

PHYSIOLOGICAL EFFECTS OF PRANAYAMA AND ITS SIGNIFICANCE IN THE COVID 19 CRISIS.**Vd. Taniya Suresh Manjani^{1*}, Dr. R. S. Dhindhime², Vd. Monika. D. Madane³, Dr. Shruti Sardeshmukh⁴ and Vd. Himadri Chaudhary⁵**¹PG Scholar (Kriya Sharir), Government Ayurved College, Osmanabad, Maharashtra- 413501.²Professor and Head of Department (Kriya Sharir), Government Ayurved College, Osmanabad, Maharashtra- 413501.³PG Scholar (Kriya Sharir), Government Ayurved College, Osmanabad, Maharashtra- 413501.⁴PG Scholar (Kriya Sharir), Government Ayurved College, Osmanabad, Maharashtra- 413501.⁵PG Scholar (Kriya Sharir), Tilak Ayurveda Mahavidyalaya, Rasta Peth, Pune, Maharashtra- 411011.***Corresponding Author: Vd. Taniya Suresh Manjani**

PG Scholar (Kriya Sharir), Government Ayurved College, Osmanabad, Maharashtra- 413501.

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ABSTRACT

“A man is known by the number of breaths he takes and not just by the number of years he lives.” Breathing in a controlled, aware manner is nothing but *Pranayama*. *Pranayama* is an age-old breathing technique described in the *Ashtanga Yoga Sutra of Patanjali*. It emphasises the use of different breathing techniques for the **Prevention and Cure** of certain diseases as well to maintain **good health**. The sequence of *Yama, Niyama, Asana* & then *Pranayama* is important to attain maximum fruits from the practice of *Pranayama*. During the year 2019-2021, we all have suffered a lot due to the ill effects of **COVID 19 pandemic**. **Breathlessness** being the chief complain in such sufferers, it makes us question that what if they were accustomed to the practice of *Pranayama* since long before, would they have suffered the agony because of the novel corona virus? Hence, an attempt is being made to make all of us aware of the Physiological Benefits of *Pranayama* and its importance in the COVID 19 crisis. Also to inculcate *Pranayama* as a regular measure for the prevention of diseases.

KEYWORDS: *Asana*, Breathlessness, COVID 19 crisis, Cure, Good Health, *Niyama*, Pandemic, *Pranayama*, Prevention, *Yama*.

INTRODUCTION

Life now a days is being trapped in the cage of stress, anxiety, worry, disease, stigma, self-doubt, fear, poor personal habits and what not. This changed lifestyle pattern is not allowing people to take deep breath also which is further leading to different Respiratory Disorder Burden viz. COPD, Asthama, & not to forget the very new Novel Corona virus i.e. COVID 19. We have forgotten to live and are merely existing. Have you noticed the pattern while we are angry, stressed, diseased is always different? When we consciously try to change the breathing pattern, we discover positive changes in our body.

These changing breathing patterns are something which our *acharyas* have long back described in *Ashtanga yoga* as *Pranayama*.

Pranayama means control of ‘*prana*’, ‘*prana*’ in Indian philosophy refer to all forms of energy in the universe. *Prana* links the body and mind. The word ‘*Pranayama*’ is made up of two words- *Prana* and *Ayama*. *Prana* means a subtle life force which provides energy to different organs including mind and controls many life processes. *Ayama* means voluntary effort to control,

lengthen, expand and direct the prana. Hence *Pranayama* is the measuring, control and directing of breath. It controls the energy or *Prana* within the organism, in order to restore and maintain health and to promote evolution.

Pranayama are a group of techniques that aim at stimulating or balancing the vital energy. They purify the physical body and removes blockages, allowing energy to flow freely. Practice of *Pranayama* requires a conscious control over the breathing.^[1]

Hence, here an attempt is being made to explain the benefits of *Pranayama* by considering the Physiological Changes occurring in the mind and body (Respiratory System in particular) by the practice of *Pranayama*. Since the sequence of *Yama, Niyama, Asana* & then *Pranayama* is mentioned in the sages of *Patanjali*, it is important to practice mastery over the three, so as to reap maximum benefits from the ritual of *Pranayama*.

