucus that is green, yellow, or even bloody colour
- Fever, perspiration, and shivering
- Shortness of breath and/or Breathlessness
- Sharp or stabbing pain in the chest
- Loss of appetite, lack of energy, and exhaustion
- Vomiting and nausea, especially in young children
- Confusion, especially in the elderly

**Tuberculosis (TB):** Mycobacterium tuberculosis, which most frequently affects the lungs, is the cause of TB, which is transmitted from person to person through the air. <sup>[28]</sup> When tuberculosis is advanced, the amount of functional lung tissue overall decreases and there are several sites of fibrosis throughout the lungs. <sup>[17]</sup> WHO estimates that 1.6 million people worldwide died from TB in 2021, including 187000 HIV-positive individuals. After COVID-19, TB is the second most common infectious killer and the 13<sup>th</sup> most common cause of death.

**Signs and Symptoms:** <sup>[29]</sup> TB bacteria usually grow in the lungs and may cause symptoms such as;

- A severe cough that lasts for three weeks or more
- Pain in the chest
- Coughing up blood or sputum
- Weakness or fatigue
- Weight loss
- Chills
- Fever
- Sweating

**Lung Cancer:** Cancer is a disorder in which the body's cells proliferate out of control. Lung cancer is a term used to describe cancer that first appears in the lungs. <sup>[30]</sup>

**Causes:** <sup>[31]</sup> Smoking is the leading cause of lung cancer deaths and many others are caused by exposure to passive smoking. Lung cancer risk is greater when asbestos, radon, and arsenic are consumed through drinking water.

There is evidence that, the use of kerosene or solid fuels like wood, charcoal or coal for domestic energy needs results in air pollution that contains carcinogens, which, according to the WHO, is responsible for about 11% of lung cancer deaths in adults. [32] In other situations, certain changes to the DNA of lung cells may cause abnormal cell proliferation and, occasionally, cancer. [33] Typically, lung cancer is caused by alterations that activate oncogenes or turn off tumor-suppressing genes. [34]

**Signs and Symptoms:** [35] Symptoms of the lung cancer develop as the condition progresses. The main symptoms include;

- A persistent cough lasting more than two or three weeks
- Chest infections that recur frequently
- Bloody sputum while coughing
- Persistent shortness of breath
- Appetite loss or unexplained weight loss
- Persistent fatigue or lack of energy

## PRANAYAMA PRACTICES AND THEIR TYPES

Pranayama is a Sanskrit word to describe a practice related to the control and regulation of breath. Chapter 2 verse 49 of Patanjali yoga sutra states that; Pranayama, according to Maharishi Patanjali, is the gradual cessation of breathing or the cessation of inhalation and exhalation. [36] Some popular types of pranayamas related to respiratory health are described below;

1. **Nadishodhan pranayama:** Sit in any comfortable meditation asana. Close the right nostril with the thumb and inhale through the left nostril. Perform kumbhaka by keeping the air in the lungs while using the ring finger to close the left nostril. Exhale through the right nostril while removing the right thumb from the right nostril. Next inhale through the right nostril and then retain the air by the same manner and then exhale through the left nostril. This is one round and the ratio of inhalation-retention and exhalation should be 1:4:2.
2. **Bhastrika pranayama:** Sit in any comfortable asana. Breathe in deeply and exhale quickly through the nose in the same motion. This is one round and repeat the process.
3. **Bhramari pranayama:** Sit in a comfortable meditative asana. Close the eyes and relax the whole body. Bring the hands to the ears while raising the arms sideways and simultaneously bend the elbows. Use thumb to plug the ears. Breathe in through the nose. Make a deep, steady humming sound while slowly and deliberately exhaling. At the end of exhalation, breathe in deeply and repeat the process.
4. **Ujjayi pranayama:** Sit in any comfortable meditative asana. Close the eyes and relax the whole body. Bring the attention to the breath and gently contract the glottis. Allow the air to pass through the constricted throat by making a snoring sound. Exhale and relax. Both the inhalation and exhalation should be long, deep and controlled.

## ROLE OF PRANAYAMA IN RESPIRATORY ILLNESS

Pranayama practices involve various breathing techniques which offer positive effects on whole respiratory system and also strengthen various corresponding muscles. Through the process of deep, quick, or slow breathing, pranayama trains the muscles of respiration and the lungs and increases lung elasticity, resulting in a healthy respiratory process. [37] According to a 2006 study by the Yoga Research Foundation (YRF) on the effects of ujjayi pranayama, the pranayama creates positive airway pressure because it prevents the closure of smaller bronchi near the end of exhalation and improves oxygenation. This helps asthmatics better empty their lungs and prevents air from becoming trapped, which makes the next inhalation more effective. [37] Phlegm in the throat is removed by ujjayi pranayama, which also cures asthma and several pulmonary illnesses. [38] For people with asthma and other lung diseases, bhastrika is an excellent practice because it reduces throat inflammation and any phlegm buildup. [39] Through the practice of pranayama, the apices of the lungs receive the proper oxygenation, making them unfavourable breeding grounds for tubercle bacilli. [39] Several studies have shown that asthma prevalence was highest among adults with obesity for all races [40, 41, 42] and pranayamas have reducing effect on obesity as evidenced by Nirmala N. Nayak et al, 2004 [43], Swami Ramdev, 2005 [44] and Dinkar R. Kekan, 2013 [45].

