

Effect Of Prāṇāyāma, The Controlled Respiratory Exercise, On Corona-Virus

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EFFECT OF PRĀṆĀYĀMA, THE CONTROLLED RESPIRATORY EXERCISE, ON CORONA-VIRUS

ABSTRACT:

Novel Corona-virus mainly create congestion in human respiratory organs. We have tried to express the effect of respiratory yoga i.e. *Prāṇāyāma* to keep us away from its deadly effect.

KEY-WORDS:

Coronavirus, respiration, yoga, Prāṇāyāma.

INTRODUCTION:

Corona-virus¹ is a kind of common virus that causes an infection in one's nose, sinus or upper throat. Most coronaviruses aren't dangerous.

COVID-19 is a disease, as per physicians, creates respiratory tract infection. It can be identified to affect upper respiratory tract i.e. sinus, nose, and throat and also lower respiratory tract i.e. windpipe² and lungs.

It spreads the same way other coronaviruses do, mainly through person-to-person contact. Infections range from mild to deadly.

This virus is of seven types, of two cause severity of the diseases like (1) Middle East Respiratory Syndrome (MERS³) and (2) Sudden Acute Respiratory Syndrome (SARS⁴). The other coronaviruses cause most of the colds that affect us but aren't a serious threat for healthy people.

The virus can lead to pneumonia, respiratory failure, septic shock, and death. Many COVID-19 complications may be caused by a condition known as cytokine⁵ release syndrome or a cytokine storm. This is when an infection triggers one's

¹ Virus is a submicroscopic infectious agent that replicates only inside the living cells of an organism. Viruses infect all types of life-forms, from animals and plants to micro-organisms, including bacteria and archaea.

² Trachea

³ As per WHO, it is a viral respiratory disease was first identified in Saudi Arabia (Middle East) in 2012. So, the disease was named as MERS. This type of Coronaviruses are viruses causing common cold to Severe Acute Respiratory Syndrome (SARS). MERS symptoms include fever, cough and shortness of breath. Pneumonia is common.

⁴ Severe acute respiratory syndrome is a viral respiratory illness, caused by a coronavirus, was first reported in Asia in February 2003. Over the next few months, the illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained. SARS begins with a high fever (temperature greater than 100.4°F or 38.0°C). Other symptoms are headache, an overall feeling of discomfort, and body aches. Some people also have mild respiratory symptoms at the outset. About 10 percent to 20 percent of patients have diarrhea. After 2 to 7 days, SARS patients may develop a dry cough. Most patients develop pneumonia.

immune system to flood your bloodstream with inflammatory proteins called cytokines. These can kill tissue and damage one's organs.

An increasingly common mutation of the novel coronavirus found in Europe, North America and parts of Asia are more infectious but appears less deadly.

This virus is intended to create mainly respiratory problem to human being then entangle to develop other symptoms within the body. So, we are concerning with respiratory trouble and trying its remedy by our traditional respiratory yoga.

MATERIALS USED:

Books and articles about importance and benefit of *Prāṇāyāma* as well as articles on COVID-19.

AIMS AND OBJECTIVES:

Effectiveness of physiological changes in respiratory system occurs due to effect of COVID-19 i.e. creating congestion within lungs by viral effect. Regular practice of *Prāṇāyāma* would be effective to fight against congestion in respiratory system.

PHYSIOLOGY OF RESPIRATION:

Breathing is automatic function but it can be consciously controlled by bringing sympathetic and para sympathetic nervous system into harmony. Inspired air pass through trachea⁶, bronchi, bronchioles and finally end in the alveoli where process of gaseous exchange takes place between lungs and blood cells (external respiration) through respiratory membrane. This process of exchange can be made properly by *Bāhirkumbhaka* (बहिरकुम्भक) or external breath retention of *Prāṇāyāma*. Then at the tissue level exchange of gases takes place between blood and tissues by *Antarkumbhaka* (अन्तरकुम्भक) or internal breath retention of *Prāṇāyāma*.

DESCRIPTION:

Coronaviruses imposed serious health threats to human with acute respiratory syndrome terminating to fatality. This virus is causing widespread respiratory, gastrointestinal and central nervous system diseases on loss of human resource.



