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Critical understanding of Prana Vayu: A review

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Abstract

The human body consists of Dosha, Dhatu, and Mala, with Doshas being the primary elements responsible for maintaining the internal homeostasis of the body. Among the various Doshas in the body, Vata Dosha holds a position of great significance due to its distinct characteristics and wide-ranging functions throughout the body. Vata dosha, one among the Tridosha plays a pivotal role in regulating various forms of bodily motion. Vata dosha not only governs the movements of other Doshas but also oversees the regulation of dhatu and mala. It plays a crucial role in sustaining a harmonious balance among the doshas, dhatus, and mala, ensuring overall equilibrium. Considering their importance and the extent of impact, the functions of Vata that are directly linked to the brain can be categorized into five separate divisions. Each of these subdivisions has specific locations and functions, with some degree of overlap in their actions. Five types of vata include prana, udana, vyana, samana and apana vayu. A comprehensive understanding of the various types of Vata, aligned with their functions that correspond to modern perspectives, will facilitate a straightforward grasp of these aspects.

Keywords: Vata; Prana vayu; Dosha; Prana; Tridosha

1. Introduction

In Ayurveda, an individual is said to be healthy when there is a state of balance in their dosha, dhatu, and mala, along with total well-being of their soul, sensory organs, and mind[1]. A balanced state of dosas is very important in maintaining the normal health of an individual. The concept of tridosha offers a legitimate perspective on physiology, offering valuable insights into its structure and function. Over time, this perspective has gradually illuminated the idea that the doshas may represent a more sophisticated comprehension of physiological function compared to what is presently recognized in modern biology. Therefore, if tridosha theory is leveraged as a guide, it could potentially lead to significant advancements in the field of biology[2].

Objectives

To gain a contemporary understanding of the roles and functions of the vata dosa with special emphasis on prana vayu

2. Materials and method

Data were collected from all ayurvedic texts including bruhathrayee and laghuthrayee. Articles available in search engines were used. A total of 62 articles were collected and reviewed. Data were collected from modern and Ayurvedic textbooks.

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2.1. Tridosha – vata dosha

The doshas operate in an integrated hierarchical manner that lacks a direct counterpart in modern biology, rendering them distinctive and inherently challenging to translate[2]. Vata dosha is attributed to the regulation of movement, encompassing both physical and mental aspects, primarily situated in the lower part of the body[3]. The specific location for other dosas pitha and kapha were also mentioned.

Many acharyas explained the importance of vatadosha among other doshas. Vata has been regarded as the foremost and primary dosha among the others because of its unique properties, its role in regulating other doshas, and its potential to manifest a wide range of diseases. Susruta Acharya regards vata dosha as eternal[Nithya], autonomous[swatantra], all-pervading[sarvagata], and fundamental to the processes of preservation, creation, and dissolution[4]. Vagbata acharya considers vata dosa as visvakarma, visvatma, viswaroopa and vibhu. According to Sharangadhara Acharya, Doshas other than vata, such as pitta and kapha, are dependent on vata. Likewise, the mala and dhatus are also reliant, as they simply follow the guidance of vata, much like how clouds are directed by the wind[5]. Vata is the most powerful among all the dosas because of vibhutva[omnipresence], asukaritva[swift action], balitva[strength], anyakopana[ability to vitiate other dosas], svatantra[independence] and bahurogatva[ability to creat diseases] [6]

The etymological derivation of the word 'Vata' comes from 'Va Gatigandhanayo' which refers to two significant aspects of functions of Vata dosha in the human body- 'Gati' which refers to movement and 'Gandhana' which refers to intiation[7]. Vayu and akasa mahabhuta contribute to vata dosa[8]. Classically the qualities of vata dosha include ruksha (rough), shita (cool), laghu (light), sukshma (subtle), chala (mobile) and khara (coarse). Hemadri explains the specific functions of this guna[9].