MATERIALS AND METHODS

- Various Ayurvedic texts on Yoga were taken into consideration.

- Books and online articles explaining about the importance of *Pranayama* were scrutinized for its benefits on Mind and Body (Respiratory System in particular).
- Supportive correlation was done between Benefits of *Pranayama* and Physiological Changes behind those benefits with the help of Modern Physiology books.

AIMS AND OBJECTIVES

1. To understand the Physiology of *Pranayama*.
2. To evaluate its effects on the Respiratory System in the Human Body.
3. To explain its significance & promote its benefits in the crucial times of COVID-19 Pandemic.

LITERATURE REVIEW

a) PHYSIOLOGICAL BASICS OF RESPIRATION^[2]

Respiration comprises of inspiration and expiration. During a normal quite breathing inspiration is the active process involving contraction of the diaphragm and external intercostal muscles. On the contrary, expiration is a passive process involving elastic recoiling of lungs and thoracic cage.

During Inspiration,

- Thoracic cage enlarges and lungs expand so that air enters the lungs easily.
 - Due to the enlargement of the thoracic cage, the negative pressure is increased in the thoracic cavity causing expansion of lungs.
- During Expiration,
- Thoracic cage and lungs decrease in size and attain the pre inspiratory position so that air leaves the lungs easily.
 - Thoracic cavity decreases in size to the pre inspiratory position. The pressure in the thoracic cage also comes back to pre inspiratory level.
 - It compresses the lung tissues so that, air is expelled out of the lungs.

Surfactant that lines the epithelium of alveoli in lungs, known as Pulmonary Surfactant decreases the surface tension of the alveolar membrane, thereby preventing the collapsing tendency of alveoli.

Respiration is a reflex process but it can be controlled voluntarily. Respiration is subjected to variation even under normal physiological conditions. Emotions and exercise increase the rate and force of expiration. But the altered pattern of respiration is brought back to normal within a short time by some regulatory mechanisms in the body.

REGULATORY MECHANISMS^[3]

Process of Respiration is under control of two mechanisms viz. Chemical and Nervous Mechanism. Chemical mechanism is again of two types- Central and Peripheral. Nervous mechanism is under the control of Medulla Oblongata (Medullary) and Pons (Pontine). Medulla Oblongata has 2 groups of neurons- Dorsal and

Ventral. Pons also has 2 groups of neurons- Pneumotaxic and Apneustic.

Pontine centres can control Medullary centres.

CONTROL OF INSPIRATION AND EXPIRATION PERIOD^[3]

Medullary Dorsal Group controls inspiration process in normal quiet breathing (unconscious), Ventral Group can control inspiration and expiration in forceful breathing (conscious). Pneumotaxic centre controls conscious process of breathing and Apneustic centre controls unconscious breathing.

BREATH HOLDING TIME^[3]

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, Medullary dorsal group of neurons will get activated which will further initiate the process of inspiration. So, breath holding time is under control of stimulation of Chemoreceptors of lungs to increased carbon dioxide levels.

b) MECHANISM OF PRANAYAMA

Pranayama is the control over breath since it comprises of two words *Prana* meaning breath, life and *Ayama* means lengthen, expand. Thus the word *Pranayama* which literally means control of *Prana*, has come to be associated in practice with control of act of respiration. Every living being in invariably observed to respire air (*Prana Vayu*) in and out of its body throughout life. *Pranayama* (Yogic breathing) is control of *Prana Vayu* and enhance the longevity of life. *Pranayama* has three components- *Puraka* (inspiration), *Kumbhaka* (breath holding) & *Rechaka* (expiration) as described in *Hatha Yoga*. *Kumbhaka* is further subdivided into 8 subtypes viz. *Suryabhedan*, *Ujjayi*, *Sheetali*, *Sitkaari*, *Bhastrika*, *Bhramari*, *Murcha* & *Plavini*.

