



# I J A P C

INTERNATIONAL JOURNAL OF AYURVEDA AND  
PHARMACEUTICAL CHEMISTRY

[www.ijapc.com](http://www.ijapc.com)

E ISSN - 2350-0204

**VOLUME 9**

**ISSUE 1**

**10TH JULY**

**2018**

Greentree Group Publishers



## A Critical Review of Prana Vayu in the Modern Perspective

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### ABSTRACT

*Vata dosha* is the most important factor of *Tridosha* which is responsible for controlling all types of movements. Among five *vata dosha*, *prana vayu* is situated in the head and travel across *urah* (thorax region) and *kantha* (throat region). It is reasonable for functioning of spitting, sneezing, eructation, respiration, and deglutition and also maintains the proper functioning of *budhhi* (intelligence/judgement), *hridaya* (heart), *chitta* (mind). Hear head refers to brain and brain stem as it controls all these functions. All the functions of *prana vayu* are compared as per modern medical science. Basically, the functions of limbic system, cranial nerves, cerebral cortex, basal ganglia and other structures might be compared with the functions of *prana vata*. So we can easily understand the basic principles of *Ayurveda* which is badly required in this present era. Most of the *vatic* disorders discussed in *Ayurveda* are being diagnosed under neurological disorders in modern medicine. Very few works have been achieved on conceptual features of *vata*. In this article an attempt has been made to correlate the physiological activity of *prana vayu* with special reference to neurophysiology. For this study, the basic materials have been collected from the *Āyurvedic* classics with the available commentaries, as well as text books of contemporary science have been referred for better understanding of the concept and its comparison with contemporary science.

### KEYWORDS

*Prana Vayu, Limbic System, Basal Ganglia, Cranial Nerves, Cerebral Cortex*



**Greentree Group Publishers**

[Received 18/06/18](#) [Accepted 06/07/18](#) [Published 10/07/18](#)



## INTRODUCTION

Ayurveda, an Indian ancient holistic science, is based on *tridosha* theory which forms the base for all *Ayurvedic* concepts. These three *doshas* function at various level of organization such as cellular level, single system level and organism level. In *vedic* literature the three terms representing *tridoshas* are *prana*, *ojas*, and *tejas*. *Vata* one among the three *doshas* plays a major role in both health and disease condition. It is the initiating and controlling factor of human body and also responsible for all type of movement<sup>1</sup>. So *Vata* is called as *Prana* for human beings. *Vata* in its normalcy maintains the whole body and its systems. 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. It joins the body tissues and brings compactness to the body, prompts speech, is the origin of touch and sound, is the root cause of auditory and tactile sense faculties, is the causative factor of pleasure and courage, stimulates the digestive fire, and helps in the absorption of the *dośhas* and ejection of the excretory products. *Vata* travels all gross and subtle channels, forms the embryo shape and is the indicator of continuity of life<sup>2</sup>. *Vata dosha* has been divided into five types namely

*prana*, *udana*, *saman*, *vyana* and *apana*. All these five *vata doshas* have their different site as well as different functions. Among the five types of *vata*, *Prana vata* has various functions which act at different level at different structure. It cannot be represented by one structure. *Ayurveda* is the science that proofs its concept based on functional understanding. There is no specific correlation of *prana vayu* mentioned any ancient literature. It seems to be a problem found in student life, particularly first year of Bachelor of Ayurvedic Medicine and Surgery to understand about the concept of *prana vayu*. Increased demand of *Ayurveda* science in the present society is required to understand the depth of *Ayurvedic* Principle in an easy mode. Hence an effort is made to ascertain and establish the knowledge regarding physiological function of *Prana vayu* and its role in nervous system.