Table 1 Guna of vata dosha with its specific action[10]

Guna	**Karma**
Ruksha	Soshana
Laghu	Langana
Sheeta	Sthambhana
Khara	Lekhana
Sookshma	Vivarana
Chala	Prerana

When vata remains in a healthy state within the body, it positively influences various functions, including enthusiasm, respiration (both exhalation and inhalation), bodily movements, regulation of natural urges, proper nourishment and functioning of dhatus (tissues), and the efficient performance of the sense organs[11] It encompasses the components of prana, udāna, samana, vyana, and apana, which collectively regulate a wide range of both obvious and subtle bodily activities. Vata controls and stimulates the functions of the mind, prompts the sense organs to perceive their respective sensory inputs, and conveys these sensory signals to the mind for processing. It initiates the process of speech, serves as the fundamental basis for touch and sound perception along with their respective sense organs, and acts as an entity for excitement and enthusiasm. Vata also escalates the digestive fire (agni), expels various waste products, permeates and traverses the body's diverse channels and metabolic pathways, contributes to the formation of the fetus in the womb, and sustains life itself[12].

2.2. Location of vata

Pakvasaya, kati, sakthini[thighs], asthini[bones] srothrendriya, asthi, sparshanendriya form the seats of vata[13]. While vata manifests throughout the entire body in various forms such as prana, the pakvashaya is designated as its primary location because most vata-related disorders originate here. Basti chikitsa is particularly effective in treating problems brought on by abnormal Vata dosha because it treats Vata dosha from its primary place.

2.3. Five subdivisions of vata

As mentioned above five divisions of vata are prana, udana, vyana, samana and apana vayu[14].

2.3.1. Prana vata

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. Of this prana vata is considered as the life of a human being[15]. According to Goudapada, *pranayati iti praana* indicates the relation of prana vata to the control of respiratory functions in the body.

Site - Pranavata is located in murdha (head) and it traverses along uras (thorax) and kantha (throat). Murdha is the avasthithi stanam and ura kanta are vicharana sthanam of prana vayu[16.] Sarangadhra mentions Nabhi and Hridaya as the seat of prana vata[17]. Here nabhi can be identified as a central point of nerve impulses that regulate respiration[18].

Functions of prana vata - It maintains the proper functioning of buddhi (intelligence judgment), hrdaya (in this context brain), indriyas (sense organs) citta (mind) and performs functions such as kshteevana (spitting), ksavathu (sneezing), udgāra (belching), niśvāsa (respiration) and annapravēša(deglutition)[18]. Here is an attempt to understand the functions of prana vata based on the modern perspective along with their applied aspect.

2.3.2. Functions of prana vata in the physiological view

Kshteevana

kshteevana refers to the act of spitting out of saliva. Salivary secretion is intricately regulated by the autonomic nervous system. Unconditioned reflexes, prompted by mechanoreceptors sensitive to tactile stimulation from the tongue, mouth, and pharynx in response to the presence of food and chewing movements, initiate the salivary secretion process. The sensory pathways for these reflexes, activated by tactile stimuli, follow branches of the trigeminal nerve, including the lingual, buccal, and palatine nerves, as well as pharyngeal branches of the vagus and glossopharyngeal nerves. Chemoreceptors, such as taste buds, respond to taste sensations and chemical cues in the food. Afferents from the posterior one-third of the tongue travel via the glossopharyngeal nerve to reach the inferior salivary nucleus, while those from the anterior two-thirds of the tongue pass through the nervus intermedius (a branch of the VII nerve) to terminate in the superior salivary nucleus. The salivary center is formed by these superior and inferior salivary nuclei. The superior salivary nucleus directs efferent signals activating the submandibular and sublingual salivary glands, while the inferior salivary nucleus triggers stimulation of the parotid glands[19]. The normal regulation of saliva expulsion is under the influence of prana vayu. Consequently, the nervous control of these reflexes is subject to the actions of prana vata. Disruptions in prana vata can lead to derangements at the nervous level, affecting the regulation of these reflexes.

Applied aspects –

- In cases where the glossopharyngeal nerve is damaged without concurrent damage to the vagal nerve, there may be a mild reduction in saliva production on one side[20].
- Facial palsy can lead to dry mouth, as two out of the three primary salivary glands, namely the sublingual and glossopharyngeal glands, receive their parasympathetic nerve supply from the facial nerve.[21] Since kshteevana is the normal function of prana vayu, the obstruction of udana vayu by prana vayu results in dryness of the mouth[mugasosha[22]].

