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Dr. Shri Krishna Patel
Professor, Department of
Education Training, D.A.V.
Training College, Kanpur,
Uttar Pradesh, India

Sanjay Srivastava
Assistant Professor, Department
of Education Training, D.A.V.
Training College, Kanpur,
Uttar Pradesh, India

Improving lung health in Kanpur's polluted environment: The role of yoga poses and pranayama

Dr. Shri Krishna Patel and Sanjay Srivastava

Abstract

This paper discusses the impact of air pollution on human health and proposes using yogic asanas and pranayama as practical strategies for addressing this issue. The cities of Kanpur and Lucknow in Uttar Pradesh, India, have been ranked 8th and 9th, respectively, on the list of the world's most polluted cities based on the air quality index. The study by IQ Air evaluated 80,000 data points to determine this ranking. The paper highlights the importance of breathing for survival and the benefits of meditation in purging the mind and promoting well-being. It also emphasizes the effectiveness of yoga in treating respiratory conditions and enhancing the immune system. The paper focuses on exploring strategies to address air pollution through the practice of yogic asanas and pranayama.

Keywords: Air pollution, yoga poses, pranayama

Introduction

Earth, the planet's sole known habitat for life, is facing significant pollution, causing deep concern among environmentalists and those prioritizing human safety^[1]. Air pollution substantially influences all human communities, whether rural or urban, industrial or technologically sophisticated. Elevated gas concentrations in the atmosphere, excluding oxygen, result in atmospheric pollution, which subsequently leads to various respiratory ailments^[2, 3].

Breathing is essential for survival; however, engaging in natural respiration promotes well-being and contentment. Meditation purges the mind, soothes emotions, and unleashes the refreshing surge of energy inside us. Yoga is an effective remedy for those suffering from severe respiratory conditions. When the mind is soothed, the excessive sensitivity that leads to bronchial asthma and nasal allergies diminishes. Pranayama, a vital component of Yoga, enhances the immune system, reducing the likelihood of persistent illnesses. Consistent practice also enhances respiration's mechanical efficacy and optimizes lung capacity^[4, 5, 6, 7].

In this paper, we will focus on the impact of air pollution on human health and explore practical strategies for addressing this issue through the practice of yogic asanas and pranayama. Kanpur, a densely populated industrial city in India, suffers from high levels of air pollution. This pollution contributes to respiratory problems like asthma, chronic obstructive pulmonary disease (COPD), and reduced lung function. Yoga, an ancient Indian practice, offers a promising approach to mitigating these issues. Yoga poses (asanas) and pranayama can improve lung capacity, strengthen respiratory muscles, and enhance overall respiratory health. While scientists and environmentalists actively fight environmental degradation, our specific study area will be limited to this aspect.

Trends in air pollution attributed disease burden in India

In a newly published research, Kumar and colleagues examined the current situation and changes in air pollution related to the burden of disease (APADB) about economic development and its direct and indirect indicators for each state in India^[8].

Kumar and his colleagues observed a detrimental correlation between the expansion of vehicles and industries and the occurrence of APADB. It is well recognized that emissions from vehicles and industries are significant contributors to air pollution and, hence, should ideally have a positive correlation with APADB.

Corresponding Author:
Dr. Shri Krishna Patel
Professor, Department of
Education Training, D.A.V.
Training College, Kanpur,
Uttar Pradesh, India

The authors' suggestion of implementing stringent measures to regulate motor engine emissions (resulting in reduced CO₂) and ensuring companies comply with rules to minimize their detrimental impact on APADB seems doubtful. The authors provide a supporting reference from the United Kingdom that advocates for stringent enforcement of motor engine regulations. However, it is essential to note that this reference may not be directly relevant to the Indian context [9].

Furthermore, the compliance of small-scale enterprises with emission laws is still being determined owing to the absence of relevant data in the literature. From 1990 to 2020, air quality data revealed a significant increase in CO₂ emissions in India, rising from 578.5 to 2441.8 million tonnes. This contradicts the authors' argument for a negative correlation [10].

Because of the plasticity of human physiology, the gradual adaptation to changing environments (air pollution) at the molecular level should be considered for the negative association with the APADB. We agree that a drop in APADB would lead to progress in economic development, and the growing market for electrical vehicles would make a significant difference in the future [11].

Cities in India are facing significant pollution challenges

India has an astonishing number of more than 35 cities in the top 50 most polluted cities in the world, with 14 of those towns located in the state of Uttar Pradesh (UP), including its capital, Lucknow (IQ Air, World Air Quality Report 2021). Uttar Pradesh has the unfortunate distinction of having the highest recorded mortality rate among all Indian states. UP reported a total of 0.35 million fatalities in 2019 that were attributed to air pollution. Among these deaths, 0.22 million were caused by ambient air pollution (AAP) and 0.11 million were linked to household air pollution [12].