It can be classified into four genera: (1) *Alpha-coronavirus* i.e. α – coronavirus (2) *Beta-coronavirus* i.e. β – coronavirus (3) *Gemma-coronavirus* i.e. γ – coronavirus and (4) *Delta-coronavirus* i.e. δ – coronavirus where α – & β –

⁵ cytokines modulate the balance between humoral and cell-based immune responses, and they regulate the maturation, growth, and responsiveness of particular cell populations. Cytokines are important in health and disease, specifically in host immune responses to infection, inflammation, trauma, sepsis, cancer, and reproduction.

⁶ कन्ठनाडी, Kanthanāḍī

coronavirus infect mammals; γ – coronavirus infect avian species and δ – coronavirus infect both mammalian⁷ as well as avian⁸ species.

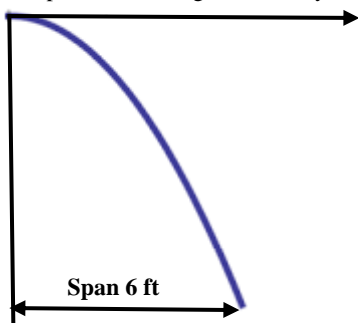
COVID-19 (Coronavirus Disease – 2019) may create complications by releasing cytokine i.e. enhancing cytokine release syndrome or a cytokine storm. This introduce infection triggering one's immune system to flood your bloodstream with inflammatory proteins called cytokines. They can kill tissue and damage one's organs.



Man expelling droplets from mouth

It spreads when a sick person coughs or sneezes. They can spray droplets⁹ as far as 6 feet away. If one breathes those in or swallow those, the virus can get into one's body. Some people who have the virus but don't have symptoms, they can still spread the virus. One can also get the virus from touching a surface or object the virus is on, then touching your mouth, nose, or possibly your eyes. Most viruses can live for several hours on a surface that they land on. A study shows that SARS-CoV-2 can last for several hours on various types of surfaces.

Droplets are coming horizontally from mouth



This projectile is launched with an initial horizontal velocity from an elevated position.

Droplets are coming down to earth in parabolic path, as projectile due

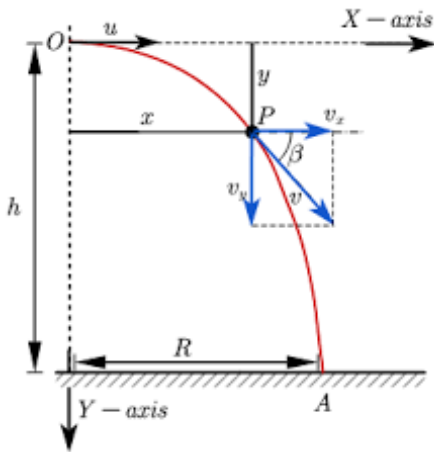
action of gravity.

⁷ Milk feeding animals.

⁸ Relating to bird i.e. winged species.

⁹ It means 'let it drop' or heavier than air. It is respiratory droplet and it is a small aqueous droplet produced by exhalation, consisting of saliva or mucus and other matter derived from respiratory tract surfaces. Droplet sizes range from $<5 \mu\text{m}$ to $1000 \mu\text{m}$. Large droplets (larger than about $100 \mu\text{m}$, but depending on conditions) fall to the ground or another surface before drying, but smaller ones fall slowly and dry so quickly that they usually become aerosolized particles. Respiratory droplets can be produced naturally as a result of breathing, talking, sneezing, coughing, or vomiting, or can be artificially generated through aerosol-generating medical procedure. Since droplets can contain infectious bacterial cells or virus particles, they are important factors in the transmission of respiratory diseases. [μm – Micrometre, also called micron, metric unit of measure for length equal to 0.001 mm , or about 0.000039 inch . The micrometre is commonly employed to measure the thickness or diameter of microscopic objects, such as microorganisms and colloidal particles].

For the derivation of formula for horizontal projectile motion, consider the figure given below:



Droplets are known to be thrown horizontally from a point O with constant velocity u . Point O is taken to be at height h (i.e. at the height of mouth of a man) above the ground. Now, for our mathematical deduction on the path, we consider the motion of one droplet. Then droplet has two simultaneously independent motions along two mutual vertical axes: (1) motion with uniform horizontal velocity u (ii) starting from rest¹⁰, vertically downward accelerated motion with constant acceleration due to gravity g .

