PRANAYAMA PRACTICES AND DISEASE CONTROL

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Abstract

The process of inhaling Prana Shakti (Energy associated with Prana) and exhaling it out is called Pranayama. This pranashakti can be achieved through the control of respiration. There are certain functions of the human body, which are both voluntary and involuntary.The benefits of pranayama for positive health are well known. Even though there are many studies published on the effectiveness of pranayama, there are very few papers, which actually have systematically studied the physiological mechanisms involved, causing the benefits of pranayama, especially with respect to the cardiac function. This article attempts to have a detailed look at the physiology behind deep breathing. The article also conjectures that voluntary, deep breathing with attention may have a role to play in faster recovery from surgeries, and prevent or delay the onset of Alzheimer's disease, Parkinson's disease and may be, even cancer. Detailed, controlled studies are needed to prove or disprove these conjectures.

Key Words: *Pranayama, Oxygen, Carbon-Dioxide, Ph, Chemoreceptors, Parkinson's Disease, Alzheimer's Disease, Cancer, Wound Healing, Respiratory Sinus Arrhythmia, CSF, Vital Capacity.*

INTRODUCTION:

Indiantraditionhasalwaysextolledthepracticeofdifferenttypesofdeepbreathingtechniques, generally known as pranayama for better health of a human being. A number ofstudies have shown reduction of heart rate and blood pressure after different types of pranayama practices.

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However, not many have looked into the mechanism of how deep breathing impacts the various physiological processes, leading to positive health, especiallythatoftheheart.

Inthisarticle,wehavecarefullystudiedtherespiratoryphysiologyandthecardio-respiratorycontrol circuits and we propose possible mechanisms behind the effect of deep breathing inenhancingcardiachealth.Wealsoestablishthatvoluntary,attentive,deepbreathingisaveryeffectivecardiacexercise.

MUSCLES INVOLVED IN BREATHING

The main muscle of respiration is the diaphragm. Other muscles that aid in respiration include the external intercostals, scalene, sternomastoid, abdominal muscles, and internal intercostals.

Diaphragm

In quiet, gentle inhalation, the diaphragm contracts, lowering air pressure inside the lungs and drawing air in. When exhaling quietly, the diaphragm relaxes and the pressure reverses, expelling air.

External Intercostals

The external intercostals are in between the ribs. During active inhalation, they expand the rib cage laterally, anteriorly, and posteriorly.

Scalene/Sternomastoid

These are the shrugging muscles. They serve to lift the sternum and the upper ribs during active inhalation.

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Abdominal Wall

In active exhalation, the muscles of the abdominal wall–rectus abdominis, internal and external obliques, and transverse abdominis–contract, raising abdominal pressure. This, in turn, raises the diaphragm, raising pressure in the lungs and expelling air.

Internal Intercostals

The internal intercostals are deep to the external intercostals. Like their counterparts, they draw the ribs in, expelling air during active exhalation.

VERTICAL BREATHING (DIAPHRAGM BREATHING)

The vertical breathing is called diaphragmatic breathing and is considered a more efficient way to inhale air. It is also called Yogic breathing. Yogic breathing is more a vertical breathing than horizontal breathing. By this vertical breathing, all the alveoli (the functional units of lungs), of both lungs, open out evenly. Due to the even expansion of all the alveoli, a vast expanse of alveolar membrane is available for exchange of gases.

There are totally about 700 million alveoli in the two lungs of an adult human being. This effect is more obvious in the apical, central and basal alveoli. This surface is about 50 square meters in extent, which is 20 times the entire body surface. The larger the surface, available for the process of diffusion, the better would be the process of breathing.

HORIZONTAL BREATHING

In horizontal breathing, the alveoli, toward the periphery, expand more than optimum, while the centrally placed alveoli do not open out properly. This affords a lesser, and uneven surface, for diffusion of gases. If some alveoli remain unopened, they get stuck. There is a collection of secretion in them, and they are prone to disease formation. Moreover, if the peripheral alveoli open wider than is preferable, they lose their elasticity.

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The interalveolar walls (the wall, which unites, as well as separates, two contiguous pulmonary alveoli) may be broken, damaging the capillaries and leading to diseases like emphysema or pulmonale. (Capillaries are the smallest of blood vessels. They serve to distribute oxygenated blood from arteries to the tissues of the body and then feed deoxygenated blood from the tissues back into the veins).

Neuralcontroloftherespiratorymuscles:

These muscles are controlled by 18 (5 cervical, 12 thoracic and one lumbar) pairs of the total31 pairs of the spinal nerves! The accessory muscles are controlled by the three pairs ofcervical nerves C1 to C3, and the diaphragm is controlled by C3 to C5. The eleven pairs ofthoracic nerves T1 to T11 are responsible for the contraction of the 11 pairs each of theexternal,internalandtheinnermostintercostalmuscles.Theabdominalmusclesareinnervate d by the thoracic nerves T6 to T12 and the lumbar nerve L1. The involvement of 36spinalnervesinbreathingclearly showstheimportancegiventorespirationbynature.