### SITE AND FUNCTION OF PRANA VATA BY DIFFERENT ACHARYA:

The location of *Prana* is vertex, thorax, trachea, tongue, mouth and nose and it performs functions of spitting, sneezing, eructation, respiration, deglutition etc<sup>3</sup>. The *Vayu* which moves inside the mouth is known as *prana vayu*. It supports the body function, helps in deglutination and sustains the functions of *prana*<sup>4</sup>. *Prana*



*vata* is located in *murdha* and it traverses along *uras* (thorax), and *kantha* (throat), it maintains the proper functioning of *budhhi* (intelligence/judgement), *hridaya* (heart), *chitta* (mind). It also performs functions such as *sthivana* (spitting), *ksavathu* (sneezing), *udgara* (belching), *nisvasa* (respiration), *annapravesha* (deglutination)<sup>5</sup>. Here *hridaya* is annotated as *adhistan* of *mana*<sup>6</sup>. *Prana* is situated in the head and moves in throat and chest. It controls or maintains the intellect, sense organ, heart/brain, arteries (blood vessel), and functions of supporting, expectoration, sneezing, belching, breathing and swallowing of food<sup>7</sup>. Here *hridaya* is annotated as *adhistan* of *buddhi adhara bhutam*<sup>8</sup>.

*Sharangdhar* refers the location of *Prana vata* at *nabhi*. After reaching the proximity of heart it passes outside through the throat to consume nectar like substance called *vishnupadamrita* (oxygen) from the external atmosphere. After consuming within no time through the same route it gets back into the body. This *Prana Vayu* maintains the entire body and nourishes the *jiva* and *jatharagni*<sup>9</sup>. In all text book site of *Prana Vayu* is mentioned as *Murdha*. But *Acharya Sharngadhara* has mentioned it as *nabhi*. The term *nabhi* in Sanskrit means a center. This has to be perceived as a center in head i.e. the

respiratory center. Proximity of heart means lungs. According to *Acharya Sushruta*, *jiva* and *rakta* are the synonyms.

### **MOVEMENT OF PRANA VATA:**

The *gati* or movement of *Prana Vayu* is in entire body considering its functions. It can travel from all direction to all directions as it is extremely powerful. For upward to downward, it includes *nihswas*, *anna pravesha*, for downward to upward it includes *sthivana*, *kshavathu*, *udgara*, for entire body movements it includes *hridaya-chitta dhrik*, *prinayan deham akhilam jivam cha jatharanalam*. *Swash* function includes both inspiration and expiration. Normal expiration is not *pratiloma gati* of *Prana Vayu*. *Pratioma gati* is reverse movement of *Prana Vayu*. *Pratioma gati* has to be associated with *kapha* to cause *swasa* and *hikka* and others. *Pratiloma gati* means there is variation in the movement of *prana vayu* that may be upward to downward, downward to upward or overall entire body movements. These variations appear due to *avarana*. For example *anna praveshakrit*, *prana vayu* help in entering the food from outside to inside or from upward to downward. If there is variation in the movement of *Prana Vayu*, *hikka* is produced.

### **MODERN ASPECTS**



The primary site of *Prana Vayu* is head. Here is an attempt to compare the function of *Prana Vayu* with its modern aspect as per contemporary science.

**STHIVANA:**

*Sthivana* means the function of spitting. It is the action of ejection of saliva or other substance from the mouth which is conducted by nucleus of facial nerve. It is the seventh cranial nerve containing sensory, motor and parasympathetic nerve. The sensory fiber carries the sensation of taste from the anterior 2/3<sup>rd</sup> of the tongue to brain. The somatic motor fibers of seventh cranial nerve supply the muscle of facial expression and muscle of scalp. Its nucleus is located in the pons. The parasympathetic fibers arise from the superior salivary nucleus and supply to sub mandibular as well as sublingual salivary gland<sup>10</sup>.

**KSHAVATHU:**

*Kshavathu* means the function of sneezing. It means to throw out mucus containing foreign particles or irritants and cleanse the nasal cavity. It is reflex action when any dust particles disturbs the nasal passage. A reflex action contains of a receptor, a sensory nerve, an integrating center, a motor nerve, and an effector. The receptors which are nerve ending in the nasal pathways detect an irritant. Maxillary branch of trigeminal nerve transport these

impulses to sneezing center of brain stem. The sneezing center sends the information to facial nerve along with the nerves that lead to lungs and diaphragm. Then eyes begin watering, nasal mucosa secretes fluid, diaphragm moves to take a deep breath. Then the muscle in the chest contracts and it causes the air to leave the nose and mouth suddenly. The whole function is under control of both trigeminal and facial nerve<sup>11</sup>.

