

Respiratory System and Yogic practices

Need of Respiratory system-

For our all living activities, we need energy, which get formed in every cell, through oxidation of glucose. Thus, Glucose and Oxygen are the two basic fuels for the energy. We can obtain glucose from diet and store in the body in liver and muscles, in the form of glycogen. When we do fasting, the glucose get used from these storages. So though there is no entry of food we can live for some day but we have no storage of oxygen in the body. That's why we cannot live more than 2 minutes without oxygen. So breathing is a non-stop process from birth to death.

When, oxygen is used in the cell to obtain energy, carbon dioxide get formed as a waste product which has to drain outside the body. Through breathing process, we can drain this waste outside the body.

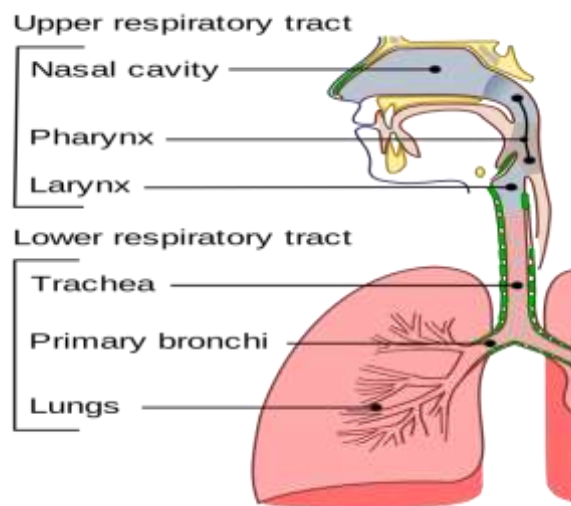
Our respiratory system is constructed in such a way, that the entry of oxygen and exit of carbon dioxide become from easy. Oxygen is transported from air to lung, lung to blood and blood to cell. Carbon dioxide is transported from cell to blood, blood to lung and lung to outside.

When we inhale the air, we perceive the cold touch and when we exhale the air we perceive warm touch in the nose. That means though exhalation, we throw heat from our body. Thus respiratory system is also one of the main systems to regulate the heat.

The blood is vehicle for the gases. The amount of oxygen and carbon dioxide determines the chemical property of the blood. - Acidic and base. Our

blood is maintained slightly alkaline always. Change in blood PH makes too much disturbances in all systems.

Parts of Respiratory track-



- 1) Nose- Made up of bones, cartilage, muscles and mucus membrane.
- 2) Pharynx- This is a common passage for food and air.
- 3) Larynx- It's a voice box. It's a passage for air and origin of speech.
- 4) Trachea- It's a wind pipe, covered by cartilage rings. We can feel it at the sterna notch.
- 5) Bronchi- It is a bifurcation and branching of airways. The branching is within the lung.

6) Alveoli- It's an air sac. The exchange of air takes place from the wall of alveoli. Externally the surface of alveoli is covered by capillary network. The external layer of capillaries and alveoli become one, called as respiratory membrane. This is permeable for the air.

Lung- Anatomy and properties

It is a highly elastic substance in the body. It is made up of numerous alveoli, branches of bronchus and elastic parenchyma. Externally it is covered by the membrane- pleura. It's just like the cushion in the loose pillow cover.

Basically lung is made up of lobes (Right-3, left-2). But not all parts of lung get used in our usual breathing. Only 1/6th part gets used. In usual breathing, 500ml air gets inhaled and 500 ml get exhaled. This is called as tidal volume of the lung. Besides that, 2400ml of air is already within the lung. When we purposefully exhale deeply, we can throw 1200ml air out of that 2400ml. This exhaled air is called as reserved respiratory volume. But remaining 1200ml cannot be exhaled during exhalation at any cost. Thus this 1200ml air is called as Residual air. (These numbers may vary according to health of the person).

Thus, in usual breathing, the amounts of air after inhalation become 2900ml. Besides that, if one inhales fully the amount of air become 6000ml. That means we can inhale 3000ml extra, than usual. This is our lungs reserved capacity (reserved inspiratory volume). Lastly conclusion is those healthy lungs can hold 6000ml air inside it. This is called as total capacity of the lung.

In the practice of pranayama, obviously functioning of lung get improved and modified according to the level of practice. Such modification can

be studied through following points- Elasticity , endurance, exchange activity and capacity.

Lung is an elastic organ .But not all parts of the lungs are equally elastic. We can distinguish three zones of varying degrees of expansibility.