Physiological changes occurring in each phase of *Pranayama*

PURAKA PHASE^[1]

During the phase of inhalation, the lungs are expanded considerably and the walls of the alveoli are stretched maximum. After a particular degree of stretching, the stretch receptors situated in the alveolar walls are stimulated. The normal stretch reflex is inhibited and therefore no exhalation is possible. The chest continues to get expanded under cortical control. This helps to hold the breath for a longer time easily.

As inhalation continues, the intra pulmonary pressure is also raised. The diaphragm does not move freely as the abdomen is kept inward and controlled. Therefore the alveoli in the upper pulmonary part are filled with air. One uses his inspiratory capacity for prolonged phase of *Puraka*. This has a beneficial effect on the gaseous

exchange which then takes place efficiently throughout the day. *Puraka* being a conscious act and not merely prolongation of inspiration is done with full concentration of mind.

KUMBHAKA PHASE^[1]

The duration of retention is gradually increased over a long practice so that Respiratory Center is gradually acclimatized and trained to withstand higher carbon dioxide concentrations in the alveoli and in blood. The ratio between inspired air and the blood is changed. Obviously the exchange of oxygen and carbon dioxide across the thin walls of alveoli and blood capillaries would take place more efficiently as they get more time. During *Kumbhaka* one has to apply *Jalandhara Bandha*, chin lock. Due to this sharp bend of the neck there will be pressure on the Jugular notch, pressure on Internal and External Carotid arteries, Carotid sinuses, Sinus nerves. The specific neuromuscular action around the neck will influence the circulation, nervous function and glandular secretion. It is claimed that, heart rate and blood pressure are reduced. *Jalandhara bandha* induces trance like awareness which helps for inward projection of mind. There will be stimulation of Vagus nerve which brings about soothing effect on higher nerve centers. As a result there is balanced autonomic functions and no thoughts in the mind, or conscious control on the mind.

RECHAKA PHASE^[1]

During exhalation *Jalandhara bandha* is released and voluntarily controlled exhalation takes place. The intra pulmonary pressure is slowly reduced and the alveoli are also deflated, the percentage of carbon dioxide is still increasing in the blood. It may be noted that carbon dioxide has got a calming effect on the nervous system up to certain limits and has been found to reduce anxiety when administered in the form of a mixture containing 65% carbon dioxide and 35% oxygen This would help mind to undergo the meditational state.

During the practice of *Pranayama* we tackle all the respiratory reflexes on account of our volitional control on respiration The impulses from both the Central Nervous System and Autonomic Nervous System are better integrated due to rhythmic and proportionate stimulation of the proprioceptors and visceroreceptors as well as the Vagus nerve. The emotions are positively influenced due to this rhythmic and smooth breathing pattern adopted every day. Like emotions the mental activities are also related with the breathing. As the mind is fully engaged in the breathing, unnecessary thought processes are checked. As the cognitive, intellectual and ego based analytical processes of the mind are minimal or even absent, the mind becomes more balanced which enables us to experience higher levels of consciousness or to get in to the meditational state as the power of concentration also increases. *Pranayama* has not been developed to just supply oxygen. It is meant for controlling and balancing and influencing other autonomic functions as well.

The mind is relaxed by decreasing sympathetic arousal. The oxygen level of blood increases and the efficiency of oxygen utilization by the tissues is maximized leading to deeper relaxation and more energy. The carbon in the system slowly increases and this has the effect of strengthening the nervous system leading to better overall health.

c) TYPES OF PRANAYAMA AND ITS MECHANISM: from *Hatha Yoga Pradipika*

i. *Kapal-Bhati* (Frontal lobe Cleansing technique)^{[2][4]}

BENEFITS - कपालभातिर्विख्याता कफदोषविशोषणी । - ह.यो.प्र. २/३७

It is basically one of the *Shat Kriyas*, generally used as a **Pre-Procedure for *Pranayama***. In *Kapalbhati*, the nostrils get flared up and the air is expelled get pushed through the nose. The constant pushes can improve the efficiency of the muscles that are involved in breathing. It can also remove the impurities from breathing tube. It increases the breath control, stretching it to the unit and dramatically affects the CO₂, chemicals, acids and alkalis in blood.

ii. *Surya Bhedana Pranayama*^{[2][5]}

BENEFITS - कपालशोधनं वातदोषघ्नं कृमिदोषहृत् । - ह.यो.प्र. २/७०

This *pranayama* aerates the lungs, removes phlegm, enhances lung compliance. There was significant increase in O₂ consumption (17%) Systolic blood pressure (mean increase 9.4 mmHg) and significant decrease in digit pulse volume (45.7%).

