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A CONCEPTUAL STUDY ON YOGIC BREATHING AND ITS COMPARISON WITH THE RESPIRATORY MECHANISM ACCORDING TO MODERN SCIENCE

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ABSTRACT

Breathing influences every cell in the body and is closely connected to brain function. On average, a person takes 15–16 breaths per minute, totaling around 21,600 breaths daily. By controlling *Prana*, the life force, one can effectively regulate bodily functions and enhance the development of the body, mind, and spirit. Breaking governs the mind, intellect, and ego, helping to balance one's individual and cosmic existence. *Hatha Yog* views *Prana Tattwa* (the life force principle) as more important than *Manas Tattwa* (the mental principle), as *Prana* remains active even when the mind is at rest, such as during sleep. Therefore, *Prana* is considered more essential than the mind.[1]

Before practicing *Pranayama* (breath control), *Yoga* practitioners must train the muscles of the pulmonary cavity and become more aware of their breathing patterns. This helps strengthen their vital energy and prepares them for practice. It is crucial to breathe slowly, deeply, and rhythmically while maintaining a calm and peaceful state of mind, as irregular breathing can disrupt brain function.

Keywords: *Prana*, *Yoga*, *Yogic* breathing, *Yogic kriya*, Respiratory mechanism, *inner energy*, *Pranayama*, Respiration

INTRODUCTION

Breathing is a fundamental function in all living beings, involving two phases: active inspiration and passive expiration. Under normal conditions, the pressure within the lungs remains slightly negative, keeping them inflated. During inspiration, an increase in negative pressure is necessary, achieved by expanding the thoracic volume in three dimensions. The diaphragm, the primary muscle involved in breathing, increases the volume in the superior-inferior direction. At the same time, the anterior-posterior dimension is expanded through the movement of the sternum and ribs (pump handle movement). The lateral movement of the ribs (bucket handle movement) increases the transverse dimension. Various respiratory muscles, categorized into primary, secondary, and accessory muscles, support these movements. Though these muscles are skeletal, they exhibit unique characteristics:

1. They function cyclically.
2. They operate from the first breath taken at birth to the last at death.
3. They do not experience fatigue.

Respiration is classified into thoracic and abdominal types. Purely thoracic or abdominal breathing is considered pathological in modern medicine, which also observes differences in breathing patterns between males and females. Males and newborns primarily use abdomino-thoracic breathing, while females engage in thoraco-abdominal breathing. Ancient Indian sages, however, advocated for abdominal breathing for the general population, as it helped reduce physical and psychological issues. *Yoga* practitioners are encouraged to fully utilise the thoracic cage to maximize lung capacity, with specific postures (Asanas) aiding in this process.[2]

Respiratory movements affect the thoracic cavity in three dimensions: transverse, anteroposterior, and vertical. Elevating the ribs increases the transverse and anteroposterior diameters while contracting the diaphragm expands the vertical dimension. During inspiration, the increase in thoracic volume lowers intra-pleural pressure, drawing air into the lungs. Conversely, expiration is a passive process driven by the elastic recoil of the thoracic wall and lungs. Quiet respiration mainly relies on the diaphragm, with minimal rib movement, while deep breathing engages additional muscles such as the Scalenes and sternocleidomastoid. Forced breathing involves maximum contraction of the diaphragm and the use of accessory muscles. Variations in thoracic movement and breathing patterns are influenced by factors such as the shape of the thoracic skeleton and habitual breathing styles. Changes in the nostrils, larynx, trachea, and bronchial tone also impact breathing dynamics.

Breathing Anatomy –

Breathing is a coordinated action involving the thoracic and abdominal muscles, with the diaphragm being the primary muscle for inspiration, contributing to about two-thirds of quiet breathing. External intercostal muscles support inspiration, while the internal intercostals assist with expiration. During inhalation, the diaphragm contracts and moves downward, increasing the volume of the chest cavity and reducing intrapleural pressure, allowing air to flow into the lungs. The lower ribs remain stationary to enable efficient diaphragm contraction, while the upper ribs elevate, and the chest expands. The diaphragm's movement and its relationship with the abdominal organs vary depending on posture—it is at its highest when lying down and lowest when standing. The diaphragm's height and movement patterns also change in different positions, such as sitting or lying on one side. Diaphragmatic excursion, or the movement of the diaphragm, ranges from 1.5 cm during quiet breathing to 6-10 cm during deep breaths. Relaxation of the abdominal muscles during inspiration is essential for optimal diaphragm function. In cases where there is resistance in the upper airway, such as during sleep for some individuals, the diaphragm and other respiratory muscles must work harder to maintain adequate breathing.

