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# A critical review of *Prana Vayu* and its correlation with contemporary science

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## ABSTRACT

Tridosha Siddhanta stands high as Vata, Pitta and Kapha are the three biological humors, present in the bodies which are responsible for the maintenance of homeostasis. Vata dosha is the most important factor of Tridosha which is responsible for controlling all types of movements. Prana Vayu, one of the five Vata Doshas, travels via the Urah (thorax region) and Kantha (throat region) from its location in the head. It is reasonable for the processes of respiration, deglutition, eructation, sneezing, and spitting. It also keeps the heart, Hridaya (intelligence/judgment), and Chitta (mind) functioning properly. Hearing head refers to the brain and brain stem, which are in charge of all these processes. According to modern medical research, Prana Vayu performs all of the same roles. In general, the Prana Vata's functions can be related to those of the limbic system, cranial nerves, cerebral cortex, basal ganglia, and other components. Thus, it is easy for us to understand the fundamentals of Ayurveda, which is desperately needed in the modern world. In modern medicine, the majority of the Vatika illnesses treated in Ayurveda are classified as neurological disorders. There aren't many published publications on the intellectual aspects of Vata. An attempt has been made in this article to correlate the physiological activities of *Prana Vayu*, with a focus on neurophysiology.

Key words: Tridosha, Prana Vayu, Srotas, Neurophysiology, Cranial nerves, Basal ganglia.

#### **INTRODUCTION**

Avurveda, an Indian ancient holistic science, is based on Tridosha theory which forms the base for all Ayurvedic concepts. These three Doshas function at different levels of organization, including the cellular, single-system, and organism levels. Prana, Ojas, and Tejas are the three names used in Vedic literature to refer to Tridoshas. One of the three Doshas, Vata, is important for both health and illness. Vata is called

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Prana for humans because it is the initiating and controlling factor of the human body and its systems, the employer of all sensory faculties, the controller and impactor of all mental functions, and the initiator of all physiological activities. It is the initiator of all kinds of activities within the body, the controller and impellor of all mental functions, and the employer of all sensory faculties. Vata is the symbol of life's continuance, creates the shape of an embryo, and flows through all gross and subtle channels. Vata Dosha has been divided into five types namely Prana, Udana, Saman, Vyana and Apana.<sup>[1]</sup> All these five Vata Doshas have their different site as well as different functions. Prana Vata is one of the five forms of Vata. It has a variety of roles which function at different levels along with different structures. It cannot be represented in one structure. The science that validates the theoretical framework of Ayurveda is functional understanding. Prana Vayu is not specifically correlated with any ancient literature. As a result, an attempt is made to determine and establish the knowledge regarding Twinkal Pramar et al. A critical review of Prana Vayu and its correlation with contemporary science

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*Prana Vayu*'s physiological function and its function in the nervous system.

#### **AIM AND OBJECTIVES**

- 1. Study the concept of Prana Vayu.
- 2. Understand the concept of *Prana Vayu* in contemporary science.

#### **MATERIALS AND METHODS**

Concepts related to *Prana Vayu* are analyzed with the modern science for better understanding and analyzing from *Ayurvedic* texts and modern books of physiology.

#### লিহুক্তি

प्राण प्ं । शरीरवायुः । (अमरकोश) [2]

प्र धात् + अण प्रत्यय ।

The word *Prana* is derived from the root word 'an' with the prefix- *Pra* 'An' means to breathe. *Prana Vata* is responsible for all vital functions like respiration which are essential for human existence.

#### परिभाषा

#### प्राणायति इति प्राण । ( गोड़पाद )<sup>[3]</sup>

It indicates the relation of *Prana Vayu* to the control of respiratory functions in the body.

#### प्राण वाय् स्थानः

प्राणोऽत्र मूर्धगः।।

उरःकण्ठचरो बुद्धिहृदयेन्द्रियचित्तधृक् ।

#### ष्ठीवनक्षवथूद्गारनिःश्वासान्नप्रवेशकृत् ।। अ.ह.स्.12/4।।<sup>[4]</sup>

*Murdha* (head) and it traverses along *Uras* (thorax) and *Kantha* (throat) through the thoracic region (chest area). *Jihva* (tongue), *Asya* (Oral cavity) and *Nasika* (Nose) which is the part of Respiratory system. So, it is associated with the brain, respiratory system, heart, and lungs. *Acharya Sharangadhara* mentions *Nabhi* and *Hridaya* as the seat of *Prana Vata*. Here, *Nabhi* can be identified as a central point of nerve impulses that regulate respiration.