**UDGARA:**

*Udgara* means belching reflex which is a polysynaptic visceral reflex. It is found in a period of less than two second. It is formed of three independent reflex responses. Due to contraction of lower esophagus and diaphragm there is inhibition of the muscle barrier between the stomach and esophagus. It is the first belching reflex. This reflex is triggered by air causing tension in the muscle fibers of the wall of stomach that is under the esophagus. So the air bolus rapidly escapes into the lower esophagus which is under pressure from the stomach wall. This reflex is determined by the brain through the vagus nerve. The rapid movement of air into the lower esophagus concurrently activates the other two reflexes. The inhibition of the muscle barrier between the esophagus and pharynx is the second belch reflex. It is developed by pharyngeal



muscles. This reflex also activates muscles whose main function is to pull the esophago-pharyngeal barrier open. It is the rapid air movement across the pharynx that causes the sound of the belch. This reflex is also mediated by the brain through the vagus nerve. At the same time, the third belch reflex is activated. It begins a contraction wave of the upper esophagus which moves upward toward the mouth bringing the air bolus to the top of the esophagus. This reflex is possibly decided by the spinal cord. The result of these two reflexes is to propel the air bolus from the lower esophagus into the oral cavity. The area postrema which is in the medulla or hind brain primarily controls the belch response<sup>12</sup>.

#### **SWASA:**

Swasa means the process of respiration. Group of neurons which is located bilaterally in the medulla oblongata and pons of brain stem are the respiratory center in brain. It is branched into three major columns of neurons. A dorsal respiratory group which is situated in the dorsal portion of medulla and it causes inspiration. A ventral respiratory group which is located in ventero lateral part of medulla mainly causes expiration. The pneumotaxic center which is present dorsally in the superior portion of pons

mainly controls rate and depth of breathing<sup>13</sup>.

#### **ANNA PRAVESHHA:**

It consists of mastication, salivation and deglutination. The fifth cranial nerve i.e. trigeminal nerve is a mixed type of nerve. The motor fibers which supply the muscle of mastication arise from the nucleus in the pons. The seventh cranial nerve i.e. facial nerve contains sensory, motor and parasympathetic fibers. The parasympathetic fibers arise from the superior salivary nucleus and supply the submandibular and sublingual salivary glands. The 9<sup>th</sup> cranial nerve i.e. glossopharyngeal nerve contain sensory, motor and parasympathetic fibers. The motor fibers arise from the nucleus ambiguus situated in medulla and supply the stylopharyngeal muscle. The 10<sup>th</sup> cranial nerve i.e. vagus nerve contain sensory, motor and parasympathetic fibers. The somatic efferent fibers arise from the nucleus ambiguus and supply the laryngeal and pharyngeal muscle.

The 11<sup>th</sup> nerve (accessory) is purely motor nerve. Its spinal root supplies the sternocleidomastoid and trapezius muscle whereas its bulbar root supplies some of the muscle of larynx, pharynx, and soft palate. The 12<sup>th</sup> cranial nerve i.e. hypoglossal nerve contains only motor



fibers arises from the medulla. It supplies the muscle of tongue<sup>14</sup>.

The sensitive tactile areas of the posterior mouth and pharynx are present in a ring around the pharyngeal opening. It helps to initiate the pharyngeal stage of swallowing. Impulses are transmitted from these areas into the medulla oblongata, either into or closely associated with the tractus solitarius through the sensory portions of trigeminal and glossopharyngeal nerves. Then the medulla oblongata receives all sensory impulses from the mouth. The stages of the swallowing process are started by the medulla and lower portion of the pons. The areas in the medulla and lower pons are called as the swallowing center. The motor impulses are transmitted by 5<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> cranial nerve<sup>15</sup>.

#### **HRIDAYA DHARANA:**

It holds the function of heart. The parasympathetic motor fibers of vagus nerve, arise from the dorsal motor nucleus situated in the floor of fourth ventricle, in medulla. The fibers supply the viscera of thorax (heart and lungs) and the gut in upper abdomen. Vasomotor center controls the activity of heart. Whenever there is a need to increase heart rate and contractility, the lateral portion of vasomotor center transmits excitatory

