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IMPACT OF *YOGA* ON RESPIRATORY SYSTEM

Susmitha P M[1], **Sowmya M N**[2]

[1]Final Year P.G Scholar, Department of PG Studies in Swasthavritta, JSS Ayurveda Medical College and Hospital, Mysuru, Karnataka, India
[2]Associate Professor, Department of PG Studies in Swasthavritta, JSS Ayurveda Medical College and Hospital, Mysuru, Karnataka, India

Corresponding Author: susmithapm31@gmail.com

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ABSTRACT

The Respiratory system is the gateway to purify the body, mind and intellect. The Respiratory tract is the anatomical structure through which air moves in and out. It includes the nose, pharynx, larynx, trachea, bronchi and lungs. The respiratory unit includes respiratory bronchioles, alveolar ducts, alveolar sacs, antrum and alveoli. *Yoga* means restraint of mental modifications or suppression of the fluctuations of consciousness. To purify the Respiratory tract, one must undergo *Shatkarmas* (Six Purificatory measures) like *Dhauti* (Purification), *Jala Neti* (Water cleansing) *and Kapalabhati Kriya.* Regular Practice of *Yoga Asanas* (Physical postures) like *ArdhaChakrasana, Ardhakati Chakrasana, Makarasana, Shavasana* etc, *Pranayamas* (breathing exercises) like *Suryabhedhana, Ujjayi, Shitali, Shitkari, Bhastrika, Bhramari*, Sectional breathing, *Bandhas* like *Uddiyana Bandha, Jalandhara Bandhas* and *Dhyana* (Meditation) can increase the vital capacity significantly from 3399 ml to 3443 ml. Regular practice of *Shodhana Kriya, Asanas, Pranayama, Bandhas* and *Dhyana* is found to improve lung volumes and capacities thereby helping in the prevention and management of different respiratory diseases. Regular efficient usage of muscles of respiration by *Yoga* practices causes their bulk to increase, elastic and collagen fibres will get strengthened and extensibility will increase thereby allowing efficient contraction results in improving the inspiratory and expiratory power. Practicing *Yoga* and especially *Pranayama* and *Dhyana* will slow down the respiratory rate. This

deeper and slower breathing activates the parasympathetic nervous system by reducing stress and rejuvenating the body. As a result, one feels calmer and more centred and sleep better.

Keywords: *Yoga, Pranayama,* Respiratory System

INTRODUCTION

The impact of *Yoga* on the human body is expansive and eternal. The muscles, bones, nervous system, respiratory, circulatory and digestive systems of the human body are greatly benefited from the regular practice of *Yoga*.[1] The respiratory system is the gateway to purify the body, mind and intellect, the key to this is *Pranayama*.[2] Breathing is the autonomic function that can be consciously controlled, and it is the key to bringing the sympathetic and parasympathetic nervous system in harmony. Rate & rhythm of respiration, lung volumes and capacities, breath-holding time etc. will get significantly and positively influenced by the practice of *Pranayama*.[3]

The Lung is the internal organ most vulnerable to infection and injury from the external environment because of its constant exposure to particles, chemicals and infectious organisms in ambient air. For decades, acute lower respiratory tract infections have been among the top three causes of death and disability among both children and adults.[4]

Yoga is a simple and non-pharmacological therapy that can be practised maintaining a healthy Respiratory System.

Yoga

Derived from the Sanskrit root "*yuj*". Meaning to bind, join, attach and direct and concentrate one's attention on, to use and apply. It was collated, coordinated and systematised by *Patanjali* in his classical work.

Restraint of mental modifications or suppression of the fluctuations of consciousness. A self-controlled man can attain divine communion if he tries hard and directs his energy by the right means. *Patanjali* enumerates these means as the eight limbs (*Ashtanga Yoga*) or stages of *Yoga* for the quest of the soul.[5] Among *Asthanga Yoga*, *Asanas* (*Yoga* postures/position), *Pranayama* (*Yoga* breathing) and *Dhyana- (*Meditation) is having more impact on Respiratory System.

