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Conceptual study of *Vata Dosha* w.s.r. to Nervous System

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ABSTRACT

The depth of *Ayurvedic* principles must be understood and emphasized in a clear, simple manner in light of the growing awareness of *Ayurveda* and its importance in today's society. Despite the rapid advancement of modern science and the plethora of new medical research projects, it would not be hyperbole to argue that *Ayurveda* has already established its distinct identity and has been steadily advancing with new insights. *Doshas* stand for the presence of *Pancha Maha Bhuta* in our bodies, *Panchamahabhuta* is the foundation upon which all *Ayurvedic* concepts are based, and *Panchabhutika* refers to everything in the universe. The management of *Panchamahabhutas*, for which the *Ayurvedic* approach is essential, determines the course of treatment, regardless of advancements in modern science. One of the three basic humors, *Vata*, has a significant impact on both health and disease. The majority of *Vata* disorders that are discussed in *Ayurveda* are classified as neurological disorders in contemporary medicine. As a result, an effort has been made to comprehend *Vata* physiological activity, paying particular attention to neurophysiology.

Key words: *Ayurveda*, *Nervous system*, *Vata*, *Humors*, *Panchamahabhutas*.

INTRODUCTION

Physiology, pathology, diagnosis, prognosis, medicine, and therapeutics are all aspects of *Ayurveda*'s holistic approach, which is founded on the three-fold management known as *Tridosha* theory, which consists of the *Vata*, *Pitta*, and *Kapha Doshas*. Some physical and physiological traits correspond to each *Dosha*.

Along with showing a variety of kinetic and physiological traits like respiration, circulation, voluntary

action, etc., *Vata* is also responsible for psychological traits like enthusiasm, concentration, etc.^[1]

The *Pitta* is responsible for intelligence, clear conception, digestion, assimilation, heat production, hormones, enzymes, and metabolism. (Although *Vata* controls the production of hormones and their release from target organs, *Pitta* is still responsible for hormonal activity; hence, hormonal issues can also be *Vata* disorders.) *Kapha* is responsible for anabolic activities, body strength, immunity, resistance, courage, and tissue building.

Basically *Vata*, *Pitta*, *Kapha* constitute three regulatory systems respectively controlling input/ output, turn over and storage making them universal properties of all living systems. Among such important *Tridoshas* the supremacy of *Vata* is explained by all our *Acharyas*. For example, it is said "*Pittam Phangu Kapham Phangu Phangavo Mala Dhatavah Vayuna Yatra Niyante Tatra Gacchati Meghavat*"^[2]

The two main *Lakshana* of *Vata*, which are movement (*Gati*) and knowledge perception (*gandhana*), are attributed to the same functional properties of the

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nervous system of modern science. *Vata* is the only principle with a predominance of *Vayu Mahabhuta*.^[3] Nonetheless, an attempt has been made to determine whether the principles of *Ayurveda* are timeless and relevant at any moment or place by comparing the physiological functions of the nervous system to those of *Vata*.

Research on the conceptual aspects of *Vata* and its subdivisions, such as *Apana*, *Udana*, and *Prana Vata*, is extremely rare. Its actions are contrasted with those of acetylcholine, and the idea of *Vata* in other conventional medicines was investigated. Therefore, the purpose of this research is to comprehend and reestablish the relationship between the nervous system and the physiological functions of all five divisions of *Vata*.

AIM AND OBJECTIVES

To ascertain and re-establish the up-to-date knowledge regarding physiological functions of *Vata* and its role in nervous system basing on *Ayurvedic* principles.

MATERIALS AND METHODS

The fundamental and conceptual materials for this study were gathered from the *Āyurvedic* classics, specifically the *Susruta Samhitā*, *Charaka Samhitā*, and other classics with available commentaries, as well as a variety of reference books to be reviewed. These texts are known as the *Brihatrayee* and *Laghutrayee*. For a deeper comprehension of the idea and a comparison with modern science, a variety of publications, textbooks of contemporary science, research papers, and seminar proceedings have been cited. The conversations with senior faculty members and distinguished academics have cleared the path for some productive findings.