#### प्राण वाय् कर्मः

*Prana Vayu* regulates the intake of *Prana* through the breath, the movement of air within the body, and the coordination of sensory perception.

#### 1) प्राणावलम्बन (Aliveness)

## प्राणांश्वाप्यवलम्बत इति प्राणानग्न्यादीन्, अवलम्बते स्वक्रियास् योजयति ।<sup>15]</sup>

*Prana Vayu* is functioning in the body, it lives. This function is expressed through respiratory movements. *Prana Vayu* keeps a living person alive.

#### 2) ष्ठीवनं (Act of splitting)

#### ष्ठीवनं कफादेस्थूत्कारणम् ।

*Sthivana* is unconditioned reflex which is control the salivary secretion through ANS. Mainly two receptors regulate salivary secretion; Mechanoreceptor and Chemoreceptor.

**Mechanoreceptor** - Mechanoreceptor activated by tactile sensation from *Jihva*, *Aasya* and *Kantha* (pharynx). Neural branch-1) Trigeminal nerve – lingual, Buccal and palatine nerves and 2) Pharyngeal branch of vagus and glossopharyngeal nerve which is responsible for salivary secretion.

**Chemoreceptor** - Chemoreceptors, such as taste buds, respond to taste sensations and chemical cues in the food. Taste buds present in posterior 1/3 – Glossopharyngeal nerve – Inferior salivary nucleus - triggers stimulation of the parotid glands and anterior 2/3 – Nervus intermedius (branch of facial nerve) – superior salivary nucleus - directs efferent signals activating the submandibular and sublingual salivary glands.<sup>[6]</sup>

#### 3) क्षवथु (Sneezing reflex)

### क्षवथु ऊर्ध्वस्रोतोंऽवस्थितप्राणोदानयोराकुलितोर्नासाविवरतो निर्गमनं ।

A defense mechanism triggered by irritation to the nasal mucous membrane. Medullary center is the spinal nucleus of the trigeminal nerve, Nucleus

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solitarius and the reticular formation of the medulla. From medullary Center afferent nerve fiber from trigeminal & olfactory nerve and efferent nerve fiber from trigeminal, facial, Glossopharyngeal, Vagus & Intercostal nerve activate the pharyngeal, tracheal & respiratory region muscles which is responsible for sneezing reflex.<sup>[7]</sup>

#### 4) उद्गार (Belching)

#### उद्गारेति उद्गतस्य वायोद्गिरणम्द्रार ।

Belching is the process by which gas accumulated in the stomach is expelled through the mouth. Due to closure of the larynx, elevation of the larynx and relaxation of UES, the opening of the LES and descent of the diaphragm which is responsible for expulsion of air from stomach to exterior. Neural pathway for belching is begins with vagus nerve & stretch receptor in the esophageal wall which carry the signals to brainstem. Belching is mainly due to function of the cricopharyngeal muscle. The belching reflex is mainly accomplished by Prana Vayu. It's dysfunction - unable to burp, leading to symptoms such as bloating, abdominal pain, discomfort in the chest or retrosternal area, gurgling sounds in the throat, increased flatulence. This symptom is due to dysfunction or retrograde malfunction of the cricopharyngeal muscle.<sup>[8]</sup>

#### 5) अन्नप्रवेश (Deglutition)

#### अन्नादानकर्मा त् प्राणः कोष्ठं प्रकर्षति । (च.चि.15/3)<sup>[9]</sup>

*Prana Vayu* that carries food to the site of Agni, where digestion takes place. Deglutition or swallowing, involves the movement of food from the oral cavity to the stomach. It occurs in two phases; first one is initial phase which is voluntary process and second one is pharyngeal phase that regulated by deglutition center. Through the trigeminal, glossopharyngeal, and vagus nerves deglutition process occurs.<sup>[10]</sup>

# 6) बुद्धि इन्द्रिय चित्तधारण (Function of sensory and motor organs)

Prana Vayu maintains functions of sense organs by way of regulation of sensory input (*Indriya*) through

ascending Reticular Activating System (ARAS) which stimulate midbrain reticular formation, cerebral cortex, thalamus, basal ganglia and brainstem. ARAS is responsible for arousal, alertness, attention maintenance, and wakefulness. This mechanism is triggered even by impulses stemming from visceral sensations. By activating the midbrain, sympathetic stimulation and adrenaline create arousal.<sup>[11]</sup>

