



TASTE BUDS AND TASTE PATHWAY WITH A BRIEF REVIEW ON RASA DYANA IN AYURVEDA

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ABSTRACT

An important function of the tongue is taste sensation, which is derived from taste receptor cells located in clusters within taste buds on the surface of the tongue. Each taste bud is an oval body structure made up of modified epithelial cells. Taste is a complicated sensation depending upon the overall pattern of responses from taste buds all over the tongue. There is a particular pathway of taste because of which we can perceive taste. Taste signals that project from thalamus to the primary gustatory area in the parietal lobe of cerebral cortex give rise to conscious perception of taste. In Ayurveda it is told that *Indriya* with the help of *mana* perceives its *indriyarth*. And in modern we can get the detail description who it is occurring and the anatomical structures involved for the same. According to Ayurveda there are six rasas. So in this paper with the help of modern it is tried to understand how *rasadyana* is perceived.

Keywords- Taste buds, Taste Pathway, *Rasa Dyana*

INTRODUCTION:

Tongue is one among the five sense organs with the primary function of taste sensation. Taste buds present in tongue plays the major role in it. Each taste bud is a barrel shaped cluster of 50-150 fusiform cells lying within an oval cavity in the epithelium, converging apically on a small space opening by a gustatory pore, about 2µm wide on to the mucosal surface. From taste buds, impulse propagate along the cranial nerves (VII, IX, X) to the medulla oblongata. From medulla, some axons carrying taste signals project to the limbic system and the hypothalamus, where as other project to the thalamus. And ultimately taste perception occurs in the gustatory area of brain.

According to Acharya *Charaka*, in *Charakasamhita sutra sthana* it is told, the sense faculties are capable of perceiving their respective objects only when they are motivated by mind, Thinking constitute the object of the mind. It is the source of knowledge of miseries as well as happiness.

Likewise to obtain *rasadyana*- there should be *sannikarsha* of *aatma*, *rasanendriya*, *manas* and *rasa*.

TASTE BUDS:

Thousands of taste buds cover the surface of papillae in the tongue.

(Papilla = nipple shaped projection)

Taste bud is an oval body with three kinds of

- Epithelial cells
- Supporting cells
- Gustatory receptor cells
- Basal cells

3 types of Papillae contain taste buds:-

1. Vallate
2. Fungiform
3. Foliate papillae

In addition-Entire surface of tongue has Filiform Papillae. Contains no taste buds.

Papillae provides rough texture to the upper surface of tongue. Mostly in anterior 2/3rd.

1. Vallate/Circumvallate: (Val-at=wall-like) Inverted V-shaped. Cylindrical projection. In a row at back of Tongue

12 large circular vallate. 1-2mm diameter. Each has 100-300 taste buds.

2. Fungiform_Papillae (FUN-ji-form = mushroom like) Bright red in color. Scattered over the entire surface of tongue, Has narrow pedicle and rounded head, Contains 5 taste buds each.

3. Foliate Papillae (Foliate = leaf like) Located in small trenches on the lateral margins of tongue, Most of its taste buds generate in early childhood. 4-5 vertical folds in front.

4. Filiform Papillae (Fil-i-form = thread like) Increase friction between the tongue and food, Makes tongue to move food easily in oral cavity, Gives velvety appearance. Smallest of all.

MICROSCOPIC STRUCTURE:

Reconstructions of taste buds from serial electron micrographs (Murray and Murray 1970) have shown at least five distinct types of epithelial cells to be present. (Type I - V)

Type I: Which forms more than half of the total is a densely staining cell.

Type II and III: Stain lightly.

Type IV: Round basal cell.

