Review Article.

International Research Journal of Ayurveda & Yoga

An International Peer Reviewed Journal for Ayurveda & Yoga

Physiological Study of *Udaan Vayu* w.s.r Speech

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ICV-70.44- ISRA-1.318

VOLUME 4 ISSUE 4

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Article received on 2nd April 2021 Article Accepted 25th April 2021 Article published 30 April 2021

ABSTRACT: -

The purpose of *Ayurveda* science is to maintain the health of the healthy and cure disease of diseased. In *Ayurveda* a person is said to be healthy when *Dosha*, *Agni* (digestive fire), *Dhatu*(tissues), all the physiological process are in homeostatic state and soul, sense organ and mind are in a state of total wellbeing. [4] *Vata dosha* acts as *yantratantradhara* which means in its normal state it maintains the function of organs and organ systems. [2] Among five *Vata Dosha*, *Udana Vayu* is located in *urah* (thorax region), and travel across *Nasa* (nasal passage), *Nabhi* (umbilicus), and gala (throat region). The term *Udana* itself signifies upward movement of *Doshas*. *Udanavata* is considered as *Pavanottama*. [4] It is responsible for the production of speech, effort, energy and maintenance of strength required for the purpose. It also helps in remembrance of vocabulary required to make the speech meaningful. All the functions of *udana vayu* can be compared with physiological functions of anatomical structure of contemporary modern medical science. Basically Broca's area, Wernicke's area, thymus gland, serotonin like happy hormone, motor area of cerebral cortex and other structures might be compared with the functions of *udana vayu*. [10]

Keywords:-*Udana Vayu, Dosha, Pavanottama, Ayurveda, Dhatu, Nabhi.*

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How to cite this article: - Dr. Mukesh Saini, Prof. (Dr.) Rajesh Kumar Sharma, Dr. Dinesh Chandra Sharma, Physiological Study Of Udaan Vayu W.S.R Speech, IRJAY, April: 2021, Vol-4, Issue-4;149-156 ; **Doi: https://doi.org/10.47223/IRJAY.2021.4412**

INTRODUCTION

Vayu is an energetic force moved in a specific direction to control the function of body. There are five types of *Vayu* firstly described by *Acharya Charak*. These are differentiating according to *Sthan* (place) and Function. *Acharya Shushruta* gives the term *Pavanottama* to *Udan vayu*. [4] *Vata* in its normal state makes all the organs in our body perform their functions. It is considered as the *Prāna* (life) of all individuals. It is responsible for the movement and functions of *Pitta* and *Kapha* just as the wind propels the clouds to different locations. In *Puranas* it is mentioned that *Vayu* is the *Prana* (vital part for life), *Sugha* and *Ayu*(age) of an individual. From different contexts we will understand the different functions of *Vata* such as *Vibhutwat* (present all over the body), *Asukaritwat* (quick in action), *Balatwat* (it is strong in *pitta* and *kapha*), *Anyakopanaat* (it is vitiating other *doshas*), *Swatantra* (independent), *Bahurogatvat* (leads to several diseases) etc: It can control both *manas* (mind) and *Indriya* (sense organs) and helps in the enjoinment of their particular *Indriyarthas*. [7] *Vata* co-ordinates the functions of *Dhatu*, Mala and brings different body parts together in their position. On the basis of *Sthanas* (locations) and *Karmas* (functions) *Vata* is classified into mainly five types such as *Prāna*,*Udāna*, *Vyāna*, *Samāna* and *Apāna*. [6] Physiology of *Ayurveda*, is based on the basic theory of *tridosha* which is the root for all *Ayurvedic* concepts. These three *doshas* do their functions at various level such as cellular, single system and organization level. *Vata* among these three *doshas* administers all the movements in mind and body including *Pitta*, *Kapha*, *Mala* (waste) and *dhatu* (body tissues). *Pitta*, *Kapha*, all *dhatu* and *mala* are immobile like lame individuals. It becomes mobile when *vata* becomes active. The active *Vata* carries them away from its location just like the clouds being carried away by the wind. It is the initiating and controlling factor of human body and responsible for all type of movements. *Vata* is considered as *Prana* for human beings. [2] 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, promotes speech, origin of sound and touch sensation, it is the root cause of auditory and tactile sense faculties, it is the causative factor of pleasure and courage, stimulates the digestive fire, and helps in the absorption of the *doṡhas* and ejection of the excretory products. [10] *Vata* travels through all gross and subtle channels, gives the shape of embryo and is the indicator of continuity of life. *Vata dosha* has been divided into five types on the basis of location 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*, *Udana vayu* has various functions which act at different level. It also performs its function with the help of *Prana* and *Vyana Vayu*. So there is need of proper coordination and cooperation of these three *vayu*. [7]