IQ Air has reported concerning findings for Kanpur and Lucknow in Uttar Pradesh. Based on the air quality index, Kanpur and Lucknow have been placed 8th and 9th, respectively, on the list of the world's most populous cities. IQ Air determined this ranking after evaluating a wide variety of characteristics comprising 80,000 data points [13]. According to several studies [14-19], the primary contributors to air pollution in Uttar Pradesh include cooking in households, industrial operations, the burning of trash and biomass, and traffic congestion during rush hour.

Air pollution's effects on human health

In recent decades, air quality has significantly declined in several Indian cities, including Kolkata and Delhi. The air pollution in these cities has exceeded the guidelines set by the Central Pollution Control Board (CPCB) and the World Health Organisation (WHO). The gaseous pollutants in Indian cities have high daily and yearly average levels [21]. Existing research indicates that the significant amount of air pollution in the Indo-Gangetic plain, as supported by references [22, 23, 24], has been recognized as a substantial factor contributing to the burden of air pollution-related disorders in India.

Air pollution is associated with varying durations of effects on human health, including short-term, medium-term, or long-term damage [25]. Multiple research investigations have been carried out to investigate the immediate health impacts of air pollution exposure. The immediate effects of air pollution include eye, throat, and nasal irritation, as well as respiratory infections like pneumonia and bronchitis. On the other hand, long-term exposure to air pollution can lead to chronic respiratory diseases, cardiovascular issues, lung cancer, and

even damage to the brain, liver, kidneys, or nerves [26]. Multiple epidemiological studies have consistently shown that the low quality of air substantially threatens human health. This includes adverse effects such as reduced lung function, respiratory symptoms, and increased incidence of asthma, allergies, and cardio-respiratory illnesses. These risks are particularly pronounced in areas with higher concentrations of air pollutants. The findings of these studies are supported by research conducted by various experts [20, 27-34].

Yoga, Science of health, healing, happiness, and harmony

All the orthodox systems of Indian Philosophy have one goal in view, the liberation of the soul through perfection. The method is by Yoga.

- Swami Vivekananda [35]

Yoga has a long history in India, spanning thousands of years [36]. The term yoga originates from the Sanskrit term 'Yuj,' which means the act of joining. Yoga primarily involves Asana, which refers to specific body postures promoting physical and mental stability. Pranayama techniques enable precise control over breathing, resulting in optimal benefits. Additionally, meditation has been found to induce consistent physiological changes [37].

Yoga poses for lung health amid pollution

Air pollution has the potential to damage our lungs through inflammation, diminished lung function, and heightened susceptibility to respiratory ailments. The importance of specific yoga poses designed to improve lung capacity and strengthen respiratory muscles cannot be emphasized enough [38, 39, 40].

Breathing exercises, yoga, and pranayama alter the breathing pattern to decrease hyperventilation, which normalizes carbon dioxide levels in the blood. Yoga is a practice that involves synchronized breathing and gentle physical exercise with little strain on the body. Yoga programs enhance physical fitness and overall well-being while mitigating bronchospasm, a condition that leads to difficulty breathing [41].

1. Ustrasana (camel pose)

Ustrasana, often known as the camel posture, is advantageous for improving respiratory well-being. This activity entails a profound arching of the spine, which results in the extension and elongation of the chest and neck muscles. This pose facilitates the expansion of the respiratory organs and enhances pulmonary capacity. Ustrasana also improves posture and alleviates neck and shoulder stress. Consistent practice of Ustrasana may help to enlarge the chest and improve the intake of oxygen, making it a beneficial inclusion in your yoga regimen to counteract the impact of pollution on the respiratory system [40, 42].

Energy expenditure during Ustrasana was studied by Dipak Kr Halder. He studied the metabolic alterations of camel stance with supine posture (laying on the back facing the ceiling). Halder found that ustrasana increased oxygen consumption by 86.6 %, from 14.18% to 293%. Carbon dioxide emission rose. This suggests that camel position or ustrasana may expand the lungs by increasing oxygen intake. Expanded lungs increase oxygen volume. This increases bodily oxygen flow. Oxygen flow increases respiratory rate and reduces breathing strain [43].

2. Bhujangasana (cobra pose)

The yoga asana, known as Bhujangasana, is based on the

natural position of a serpent with its head held high. This position is excellent for protecting your respiratory system from pollutants. It improves breathing by stretching the chest and opening the lungs. Consistent practice can reduce muscular tension in the respiratory system and increase lung capacity [44, 45, 46].

3. Sirsasana (headstand)

Sirsasana, often known as the headstand, is a challenging yoga posture that provides numerous health advantages. By inverting the body's gravitational force, it enhances the flow of blood and oxygen to the brain and lungs, hence improving circulation. This pose may aid in eliminating toxins from the body and enhancing the functionality of the respiratory system. Nevertheless, it is essential to engage in headstands under a proficient yoga teacher's supervision to prevent any potential harm. Sirsasana, also known as a headstand, may enhance blood circulation in the lower extremities, revitalizing the body. Additionally, it enhances cardiovascular function by improving blood circulation to the brain and heart. Performing a headstand may enhance blood circulation to the face, arms, and shoulders and increase the oxygen supply to the brain [47-50].