Chronic inflammation of the lung contributes to its damage and development of COPD. Patients of COPD share a key risk factor for lung cancer particularly for squamous cell carcinoma [46] which may be associated with cigarette smoking. Because in the patients of COPD the adaptive immune response system is found to be impaired [47, 48] and such weakened immune system is associated with recurrent respiratory infections, therefore, specific pranayamas are required to strengthen the immune system. The anti-inflammatory and immune boosting effect of various pranayamas are evidenced by Pullen et al, 2008 [49], Rao et al, 2008 [50] and Agnihotri et al, 2014 [51]. Patients with COPD and Asthma exhibit respiratory muscle weakness. In order to strengthen the capacity of the thoracic compartment and to improve the performance of the inspiratory and expiratory muscles, respiratory muscle training involves both inspiratory and expiratory muscle training in the form of pranayama. [52]. The respiratory muscles become stronger during pranayama because the corresponding muscles work to their fullest capacity. [53] Hence it can be concluded that pranayamas improve various lung volumes, lung capacities and pressures in young adult [54] as well as in patients of various respiratory illnesses.

## SUMMARY OF SCIENTIFIC EVIDENCES

Arulmozhi S, et al [55] carried out a 12-week study on 100 asthmatics to assess the patients' maximum expiratory pressure (MEP) and maximum inspiratory pressure (MIP) before and after practicing Nadishodhan pranayama. The results demonstrated a statistically significant improvement in MIP and MEP in asthma patients following pranayama, along with evidence of an improvement in respiratory muscle strength. In order to investigate the effects of particular pranayamas such as ujjayi, nadishodhan, and bhastrika, Parmar J. et al. [56] studied thirty asthmatic patients. After pranayama, patients with bronchial asthma show a considerable improvement in FEV1, PEF, and quality of life. The results of a 12-week trial by Saxena T, et al [57] after performing deep breathing, bhramari and nadishodhan pranayama on 50 patients with bronchial asthma showed significant improvements in

symptoms, FEV1, and PEFr along with increased lung function. 40 healthy male volunteers between 60 to 70 years participated in a study conducted by Bamne SN. <sup>[58]</sup> Before beginning Bhastrika pranayama and six weeks later, the PFT (Pulmonary Function Test) was compared. Regular practice of Bhastrika pranayama may have an ability to strengthen the respiratory musculature, which enhances lung functioning. A study on 50 people with moderate to severe COPD was conducted by Gupta A, et al. <sup>[59]</sup> 25 people, who were in the intervention arm (IA) were given training in pranayama such as suryabhedana, nadishuddhi and bhrumari for a total of 30 minutes and three months. According to the results of the current study, pranayama is effective for people with mild to moderate COPD. A study by Sivapriya DV, et al <sup>[60]</sup> included 40 healthy adult males between the age of 18 and 23 to evaluate 40 mmHg endurance, peak expiratory flow rate (PEFR), and breath holding duration (BHT). Bhastrika pranayama was practiced by participants for three hours after lunch, five days a week for 45 days. All of the aforementioned metrics were reevaluated after 45 days of consistent practice and found a considerable increase in PEFR, BHT, and the 40 mm Hg endurance test. 50 study participants were enlisted by Jain MK, et al. <sup>[61]</sup> who had bronchial asthma symptoms for more than six months. Anulom-vilom pranayama was practiced for four weeks. Anulom-vilom pranayama was considered as a highly effective treatment for reducing the severity of dyspnea and was recommended for the prevention of acute severe asthma. 41 male adults with COPD participated in a study by Kapre VM, et al. <sup>[62]</sup> Participants in Group B were instructed to practice alternate nostril breathing (nadi-shodhan pranayama) for 10 minutes twice daily for two consecutive weeks. It is evident that alternating nostril breathing helps COPD patients with autonomic dysfunction. Additionally, respiratory function has improved. In summary, pranayama is a very powerful tool for enhancing respiratory function and strengthening respiratory muscles. Pranayama therefore corrects a variety of respiratory system abnormalities.

### CONCLUSION:

The present study concludes that the effect of various pranayamas for improving respiratory health can be applied in clinical practices. Pranayama eliminates toxins and enhances the elasticity and endurance of respiratory muscles by increasing blood flow and oxygen supply to the vital organs. One can experience breathlessness, asthma and other respiratory diseases if too much vata accumulates in the lungs. Along with Ayurveda, pranayama can be applied to ensure health and wellbeing. It is clear from the above discussion that pranayama can improve quality of life in patients living with various respiratory diseases. Available evidences on pranayama demonstrate numerous health benefits. Hence pranayama can be used as complementary and alternative therapy as a standard treatment or as an adjuvant therapy with Ayurveda.

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