Type V: Cells form the boundary with the surrounding epithelium. (Precise identities of the first three of these cell types is not certain)

TASTE PATHWAY: The taste fibers from the cranial nerves - VII, IX, and X enter the medulla oblongata. After descending in the tractus solitarius, they terminate at different levels in the nucleus solitarius., (the solitary nucleus is a series of nuclei forming a vertical column of grey matter embedded in the medulla oblongata)

The fibers from CN VII and IX end in the rostral part, and the fibers from the vagus end in the caudal part of the nucleus

From this nucleus, 2 sets of fibers project. The first set projects to the preganglionic parasympathetic neurons in the superior and inferior salivary nuclei and the dorsal vagal nuclei. These represent interneurons in the gustatory pathway. A reflex (inborn) response to taste includes an increase in salivary secretion, as well as gastric and pancreatic juice.

The bulbo-thalamic (second-order ascending neurons) pathway joins the medial lemniscus of the opposite side. These fibers relay in the thalamus close to the fibers of somatic sensations for the face. The third-order neuron projects from the arcuate thalamic nucleus to conduct taste to the cortical taste center. This center is in the inferior part of the parietal lobe cortex adjacent to the somatosensory area of the tongue and face. This area extends into the lateral fissure and on to the insula.

On stimulation of taste receptors, electrophysiological studies have shown potential changes in the inferior part of the postcentral gyrus in the corticofunctional area of the tongue and face. Overlap and intermingling exists between the cortical taste area and that of somatic sensations of the face and tongue. Furthermore, evidence exists to support an ipsilateral gustatory system that ascends to the thalamus via the trigeminal tract. Stimulation of the insular region causes taste hallucinations.

REVIEW ON RASA DYANA:

Ayurveda mentioned six rasas (six types of tastes) which are madhura, amla, lavana, katu, tikta, and kashaya.

Rasa is *aapya* and is *avyakta* (unmanifested form) in the beginning. *Aapmahabhuta* is the primary cause of taste, without that it cannot manifest at all. Due to the effect of six *ritus*, the combinations of *mahabhutas* in a substance is the cause for innumerable kinds of substances, so also their peculiar qualities including the tastes and thus *rasa* gets differentiated into six different kinds.

According to Acharya Vagbhata, madhura is formed by the predominance of *prithvi* and *jala*; predominance of *prithvi* and *tejas* is the cause for *amlarasa*; *jala* and *tejas* produce *lavanarasa*; *vayu* and *kasha* produce *tiktarasa*; *vayu* and *tejas* produce *katurasa*; *vayu* and *prithvi* produce *kashaya rasa*.

Katu and *kashaya* *rasa* are additional tastes told in Ayurveda when compared with modern. There are only four basic tastes explained in modern which are

sweet, salt, bitter, sour. And recently metallic and umami are added by modern science.

EFFECT OF RASAS ON JIHWA:

Each *rasa* is having its own particular *gunas*. And as *jihwa* is the *rasanendriya*, when the *rasa dyana* is perceived it has different effects over *jihwa*.

Madhura *rasa* forms a coating inside the mouth, gives pleasure to all sense organs including *jihwa*. Provides happiness to the body and is very much liked by even *shadpada*, *pipilika* (ants, flies) etc.

Amla *rasa* irritates *jihwa*, produces excess salivation and makes the person close his eyes and brows tightly, causes horripilations. Also produces burning sensation in throat and chest region.

Lavana *rasa* when perceived by *jihwa*, produces excess salivation, burning sensation of throat and cheek and it makes food tasty.

Tikta *rasa* cleanses the mouth, clears the throat and hinders perception of other tastes.

Katurasa gives severe stimulation, irritates the tip of *jihwa*, throat and cheeks; causes watery discharge from the mouth, eyes and nose; and a feeling of burning sensation in the body.

Kashaya *rasa* inactivates *jihwa*, obstructs the throat and produces discomfort in the region of heart.

The above mentioned are the *rasa gunas* mentioned by *Vagbhatacharya* in *Ashtanga Sangraha Sutra Sthana*. From that its effect on *jihwa* can be understood.