MATERIAL AND METHODS

- Site (*Sthana*) of *Udana Vayu*: -

Most *Acharya* have the same opinion that *Udana* is located in *Uras* (chest).There is another opinion that it is located in *Phuphusa* (Lungs), which is in *Urahpradesha* (thorax region) only. Other *staanas* (breast) are considered as its *Sancharastaanas*(important region it covers while moving), such as *Kanta* (throat), *Nasika* (nose) and *Nabhi* (around umbilicus). [6]

Table 1 Showing Site (*Sthana*) Of *Udanavata* By Different *Acharya*

No.	*Acharya*	*Sthana*
1	*Charaka* [1]	*Nabhi*, *Uraha*, *Kantha* (umbilicus, thorax and trachea)
2	*Shusruta* [4]	*Vata Dosha* which leads upwards is *Udana Vayu*
3	*Vardh Vaghbhata* [7]	*Nasa*, *Nabhi*, Gala (throat, nose and umbilicus)
4	*Laghu Vaghbhata* [6]	*Uras* and traverses from *nasa* (nasal passage) to *nabhi* (umbilical region) through gala (throat)
5	*Bhel* [8]	*Urdhwa*
6	*Sharangdhar*[11]	*Kantha* Pradesh

- *Acharya Arunadutta* and *Hemadri* has described the chief location of *Udana Vayua surah* (thorax region), and it acts from thoracic area to nasal area.
- *Acharya Sarngadhara* has mentioned lungs as the chief organ of *Udana vayu*.
- *Acharya Chakrapani*, commentator of *Charak Samhita* agrees with similar locations and areas of functions of *prana* and *udana vayu*. He states their location may be same but functions are different. He simplifies his statement by giving an example. If round shaped earthen pots are kept one on the top of the other, their location in relation to house is similar yet each pot h as different existence and different functions. This is the relation between *Prana* and *Udana vayu* in terms of their location and functions.
- *Acharya dalhana* in his commentary mentioned the *uchvasana* karma of *udana vayu*.
- Due to aggravation of *Udana vayu* diseases above shoulder level are observed. All Ear, Nose and Throat diseases and *shiro roga* are included under this category. If *kapha* covers and block *dhamani* that convey words a person is unable to speak properly. Depending upon area of blockade various defects of speech are observed.

- Karma (Functions) of *UdanaVayu*:

Helps in *Vak Pravruti* (to speak or in speech mechanism), *Prayatna* (efforts), *Oorja* (provide energy), *Bala* (strength), Varna (helps in pronouncing different alphabets).

Table 2 Showing Karma (Functions) Of *Udana Vayu* According To Different *Acharya*

No.	*Acharya*	Karma (Functions)
1	*Charaka* [1]	*Vakpravrutti*, *Prayatna*, *Bal*, *Urja*, *Varna* (vocalization, drive, energy, strength, complexion)
2	*Shusruta* [4]	*Bhashit*, *Geetadi* (exhalation, speech, singing)
3	*Vardh Vaghbhata* [7]	*Prinana*, *Manobhodhan* (Production of speech, activities(physical movements, actions), valor, strength, nourishing the tissue pores, (by providing them nutrition), discrimination, courage, memory, awakening of the mind)
4	*Laghu Vaghbhata* [6]	*Vak pravritti* (speech), *prayatna* (enthusiasm), *urja* (energy), *bala* (strength), *varna* (production of alphabets) *smriti* (memory)
5	*Bhel* [8]	*Kshavathu*, *Uchhavasa*, *Hikka*, *Kas*
6	*Sharangdhar* [11]	*Vakpravrutti*, *Prayatna*, *Bal*, *Urja*, Varna