impulses through the sympathetic nerve fibers to the heart. On the contrary the vasomotor center sends signal to the adjacent dorsal motor nuclei of vagus nerve whenever there is a require to decrease heart pumping, which then transmit parasympathetic impulses through the vagus nerves to the heart. It causes decrease of heart rate and heart contractility. Therefore the vasomotor center has an important role in either increase or decrease heart activity. Every part of the reticular substance of pons, mesencephalon and diencephalon carries large number of small neurons. These neurons can either excite or inhibit the vasomotor center. The vasoconstrictor system is controlled by hypothalamus. It brings powerful excitatory or inhibitory effects on the vasomotor center. The vasomotor center can also be excited or inhibited by many parts of the cerebral cortex. The vasomotor center is excited by stimulation of the motor cortex because the impulses are transmitted downward into hypothalamus and then to the vasomotor center. Also stimulation of anterior temporal lobe, the orbital areas of the frontal cortex, the anterior part of the cingulated gyrus, the amygdale, the septum and the hippocampus can either excite or inhibit the vasomotor center. These are depending upon the precise



portion of areas that are stimulated and the intensity of the stimulus<sup>16</sup>.

**BUDDHI INDRIYA CHITTA  
DHARANA:**

*Buddhi* means intelligence, *indriya dhaarana* means all sensory and motor function, *chitta dhaarana* means the function of *mana* (mind). Things requiring thought, consideration, hypothesis, attention, determination or whatever can be perceived by the mind, are regarded as its objects. Control of sense organs, self restraint, hypothesis and consideration represent the action of the mind. Beyond that flourishes the domain and intellect<sup>17</sup>. Apart from this memory, emotion, knowledge through direct perception, inference, analogy, verbal testimony is considered to be the function of mind.

Emotional behavior and encouragement is basically controlled by limbic system. Hypothalamus, the septum, paraolfactory area, anterior nucleus of the thalamus, portions of basal ganglia, hippocampus and amygdale are the basic structures in limbic system. Hypothalamus is one of the central elements of limbic system. Limbic structures are concerned with affective nature of sensory sensation whether the sensations are pleasant or unpleasant. These affective qualities are also called reward or punishment function. The major reward centers are situated in the lateral

and ventromedial nuclei of hypothalamus. The most potent areas for punishment are found in the central grey area surrounding the aqueduct of sylvius in the mesencephalon. It extends upward into the periventricular zones of the hypothalamus and thalamus. The reward and punishment centers control our bodily activities, our unwillingness, and our motivations<sup>18</sup>.

Incoming sensory signals can introduce behavioral reactions for different desire through Hippocampus. It can cause any of the different behavioral patterns such as happiness, anger, obedience, or excess sex drive. It can become hyper excitable. Hippocampi can exhale prolonged output signals even under normal conditions. Hippocampus is originated as part of the olfactory cortex. Very early in evolutionary development of brain the hippocampus most probably became a critical judgment making neuronal mechanism, determining the significance of the received sensory signals. Once the critical decision making capability had been recognized, the remnants of the brain also began to call on the hippocampus for decision making. The hippocampus also supple the drive that causes conversion of short term memory into long term memory. The amygdale appears as behavioral awareness areas that operate at a semiconscious level. The amygdale





makes the person's behavioral response suitable for each event. The ability of the prefrontal areas to keep track of many beats of information concurrently and to cause recall of this information immediately as it is needed for subsequent thoughts. So it is called the brain's working memory<sup>19</sup>.

Learning is described as the process of acquiring knowledge while memory is the process of storing knowledge. Neural mechanism of thoughts is not clearly illustrated in texts. Destruction of large portion of cerebral cortex reduces the depth of the thoughts and degree of awareness of the surroundings but it does not prevent a person from having a thought. Each thought involves instantaneous signal in many portion of the cerebral cortex, thalamus, limbic system and reticular formation of the brain stem. A thought results from a pattern of stimulation of many part of the nervous system most importantly the cerebral cortex, thalamus, limbic system and upper reticular formation of the brain system. This theory is described as the holistic theory of thoughts. The general nature of thought is determined by the stimulated area of the limbic system, thalamus and reticular formation. It gives the qualities like pleasure, displeasure, pain, comfort, crude modalities of sensation localization

to all the areas of the body. Memories are stored in the brain. It changes the basic sensitivity of synaptic transmission between neurons. The facilitated pathway is called memory traces. They are important because once the traces are recognized; they can be selectively activated by thinking mind to repeat memories<sup>20</sup>.