CONCEPTUAL STUDY

Physiological function of *Vata Dosha*^[4]

| SN | Charaka | Vagbhata | Susruta |
|----|-----------------|-----------------|------------------------------|
| 1. | <i>Utsaha</i> | <i>Utsaha</i> | <i>Praspanadana movement</i> |
| 2. | <i>Ucchvasa</i> | <i>Ucchvasa</i> | <i>Udvahana</i> |

| | | | |
|----|--|------------------------------|----------------|
| 3. | <i>Nicchvasa</i> | <i>Nicchvasa</i> | <i>Purana</i> |
| 4. | <i>Chesta</i> | <i>Praspanadana</i> | <i>Viveka</i> |
| 5. | <i>Samahatu Gati</i> (proper metabolism) | <i>Indriya Patutva</i> | <i>Dharana</i> |
| 6. | <i>Sama Moksha</i> (proper elimination of waste) | <i>Vega Pravartanadibhih</i> | - |

Though *Vata* is all pervading and responsible for all activities in our body, basing on the names, site and functions *Sareera Vata* is divided into 5 categories which undertake almost all the functions of *Vata* explained separately in *Vata Kalakaliya* chapter of *Charaka Samhita*.^[5]

Functions of *Prana Vata*^[6]

| Types of <i>Vata Dosha</i> | Functions | Anatomical relation with nervous system | physiological |
|----------------------------|--|--|---|
| <i>Prana Vata</i> | 1. <i>Budhi Dharana - Mano Buddhi Indriya Buddhi Smriti</i> (memory) | Pre frontal area Hippocampus, cerebral cortex, wernicke's area, physical cortex anterior thalamic group | Site of working memory helps in complex intellectual activities like judgment, decision making. Helpful in retention and recollection of recent and past experiences. |
| | 2. <i>Chitta Dharana: holds functions of Mana (Indriabhigraha - initiates and withdraws Indriyas (Gnana - intellectual, Karma-motor)</i> | Heschl's gyrus, post central gyrus, insular cortex, pre pyriform cortex, amygdala, cerebellum, hypothalamus dorsomedial aspect of thalamus | Intellectual, emotional, motor activities |

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| | from perceiving their objectives and sends information to <i>Atma</i> (intellectual, motor, emotional). <i>Swasya Nigraha</i> (self-control) | associating with prefrontal gyrus, primary motor area, pre motor area, basal ganglion. | |
| | 3. <i>Hridaya Dharana</i> : holds functions of <i>Hridaya</i> (heart) | Neurons lie in dorsal motor nucleus of the vagus nerve in reticular formation of medulla, caudal hypothalamus, vasomotor centre in medulla | Cardio inhibitory |
| | 4. <i>Swasa</i> (respiration) | Respiratory centers located in the reticular formation of brain stem, dorsal group of respiratory neurons of medulla, pneumotaxic centre and apneustic centre of pons | |
| | 5. <i>Anna Pravesana</i> (mastication, salivation, deglutition) | Nuclei of trigeminal, facial, glossopharyngeal, vagus, hypoglossal, located in pons, medulla, other parts of brain. | salivation and deglutition, chewing. |
| | <i>Kshavadhu</i> (sneezing) | Sneezing centre of CNS stimulated by impulses through trigeminal nerve from nasal mucosa | Sneezing |
| | <i>Nishteeva</i> (spitting) | Nucleus of facial nerve located in | Spitting |

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| | | caudal portion of pons. | |
| | <i>Udgara</i> (belching) | Medulla (a poly synaptic visceral reflex) | Holding of breath, contraction of diaphragm and abdominal muscles, relaxation of sphincters, initiation of reverse peristalsis. |