In *Ayurveda*, breath is intrinsically connected to *Prana*, the life force or vital energy that sustains the

body and the mind. In *Ayurveda* and *Yogic* philosophy, *Prana* is extensively discussed in ancient texts such as the *Samhitas* and *Upanishads.* [3] According to the *Yoga Chudamani Upanishad*, during *Yoga* practice, when one experiences a vision of a fiery flame, it signifies liberation from the cycle of worldly existence. *Prana* is said to reside in the *Swadhisthana Chakra* (the sacral chakra). The term "*Prana*" is also referred to as "*Swa*," and since it resides in the *Swadhisthana*, it is sometimes called "*Medhra.*" In this context, the Kanda (a cluster of energy channels, or *Nadis*) is connected to the *Sushumna* (the central *Nadi* through which spiritual energy flows), likened to a thread strung through a jewel. [4]The *Shiva Swarodaya* describes *Prana* as the ultimate companion, stating that no other relative is as essential as Prana. Air (Vayu) exists within Prana, and yogis gain insight into the nature of *Prana* by meditating on the elements and understanding the body's energy systems. [5]

In an analogy, the body is compared to a town, and *Prana Vayu*(the air associated with *Prana*) acts as its guardian. The *Prana's* movements are measured by Angul (finger units). During inhalation, it covers a distance of 10 Angul; during exhalation, it covers 12 Angul. While walking, the *Prana* extends 24 Angul; during running, 42 Angul; in sexual activity, 65 Angul; and during sleep, it stretches 100 Angul. The natural pace of *Prana* is considered to be 12 Angul. Some *Yogis* engage in reverse breathing, making exhalation seem like inhalation and vice versa. Practitioners of *Pranayama* (breath control) often regulate their diet and breath, directing their vital energy inward. This practice is a form of sacrifice that purifies sins and leads to a profound understanding of worship. [6]Through deep concentration on the space between the eyebrows, regulating the breaths of *Prana* and *Apana* (the energy that governs elimination) in the nostrils, and withdrawing from external distractions, a *Yogi* who has mastered their senses, mind, and intellect becomes free from desires, fears, and anger. In doing so, they achieve liberation and maintain a state of constant freedom.

To date, no research has thoroughly examined the anatomical and psychological aspects of *Yogic* breathing. This study addresses that gap by bridging traditional knowledge and modern science from a conceptual perspective. In *Yogic* breathing, during inhalation, the process begins with the lower lobes of the lungs filling first as the diaphragm extends downward into the abdominal cavity, pushing the abdominal muscles outward. This is followed by thoracic breathing, where the middle lobes of the lungs fill, resulting in an outward and upward movement of the ribcage. Finally, clavicular breathing completes the inhalation process as the upper lobes of the lungs fill, and the accessory muscles of the neck and shoulders lift the ribcage. Breath is understood in two forms: gross and subtle. The gross breath is physically perceptible, while the subtle breath is more challenging to detect. When the breath shifts into its subtle form, it leads to an enhanced state of awareness. This subtle transformation of breath is vital in deepening mindfulness and connecting the body and mind during *Yogic* practice.[7]

Importance of *Yogic* breathing -

Yogic breathing aims to master the breath, correct poor breathing habits, and enhance oxygen intake. Through *Yogic* breathing, individuals can become aware of the varied and often irregular ways men and women typically breathe. This awareness enables the full advantages of deep, controlled breathing. As one learns to exert more control over their breathing, it becomes possible to influence the subtleties of mental processes.[8]

Different Breathing Techniques -

1. Abdominal Breathing
2. Thoracic Breathing
3. Clavicular Breathing

Both Men and women exhibit different breathing patterns, which are often inconsistent. Normal breathing typically includes both thoracic and clavicular methods. However, diaphragmatic breathing is more efficient, requiring less effort for the same amount of air intake. It is essential to practice daily until it becomes

second nature. Mastering diaphragmatic breathing can significantly enhance physical and mental well-being.

1. **Thoracic Breathing:** This method is usually shallow and rapid, involving the expansion and contraction of the ribcage. It often occurs in stressful situations and fails to fully engage the lungs, resulting in limited oxygen intake and increased anxiety.[7]

2. **Clavicular Breathing:** This type involves raising the clavicle and shoulders. It is more common among women, partly due to restrictive clothing such as tight bras and corsets. Like thoracic breathing, it is shallow and inefficient, leading to minimal oxygen exchange.

3. **Abdominal Breathing:** This technique is more profound and advantageous, as it utilises the diaphragm's movement, allowing the lungs to fill with air. This method improves oxygen intake while promoting relaxation and mental clarity.[11]

Material and methods -

Ancient Indian literature, *Yoga* literature, *Ayurveda Samhita* and their available commentaries on *Yogic* breathing and relevant modern literature related to the topic. According to the literature, all concepts will be analysed and presented with the help of the topic references.