Let a droplet moves along the path OPA under the influence of these two motions. Here it is important to note that this motion is controlled by gravitational force.

Here, X -axis is horizontal and Y -axis is taken downwards. Here downward direction is considered to be positive and acceleration is $+g$.

Let us consider after time t the droplet reaches the point $P(x, y)$ where along horizontal axis velocity $= u_x = u$; distance $=$ speed \times time i.e. $x = u \times t$ and along vertical axis initial velocity $u_y = 0$ at $t = 0$, and acceleration along y -axis $= a_y = g$, distance traversed along Y -axis $= s_y = y$ then $s_y = u_y + \frac{1}{2}a_y t^2 = \frac{1}{2}g \left(\frac{x}{u}\right)^2$; Therefore, $y = \frac{gx^2}{2u^2}$ being g, u to be constant, the curve is a parabola.

Covid-19 is a respiratory illness disease and is largely spread via droplets in the air, where heavier particles fall to the ground immediately, but it contains some smaller as well as lighter particles which can travel further and linger in the air. On ground coronavirus loses its activity.

This virus has been declared **PANDEMIC**¹¹ due to massive loss of human resource globally.

As this type of viral infection creates mostly respiratory trouble, we are intended to advice to practice Indian method of respiratory exercise i.e. **Prāṇāyāma**¹², as remedy of trouble or disease.

In second chapter¹³ of **Haṭha Yoga Pradīpikā**¹⁴ we find following Śloka:

Following six stanzas deals with effect of air on our body and its practicing under supervision by an expert.

अथासने दृढे (दृढे) योगी वशी हित-मिताशनः ।
गुरुपदिष्ट-मार्गेण (गुरुपदिष्टमार्गे) प्राणायामान्समभ्यसेत् ॥२/१॥

Roman Transliteration:

Athāsane dṛḍhe (dṛḍhe) yogi vaśī hita-mitāśanaḥ |
Gurūpaḍiṣṭa-mārgēṇa (gurūpaḍiṣṭamārgē) prāṇāyāmānsamabhyaset ||2/1||

Thus, being established in āsana¹⁵ and having control¹⁶, taking balanced diet; Prāṇāyāma should be practiced as per instruction of the guru; i.e. Respected Yogī sits on selected seat which is selected for good and under measured area, direct to practise Prāṇāyāma under his supervision.

¹⁰ Droplets move horizontally, it should not have any component in its vertical direction as $u \times \cos 90^\circ = 0$

¹¹ Panic + Epidemic i.e. Epidemic creating panic.

¹² प्राणायाम - "Science of breath control". It is extension of Prāṇa or breath i.e. extension of life-force or vital energy under control (Prāṇa + Ayāma means breath + extend under control). The word Prāṇa may be composed into *prā* (first unit) and *ṇa* (energy). Prāṇa denotes force of constancy to produce constant motion i.e. Prāṇa indicates vital life force whereas Prāṇāyāma is the process by which internal *prāṇic* store is increased. It is not merely a breath control but a technique through which the quantity of *prāṇa* in the body is activated to a higher frequency.

¹³ द्वितीयोपदेशः (dviṭīyopadeśaḥ)

¹⁴ हठ-योग-प्रदीपिका

¹⁵ Sitting posture

¹⁶ Of the body

So, *Prāṇāyāma*, respiratory yoga exercise should be practised under direct supervision of expert accordingly his demonstrating posture.

छले (चले) वाते छलं (चलं) छित्तं (चित्तं) निश्छले (निश्चले) निश्छलं (निश्चलं) भवेत् ।
योगी स्थाणुत्वमाप्नोति ततो वायुं निरोधयेत् ॥२/२॥

Roman Transliteration:

Chale (cale) vāte chalam (calam) chittam (cittam) niśchale (niśchale) niśchalam (niśchalam) bhavet |

Yogī sthāṇutvamāpnoti tato vāyūṁ nirodhayet ||2/2||

When *Prāṇa*¹⁷ moves, *chitta*¹⁸ moves. When *prāṇa* is without movement, *chitta* is without movement. By this¹⁹ the yogī attains steadiness and should thus restrain the *vāyu*²⁰; i.e. Irregularity in respiration create disturbing mind. Yogī keeps steadiness of mind by making regularity in respiration.