It also reduces excessive *vaat dosha* and *krumi dosha* in the body.

iii. *Ujjayi Pranayama* (Hissing breath)^{[2][6]}

BENEFITS - श्लेष्मदोषहरं कण्ठे देहान्त विवर्धनम् । नाडीजलोदराधातुगत दोष विनाशनम् ॥ - ह.यो.प्र. २/७२-७३

Ujjayi or Psychic Breath increases the pressure of air in the lungs and expands the effective use of lungs. It increases O₂ transfer in lungs enhances blood flow throughout the body while the body is in a relaxed state. The contraction of throat caused by *Ujjayi* affects the Carotid sinuses which regulate blood pressure in arteries. *Ujjayi* exerts a slight pressure on the Carotid sinuses which over time lowers the blood pressure which leads to reduced tension and slows the thought processes of the mind. This type of technique can open the alveoli in lungs thus allowing the lungs to absorb more O₂. It improves the lung capacities, removes the excess of *Kapha*, improves the digestive fire & soothes the nerves.

iv. *Sitkari Pranayama*^{[2][7]}

BENEFITS - एवमभ्यासयोगेन कामदेवो द्वितीयकः । न क्षुधा न तृषा निद्रा नैवालस्यं प्रजायते ॥

भवेत्सत्त्वं च देहस्य सर्वोपद्रववर्जितः | - ह.यो.प्र. २/१४-१६

The proper practice of *Sitkari Pranayama* makes one beautiful like *Kamadeva*. This practice destroys appetite, thirst, sleep, laziness. It enhances body strength & destroys all complications.

v. Shitali Pranayama (Cooling breath)^{[2][8]}

BENEFITS - गुल्मप्लीहादिकान् योगान् ज्वरं पित्तं क्षुधां तृषणम्
विषाणि शीतली नाम कुंभिकेयं निहन्ति हि || - ह.यो.प्र. २/१८

This breathing technique provides a cooling effect in the body, and reduces complications due to *Jwara*, *Pitta* or excessive thirst.

vi. Bhastrika Pranayama (Bellows breath)^{[2][9]}

BENEFITS - वातपित्तश्लेष्महरं शरीराग्नि विवर्धनम् |

कुण्डली बोधकं क्षिप्रं पवनं सुखदं हितम् ||

ब्रह्मनाडी मुखे संस्थकफाघर्गलनाशनम् |

सम्यक् गात्रसमुद्भूता..... || - ह.यो.प्र. २/६१-६६

It is the type of *Pranayama* where in fast breathing is employed. This *Pranayama* can also improve the lung capacity and can make the respiratory system strong and efficient. In *Bhastrika*, diaphragm the principle respiratory muscle is exercised which renews the residual air in the lungs. It is a **process of hyperventilation**, thus produce slight alkalosis leading to soothing effect in respiratory center. Rapid exchange of gases at cellular level remove accumulated toxins and re energizes the cells.

It provides a balance between the *tri dosha* and removes any of the excess, improves the digestive fire, it helps to expel the excess *kapha* seating in the throat region.

vii. Bhramari Pranayama^{[2][10]}

BENEFITS - योगीन्द्रायामेवसभ्यास योगात् चित्ते जाता
काचिदानन्दलीला ||

- ह.यो.प्र. २/६८

Regular Practice of this *Pranayama* relieves stress, tensions, anxiety, blood pressure and brings in a sense of happiness and satisfaction. It is also beneficial for voice & throat ailments.