LUNG VOLUMES AND THE LUNG CAPACITIES:

• The total lung capacity (TLC), about 6,000 ml, is the maximum amount of air that can fill the lungs (TLC = TV + IRV + ERV + RV).
• The vital capacity (VC), about 4,800 ml, is the total amount or air that can be expired after fully inhaling (VC = TV + IRV + ERV = approximately 80% TLC).
• The inspiratory capacity (IC), about 3,600 ml, is the maximum amount of air that can be inspired (IC = TV + IRV).
• The functional residual capacity (FRC), about 2,400 ml, is the amount of air remaining in the lungs, after a normal expiration (FRC = RV + ERV).

• Some of the air in the lungs does not participate in gas exchange (150ml). Such air is located in the anatomical dead space, within bronchi and bronchioles—that is, outside the alveoli.

• The instrument that is used to measure the volume of air, inspired and expired by the lungs is called spirometer.

900%increaseispossiblefromthe tidalvolumetothevitalcapacity!

In normal (involuntary, passive) breathing, the volume of air displaced between inhalationandexhalation(calledthetidalvolume)isabout500mlor7mL/kgofbodymassforahealthy,young adult. With deep breathing with maximal effort, one can reach the vital capacity(maximum amount of air that can be moved in and out of the lungs in a respiratory cycle) ofabout 4.8litres perrespiration.

This is almost 10 times the tidal volume or a 900% increase in the effectiveness of breathingOR the volume of air displaced per breathing cycle. Together with holding the breath afterinhalationtaughtaspartofadvancedpranayamapractices,thiscanensureextremelyeffectivegasexchange,bettereliminatingthecarbon-dioxide fromthebody!

Involvementofchemoreceptors,baroreceptorsandglands:

studies showed that breathing pure oxygen decreases the heart rate. Deepbreathingnaturallyresultsinincreasedoxygenandreducedcarbon-dioxidelevelsinthebloodand consequently, reduced heart rate and pumping force of the heart due to the feedbackgiven by the chemoreceptors at the aorta and carotid artery to the cardiorespiratory controlcentreslocatedintheponsandmedullaoblongatainthebrainstem.Thebaroreceptorsinthe carotid sinus and the aortic arch constantly sense the changes in the blood pressure bysensing the changes to the tension of the arterial walls. The adrenal and the thyroid glandscan also change the heart rate and blood pressure, by controlling the release of epinephrineand thyroid harmones. Thus, the whole process involves the complex feedback circuitryinvolving the baroreceptors, chemoreceptors and hormones. Thus, deep breathing is a veryeffectivecardiacexercise!

Pranayama and wound healing:

Wounds need oxygen to heal.Continuoussupplyof oxygen tothetissuethroughmicrocirculation is vital for the healing process and for resistance to infection. One of thebiggestfactorsthatcaninhibitthebody'sabilitytorecoverislowoxygenflowtotheaffectedarea.We normally think of cuts, falls and accidents when we hear the word ‘wound’.However,allsurgeriesresultinwoundsthattaketimetoheal.Thus,itistheconjectureoftheauthorthatrecoveryfromsurgeriesmaybeacceleratedby deep breathing.

Role of Oxygenin cancertreatment:

Study of The Nobel-prize winning biochemist Dr. Otto Heinrich Warburg showed that cancerbasically needs a low oxygen environment to survive. He suggested that cancer cells “live inhypoxic,verylowoxygen,andacidicconditionsandderiveenergyfromsugarsbyfermenting them the way yeast does.” From this, he theorized that these low-oxygen and highly-acidicconditions caused cancer. Thus, it is the author’s conjecture that when the body cells havesufficient oxygen, cancer may be prevented or at least delayed! Hyperbaric oxygen has beenshown to induce an antiangiogenic effect in two mammary tumor models, in addition to onegliomamodel.

Treatment ofParkinson’s through Pranayama

Parkinson’sdiseaseinvolveslossofdopaminergicneuronsinSubstantiaNigraparscompacta(SNc) [13]. Due to their structural and functional properties, neurons in the SNc are one ofthe most vulnerable and energy consuming neurons. It has been proposed that the primaryfactorthatcausesthedegenerationofSNcneuronsistheirhighmetabolicrequirements[14].A very recent paper [15], based on computational modelling of basal ganglia, suggests thatthisprocess might beinitiated byweak-excitotoxicity mediated byenergydeficit.

The author conjectures that regular, voluntary deep breathing can increase the supply ofoxygen to the brain, thus preventing or delaying the onset of Parkinson’s disease. Once thesupplyofnutrientsissufficient,thebodyhasadequatemechanismsintermsoffeedbackandpreferential supply, to ensure that the needs of structures that demand additional nutritionaremet.

CONCLUSION:

Active, deep pranayamic breathing is a very effective, cardiorespiratory exercise, with apotentialtorecruitupto89muscles,36spinalnervesandanumberofperipheralandcentralchemoreceptors,volumereceptors,besidespossiblytheadrenalandthyroidglands(inreleasingepinephrineandthyroidhormones).Thus,thehealthoftheheartimproves,andtheheartrateandthebloodpressureareboundtoreducewithprolongedpracticeofpranayama.IftherecentfindingsofCSF flowmodulationbyrespirationareconfirmed,thenregulardeepbreathing has the potential to provide sufficient supplies and also delay or prevent theaccumulation of beta amyloids in the brain, thus preventing Parkinson’s and Alzheimer’sdiseases.

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