Sneezing reflex

Sneezing, a modified respiratory process involving forceful expiration, serves as a defense mechanism triggered by irritation to the nasal mucous membrane. Afferent nerve fibers pass through the trigeminal and olfactory nerves, with the medulla oblongata acting as the central control. The medullary center is located diffusely in the spinal nucleus of the trigeminal nerve, nucleus solitarius and the reticular formation of the medulla. Efferent nerve fibers from the medullary center pass via trigeminal, facial, glossopharyngeal, vagus, and intercostal nerves. These fibers activate muscles in the pharyngeal, tracheal, and respiratory regions, culminating in the completion of the sneezing reflex. Prana vata plays a predominant role in orchestrating the sneezing reflex, and any disruption to prana vata can result in irregularities in the neural aspects of this reflex[23].

Applied aspects: Irregularities in sneezing typically result from the irritation of the trigeminal nerve terminals in the nasal mucosa[24]. A specific sneeze-inducing area has been identified in the ventromedial spinal trigeminal nucleus in both cats and humans. In cats, electrical stimulations in this area elicit behaviors resembling sneezing. For humans, lesions induced by strokes in this region can lead to paroxysmal sneezing or a loss of the ability to sneeze[25].

Belching

Belching is the process by which gas accumulated in the stomach is expelled through the mouth. Act of belching includes closure of the larynx, elevation of the larynx and relaxation of UES, the opening of the lower oesophageal sphincter and descent of the diaphragm. All these factors result in the expulsion of air from the stomach to the exterior[26]. The neural pathway for glottal closure during belching begins with the vagus nerve and the stretch receptors in the esophageal wall that carry the signal to the brainstem[27]. The belching reflex is mainly accomplished by prana vata. Therefore, the disruption of prana vata leads to irregularities in the neural aspect of this reflex.

Applied aspect - Abelchia refers to a condition in which individuals are unable to burp, leading to symptoms such as bloating, abdominal pain, discomfort in the chest or retrosternal area, gurgling sounds in the throat, and increased flatulence. The root cause of this inability to burp lies in a dysfunction of the cricopharyngeal muscle, which fails to detect and release trapped gas beneath the upper esophageal sphincter, resulting in a retrograde malfunction of the cricopharyngeal muscle. The cricopharyngeal (CP) muscle receives innervation both from below via the recurrent laryngeal nerve (RLN) and from above via the pharyngeal plexuss[29].The recurrent laryngeal nerve is also a branch of the vagus nerve.

Niswasa[respiration]

Sarangadhara Acharya explains the relationship between respiration and circulation by incorporating prana vayu. This can be attributed to the regulation involved in respiration. The nervous mechanism that regulates respiration includes respiratory centres, afferent nerves and efferent nerves[30]. Neurons in the medulla generate appropriate motor signals that drive the cranial and spinal motor neurons innervating respiratory muscles. The area in the medulla that generates this respiratory rhythm is called as central pattern generator of respiration[31]. The medullary centre consists of the dorsal respiratory group of neurons[inspiratory centre] and the ventral respiratory group of neurons [expiratory centre]. Pontine centre consists of apneustic and pneumotaxic centre. The apneustic centre increases the depth of inspiration by acting directly on dorsal group neurons. The pneumotaxic center inhibits the apneustic center and thereby occurs starting with expiration[30]

Applied aspects - Central neurogenic hyperventilation is a persistent condition characterized by excessive breathing, typically induced by factors such as head injuries, severe brain oxygen deprivation, or inadequate cerebral blood flow. The core association of this condition lies with damage occurring in the midbrain and upper pons regions. Conversely, central neurogenic hypoventilation occurs when the respiratory centers in the medulla fail to appropriately respond to essential signals. This occurrence may be noted in instances of head trauma, cerebral oxygen deficiency, or suppression induced by narcotics[32].