#### 7) हृदय धारण (Maintain proper function of heart)

Here, धारण meaning धृ which means to exist, continue to live, survive etc. *Dharana* is holding, preserving, protecting etc. *Hridaya dharana* functions of *Prana Vata* can be attributed to the vasomotor Centre and various nerves associated with its functions. A vasomotor Centre that regulates heart rate and blood pressure is situated in the reticular formation of the medulla oblongata and reticular formation of the pons. The vasoconstrictor area increases heart rate and arterial BP by sending accelerator impulses to the heart through sympathetic nerves. The vasodilator area decreases heart rate by sending inhibitory impulses to the heart through the vagus nerve.<sup>[12]</sup>

Physiology of Respiration as Per Ayurveda

नाभिस्थः प्राणपवनः स्पृष्ट्वा हृत्कमलान्तरम् ।

कण्ठाद्वहिर्विनिर्याति पात्ं विष्णुपदामृतम् ।।

पीत्वा चाम्बरपीयूषं पुनरायाति वेगतः ।

प्रीणयन्देहमखिलं जीवयञ्जठरानलम् ॥ (शा.पू.5/44-45)<sup>[13]</sup>

प्राण वायु located in the नाभि (navel) and travels to इत्कमलान्तरम् (region of heart). Further it travels to the कण्ठ (throat). From the कण्ठ, the प्राण वायु (CO<sub>2</sub>) comes out to the environment. प्राण वायु takes the विष्णुपदामृतम् (ext. environment) or अम्बरपीयूष (O<sub>2</sub>). Taking the अम्बरपीयूष with it, the वायु once again gains entry into the body. It nourishes all the धातु (tissues) & ignites the जठरानल (Digestive fire). The modern science has the same concept of circulation of nutrition

and oxygen through the heart and its vessels. The references explaining the circulation of oxygen, nutrients and oxygenated blood from the heart which is explained by *Acharya Bhela* which stated that '*Nabhi* is the root of *Siras*'. *Nabhi* is considered as Heart. So, here we can understand that *Sira* coming from heart is responsible for carrying oxygen.

प्राणवह स्रोतसः -

 तत्र प्राणवहे द्वे, तयोर्मूलं हृदयं रसवाहिन्यश्व धमन्यः। (स्.शा.9/12)<sup>[14]</sup>

तत्र प्राणवहानां स्रोतसां हृदयं मूलं महास्रोतश्च ।
(च.वि.5/8)<sup>[15]</sup>

In classics *Prana* as life, it does *Preenana* of entire *Sharira* and responsible for metabolism of *Jatharagni* and it is a *Lakhshana* of *Atma* consider one amongst *Panchavata*.

#### हृदयं (Heart)

निरुक्ति of हृदय:

1) हरति - The one which receives and removes impurities (*Harati*).

2) ददाति – Does analysis and sends (Dadati).

3) यायति - The one which helps in accumulation of blood all over body (*Yayati*).

This word *Hridaya* can refer to both the heart and the brain (ANS). The appropriate functioning of the heart, which is responsible for absorbing blood, eliminating impurities, and circulating it to all regions of the body. Acharya *Sharangdhara* on the term *Pranvahadve*, believes that both lungs on either side of the thorax should be considered. The term *Moolam Hridayam* refers to the pulmonary arteries that branch from the heart and go transversely to the lungs. This description concludes that the take up and carry of the *Pranavayu* are mainly conducted by lungs and its accessory channels. The commentator *Adhamalla*, in his commentary *Gudharth Sandipani* over the above verse describes that; *Nabhistha-Iti-Hridayasth*. Heart with

vessels is called *Nabhi* in *Ayurveda*, not only lungs concern with the respiration but lungs along with heart are responsible for respiration.

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#### महास्रोतस (Alimentary tract)

#### महास्रोतसीति कोष्ठे ।

Acharya Sushutha Koshta includes Amashaya, Agnashaya, Hridaya, Unduka, Phupusa etc. The important hollow organs present in trunk are digestive tract, heart and lungs and the functioning of these organs is controlled by Vagus Nerve. Acharya Sushruta mentioned the organogenesis of the body; Phupphusa as Shonitaphenaprabhava. Here, the Phenadhatu resembles the lightest part of blood which is rich in Vayu and Akasha Mahabhutas, by that the lungs resembles a cluster of bubbles or multiple air-filled sacs for providing a large surface area for gaseous exchange as in alveoli. So, it is clear that Shonitaphenaprabhava indicates the functional anatomy of lungs. This also supports Phupphusa as Mahasrotas.