Respiration exercise is essential to keep the body and mind fresh.

यावद्वायुः स्थितो देहे तावज्जीवनमुच्यते (तावज्जीवनमुच्यते) ।
मरणं तस्य निष्क्रान्तिस्ततो (निष्क्रान्तिस्ततो) वायुं निरोधयेत् ॥२/३॥

Roman Transliteration:

Yāvadvāyuh sthito dehe tāvajjīvanamuchyate (tāvajjīvanamuchyate) |

Maranaṁ tasya niṣkrāntistato (niṣkrāntistato) vāyūṁ nirodhayet ||2/3||

As long as the *vāyu*²¹ remains in the body, that is called life. Death is when it leaves the body. Therefore, retain *vāyu*; i.e. How far breathing on our life exist. When we are out of breath we die.

Breath is our *Prāṇa*.

मलाकलासु नाडीषु (नाडीषु) मारुतो नैव मध्यगः ।
कथं स्यादुन्मनीभावः कार्य-सिद्धिः कथं भवेत् ॥२/४॥

Roman Transliteration:

Malākālāsu nāḍīṣhu (nāḍīṣu) mārūto naiva madhyagaḥ |

Katham syādunmanībhāvaḥ kārya-siddhiḥ katham bhavet ||2/4||

The vital air does not pass in the middle channel because the *nāḍīs*²² are full of impurities. So, how can the state of *unmanī*²³ arise and how can perfection or *siddhi* come about? i.e. Breath never pass through middle-channel of the human body for cleaning of impurities in abdomen²⁴ then how can we get refreshed.

शुद्धमेति यदा सर्वं नाडी-छक्रं (चक्रं) मलाकुलम् ।
तदैव जायते योगी प्राण-संग्रहणे कष्टमः (क्षमः) ॥२/५॥

Roman Transliteration:

Śuddhameti yadā sarvaṁ nāḍī²⁵-chakraṁ (cakram) malākulam |

Tadaiva jāyate yogī prāṇa-saṁgrahaṇe kaṣṭamaḥ (kṣamaḥ) ||2/5||

When all *nāḍīs* and *chakras*²⁶ are full of impurities then these are to be purified with help of *yogī* to retain *prāṇa*; i.e. When all channels are filled with impurities then these are to be cleaned by breathing under *Yogī*, master, to control life i.e. *Prāṇa*.

¹⁷ प्राण – inhaling whereas अपाण (apāṇa) – exhaling.

¹⁸ The mental force

¹⁹ The steadiness of *Prāṇa*

²⁰ air

²¹ Air and *prāṇa*

²² Nerves or nervous system which was considered to carry Flow of energy through wire-like structure.

²³ Lethargic

²⁴ *Suśumnā* (सुशुम्ना): — a particular artery (probably ‘the carotid’ – These are major blood vessels in the neck that supply blood to the brain, neck, and face.) or vein of the body, supposed to be one of the passages for the breath or spirit. Two medium size arteries on each side of the neck to supply blood in the brain. (Internal carotid, अन्तर मातृक and vertebral arteries, सुशुम्ना मातृक धमणि). *Suśumnā* (सुषुम्णा) also known as spinal cord to connect cakras or effecting spots i.e. six plexuses whereas there is spelling difference to indicate two are different i.e. one indicate artery and other cord.

²⁵ In yoga theory, *nāḍīs* carry *prāṇa*, life force energy. In the physical body, the *nāḍīs* are channels carrying air, water, nutrients, blood and other bodily fluids around and are similar to the arteries, veins, capillaries, bronchioles, nerves, lymph canals and so on.