Stable and comfortable posture is *Asana*.[6] Controlling the motion of the exhalation and inhalation is *Pranayama.*[7]Deep concentration in a particular thought or region like a heart the seat of *Chakras* in which, the mind is in state of complete concentration is called *Dhyana*.[8]

To purify the Respiratory tract, one must undergo *Shatkarmas* (Six Purificatory measures) like *Dhauti* (Purification), *Jala Neti* (Water cleansing), *Kapalabhati Kriya.* Regular Practice of *Yoga Asanas* (Physical postures) like *Ardhachakrasana, Ardhakati-Chakrasana, Matsyasana, Ardha Matsyendrasana, Ushtrasana, Supta Vajrasana, Bhujangasana, Shalabhasana, Dhanurasana, Sarvangasana, Makarasana and Shavasana* and *Pranayamas* (breathing exercises) like *Suryabhedhana, Ujjayi, Sitkari, Shetali, Bhastrika, Bhramari*, Sectional breathing, and *Bandhas* like *Uddiyana Bandha*, *Jalandhara Bandha* and *Dhyana* (Meditation) is having an impact on Respiratory System.

Respiratory System:

Functional Anatomy of Respiratory Tract-

The Respiratory tract is the anatomical structure through which air moves in and out. It includes the nose, pharynx, larynx, trachea, bronchi and lungs. There are two types of Respiration: External respiration involves the exchange of respiratory gases i.e oxygen and carbon dioxide between lungs and blood. Internal respiration, which involves the exchange of gases between blood and tissues. Respiration occurs in two phases. Inspiration during which air enters the lungs from the atmosphere. Expiration during which air leaves the lungs. During normal breathing, inspiration is an active process and expiration is a passive process.

Normal Respiratory Rate: Adult: 12- 16 /minute

Respiratory unit: The parenchyma of the lungs is formed by a respiratory unit that forms the terminal portion of the respiratory tract. The respiratory unit is defined as the structure and functional unit of the lung. The exchange of gases occurs only in this part of the respiratory tract. The respiratory unit starts from the respiratory bronchioles. Each respiratory bronchiole divides into alveolar ducts. Each alveolar duct enters an enlarged structure called the alveolar sac. Space inside the alveolar sac is called antrum. The alveolar sac consists of a cluster of alveoli. Few alveoli are present in the wall of the alveolar duct also. Thus, the respiratory unit includes-Respiratory bronchioles, Alveolar ducts, Alveolar sacs, Antrum, Alveoli.[9]

Muscles of Respiration: Respiratory muscles are of two types-Inspiratory muscles & Expiratory muscles. Respiratory muscles are generally classified into two types. Primary respiratory muscles& Accessory respiratory muscles. Inspiratory muscles include- Primary- Diaphragm and accessory- sternocleidomastoid, scalene, anterior serrati, elevators of scapulae and pectorals. Expiratory muscles include- Primary- Internal intercostal muscles and accessory muscles- abdominal muscles.

Movement of the thoracic cage: Inspiration causes enlargement of the thoracic cage. Thoracic cage enlarges because of an increase in all diameters, viz. anteroposterior, transverse and vertical diameters. Anteroposterior and transverse diameters of the thoracic cage are increased by the elevation of ribs. Vertical diameter is increased by the descent of the diaphragm. In general, change in the size of the thoracic cavity occurs because of the movements of four units of the structures-thoracic lid, upper coastal series (second to the sixth pair of ribs), lower coastal series (seventh to the tenth pair of ribs) & diaphragm.

Movement of lungs: During inspiration, due to the enlargement of the thoracic cage, the negative pressure is increased in the thoracic cavity. It causes expansion of the lungs. During expiration, the thoracic cavity decreases in size to the pre-inspiratory position. Pressure in the thoracic cage also comes back to the pre-inspiratory level. It compresses the lung tissues so that, the air is expelled out of the lungs.[10]

Regulatory mechanisms: The process of respiration is under the control of two mechanisms like Chemical and Nervous mechanisms. The chemical mechanism is again of two types like central and peripheral. The nervous mechanism is under the control of Medulla oblongata (Medullary) and Pons (Pontine). Medulla oblongata has two groups of neurons like Dorsal and Ventral. Pons also has 2 groups of neurons – Pneumotaxic & Apneustic. Pontine centres can control medullary centres.

Control of inspiration and expiration period: Medullary Dorsal group control inspiration process in normal quiet breathing. Ventral Group can control inspiration and expiration in forceful breathing. Pneumotaxic centres control the conscious process of breathing. The apneustic centre controls unconscious breathing.