1)Root zone- It has least distensibility. It contains bronchi, arteries and some fibrous tissue.

2)Intermediate zone-In contains branches of bronhi and vessels.

3)Outer zone- It is highly elastic.

The apical , posterior and mediastinal surfaces of the lungs are in contact with regions of the thorax which move very little. These are called as indirectly expanded regions. The sterno-costal and diaphragmatic regions of the lungs have the greatest motion for expansion. These are called as directly expanded regions.

During normal quiet breathing not all alveoli share equally for the exchange of gas with blood. Indirectly unexpanded regions have smaller ventilation. (so these are very much prone for the infections.)

Regular practice of pranayama increases the work of elastic tissue in all parts of the lung. Especially in ujjayi type of breathing, we can expand unused part also i.e. Apical lobe.

All elastic tissue contains two types of stretch receptors- slow adapting and rapid adapting. When one starts the practice, slow adapting stretch receptors get activated which leads to tendency not to inhale more or hold the breath. Or sometimes it may leads to rapid exhalation for the further inhalation. But the regular practice reduces this phenomenon , either by training the local tissue or by

increase in will. This is improvement in the endurance. This modification helps to develop the length of kumbhaka and also the rhythm in pranayama.

Ageing process in the Respiratory system-

The lungs become more rigid. The elastic tissue gets reduced. The number and size of alveoli get decreased. This reduces the total capacity of the lung. Also reduces the capacity of diffusion (exchange of air)

The mucus secretion in the respiratory track gets reduced. So the trachea and bronchi get irritated during entry of air. This leads to chronic cough, bronchitis etc.

Also the thoracic cage get degenerated which minimizes the space for expansion of lung.

To live in polluted area, smoking, lack of lung exercise, faulty breathing habits leads to early degeneration or ageing. Variety of breathing practices for the health of respiratory system through various ways.

1.	Kapalbhati	Wash out the bad air from the lungs. Improves the tone of smooth muscles of the respiratory track.
2.	Ujjayi	Expands the lung in all directions. Improves the capacity of lung.
3.	Anulom-vilom	Trains the respiratory muscles to contract and relax slowly and deeply.
4.	Bhramari	Improves the length of exhalation. And thus further

		inhalation.
5.	Shitali	Reduces extra heat from the respiratory track. Improves lung capacity.
6.	Bhastrica	It improves the breath holding capacity.

Health of Thoracic cage:

Thoracic cage is made up of following bones-

Sternum- During inhalation, it get moved slightly upward and forward.

12 pair of Ribs- Having some elastic properties so that, during inhalation it gets expanded and during exhalation it gets squeezed. It helps to Space and exercise of heart and lungs. Regular slow deep breathing helps to maintain the elasticity of ribs. Especially, ujjayi type of breathing . 12 Thoracic vertebrae- these are having slightly moveable, synovial, intervertebral joints. Vertebro-thoracic joints are also slightly moveable.

Respiratory muscles-

We can divide it into two groups-

Main respiratory muscles- Intercostals (external and internal), diaphragm.

Assessory respiratory muscles- Subclavious, sternocledomastoid, pectoralis minor, serratus posterior, abdominal muscles.

Following asanas are helpful to improve elasticity and strength of these muscles-

Simple group-Parvatasana, Side bending chakrasana, Katichakrasana, Bhujangasana, Pavanmuktasana.

Advanced Group- Virbhadrasana, Ushtrasana, Dhanurasana,Rajkapotasana, Triconasana, Shwanasana.

Regulation of Respiration-

Medulla oblongata	Usual breathing, involuntary
Pons	During increased physical work, involuntary
Limbic system	During emotional arousal, stress, involuntary.
Cortex	Voluntary, during pranayama.

Conclusions:

This clears that our breathing process happens according to need of oxygen, activity, mental status, specific posture and also the will. Mostly , the emotional status reflects on our breathing pattern. So the chronic stressed people have very small breath cycle and the speed is high. Or sometime bizarre breathing pattern (long, short, and arrhythmic). Through yoga practice, when the calmness appears and sustains persistently, the regular breathing pattern also get modified. It becomes slow and slightly deep. Especially, regular practice of pranayama, for a long times, modifies the usual medullary rhythm (one can get the healthy breathing rhythm.)

Our regular sitting posture modifies the breathing pattern. To sit in the erect trunk position allows the chest to expand in all directions easily. This also helps to improve the alertness and positive attitude in daily activity.