प्राणायामं ततः कुर्यान्नित्यं सात्त्विकया धिया ।
यथा सुषुम्णा (सुशुम्ना)-नाडीस्था मलाः शुद्धिं प्रायान्ति च (च) ॥२/६॥

Roman Transliteration:

Prāṇāyāmaṁ tataḥ kuryānnityaṁ sāttvikayā dhiyā |

Yathā suṣumṇā (suśumṇā)-nāḍīsthā malāḥ śuddhiṁ prāyānti cha (ca) ||2/6||

There prāṇāyāma should be done with sāttvic²⁷ state of mind so that the impurities are driven out of suśumṇā nāḍī to achieve purification; i.e. Daily performing Prāṇāyāma genuinely drive out impurities of the Suśumṇā make an intellect freed from all hazards of mind.

Prāṇāyāma deals with 'science of breath'. There are four steps in it but methods are different.

- 1) *Pūraka*²⁸ (पूरक) or inhalation.
- 2) *Kumbhaka*²⁹ (कुम्भक) or confining.
- 3) *Recaka*³⁰ (रेचक) or exhalation.

प्राणायामस्तिधा प्रोक्तो रेच (रेच)-पूरक-कुम्भकैः ।
सहितः केवलश्चेति (केवलश्चेति) कुम्भको द्विविधो मतः ॥२/७१॥

Pāṇāyāmastidhā prokto recha (reca)-pūraka-kumbhakaiḥ |

Sahitaḥ kevalaścheti (kevalaśceti) kumbhako dvividhā mataḥ ||2/71||

Prāṇāyāma is in three stages: exhalation (*Recaka*), inhalation (*Pūraka*) and retention (*Kumbhaka*). Again *Kumbhaka* is of two types connected (*Sahita*) and unconnected (*Kevala*). There are three stages of performing Prāṇāyāma and are Pūraka, Rechaka and Kumbhaka.

There are different methods of performing the exercise but we are not concerning ourself with the process.

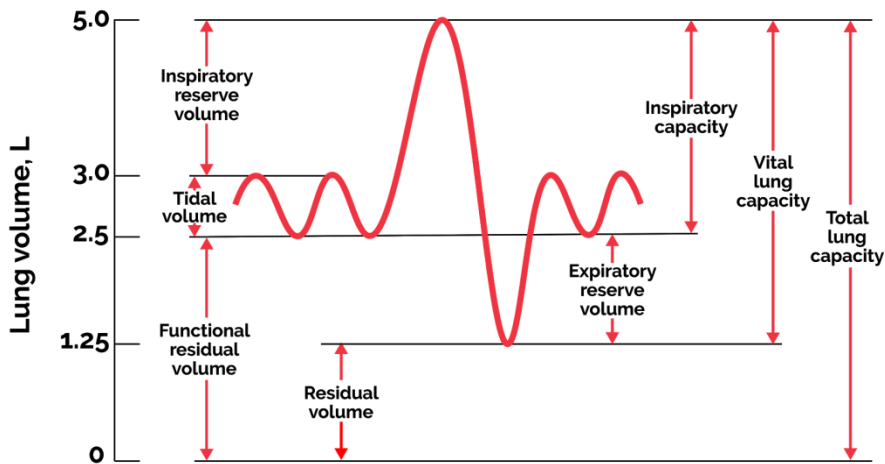
युक्तं युक्तं त्यजेद्वायुं युक्तं युक्तं च (च) पूरयेत् ।
युक्तं युक्तं च (च) बध्नीयादेवं सिद्धिमवाप्नुयात् ॥२/१८॥

Roman Transliteration:

Yuktaṁ yuktaṁ tyajedvāyuraṁ yuktaṁ yuktaṁ cha (ca) pūrayet |

Yuktaṁ yuktaṁ cha (ca) badhniyādevaṁ siddhimavāpnuyāt ||2/18||

The vāyu should skillfully be inhaled, retained and exhaled, so that perfection of siddhi attained; i.e. Air should be filled and expelled after retention properly as well as skillfully.



Total capacity of air within the human lung = 5 Liters = 5000 ml.

²⁶ Channels of flowing oxygenated blood and it circulates at chakras where each chakra vibrates at a particular rate and velocity.

²⁷ Steady-state

²⁸ Filling of total inspiration capacity

²⁹ It can be subdivided into a) *Antarkumbhaka* (अन्तर्कुम्भक) or internal breath retention and b) *Bāhirkumbhaka* (बहिर्कुम्भक) or external breath retention.

³⁰ Expelling total expiration volume.