When udana is obstructed by prana, a hindrance to respiration can be seen[niswasa uchwasa samrodha][33]

Benefits of good breathing - Effective breathing also offers advantages similar to the typical physiological functions of prana vata within the body. It augments the action of prana vata in the body. Good breathing can enhance action of prana vata in body. According to sarangadhara, prana vayu entering into body nourishes all the dhatus and inspires jataragni. It is helpful to the body in various aspects. It improves nervous systems and helps in the proper functioning of reflexes and also increases digestion and absorption of food

Anna pravesha[deglutition]

In the digestive process, the action of prana vayu is specifically mentioned. It is the prana vayu that carries food to the site of agni, where digestion takes place[34]. Deglutition, commonly known as swallowing, involves the movement of food from the oral cavity to the stomach. The initial oral phase is a voluntary process. During the subsequent pharyngeal phase, impulses are conveyed to the deglutition center through the trigeminal, glossopharyngeal, and vagus nerves[35].

Applied aspects - Individuals experiencing deficiencies in the glossopharyngeal or vagus nerves may display symptoms such as dysphagia, dysphonia, dyspnea, or a combination of these issues. Patients with vagus nerve dysfunction may exhibit dysphagia, hoarseness, or dyspnea, however, those with an isolated glossopharyngeal lesion may not exhibit any symptoms due to redundancy in the nerve's motor output[36].

Buddhi indriya chitha dharana

Buddhi means intelligence, *indriya dhaarana* means all sensory and motor function, *chitta dhaarana* means the function of *mana* (mind). Prana vata maintains functions of sense organs by way of regulation of sensory input [indriya][37]

The Ascending Reticular Activating System (ARAS) is instrumental in eliciting emotional reactions and plays a crucial role in regulating the learning process and the development of conditioned reflexes. Responsible for arousal, alertness, attention maintenance, and wakefulness. Stimulation of the midbrain reticular formation produces wakefulness by generalized activation of the entire brain, including the cerebral cortex, thalamus, basal ganglia, and brainstem. Arousal phenomena occur in both animals and humans when various sensory impulses, such as those related to proprioception, pain, auditory, visual, taste, and olfactory sensations, activate the ARAS suddenly. This mechanism is triggered even by impulses stemming from visceral sensations. By activating the midbrain, sympathetic stimulation and adrenaline create arousal[38].

Applied aspects - The correlation between injury to the Ascending Reticular Activating System (ARAS) and a decline in consciousness has been documented in patients with diverse brain pathologies, such as stroke, traumatic brain injury, and hypoxic-ischemic brain injury[39].

Hridaya dharana

The word dharana is derived from the Sanskrit word 'dhr' which means to exist, continue to live, survive etc. The meaning of dharana is holding, preserving, protecting etc[37]. Pranavata not only sustains the functions of Hridaya (heart) but also serves to safeguard them. Hridhaya 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 by sending accelerator impulses to the heart through sympathetic nerves. Stimulation of vasoconstrictor area results in rise in arterial BP. The vasodilator area decreases heart rate by sending inhibitory impulses to the heart through the vagus nerve[40]

Applied aspects - Vasovagal syncope manifests when the vagus nerve connected to the heart excessively responds to specific situations, such as extreme heat, anxiety, hunger, pain, or stress. This exaggerated response results in a rapid drop in blood pressure, known as orthostatic hypotension, leading to sensations of dizziness or fainting in the affected individual[41]. In the context of prana vayu's role in hridayadharana, the obstruction of udana by prana can be observed as a symptom in conditions like hridroga[42].

3. Conclusion

Vata which is one of the important tridosha plays a major role in maintaining the health of a person. Prana, udana, samana, vyana and apana are the five types of dosa. Pranavata aids the various vitalizing elements of the body in carrying out their life-sustaining functions and contributes to the overall well-being of an individual. The main functions of prana vayu include kshteevana (spitting), ksavathu (sneezing), udgāra (belching), niśvāsa (respiration) and annapravēša(deglutition) along with the proper functioning of buddhi (intelligence judgment), hrdaya (in this context brain), indriyas (sense organs) citta (mind). The functions of Prana are associated with the essential faculties required for sustaining a person's life, including respiration, swallowing, sensory organ functions, and the mind, thereby governing higher intelligence. So proper understanding of these subtypes with the corresponding modern aspects will be helpful in easy and effective comprehension of vata dosa.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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