#### रसवाही धमनी

Dhamani is a structure mentioned in classics which carry *Rasa* all over the *Shareera* and maintains the *Poshana* of the *Sharira*. Origin of *Rasavahi Dhamani* is *Hridaya* and these are said as the carrier of *Rasa* from *Hridaya* to all the body parts. *Prana* reaches to every corner of the body through *Rasavahi Dhamani* and then perform the categorical functions. So, thereby *Rasavahi Dhamani* is considered as *Moolasthana* as mode of transportation. *Rasavaha Dhamani* is considered as the Aortic bodies which give feedback to Medulla Oblangata, specifically to DRG of neuron via the afferent branches of the vagus nerve that regulates breathing and blood pressure.

#### प्राणवह स्रोतोदुष्टि निदानः

क्षयात् सन्धारणाद्रौक्ष्याद्व्यायामात् क्षुधितस्य च ।

प्राणवाहीनि दुष्यन्ति स्रोतांस्यन्यैश्व दारुणैः।। च.वि.5/10।।<sup>[16]</sup>

क्षय (धातु क्षय) - refers to hypovolemia. This can cause respiratory distress in two different ways.

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Development of shock with reduced cardiac outputcardiac abnormalities that decrease the ability to pump blood. Disease such as arrhythmias, old myocardial infraction.

#### सन्धारण - Vega Sandharana of Mutra, Pureesha. i.e.,

पुरीष वेगधारण - Increase absorption of water and salts from absorptive colon which increase in the volume of blood causing higher pulmonary pressure that leads to pulmonary congestion.

रोक्ष्य - Ruksha Guna Ahar Vihara activate the PNS which act on respiratory passages is responsible for contraction of bronchioles and hampers the respiratory system.

व्यायामात् क्षुधितस्य - Exercise during hunger or starvation there is shift in the metabolism from carbohydrate to fat metabolism that leads to hypovolemia and reduced renal perfusion is responsible for keto acidosis mechanism which disturbs the breathing pattern.

अन्य दारुण कर्म - Doing many such activities which are beyond one's physical capacity which hampers respiration by mechanism of ketoacidosis by fat metabolism.

#### प्राणवह स्रोतोदुष्टि लक्षणः

तद्यथा- अतिसृष्टमतिबद्धं कुपितमल्पाल्पमभीक्ष्णं वा सशब्दशूलमुच्छ्वसन्तं दृष्ट्वा प्राणवहान्यस्य स्रोतांसि प्रदुष्टानीति विद्यात् ।। च.वि.5/8।।<sup>[17]</sup>

अतिसृष्ट श्वास (Increased phase of respiration) - Rapid prolong breathing (RR > 20/m) along with increased rate (tachypnoea) and depth (hyperpnea). Results in the lack of  $O_2$  or too much  $CO_2$  in the cellular level of the body that which increased demand for ventilation such as exercise, fever, thyrotoxicosis, ketoacidosis.

अतिबद्धं श्वास (Reduced or cessation of respiration) -Obstruction in upper air way (i.e., nasal cavity, oral cavity, pharynx and larynx) varying from narrowing to partial or complete occlusion due to Epiglottitis, Foreign body in throat, nose etc. Decreased respiratory rate is seen during sleep and depression of respiratory center due to cerebral disease.

कुपित श्वास (Breathlessness) - Abnormal rate, rhythm and force of respiration.

अल्प श्वास (Increased short phases of respiration) Pleural involvement where in irritation of parietal and visceral pleura occurs during inspiration. Cheyne stoke breathing pattern - An abnormal breathing pattern characterized by progressively deeper, sometimes faster followed by a gradual decrease that results in a temporary stop in breathing called an Apnea.

अभीक्ष्णं श्वास (Frequent breathing) Biot's breathing -Changes in the pitch, rhythm and force of respirations leading to hypoventilation, apnea and hyperventilation.

सशब्द श्वास (Breathing with sounds) The presence of Rhonchi implies bronchospasm or bronchoconstriction whereas in the presence of crepitation in the chest suggest the presence of free fluid in the Alveoli.

सशूल श्वास (Pain while breathing) - Chest pain while breathing seen in pleurisy, chest trauma etc. Due to nerve irritation and inflammation of pleura results in the pain in the sides of chest.