Functions of *Udana Vata*^[7]

| Type of <i>Vata</i> | Functions | Anatomical relation with nervous system | Physiological function |
|---------------------|--|---|--|
| <i>Udana Vata</i> | 1. <i>Vakpravritti</i> - (speech) , 2. <i>Prayatna</i> (motivation), 3. <i>Urja</i> , 4. <i>Balakara</i> , 5. <i>Varnakara</i> , 6. <i>Smritikaraka</i> (sensory adaptation) | Motor fibres of the cranial nerves- facial, glossopharyngeal, vagus, and accessory, hypoglossal as a whole can be compared to cervical plexus as it is formed by these along with nerves arising from vertebrae C 1- C4 | Speech, swallowing, respiration etc. All other functions can be included in it as speech is an integrated outcome of motivation, emotion, sensory adaptation in terms of performance of an individual. |

Functions of *Vyana Vata*^[8]

| Type of <i>Vata</i> | Functions | Anatomical relation with nervous system | Physiological function |
|---------------------|--|---|--|
| <i>Vyana Vata</i> | 1. <i>Gati</i> – voluntary movements of muscles, <i>Prasarana</i> (extension), <i>Akunchana/Akshepana</i> (flexion/ withdrawal), | CNS | All these movements are nothing but the functions of motor neurons |

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| | <i>Vinamana</i> (bending), <i>Unnamana</i> (upward movement) <i>Tiryaggamana</i> (lateral movement) | | regulated by the CNS based on the sensory information received. |
| | 2. <i>Rasa Samvahana</i> (circulation of <i>Rasa</i>) - circulation of <i>Rasa</i> along with other <i>Dhatus</i> like <i>Rakta</i> (according to <i>Gayadasa</i>) to nourish all the <i>Dhatus</i> | Motor nerve supply to the cardiac muscle. | The circulation is effected by the force of regular contractions of cardiac muscles. |
| | 3. <i>Sweda Asrik Sravana</i> (effecting the outflow of blood and sweat) - this depends on effective contraction of heart and calibre of vasculature. | Thoraco lumbar sympathetic division and Vasomotor centre of ANS and parasympathetic. Divisions in turn are regulated by CNS. Hypothalamus | Simultaneous and continuous functioning of the muscles of heart and vasculature. Sweat production is stimulated when hypothalamus is triggered due to the heat produced as a result of increased blood flow to the musculature in conditions like exercise, fight etc. |
| | 4. <i>Sukra Pratipadana</i> (deposition of semen inside the vaginal cavity) - here only the act of intercourse can be considered as the actual ejection of semen is the function of <i>Apana Vata</i> . | Sympathetic flow arising from inferior horn cells of the spinal cord regulated by the CNS. | Movement of the skeletal muscles. |

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| | <i>Sroto Vishodhana</i> (clearing the channels) | Sympathetic division and Vasomotor centre of ANS | Increased circulation to muscle helps in better supply of oxygen and removes the waste products. |
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Almost all the functions of *Vyana Vata* are motor in nature related to ANS which are performed by the command send by the CNS after analyzing the sensory input.

Functions of *Samana Vata*^[9]

| Type of <i>Vata</i> | Functions | Anatomical relation with nervous system | Physiological Function |
|---------------------|--|--|---|
| <i>Samana Vata</i> | 1. <i>Annam Grihnati</i> (receiving and withholding it in <i>Annavaha Srotas</i>) | Vagal, glosso pharyngeal supply of the GIT (gastro intestinal tract), ENT (enteric nervous system) | Vagal, glosso pharyngeal reflexes facilitate the entry of the food into stomach through oesophagus and storage of food is monitored by duodenal gastric reflex of vagus and by prevention of the reverse peristalsis by ENS |
| | 2. <i>Annam Pachati</i> (helps in proper digestion by regulating production of digestive juices, movement of parts of digestive system for proper mixing and | Sympathetic, para sympathetic supply of glands of digestive system, myo-enteric plexus. | Secretion of the digestive juices through vago-vagal reflex, sympathetic stimulation. Movement of digested food into duodenum, towards iliocaecal valve for absorption is initiated by the |