- ***Vakpravrutti* (speech):-**

Vakpravrutti[9] According to *Acharya* Panini *Vakpravrutti* develops coordination in *Atma*(soul), *Man* (mind or heart), *Buddhi* (intellect) stimulated by *Jatharagni* and with the help of *Udana Vayu* In *Urha Sthana* (thorax) produces *Shabda* (speech). This *shabda* can be spoken by *Kanthadi Avayava* (organs) like *Ostha* (lips), *Talu*(palate), *Danta* (teeth) etc. *Acharya* Panini mentions different *Varna* (alphabets) that can be spoken with the help of different organ like lips, teeth, palate, tongue. Route of *Udanavayu* includes *Ura*(chest), *Kantha*, *Mukha* (mouth), *Nasa*(nose) etc: through which the functions *bhashita*, *geeta* etc: occurs, that is they helps in Speech mechanism or in Sound mechanism. [9] The coordinated action of *Atma* (soul), *Budhi* (intellect) and *Mana* (mind) stimulate *Jataragni* , which again stimulate the upward movement of *Vata* through the *Urapradesha* and produces *Sabda* (sound) .This *Sabda* due to the involvement of *KantadiAvayavas*(organs involved in speech-tongue, lips, palate etc:) Varna *Samamnaya* (meaningful words) are uttered. *Susruta* mentioned different Varna (alphabets) that can be spoken with the help of different organs like lips, teeth, tongue etc. and the *Sabda* is created when this *Vayu* flows in spaces and different organs come in contact with such moving air. During inhalation, air flows through *Nasa* (nose), *Talu* (palate) and finally reaches the *Uras*. During exhalation, the air from the *Uras* flows out and comes in contact with *Ostha* (lips), *Talu*(palate), *Danta* (teeth) *Jihwa* (tongue) finally spoken words are formed. Considering the *Vakutpatti* as Speech Mechanism, we can explain the Physiology of Speech in brief. [11]

➢ Modern aspect:-

The most important function of *Udana vayu* is *Vakpravritti* which means production of speech. It also helps in singing which is also a type of *Vakpravritti*. The mechanism of singing and speech are alike. The term Varna should not be alienated with *Smriti*. It is not Varna and *Smriti*. It is *Varnasmriti* which refers to the process of recall of vocabulary. Recalling the vocabulary is required to frame a meaningful sentence during *Vakpravritti*. Varna means vocabulary. Repetition of vocabulary potentiates the *Smriti* or memory power. So Smriti comes under the function of *Udanavayu* as it regulates the function of speech. Language is meant for communicating one's thought through spoken words or in writings and is also the medium for all delicate interpersonal transactions. There are four main areas in the brain that play important role in processing of language and speech. These four areas are collectively known as language zone that are present around the sylvian fissure. Two are called receptive area and the other two are called executive area. Receptive area is also called sensory speech area. They are wernicke's area that perform the perception of spoken language and the angular gyrus that subserve the perception written language. Area 41 and 42 are also included in receptive areas that take part in processing spoke language. Wernicke's area is located behind the primary auditory cortex in the posterior part of the superior gyrus of temporal lobe. This is major association area for processing sensory information from the somatic sensory, visual and auditory cortices. It is essential for the comprehension, recognition, and construction of words and language. It is the most important part of the whole brain for higher intellectual function because almost all intellectual functions are language based. Angular gyrus is second receptive area which is present in the inferior parietal lobule anterior to the visual receptive area. This subserves the perception of written language. The executive area initiates the production of speech. These are Broca's area (area 44, area 45) and writing area. Broca's area is concerned with motor aspect of speech which is located in the prefrontal association cortex, adjacent to the motor cortex. Broca's area regulates the function of muscles of lip, tongue, pharynx and larynx. Exner writing area is located in the posterior part of the frontal lobe. This area helps in writing after visual perception of word. The sensory and motor areas are connected with each other. A rich network of nerve fiber, the arcuate fasciculus which passes through the isthmus of temporal lobe and posterior end of sylvian fissure connects Wernicke's area and Broca's area. This fasciculus coordinates the understanding and execution of speech and the language skills. Angular gyrus receives visual and auditory inputs and makes preliminary processing of this information. Angular gyrus projects to Wernicke's area, which is concerned with the comprehension of visual and auditory information. Wernicke's area projects to Broca's area through arcuate fasciculus, which further processes information received from Wernicke's area into elaborate process of vocalization. Broca's area projects to motor complex that brings about the motor activities of speech apparatus, which finally produces speech. [10]

The stages of Speech mechanism are:-

- Breathing stage
- Phonation stage
- Resonation stage
- Articulation stage

- Breathing stage:-During Speech both inhalation and exhalation takes place, for maintaining the life. This is called Phonic

respiration. Here inhalation time is reduced while exhalation time increased to 5-10 sec and it can go up considerably.