Breath-holding time: The length of time one can voluntarily stop breathing is called breath holding time. Increased Carbon dioxide (Hypercapnea)/ decreased oxygen levels in the blood stimulates Chemoreceptors of the lungs to send the sensory reflex to the brain centres thereby, the Medullary dorsal group of neurons will get activated which will further initiate the process of inspiration. So, breath-holding time is under the control of stimulation of Chemoreceptors of the lungs to increased carbon dioxide levels.[11]

Materials and Methods: Classical Texts related to *Yoga* such as *Hata Yoga Pradipika*, *Ghrenda Samhita*, books on *Yoga*, books on Physiology and different journal articles were reviewed to analyse the concept of *Yoga* and the impact of *Yoga* on the Respiratory System

DISCUSSION

Impact of *Yoga* on Respiratory System:

Practising *Yoga* can increase the vital capacity significantly from 3399 ml to 3443 ml. Lung volumes and capacities convey the condition of a functional status of the respiratory system in physiological and pathological conditions.[12]

Impact of *Shatkarma:*

There is no doubt that *Kasa, Shwasa, Pleeha roga, Kushta* and 20 types of *Kaphaja roga's* are destroyed through the effects of *Dhauti karma*. The combination of all the practices of *Dhauti* cleans the entire digestive tract and respiratory tract.[13] On the physical level, irrigation of the nasal mucosa by *Neti* removes accumulated mucus from the nostrils, associated passages and sinuses, allowing air to flow without obstruction. Due to rapid exhalations of *Kapalabhati,* impure air is thrown out to its maximum.CO_2 levels fall, which in turn increases oxygenation. Forceful exhalations clean and tone up the respiratory tract, diaphragm and stimulate the abdominal viscera.

***Asanas* and its effect on Respiratory System:**

Suryanamaskara- *Suryanamaskara* is done after the utterance of '*Omkara*' with the appropriate '*Bija mantra'* along with the corresponding name of Sun God. These specific words have got a certain scientific background and cause definite effective vibrations in the body through Vocal cords. The prolonged pronunciation of *Omkara,* the basic word '*Ha*' and the letter or sound 'R' which is included in every step in *Suryanamaskara* rhyme stimulate the Nerve centres in the brain which control the Respiratory, Circulatory and Digestive Systems and tone up these systems. The proper scientific utterance of the word '*Omm'* stimulates the Lungs, Heart and Digestive systems. The proper utterance of ''*Hram*' stimulates the Lungs and Upper ribs. The proper utterance of '*Hrim'* stimulates Respiratory System. The first step in *Suryanamaskara* stretches the Arms, Chest and abdomen so that the muscles are toned up and deep breathing is greatly helped. Vital Organs like the Heart, Lungs and Brain are stimulated with improved Circulation and Respiration.

Table 1: Effect of *Asanas* on the Respiratory System

Asanas	**Effects and Benefits**
Ardhachakrasana	• Effects: Chest muscles are stretched • Benefits: Lung functions are improved
Ardhakati Chakrasana	• Effects: Muscles of the lateral wall of the chest, abdomen and waist are stretched and relaxed. • Benefits: Respiratory capacity increases
Ardha Matsyendrasana	• Effects: Lung Ventilation is improved
Ushtrasana	• Effects: Intercostal muscles are stretched. Expansion of rib cage. • Benefits: Lung Ventilation is improved and Lung capacity increases.
Supta Vajrasana	• Effects: The intercostal muscles are stretched and toned up and the Respiratory rate is slowed down. • Benefits: Beneficial in Asthma and other respiratory disorders.
Matsyasana	• Effects: Stretching and Tone-up of Intercostal muscles increase Lung capacity. • Benefits: Asthma and other Lung disorders are controlled.
Sarvangasana	• Effects: Breath-holding time and Vital capacity of the Lungs is improved. • Benefits: Cardio-respiratory functions are remarkably improved.
Shavasana	• Calms the mind and reduces Stress
Bhujangasana	• Effects: Muscles of the chest are stretched. All lobes of the lungs are involved in respiration.
Shalabhasana	• Effects: Lung Ventilation is improved.
Dhanurasana	• Effects: The Intercostal and Chest muscles are stretched, and Lung Ventilation is improved. • Benefits: There will be lung expansion.
Makarasana	• Facilitates diaphragmatic breathing.

Regular practice of *Asanas* stimulates the dorsal and ventral respiratory centre of the medulla oblongata which sends signals to respiratory muscles i.e diaphragm and intercostal muscles to control respiration.[14]

Impact of *Bandha* on Respiratory System:

In the final position of *Uddiyana Bandha*, the upward movement of the diaphragm exerts pressure on the lungs, massaging the entire respiratory system and enhancing the efficacy of the lungs.

Jalandhara Bandha is extremely useful for alleviating throat disorders such as inflammation, stuttering, excess mucus in the throat, tonsilitis, etc. It also improves the quality of the voice and increases the quantum of prana in the thoracic region.