DISCUSSION

In this work, we have explored the known history of *Yoga* and how this knowledge gradually spread from the Indian subcontinent to the Western world. *Pranayama*, the practice of breath control, is utilised by *Yogis* to regulate energy, sharpen focus, and achieve spiritual enlightenment. This technique encompasses various breathing methods aimed at cleansing the body, calming the mind, and enhancing vital energy (*Prana*). By slowing and controlling their breath, practitioners can quiet their minds, facilitate meditation, and connect with their inner selves. *Pranayama* also aids in managing negative emotions such as anxiety and anger, fostering a sense of peace and contentment. Yogis can enter deep states of meditation through reduced breath frequency and depth, leading to increased awareness and spiritual insight. The verse "वायुः नियन्ता प्रणेता च मनसः" (*Vayu* is the controller and the initiator[9] of the mind) highlights the significant role of *Vayu* (air) in regulating mental activities. In *Ayurveda*, "*Vayu*" represents the vital life force or the principle of movement, often associated with the element of air. This verse underscores the importance of balancing and flowing *Vayu* for proper mental function and stability.

Understanding the mechanics of the respiratory system is essential for comprehending how breath control influences the body and mind. Respiration consists of two main types: external respiration, which involves gas exchange between the lungs and blood, and internal respiration, which pertains to gas exchange between blood and tissues. The breathing process is divided into two phases: inspiration (active), where the thoracic cavity expands to allow air into the lungs, and expiration (passive), where the thoracic cavity and lungs return to their original size, expelling air. Respiratory muscles, such as the diaphragm and external intercostals, along with accessory muscles, aid in achieving deeper breaths, while expiratory muscles, including the internal intercostals and abdominal muscles, facilitate forced expiration. The thoracic movements, characterised by the "pump handle" and "bucket handle" motions of the ribs and the diaphragm's downward movement, are vital for effective lung expansion during breathing.

CONCLUSION

Indian philosophy and Western philosophy exhibit notable differences in their practical approaches. Indian philosophy strongly emphasises concepts like the continuity of the soul, reincarnation, and the ultimate goal of liberation. In contrast, Western philosophy typically concentrates on single life. This foundational difference in perspective influences the distinct life goals of the two cultures. [9] In contemporary times, scientific advancements have revealed that skeletal muscles play a crucial role in expanding the dimensions of the thoracic cage, leading to decreased air pressure in the lungs during inspiration. The subsequent phase, known as expiration, occurs passively. Recent studies have also highlighted that respiratory muscles possess

unique characteristics compared to other skeletal muscles, including:

1. Their activation from the moment of birth until death.
2. Their fatigue resistance.
3. Their cyclic, rhythmic, and periodic movements.

Current research in human psychology suggests that these respiratory patterns significantly impact both the brain and psychological states and vice versa. Turning to ancient knowledge, the insights into the respiratory system were remarkably scientific and practical. According to *Ayurveda*, respiration is divided into three phases: *Pooraka* (inhalation), *Kumbhaka* (breath retention), and *Rechaka* (exhalation). Various *Yogic* breathing techniques are designed to alter and harmonise the rhythm of these respiratory muscles, thereby affecting mental and emotional states. [i]These practices can release chemicals that influence human psychology, enhance emotional well-being, promote control over negative habits and behaviours, and fostering emotional stability. The brain's functions, or mind, are subtle and complex, making it challenging for individuals to gain control over them. To address this, ancient Indian sciences developed diverse methods, including Hath Yoga, Gyan Yoga, Bhakti Yoga, Karma Yoga, and Pranayama. Each technique was tailored to the individual's unique physical and mental characteristics. *Yogic* breathing, in particular, is highly effective across these methods, often practiced in conjunction with others. Given that many individuals today breathe unconsciously, *Yogic* breathing techniques can benefit everyone, regardless of age, gender, or physical and mental conditions.

This research examines *Yogic* breathing holistically, emphasising its essential role in *Yoga* for overall well-being. Among various techniques, abdominal breathing is particularly prominent in *Yoga*, enhancing oxygen exchange, reducing stress, and promoting mental clarity. These practices can release chemicals that influence human psychology, enhance emotional well-being, promote control over negative habits and behaviors, and fostering emotional stability. *Yogic* breathing, in particular, is highly effective across these methods, often practiced in conjunction with others. Given that many individuals today breathe unconsciously, *Yogic* breathing techniques can benefit everyone, regardless of age, gender, or physical and mental conditions.

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