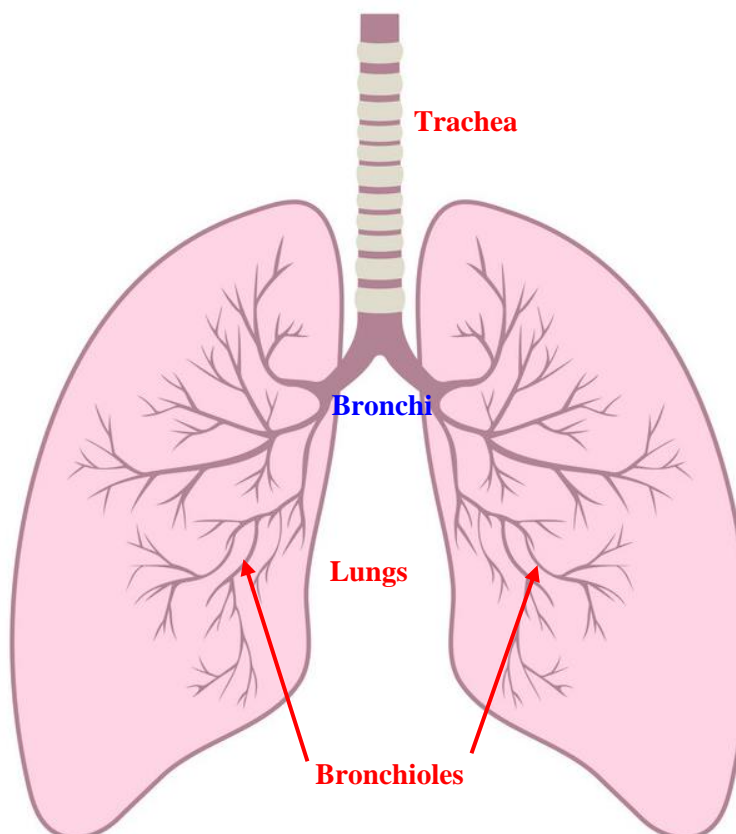
In respiration:

- a) Inspiration: -
 1. Tidal Volume (TV) = Volume of air inhaled or exhaled by each breath under normal condition = 0.5 Liters = 500 ml.
 2. Inspiratory Reserve Volume (IRV) = Amount of air that can be forcefully inhaled after inhalation of tidal volume of air = 2 Liters = 2000 ml.
 3. Total Inspiratory Capacity (TIC) = TV + IRV = 2.5 Liters = 2500 ml.
- b) Expiration: -
 1. Expiratory Reserve Volume (ERV) = Amount of air can be forcefully exhaled after normal exhalation (TV) = 1.25 Liters = 1250 ml.
 2. Expiratory Volume of Air (EVA) = TV + ERV = 1.75 Liter = 1750 ml.
- c) Residual Volume of Air (RV) = Volume of air remained within the lung even after all sorts of exhalations.
- d) Vital Capacity of Lungs = IRV + ERV = 3.25 Liters = 3250 ml.

Prāṇāyāma deals with the fully use of **Vital Capacity** of lungs by respiratory exercise to increase vitality of human body. As '*Pāṇa*' indicates Breath or vital energy of the body i.e it represents the **prāṇic energy** responsible for life or life force whereas '*ayāma*' means control. So, it indicates total controlled breath exercise.

This process will make regular efficient usage of muscles in respiration to increase the strength and extensibility of elastic collagen fibre³¹; ultimate improving inspiratory and expiratory contraction power, cleansing the airways secretions thereby decreasing the resistance to air flow for making full and free utility of alveoli to form better amount of oxy-hemoglobin.

Respiration during *Prāṇāyāma* practice³² is adopted leading to decreased rate of respiration.



The **trachea** is called the windpipe, is a cartilaginous tube that connects the larynx³³ to the bronchi³⁴ of the lungs, allowing the passage of air. Bronchioles are tiny ways to come out air into the lungs, fountain like, to exchange carbon-dioxide from blood to make oxygenated-blood.

³¹ It is a type of protein and it present in connective tissues for tensile strength and elasticity.

³² Conscious process of very much regulated respiration



How blood is mixed with air

EFFECT & REMEDIES:

Coronavirus creates respiratory trouble to accumulate cough in lungs to inactive the proper oxygenation of blood through bronchioles.