Uddiyana Bandha and *Jalanadhara Bandha* stimulate phrenic nerves to control movements of diaphragm and stimulate Vagus nerve and produce a parasympathetic effect on respiration.[15]

Impact of *Pranayama* on Respiratory System:

Regular practice of *Pranayama* is found to improve lung volumes and capacities thereby helping in the prevention and management of different Respiratory diseases.[16]Just as emotions and different mental conditions or moods can influence respiration, one can also control emotions and mental tensions by modifying the breathing pattern. This is done through the *Pranayama*. Breathing in the human body is related to *Prana* (Lifeforce) on one side and the mind on the other. Therefore, the *Pranayama* is like a bridge between physical existence and mental activity.[17]The Vital Index is considerably increased through the regular practice of *Pranayama.* It has been observed that a significant increase of 15.7 ml in vital capacity and an average of 15 sec in the Breath Holding Time is achieved by three weeks practice of *Pranayama.*[18]

Sectional Breathing: In *Adhobhagiya Pranayama* (Abdominal or Diaphragmatic) air entry into lower segments of the lungs is increased and lower segments of the lungs are better ventilated. In *Madhyamabhagiya Pranayama* (thoracic or chest type) air entry into the mid-portion of the Lungs is increased. Oxygenation is improved and the middle portions of the lungs are better ventilated. In *Urdhwabhagiya Pranayama* (Apical or Clavicular) air entry to the uppermost (Apical) region of the Lungs is increased. Oxygenation is improved and uppermost portions of the lungs are better ventilated.[19]

Nadi Shuddi Pranayama imparts voluntary control over breathing and oxygenation is improved.

By *Suryabheda Pranayama***,** the right nostril is cleared off**,** the right nasal mucosa is stimulated, nasal circulation is improved, and it is beneficial in Sinusitis.

By the practice of *Ujjayi Pranayama*, voluntary control over breathing is achieved. About a 24.5% increase in oxygen consumption over normal breathing is sought. The larynx is stimulated and toned up. It is beneficial in hoarseness of voice.

During *Seetkari &Sheetali Pranayama* when you breathe through the teeth or tongue the air is cooled by the saliva and this cools the blood vessels in the mouth, throat and lungs. Relives congestion in the respiratory tract.

By Practice of *Bhastrika*, over 18.5% increase in Oxygen consumption over-breathing is noted. Due to rapid expulsions, impure air is thrown out at its maximum.CO_2 levels fall, which in turn increases Oxygenation. Forceful Exhalations clear and tone up the Respiratory tract. The nasal mucosa is stimulated and cleared off. The respiratory tract is kept healthy. Beneficial in chronic sinusitis, asthma and bronchitis.

Bhastrika opens up the closed air sacs and expels the germs, excess mucus and impure air from the lungs.

Anuloma- Viloma Pranayama reduces the basal metabolic rate, increases the vital capacity and strengthens the immune system. Helps in clearing the congestion in the nostrils and is very useful for Nasal allergy.[20]

In all *Pranayama* procedures, the only respiratory parameter that will reduce is the rate of respiration and all other parameters including volumes and capacities will increase depending on the regularity of practice. Increased lung volume and capacities due to increased strength of respiratory musculature release of lung surfactant and prostaglandin, stimulation of stretch receptors and removal of undue tension. Respiration during *Pranayama* is under the control of the Pneumotaxic respiratory centre. The pneumatic centre will control the Apneustic centre which has its role in normal quiet breathing. So, this regulated pattern of breathing during *Pranayama* may be adopted by the Apneustic centre in normal breathing leading to decreased rate of respiration. With regular practice of *Pranayama* dorsal

group neurons responsible for inspiration in normal quiet breathing may be inhibited by Apneustic and Pneumotaxic centres leading to extended expiratory period. Increase in the voluntary breath-holding time due to acclimatization of the chemoreceptors of lungs to hypercapnia and hypoxia or decreased responsiveness of respiratory centre or increased development of respiratory musculature leading to increased muscle endurance and delayed fatigue. Lung inflation near to total lung capacity in *Pranayama* acts as a major stimulus for secretion of pulmonary surfactant and prostaglandins.[21]

***Dhyana*: Effect on Respiratory System**

According to *Hata Yoga Pradipika*, when *prana* moves, *Chitta* moves. When *prana* is without movement, *Chitta* is without movement. By this, the *Yogi* attains steadiness and should thus restrain the *vayu*. *Prana* and mind are closely linked. By practising *Dhyana* mental health is achieved thereby, in turn, achieving control over respiration.[22] During *Dhyana* apnuestic centre in pons is being stimulated so that long deep breathing can be observed.[23]