RASA DYANAGRAHANA:

The *guna* of *adravya* perceived by *rasanendriya* is *rasa*. *Rasa*, grossly means the taste of a substance, which is perceived by *rasana* or *jihwa*, when the particles of substances are dissolved in saliva or water and come in direct contact with cells present in tongue. While the *rasa* are perceived by the gustatory sense organs, their composition is inferred by their effects on *doshas* of the body.

Pratyakshadyana is the knowledge which needs immediate presence of sense or-

gans. In general, to obtain a *pratyakshadyadna*, *aatma-indriya-manasandindriyaartha* should act together.

Likewise to obtain *rasadyadna* there should be *sannikarsha* of *aatma*, *rasanendriya*, *manas* and *rasa*.

After going through the references of various acharyas, regarding the perception of *indriyas*, a pathway of *rasa dyanagrahana* is derived for precise understanding of the same.

When *madhuradiannadravyas*, *dravasetc* are placed over *jihwa*, it comes in contact with the *bodhakakapha*, which is having *adhithana* in *jihwa*. *Rasabodhana karma* starts here.

There after it is carried by *rasavahadhamini* with the help of *vaayu*, to the higher centres, i.e. brain.

Along with the involvement of *manas* and *aatma*, ultimately perception of *rasa* occurs

DISCUSSION:

Taste is a chemical sense. The sensory experience is produced by stimulation of specific receptors in the oral cavity. Taste buds are specialized structures in different papillae which are present in tongue. In general, chemical substances dissolving in the oral mucus diffuse through the taste pores of the buds and through the dense extra cellular material within their apices to reach the taste receptor cell membranes. Here they cause membrane depolarization by a variety of mechanisms depending on the type of receptor and this indicates an action potential within receptor cell. In turn, the synapses at their bases are activated to initiate action potentials in the terminals.

The glossopharyngeal (IX) is the most important nerve for the sense of taste. It provides sensory innervation to the base of the tongue and both motor and sensory innervation to part of the pharynx. The lingual branches of the glossopharyngeal nerve mediate taste sensations to the circumvallate papillae of the tongue, situated at the junction between the anterior two thirds and posterior third of the tongue and

foliate papillae, situated at the rear edge of the tongue.

The Facial nerve (VII) serves the anterior 2/3rd of the tongue include the chorda tympani and the greater petrosal nerve, which arise from the nervus intermedius (smallest afferent branch of the facial nerve). The chorda tympani (CT) receives taste information from the anterior two thirds of the tongue. It courses along the lingual nerve, and they both leave the undersurface of the tongue to run beneath the submandibular (Wharton) duct, then ascend after crossing the duct lateral to the hyoglossus and styloglossus muscles.

The Vagus nerve (X) innervates taste buds on the laryngeal surface of the epiglottis. It also serves throat along with epiglottis. The role of these fibers in daily taste perceptions is not well understood so far.

Taste buds are innervated by nerves that respond to chemicals from food in solution, thereby providing the sensation of taste. So the gustatory pathway with the involvement of above mentioned cranial nerves are responsible for the ultimate taste sensation.

Ayurveda says *rasa dyana* (taste perception) is because of the combined action of *aatma, manas, rasanendriya* and *rasas*.

CONCLUSION:

Taste is a sense which is perceived by human with the help of taste buds present in tongue structurally and by the real physiology of taste/gustatory pathway.

In modern science, detail anatomy of taste buds, taste pathway, how taste is perceived are mentioned as discussed above. But in Ayurveda, though it is mentioned, about *trasa, rasanendriya, rasadyana* etc a detailed information is unavailable about exactly how taste is getting perceived. But when we compare both Ayurveda and Modern Science, a systematic information can be obtained for proper understanding. And thus both can be correlated also.

Though taste pathway is not mentioned separately in ayurvedic literature, we can

compile the opinions of different ayurvedic Acharyas about how perception occurs in *indriyas* and can be correlated with the modern science. It is seen to be almost equivalent.

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