viii. Murcha Pranayama^{[2][11]}

BENEFITS - मनोमूर्च्छा सुखप्रदा | - ह.यो.प्र. २/६९

This *Pranayama* enhances excellent preparation for meditation, helps to draw in the mind. It alleviates anxiety, tension, anger, neurosis and raises the level of *Prana*.

ix. Plavani Pranayama^{[2][12]}

BENEFITS - सुखात् प्लवते पद्मपत्रवत् | - ह.यो.प्र. २/१०

It enhances the capacity to swim. In broader terms, it means stress free light headedness is observed. Tranquility of the mind is attained and so all actions in the body are within normal limits.

d) STRESSFUL EFFECTS OF COVID 19 PANDEMIC ON THE MIND & BODY

Covid 19 is a respiratory illness that particularly ventures into the respiratory system, which incorporates your lungs. It can cause a scope of breathing issues, from mellow to basic, including Breathlessness, Pneumonia or Intense Respiratory trouble condition (ARDS). The complications of Post Covid are even worse which include difficulty in breathing, cough, loss of smell, depression, anxiety, difficulty in thinking and concentration (Brain Fog), Multi System Inflammatory Syndrome (MIS), auto immune complications, Mucormycosis, thrombus formation, can also lead to Post Traumatic Stress Disorder (PTSD), and the list carries on.

The COVID-19 pandemic has had a major effect on our lives. Many of us are facing day to day challenges that can be stressful, overwhelming, and cause strong emotions in adults and children. Public health actions, such as social distancing, are necessary to reduce the spread of COVID-19, but they can make us feel isolated and lonely and can increase stress and anxiety. And with the direct causative factor (चिन्त्यनां चातिचिन्तनात् - च. वि. १/१३)^[13], *Rasa Vaha Strotas* gets vitiated. Since *Rasa Vaha Strotas* and *Praan Vaha Strotas* share the same moolsthana, (प्राणवाहानां स्रोतसां हृदयं मूलं महास्रोतस च - च. वि. १/११ & रसवाहानां स्रोतसां हृदयं मूलं दश च धमन्यः - च. वि. १/८)^{[14][15]} functions of *Pranavaha Strotas* also gets

disturbed (leading to breathlessness like condition in Covid 19 patints). This condition is commonly seen in Covid 19, because people are panicking more due to fear of contracting with Covid than the Actual Covid infection. Learning to cope with stress in a healthy way will make you, the people you care about, and those around you become more resilient.

Stress can cause the following

- Feelings of fear, anger, sadness, worry, numbness, or frustration
- Changes in appetite, energy, desires, and interests
- Difficulty concentrating and making decisions
- Difficulty sleeping or nightmares
- Physical reactions, such as headaches, body pains, stomach problems, and skin rashes
- Worsening of chronic health problems
- Worsening of mental health conditions
- Increased use of tobacco, alcohol, and other substances

It is natural to feel stress, anxiety, grief, and worry during the COVID-19 pandemic.^[16]

Out of many such ways, *Pranayama* can help you, others, and your community manage stress mindfully. Since it boosts your immunity, your lung capacities, brings tranquility to the mind and manages stress and helps to keep yourself calm and sane during these topsy turvy times of the pandemic.

DISCUSSION

The reasons for the increase of Respiratory parameters can be justified the following ways.

1. Increased volumes & capacities can be justified with the following reasoning^[3]

A. Increased strength of Respiratory Musculature

Regular efficient usage of muscles of respiration causes their bulk to increase and Elastic & Collagen fibres will get strengthened and extensibility will increase thereby will allow efficient contraction, improving the inspiratory and expiratory power, Cleansing of airway secretions thereby decreasing the resistance to the air flow which will aid in full and free utility of alveoli.

B. Release of Lung Surfactant & Prostaglandins

Lung inflation near to total lung capacity in *Pranayama* acts as a major physiological stimulus for the secretion of pulmonary surfactant and prostaglandins. Pulmonary surfactant increases the lung compliance and Prostaglandins reduce the bronchiolar smooth muscle tonicity thereby allowing more and more air to enter into lungs which leads to increase of lung volumes and capacities.