Regular practicing respiratory exercise i.e. Prāṇāyāma under the supervision of an expert, better to be physician may help to come off the pandemic effect.

यदा तु नाडी-शुद्धिः स्यात्तथा छिह्नानि (चिह्नानि) बाह्यतः ।
कायस्य कृशता कान्तिस्तदा जायते निश्चितम् (निश्चितम्) ॥२/१९॥
यथेष्टं (यथेष्टं) धारणं वायोरनलस्य प्रदीपनम् ।
नादाभिव्यक्तिरारोग्यं जायते नाडि-शोधनात् ॥२/२०॥

Roman Transliteration:

Yadā tu nāḍī-śuddhiḥ syāttathā chihhnāni (cihnāni) bāhyataḥ |
Kāyasta kṛśtā kāntistadā jāyate niśchitam (niśchitam) ॥2/19॥
Yatheshṭam (yatheshṭam) dhāraṇam vāyoranalasya pradīpanam |
Nādābhivyaktirārogyam jāyate nāḍi-śodhanāt ॥2/20॥

When nāḍīs are purified there are external symptoms. Success is definite when the body becomes this and glows & When one is able to hold the vāyu according to one's will, the digestive power increases. With the nāḍīs purified, thus the inner sound or nāda³⁵ awakens and one is free from disease; i.e. After proper respiration our body will be free from impurities and work is done by air³⁶ which cleans through gas exchange by blood. By this process appetite is increased, the divine sound is awakened and our body becomes healthy with the appearance of glowing colour and feeling of success.

CONCLUSION:

As per our medical science we fill up our lungs with air, by breathing, which in our *sāstras*³⁷ known as *Prāṇa-vāyu*. There oxygen from air to all the blood vessels spread over the lungs to expel carbon-dioxide from them.

प्राणायामेन युक्तेन सर्व-रोग-कषयो (क्षयो) भवेत् ।
अयुक्ताभ्यास-योगेन सर्व-रोग-समुद्रमः (समुद्रमः) ॥२/१६॥

Roman Transliteration:

Prāṇāyāmamena yuktena sarva-roga-kṣayo (kṣayo) bhavet |
Ayuktābhyāsa-yogena sarva-roga-samudgamaḥ (samudbhavaḥ) ॥2/16॥

³³ It is an organ in the top of the neck involved in breathing.

³⁴ The bronchi are the airways that lead from the trachea into the lungs.

³⁵ Resonance

³⁶ Prāṇa-vāyu (प्राण-वायु)

³⁷ शास्त्र – Text devising theory as well as practice.

By proper practice of *prāṇāyāma* etc., all diseases are eradicated. Through improper practice all diseases can arise; i.e. If *Prāṇāyāma* performed properly then all diseases are eradicated, but improper practice of *Prāṇāyāma* may generate diseases.

Prāṇāyāma strengthens respiratory muscles to improve lungs volume and capacities in healthy and diseased³⁸. Supplement of protein is essential to increase the activity of collagen fibre which is evitable to uplift respiratory capacity to fight against COVID-19³⁹. This process, *Prāṇāyāma*, tries to keep lungs strong and effective to increase amount of oxygenated blood in the body. The activity can lead us to overcome weakness, disorder in body parts and intend to keep us away from the disease as well as dis-ease.

Regular practice of *Prāṇāyāma*, properly under supervision of an expert, will make one free from congestion in respiration that may keep one away from COVID-19 infection.

Note: In Sanskrit texts language has been corrected within brackets as per modern concept as because at the time of Patañjali⁴⁰ but he did not put Sanskrit under rule. Though linguistic⁴¹ was expressed in Aṣṭādhyāyī⁴² of Pāṇini⁴³ before him.

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³⁸ Restrictive and obstructive respiratory diseases.

³⁹ Principal effect of COVID-19 to infect respiratory system.

⁴⁰ पतञ्जली, Flourished in second century BCE.

⁴¹ Perfection of Sanskrit language by grammar i.e. placed under rule.

⁴² अष्टाध्यायी - Contain 8-Chapters

⁴³ पाणिनि, Grammarian flourished about 700 BCE.