Respiratory Diseases and Indicated *Yoga*

- Chronic Rhinitis- *Ardha Matsyendrasana, Bhujangasana, Bhastrika, Ujjayi, Kapalabati, Jala neti.*
- Bronchial Asthma- *Ardha Chakrasana, Supta Vajrasana, Bhujangasana, Suryabhedhana, Ujjayi, Bhastrika*.[24]

CONCLUSION

As food is essential to sustain the body, the proper intake of air must be provided for the lungs to maintain the life force (*Prana*). Regular efficiency of Respiration is enhanced by *Shatkarma, Asanas, Pranayama, Bandhas* and *Dhyana* practice. It strengthens elastic and collagen fibres of the lungs thereby allowing efficient contraction, results in improving the inspiratory and expiratory power and activates the para-sympathetic nervous system, thereby reducing stress and rejuvenating the body.[25] As a result, one feel calmer and more centred and sleep better.

REFERENCES

1. Sen Sarma Anantarup. Effect of Yogasana on the circulatory and respiratory system. International Journal of Physiology, Nutrition and Physical Education. 2018;3(1): 190-192.
2. Iyenkar, B.K.S. Light on Pranayama. (Reprinted.): Harper Collins; 2013.
3. Raj Navoday, N.R, Deepika, S, Kulkarni pratibha, Kekuda prashanth, T.R. Effect of Pranayama on Respiratory System. Unique Journal of Ayurvedic and Herbal Medicines. 2015;3(4): 79-82.
4. The Global Impact of Respiratory Disease, Forum of International Respiratory Societies: Second Edition.
5. Iyenkar, B.K.S. Light on Yoga. (6 ed.): Thorsons Publications; 2015.
6. Patanjali Yoga Sutras, Commentary: Swami Vivekananda, Chapter 2, pgno:92
7. Patanjali Yoga Sutras, Commentary: Swami Vivekananda, Chapter 2, pgno:94
8. Patanjali Yoga Sutras, Commentary: Swami Vivekananda, Chapter 3, pgno:98
9. Sembulingam, K, Prema sembulingam. Essentials of Medical Physiology. (6 ed.). New Delhi: Jaypee Brothers Medical Publishers; 2012, Chapter 118, pg no-673-675
10. Sembulingam, K, Prema sembulingam. Essentials of Medical Physiology. (6 ed.). New Delhi: Jaypee Brothers Medical Publishers; 2012, Chapter 120, pg- 682-683
11. Raj Navoday, N.R, Deepika, S, Kulkarni pratibha, Kekuda prashanth, T.R. Effect of Pranayama on Respiratory System. Unique Journal of Ayurvedic and Herbal Medicines. 2015;3(4): 79-82.
12. Sen Sarma Anantarup. Effect of Yogasana on the circulatory and respiratory system. International Journal of Physiology, Nutrition and Physical Education. 2018;3(1): 190-192.
13. Swami muktibodhananda. Hatha Yoga Pradipika. (Reprint ed.). Bihar: Yoga Publications Trust; 2006, Chapter-2/25
14. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno-25-62
15. Swami muktibodhananda. Hatha Yoga Pradipika. (Reprint ed.). Bihar: Yoga Publications Trust; 2006.
16. Raj Navoday, N.R, Deepika, S, Kulkarni pratibha, Kekuda prashanth, T.R. Effect of Pranayama on

Respiratory System. Unique Journal of Ayurvedic and Herbal Medicines. 2015;3(4): 79-82.
17. Sen Sarma Anantarup. Effect of Yogasana on the circulatory and respiratory system. International Journal of Physiology, Nutrition and Physical Education. 2018;3(1): 190-192.
18. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno-63
19. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno-66-68
20. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno- 71-77
21. Raj Navoday, N.R, Deepika, S, Kulkarni pratibha, Kekuda prashanth, T.R. Effect of Pranayama on Respiratory System. Unique Journal of Ayurvedic and Herbal Medicines. 2015;3(4): 79-82.
22. Swami muktibodhananda. Hatha Yoga Pradipika. (Reprint ed.). Bihar: Yoga Publications Trust; 2006, Chapter-2/2
23. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno-79
24. Dr Javalgekar Ravi, R. The Yoga Science for Everyone. (Second ed.). Varanasi: Chaukhambha Sanskrit Bhawan; 2005, pgno-108-109
25. Sen Sarma Anantarup. Effect of Yogasana on the circulatory and respiratory system. International Journal of Physiology, Nutrition and Physical Education. 2018;3(1): 190-192.

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