Table 1: Example of symptoms of PranavahaSrotodushti.

प्राणवह स्रोतोदुष्टि लक्षण	दष्टांत
अतिसृष्ट श्वास	उर्ध्व श्वास
अतिबद्धं श्वास	नाशार्श, अपची, गलशालूक (अतिउच्छ्वास)
कुपित श्वास	तमक श्वास
अल्प श्वास	क्षयज कास
अभीक्ष्णं श्वास	क्षतज कास

सशब्द श्वास	क्षयज कास (प्रवात एव कुचनम्), तमक श्वास (घूरघुर), महा श्वास , महा हिक्का
सशूल श्वास	महा श्वास , वातज कास ,गम्भीर हिक्का

तत्र विद्धस्याक्रोशनविनमनमोहनभ्रमणवेपनानि मरणं वा भवति ।। स्.शा.9/12।।<sup>[18]</sup>

आक्रोशन - Due to significant pain, depending on whether the injury is to the retrosternal area or the sides of the chest.

विनमन - Forward bending is responsible for relaxing the abdominal muscles, which in turn helps to relax the thoracic muscles.

मोहन - Altered state of consciousness

भ्रमण - Giddiness. This is leading to the manifestation of episode of syncope.

वेपन - Lead to limb weakness, disturbance of movements.

मरण - Profuse fluid or blood loss - Person is prone to have deprived blood supply to either brain or heart leading to sudden death.

#### DISCUSSION

In essence, all biological systems are regulated by the three components of Vata, Pitta and Kapha which are the neurological, endocrine, and immunological systems, respectively. All our Acharyas explain the superiority of Vata among these Tridoshas of great importance. The only principle that has the predominance of Vayu Mahabhuta is Vata, and its primary Lakshanas are Gandhana (perception of knowledge) and *Gati* (moving).<sup>[19]</sup> It is commonly related to the modern scientific neurological system, which has the same functional characteristics. The principal location of Prana Vata is the Murdha (head), according to Ayurvedic science. Because all Pranas are located in one area, and all motor and sensory functions are governed from there. That why head is called as the most superior organ among all organs of the body. Head in this context refers to brain. Indrivas stand for sensory, motor organs and mind. Different descending and ascending channels made up of individual neurons in the nervous system connect that the central nervous system (CNS) with peripheral structures. All sensory and motor organs, with their Pranavaha Srotamsi, are essentially attached to the brain in a manner homogeneous to the connection between the sunrays and sun. The mind is situated in between the head and palate. Its efficiency surpasses that of any other motor or sensory organ. It is attentive of all sensations. The site of mind explained in the statement indicates the situation of brain in the cranial cavity and its functioning. Prana Vayu's functions are comparable to those of many other structures, such as the cranial nerves in relation to Sthivana, Kshavathu, Udgara, and Anna Pravesha. Medulla may be compared for the functions of Swasa and Udgara. Budhhihridayaindriyachitta Dhrik may be compared with Limbic system, basal ganglia, somatosensory area, somatic association area, primary motor cortex, pre motor cortex, supplementary motor area, Wernicke's area and vasomotor center. Overall, Prana Vata can be compared to the CNS anatomically and physiologically as its main seat is Murdha and controls all the physiological functions by generating motor impulses after the integration of the sensory impulses from all over the body.

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#### CONCLUSION

It can be concluded that the *Prana Vata* cannot be limited by simply comparing it with central nervous system as *Vata dosha* is involved in any systemic activity. Thus, there exists a partial correlation between the functions of the central nervous system and the functions of *Prana Vata*. The first and important *Srotas* of the body is the *Pranavaha Srotas*. It is made up of the pharynx, trachea, bronchus, bronchioles, external nares, nasal chambers, and trachea, which transport carbon dioxide or oxygen to the lungs. Every cell in the body receives oxygen from the heart. Then gases exchange occurs in tissue cell level. Heart is mentioned as *Mulsthana* of the *Pranavaha Srotas*. The gases move through the nose, pass through the alveoli, enter the heart through the

pulmonary veins, travel through the arteries to every cell in the body and return via the veins to every cell in the body. *Pranavahini Dhamani* is included throughout this entire course. Thus, we concluded that connection between *sharira* and *Prana Vayu* is responsible for life or lifespan. Detachment of *Prana Vayu* from *Sharira* leads to death.

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