Wernicke's area is important for language comprehension. It is situated behind the primary auditory cortex the posterior part of the superior gyrus of temporal lobe. It is most significant region for higher intellectual function. All the intellectual functions are language based. Angular gyus area is needed for initial processing of visual language (reading). Anterolateral region of the occipital lobe is lying posterior to the language comprehension area. It is a visual association area that feed visual information suggested by words read from a book into wernicke area. The limbic association area is found in the anterior pole of the temporal lobe, in the ventral portion of frontal lobe, and in the cingulated gyrus lying deep in the longitudinal fissure on the mid surface of each cerebral hemisphere. It is concerned primarily with behavior, emotions and motivation<sup>21</sup>.

The basal ganglia help plan and control complex patterns of muscle movement.



Relative intensities of the separate activities, way of movements, and sequencing of multiple successive parallel movements to achieve specific complicated motor activity are regulated by basal ganglia<sup>22</sup>.

### **EMOTION:**

Emotion accompanies many of our conscious experiences. It is an aroused state involving intense feeling, autonomic activation, and related behavior. It has two major components.

### **MENTAL COMPONENT:**

It consists of cognitive, affective, and conative changes. Cognition means by which one is aware of the processes of thinking and perceiving. It involves an awareness of sensation and usually its cause. Affect is the reflection of mental state. It involves the feeling itself. Conation is the force which directs to take action and involves the urge to take action. For example I hear a noise, which I recognize as that of an exploding bomb (cognition); I feel frightened (affect), and I want to take shelter (conation).

### **PHYSICAL CHANGE:**

It consists of changes in viscera and skeletal muscles. These conditions are often generalized and involve the coordinate activity of both the autonomic and somatic nervous system.

### **MECHANISM OF EMOTION:**

The hypothalamus and limbic system are intimately concerned with emotional expression and with the genesis of emotions. The complex patterns of emotional mental state are achieved by the papez circuit. The orbito-insulo-temporo-cingulate areas of the cerebral cortex in particular are intimately concerned in the production of autonomic changes of emotion. These areas project mainly

- To the hypothalamus which in turn send fibers to the bulbar autonomic centers, and
- To the reticular formation of brain stem which modifies somatic motor neuronal activity appropriately<sup>23</sup>.

### **DISCUSSION**

Basically *Vata*, *Pitta*, *Kapha* constitute three regulatory systems i.e. nervous, endocrine and immune system respectively of all living systems. Among such important *tridoshas* the supremacy of *Vata* is explained by all our *Acharyas*. *Vata* is the only principle having predominance of *Vayu mahabhuta* and its main *lakshana* is *gati* (movement) and *gandhana* (knowledge perception). It is generally attributed to nervous system of contemporary science presenting the same functional properties.



As per *Ayurveda Science murdha* (head region) is the primary site of *Prana Vata*. Because it is the region where all *prana*'s are situated and all sensory and motor activities are controlled from. That why head is called as the most superior organ among all organs of the body. Head in this context refers to brain. *Indriyas* stand for sensory, motor organs and mind<sup>24</sup>. All sensory and motor organs with their *Pranavaha Srotamsi* are basically attached to brain in a fashion homogeneous to connection between the sunrays and sun which means different descending and ascending tract comprising of individual neurons in the nervous system connects the CNS with peripheral structures<sup>25</sup>. The mind is situated in between the head and palate. Its efficiency is beyond any other sensory and motor organ. It perceives all sensations. The site of mind explained in the statement indicates the situation of brain in the cranial cavity and its functioning<sup>26</sup>.

From the above details as per the functions of *prana vayu* it can be compared with many structures like cranial nerves regarding *sthivana*, *kshavathu*, *udgara*, *anna pravesha*. Medulla may be compared for the functions of *swasa* and *udgara*. Limbic system, basal ganglia, somatosensory area, somatic association area, primary motor cortex, pre motor

cortex, supplementary motor area, wernicke's area and vasomotor centre may be compared with *budhhihridayaindriyachitta dhrik*. 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.

## 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. So, functions of *Prana Vata* can be partially correlated with the functions of central nervous system. There is a need of further research to evaluate in detail of all other *vata dosha*, *kshaya*, *vridhhi* and *avarana* for the betterment of mankind.



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