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| | transferring the contents to next stage of digestion. | | myo enteric plexus. |
| | 3. <i>Annam Vivechayati</i> (discrimination of essence and waste products of digested food by the absorption of essence, water etc. and forming solid wastes) | Myo- enteric plexus, vagus nerve innervation | The retention of chyme in ileum for more absorption is facilitated by relaxation of iliocaecal sphincter by vagus stimulation initiated by gastrin feedback. Absorption of water, electrolytes in colon is by Haustrations controlled by myo enteric plexus. |
| | 4. <i>Munchati</i> (passing away the contents) | Parasympathetic innervation of colon, myo- enteric plexus | The movement of the remnants from colon to rectum and anus is by gastro colic, duodeno colic reflexes transmitted by myoenteric plexus by initiation of Para sympathetic nerves stimulated by over distension of colon. |

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| | of bladder) the urine formed by Samana Vata is excreted out by the coordinative function of the <i>Apana-Prana Vyana Vatas</i> . | branches of the pudendal nerve (Central control is by the centres in cortical, pontine, spinal regions which can be considered as <i>Indriya Dharana of Prana</i>). | pudendal nerve, voluntary control of micturition is by sacral reflex |
| | 2. <i>Sakrit Nishkrama</i> (bowel evacuation/ defecation) A process of evacuation of solid wastes from <i>Guda</i> by coordinative function of the <i>Apana-Prana Vyana Vatas</i> . | Pudendal nerve, nervi erigentes which inturn are under the control of CNS. | The process of defecation is through Mass peristalsis, intrinsic reflex, defecation reflex. |
| | <i>Sukra Nishkrama</i> (Ejection of semen) the movement of <i>Sukra</i> from <i>Vrishana</i> to <i>Sishnendriya</i> and its ejection. | Parasympathetic supply, nervierigentes, sympathetic supply in L1-L2 level, pudendal nerve | CNS analyses Sensory, psychic stimulus, initiates parasympathetic supply through nervi erigentes results in erection, simultaneously initiates sympathetic supply in L1- L2 level resulting in contraction of epididymis, vas deference, seminal vesicles, and prostate causing expulsion of semen into the urethra, urethra then elicits signals to pudendal nerve which inhibits micturition and facilitates |

Functions of *Apana Vata*^[10]

| Type of <i>Vata</i> | Functions | Anatomical relation with nervous system | Physiological function |
|---------------------|-------------------------------------|--|---|
| <i>Apana Vata</i> | 1. <i>Mutra Nishkrama</i> (emptying | sensory fibres of the pelvic nerves, motor | Micturition reflex is through sensory fibres of pelvis, |

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| | | | ejaculation by rhythmic contraction. |
| | 4. <i>Artava Nishkrama</i> (menstrual flow) <i>Artava</i> is described both as menstrual blood and ovum, hence here menstruation, ovulation both can be considered under this heading. | HPO axis | Ovulation and menstruation both are due to the interplay of hormones through HPO axis |
| | 5. <i>Garbha Nishkrama</i> (bearing down the foetus during labour) | Nerve supply to the muscles of uterus and abdomen, hypothalamus | The expulsion of the foetus is by coordinative rhythmic contractions of uterine and abdominal muscles explained by optimal distension theory and Ferguson reflex mechanism (weak uterine contractions of uterus caused due to over stretching of cervix neurogenic reflex to hypothalamus oxytocin intensifies the contractions neurogenic reflex to hypothalamus oxytocin production, it is a positive feedback mechanism which continues till the delivery of the baby. |

DISCUSSION

According to the above information, the *Prana Vata* can be roughly compared to the central nervous system (CNS) in terms of anatomy and physiology. This

is because the *Prana Vata's* primary seat is the *Murdha*, which regulates nearly all bodily functions through the generation of motor impulses following the integration of sensory impulses from all over the body.

The mouth and throat contain large muscle groups involved in speaking and breathing, and *Udana Vata* can be linked to the nerve fibers supplying these regions.