- Phonation stage:- During speaking, voice is produced when the expiratory air streams from lungs, and goes up through Trachea, to the Larynx. The rapid vibration of vocal folds in the Larynx results in phonation. We can feel this vibration when we talk by holding index finger and thumb to our larynx.
- Resonation stage:- Resonation is the process of voice amplification and modification. Normally voice produced in phonation is weak. It becomes strong and rich only when amplified and modified by human resonators and they are:-Upper part of larynx, oral cavity, pharynx, nasal cavity.
- Articulating stage:-Articulation occurs when the tone produced in the larynx is changed into specific sounds. This is the result of movement of articulators towards the points of articulation. Lips, Teeth, Hard palate, Soft palate and Uvula help in articulation. There are a number of types of phonation. The vocal folds can operate in a number of different ways, resulting in different types of phonation such as Murmur, creaky voice, whisper etc: [10]

DISCUSSION

Vata is necessary for doing all the karma of our body. *Udana* does the functions related to *Urah* (chest) and *Manas*(mind). It has been mentioned that *Udana* has an upward motion. 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*. [12]

Vata is the natural pacemaker from where all the activities are initiated and continuing. It is the basic humoral element which controls all the function of the body. *Udanavayu* which is termed as *pavanottama* by *Acharya Sushrut* performs different functions like *Vakpravritti*, *Bala*, *Varnasmriti*. It executes its functions with the help of *Prana* and *Vyanavayu*. *Dhriti* (power of retention of information), *Smriti* (power of reproduction of information) and *Manobodhana*(stimulation of mind) are higher mental activities and are governed by the brain and other parts of the nervous system which are located in *Sira* (cranial cavity). *Sira* is not been considered as the site of *Udanavayu* by *Acharyas*. [4]

The development of speech is associated with neuro-physiological phenomenon of learning which occurs as an integrated outcome of motivation, emotion, and sensory adaptation in terms of performance of an individual. Major groups of muscles that take part in speech and respiration are located in the mouth and throat. Apart from this *Ayurveda* opines that major physiological functions occur through higher centre of brain. So a stimulus may reach higher centers in *Mastishka* (brain) from the *Nabhi*(umbilicus), *Uras*(chest), *Kantha sthana* through *Udana* because of its nature (moving upward). Integration of stimulus is done through *Pranavata* and a motor impulse may be sent to muscles of the above said *Sthana* where the movements of skeletal muscles occur due to *Vyanavata*. Hence it is clear that *Udanavata* performs its functions through the combined functioning of *Prana* and *Vyanavata*. [13]

For speech Broca's area, Wernicke's area is play important role. From the above details as per the functions of *Udanavayu,* it can be compared with many structures like Broca's area, Wernicke's area, Motor cortex, Serotonin like happy hormones, Thymus gland. The function *Vakpravrittimay* be compared with Broca's area, Varna and *smriti* may be compared with Wernicke's area. *Oorjamay* be compared with neurotransmitters like serotonin, dopamine like happy hormone with helps in enthusiasm. *Praytna* may be compared

with the initiative functions of motor cortex which helps in initiation to do effort. *Bala* (strength) may be compared with the physiological functions of thymus gland which provides cellular immunity by the activation of T lymphocyte. Some of the physiological functions of *Udana Vayu* explained by *Acharyas* is found in relation with the location of anatomical structures. Some physiological functions like *Vakpravritti*, *Prayatna*, *Smriti* are not related with function of anatomical structures explained by *Acharyas* under *Udana vayu*. As per modern medical science *Vakpravrriti*, *Praytna* And *Smriti* is the physiological function under the control of cerebral cortex i.e., higher center of brain. Brain is not included under anatomical structures explained in the location of *Udanavayu* but its physiological function is explained. [10]

CONCLUSION

Function of *Udana vayu* varies by different *Acharyas*. In *Ayurveda* it is believed that *Vata* when it circulates in the *Shabdavaha dhamani* (channels for carrying sound) is responsible for production of sound. *Vayu*, which one of the three types of *Tridosha*, along with physical and psychological factors were believed to be responsible for production of sound. [4] Speech is a multiphase unique phenomenon and is believed to be outcome of combined effort of acoustic signals, articulatory signals and muscles coordination along with nervous assistance. [10] *Ayurveda* proclaims with the production of speech as a function of *Vata Dosha*, precisely *Udana Vayu* (subtype of *Vayu*) which is held responsible for production of speech. Speech is the result of the complex activity of *Dosha* but the ultimate perception of the subject is done with the help of *Mana* (Psyche). [12] The initiation of Speech is through the thoughts that emerges in mind and is expressed as a speech. It is primarily responsible for *Vagutpatti* and its functions can be co-related with the functions of Glosso-pharyngeal nerve, Vagal nerve, Recurrent laryngeal nerve, Phrenic nerve. [10] So diseases affecting these nerves and the associated parts can be managed by the management of *Udana vayu*. It can be partially correlated with Broca's area, Wernicke's area, and motor part of nervous system, thymus gland, and serotonin like happy hormones. Conclusively it can be said that *Udana vayu* has a special force responsible for physical as well as mental vocal function. [13]

Acknowledgment: Nil.

Financial Support: Nil.

Conflict of Interest: Nil

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