C. Stimulation of Stretch Receptors

Inflation of the lungs nearly to total lung capacity stimulates the stretch receptors, which reflexively relaxes smooth muscles of larynx and Tracheo- bronchial tree, thereby improving the lung volumes and capacities.

D. Removal of Undue Tension

Practice of *Pranayama* in relaxed state of body and mind, relaxes the skeletal muscles which help the thoracic cage to relax better than before and it will also cause withdrawal of the Broncho- constrictor effect by relaxing smooth muscles of Bronchi, thereby we can appreciate hike in the values of pulmonary function parameters.

2. Decreased Rate of Respiration^[3]

Respiration during *Pranayama* practice (i.e.conscious process of regulated respiration) is under the control of Pneumotaxic respiratory centre. Pneumotaxic centre will control the Apneustic centre which has its role in normal quite breathing. So this regulated pattern of breathing during *Pranayama* may be adopted by Apneustic centre in normal quiet breathing leading to decreased rate of respiration.

3. Extended Expiratory Period^[3]

With a regular practice of *Pranayama* Dorsal group neurons responsible for inspiration in normal quite breathing may be inhibited by Apneustic and Pneumotaxic centres leading to extended expiratory period.

4. Increase in the Voluntary Breath Holding Time^[3]

This may be due to acclimatization of the chemoreceptors of lungs to hypercapnea and hypoxia (decreased oxygen levels) or decreased responsiveness of

respiratory centre or increased development of respiratory musculature leading to increased muscle endurance and delayed fatigue.

The reasons for the increased awareness towards, better mental presence, tranquility of mind and stillness of body can be justified by.

5. Reduced Stress and Anxiety^[17]

The Practice of *Pranayama* leads to greater O₂ supply to the blood stream and CO₂ drainage. As a result, greater amount of oxygen is available for cerebral metabolism. Regular practice of various *Pranayama* will promote mental calm and concentration, which resembles a state of meditative relaxation. Mental and physical relaxation leads to an integrated physiological response in which blood is redistributed to the effect of providing greater supply to the cerebral cells. Practice of *Pranayama*, controls the limbic hypothalamus axis. This reduces the anxiety and reduces the high level of stress hormones present in the blood.

CONCLUSION

- i. The regular practice of *Pranayama* can be quite effective in not only overcoming anxiety and depression but also help them in promoting mental health which will help them develop a sort of resilience to any kind of mental or physical illness. *Pranayama* has been reported to be beneficial in treating a range of stress related disorders improving autonomic functions, relieving symptoms of asthma, and reducing signs of oxidative stress.^[1]
- ii. By the practice of rhythmical breathing one will enjoy real good rest. One can control the Respiratory Centre that is situated in Medulla Oblongata and other nerves also, because the centre of respiration has a sort of controlling effect on other nerves. One who has **calm nerves has a calm mind** also. When one is going through a stressful situation, the whole physiology, the brain and endocrine system, is influenced negatively. *Pranayama* establish a positive body-mind relationship. Removal of negative thoughts and tensions leads to a positive and healthy physiology. Practitioners report that the practice of *Pranayama* develops a steady mind, strong will-power, and sound judgment, and also claim that *Pranayama* practice extends life and enhances perception.^[1]
- iii. It reduces undue tension from the respiratory system and promotes healthy and active lungs along with rock solid immunity, which turns out to be the need of the hour in the COVID 19 pandemic crisis.
- iv. Cost effective: Its absolutely free of cost and will not burn the pockets of the people who's economy has declined by folds since the coronavirus outbreak. Hence an attempt has been made here to include *Pranayama* as an effective measure in the COVID 19 pandemic crisis.
- v. Purpose of Ayurveda is served: स्वस्थस्य स्वास्थ्य रक्षणं | - च.सु.३०/२६^[18] since we all know **Prevention is better**

than Cure, *Pranayama* literally serves this objective & helps to combat the increased respiratory disorder burden in the hard times of Covid 19 pandemic.

- vi. *Pranayama* can be propagated in the society as a social correction for corrupted and sinful minds in the dark times of covid 19, since it awakens the mind.

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