

# Yoga Therapy: The Significant Impact of Pranayama on Respiratory Functions

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**Abstract**—The benefits of Yoga have been known to us since thousands of years. The regular practice of it is accompanied by a number of beneficial physiological effects in the body. Pranayama is an art (Prana - "life energy"; Yama - "discipline"), improves the lung functions and overall health of the body. The Yogic techniques (like Suryanamaskar, Bramhari and Kapalbhathi Pranayama) increase the compliance of the lungs and strengthen the respiratory musculature. A healthy respiratory profile is maintained by the ability of the lungs to inflate and deflate to fullest possible extent. Lungs consists of approximately 300 million tiny sacs called alveoli, where the exchange of O<sub>2</sub> and CO<sub>2</sub> take place. These sacs are continuous with the lumen of the air ways. The air-facing surface of the alveoli sacs is lined with Type I alveolar epithelial cells with interspersed Type II specialized alveolar cells having stretch receptors. The latter secretes a substance known as surfactant (phospholipid and protein; the main lipid component of surfactant is dipalmitoylphosphatidyl choline, which reduces surface tension) and the amount of surfactant determines the lung compliance. The compliance is the inverse of stiffness of lungs and depends upon the stretch ability of lung tissues. A deep breath stimulates the stretch receptors on the type II cells which further increase the secretion of the surfactants on inspiration, thus improving the lung compliance and its functioning.

During respiration, the blood that enters the lungs through pulmonary arteries have relatively high partial pressure of CO<sub>2</sub> (Pco<sub>2</sub>) and low partial pressure of O<sub>2</sub> (Po<sub>2</sub>), whereas the alveoli have high Po<sub>2</sub> and low Pco<sub>2</sub>. This difference in the partial pressure of CO<sub>2</sub> and O<sub>2</sub> in the capillary and the membrane of alveoli results in the net diffusion of O<sub>2</sub> from the alveoli to blood and CO<sub>2</sub> in the alveoli. When there is an increase in metabolism as compared to alveolar ventilation, there is an increase in Pco<sub>2</sub>. With the increase in Pco<sub>2</sub> there is corresponding increase in arterial H<sup>+</sup> concentration because of CO<sub>2</sub> retention and this state is called as respiratory acidosis. The deep inspiration techniques of Yoga, can increase the compliance of the lungs leading to increase Po<sub>2</sub> in the alveoli, thus taking care of respiratory acidosis (an acid-base balance disturbance due to alveolar hypoventilation) and pulmonary edema. (accumulation of fluid in lungs).

**Keywords:** Yoga Therapy, Pranayama, Suryanamaskar, Bramhari, Kapalbhathi, Type I & II alveolar epithelial cells, Dipalmitoylphosphatidyl choline, Lung Compliance, Respiratory acidosis and pulmonary edema.