The development of speech is associated with neurophysiological phenomenon of learning which occurs as an integrated outcome of motivation, emotion, and sensory adaptation in terms of performance of an individual. Apart from this *Ayurveda* opines that this physiological phenomenon acts through *Mana* and *Buddhi*. So, a stimulus may reach higher centers in *Mastishka* from the *Kanta*, *Uras*, *Nabhi Sthana* through *Udana* because of its nature (moving upward) and as said earlier integration of stimulus is done through *Prana Vata* and a motor impulse may be sent to muscles of the above said *Sthana* where the movement of muscles occur due to *Vyana Vata*. Hence it is clear that *Udana Vata* performs its functions through the combined functioning of *Prana* and *Vyana Vatas*.

As previously mentioned, one tries to speak or act in accordance with the guidance and incitement of *Manas* and *Buddhi* (*Prana Vata*). All of these functions are directly or indirectly caused by voluntary and involuntary movements of the muscles caused by their contraction and relaxation all over the body. This can be understood by polysynaptic reflex arc with a single stimulus, i.e., *Sarva Vyapta* of *Vyana*. Motor pathways are generally referred to as *Vyana Vata* because they control the movement of muscles in various body parts to accomplish functions like glandular secretion, body part movement, and peristaltic movements that support the appropriate physiological functions of local *Vata*, such as *Samana*, *Udana*, and *Apana*.

Samana Vata is related to the ENS, which controls the entire gastrointestinal tract, based on their respective functions. In actuality, the CNS receives sensory input from the ENS (*Samana Vata*), which then triggers vagal stimulation and the gastrin feedback mechanism

(Prana Vata). This causes the muscles to contract and the stomach juices to be secreted (*Vyana Vata*) for digestion, absorption, and discrimination. *Apana Vata* action can be defined as the primitive micturition reflex caused by the central integrating center in the sacral spinal cord. *Prana Vata Karma-Indriya Dharana* can be used to describe the influence of higher centers on micturition, and *Vyana Vata Karyas* can be defined as the voluntary contraction and relaxation of muscles.

In the action of defecation, the initiation of reflex can be described as action of *Apana Vata*, the control of the CNS over the sphincters can be considered as *Indriya Dharana Karma* of *Prana Vata*, the contraction and relaxation of the muscles of the sphincters can be considered as the action of *Vyana Vata*.

The movements of the body during a sexual act can be ascribed to *Vyana Vata*, as it is accountable for any *Cheshta Vyapara*. Additionally, *Prana Vata* can be attributed for controlling the Manas, Indriyas, and the movement of *Sukra* from *Vrishana* to *Sishnendriya*, while *Apana Vata* is in charge of controlling the ejaculation. Thus, the three forms of *Vata*, *Prana*, *Vyana*, *Apana*, and *Sukra* - coordinate to produce *Sukra Nischanamana*.

In a broad view the anatomical spread and functional aspects of Lumbo sacral plexus appear similar to that of the *Apana Vata*. There are scientific evidences showing the surgical removal of the sacral plexus or any injury resulting in loss of sensation over anterior abdomen and thighs, loss of erection, loss of bladder and bowel control, sciatica, paraplegia of both lower limbs, hence *Apana Vata* can be partly correlated to lumbosacral plexus.

As a whole all functions of the five divisions of *Vata* - *Prana*, *Vyana*, *Udana*, *Samana* and *Apana* are facilitated by coordination of *Prana* and *Vyana* with each other. Hence these can be correlated to three basic functions of nervous system

CONCLUSION

Since *Vata* is always involved in systemic activity, comparing it to the nervous system or any other

system in isolation will not be sufficient to limit the functional field of *Vata*. Thus, there exists a partial correlation between the nervous system and *Vata* functions. In addition, more study is required to thoroughly assess the physiological and pathological aspects of the *Vata* phases - *Kshaya* (decrease), *Vridhhi* (increase), *Samatva* (normalcy), and *Avarana* - for the benefit of humankind.

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