4. ArdhaMatsyendrasana (Sitting half spinal twist)

Ardha means half and matsya means fish. The sitting half spinal twist opens the chest and improves the supply of oxygen to the lungs. Studies have reported that exercise may improve breathing and quality of life along with medicines. Ardha matsyendrasana is one of the asanas that may stretch your chest and open up the airways. More oxygen may enter the lungs and improve the lung's oxygen capacity. Therefore, doing ardha matsyendrasana might be helpful for asthma; however, more research is needed to confirm this claim [51].

5. SetuBandhasana (Bridge pose)

This asana stretches and tones the neck, spine, and chest. The lungs are opened up, and thyroid problems are reduced. The opening of the chest entails an increase in the lung capacity. It may open up the chest which might further help in increasing the lung capacity. This might help people with asthma as it may relieve the symptoms of asthma. In addition, it might also help relieve sinusitis by allowing blood to flow to the head [52].

6. AdhoMukhaSvanasana (Downward-facing dog pose)

This yoga for asthma helps in calming the mind, relieves stress and is good for people suffering from asthma and sinusitis. It lengthens the spine, strengthens the muscles of the chest increasing lung capacity. It also increases circulation to the brain [53].

7. Purrvottanasana (Upward plank pose)

The Upward plank pose improves the respiratory system, stimulates the thyroid gland and also strengthens wrists, arms, back and spine [54].

Pranayama techniques for lung health in the midst of air pollution

Pranayama is an ancient practice that involves controlling one's breath, a fundamental aspect of yoga. Below are a few pranayama practices that may effectively aid in combating pollution: These activities, such as Kapalabhati, Anulom Vilom, and Bhastrika have enhanced respiratory function.

1. Kapalabhati

This breathing method involves vigorous expulsions of air via the nostrils while maintaining passive inhalations. Kapalabhati aids in purifying the respiratory airways and augmentation of pulmonary capacity. Consistent practice may help eliminate toxins from the body and enhance oxygen uptake. Rapid Kapalabhati Pranayama is recognized for its ability to preserve the acid-base equilibrium. Taking a deep breath activates the inactive areas of the lungs, leading to improved oxygenation of tissues and overall body cleansing. The user's text is "[55]". Kapalabhati involves forceful breathing in a shorter duration, significantly influencing the belly and its contents, particularly the glands—the resulting augmentation in blood circulation and rectification of glandular secretions aid in treating diseases. The benefits of Kapalabhati are many, with notable effects including the harmonization of vata (air), pitta (fire), and kapha (earth), psychological equilibrium, activation of the "Kundalini" energy, and enhancement of focus. The user's text is "[56]".

2. Anulom Vilom

Anulom Vilom, sometimes called alternating nostril breathing, is a pranayama method that promotes relaxation. It facilitates energy equilibrium, mitigates stress, and improves lung efficacy. By consistently using this method, you may enhance the functionality of your respiratory system and develop immunity against illnesses caused by pollution. In a study conducted by, it is evident that consistent pranayama practice over the course of 12 weeks improves FVC, FEV1, and PEFr in healthy persons. Also, it can be concluded that Bhastrika (Bellowsbreath) is comparatively more effective than Suryabhedan (Right nostrilbreathing) and Anulom - Vilom(Alternate nostril breathing) in improving pulmonary functions. This study supports the therapeutic benefits of pranayama and aligns with prior reports. The practice of pranayama can be a crucial component for a healthy lifestyle. Due to its accessibility, affordability, longevity, and safety, this ancient system of treatment is growing in popularity as a clinical discipline. It can be recommended as a supplement to or a substitute for conventional therapies for respiratory diseases [57].

3. Bhastrika

Pranayama is a vital aspect of yoga that has been shown to have several beneficial effects on human physiology. Bhastrika Pranayama is a well-known breathing method in yoga and is categorized as one of the Pranayamas. It is said to affect pulmonary, cardiac, and psychological functions positively. Bhastrika is a vigorous and potent breathing method characterized by vigorous inhalations and exhalations. It enhances the flow of oxygen throughout the body and facilitates the excretion of carbon dioxide. It is a very efficient method for opening the respiratory passages and improving pulmonary function. The findings of ten high-quality trials were discussed in the study conducted by Chetry *et al.*, revealing that Bhastrika Pranayama has a significant positive impact on pulmonary, cardiovascular, and psychological variables [58].

Conclusion

Perfection in life is the pinnacle of Yoga's aspirations. Incorporating Yoga into our lives helps us become more self-aware by bringing us into the present moment, where we may learn about our strengths and the opportunities inside us. One of the most significant ways to deal with respiratory illnesses

brought on by air pollution or other naturally occurring respiratory diseases is to practice pranayama, a kind of Yoga. To get the most out of these exercises, do them first thing in the morning every day. When combined with asanas and meditation, pranayama prepares the mind and body to deal with life's challenges.

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