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IMPETUS DEMAND IN DEVELOPING A RASA (TASTE) ASSESSMENT TOOL FOR AYURVEDA CRUDE DRUGS

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ABSTRACT:

The identification of *Rasa* (taste) of any Ayurveda crude drug acts as a predictor of its pharmaco-therapeutic effects thereby helping assume its applicability as food and medicine. Therefore, *Rasa* identification may facilitate the selection of *Rasa* - based substitutes. Ayurveda literature points towards role of *Rasa* assessment in drug development and standardization of Ayurveda raw drugs. The aim of this paper is to highlight the scope and present status of Rasa evaluation tool in Ayurveda. A thorough search of electronic databases including Google Scholar and PubMed using the keywords "*Rasa*," "taste assessment," "*Rasa nirdharana*" and "Ayurveda" was performed. Ayurveda classical textbooks were thoroughly scrutinized to gain leads for development and validation of tool for *Rasa nirdharana*. Presently studies use single-blind trials to assess the Rasa of crude drugs wherein healthy volunteers of either sex having knowledge of Rasa were participants. The identification of the Rasa was performed by virtue of a tool notably a structured proforma as well as direct identification of the taste. The structured proforma commonly in use is developed by Dr. Nisteshwar, a specialist in Ayurveda and Materia medica. This proforma is based on "*Rasa Lakshana*" the traits of each *Rasa* (taste) as described in classical Ayurveda literature. This popular tool has been in use for a decade and there is no denying that the idea as to how to develop a *Rasa* assessment tool begins from it. Development and validation of a tool for *Rasa* assessment is need of the hour. There are few lacunae in the proforma used in *Rasa* assessment today. A suitable qualitative research method needs to be employed to develop a suitable tool that justifies the unique description of each *Rasa* in Ayurveda scriptures.

Keywords: Rasa, Rasa nirdharana, Taste assessment , Ayurveda crude drugs, Rasapanchaka

INTRODUCTION:

At present the focal point of Ayurveda drug research is drug development, quality standardization and pre-clinical and clinical validation of the safety and efficacy of Ayurveda medicine. Numerous Ayurvedic herbs and formulations are currently being scrutinized and undergoing rigorous scientific validation. Meticulous research in the lines of pharmacognosy, phytochemistry, DNA barcoding, toxicity study, preclinical studies and clinical trials are being undertaken. These studies certainly provide "evidence" for the safety and efficacy of the medicines and generate Reference Standards. Unravelling the "mode of action" remains the arduous task in Ayurveda drug research. Hope lies in the advanced system biology-based paradigm called network pharmacology wherein the discovery of novel entities that act on multiple targets could possibly be discovered. It remains to see if it could lead to plausible breakthroughs.

To put it more accurately, contemporary research methodologies could be used to translate, develop and validate practically useful tools based on Ayurvedic concepts. Ayurveda classical texts include extensive documentation of ideas and methods for probing into notions of quality standardisation of medicine and drug development. The five principles "*Rasapanchaka"* consisting of *Rasa* (taste), *Guna* (property), *Veerya* (potency), *Vipaka* (bio-transformed taste), and *Prabhava* (specific action) are the basic bricks to build the pharmacotherapeutic principles of Ayurvedic treatments, therapeutics, and diet[1]. The best way forward in Ayurvedic drug research and standardisation is to identify, explore, and comprehend the *Rasapanchaka* of crude drug and formulations. "*Rasa"* (taste) -the first and foremost principle is most the suitable choice for initiating research in this area as it a sensory factor which produces immediate distinctively perceivable effects in an individual when a substance is tasted[2,3].

Relevance of *Rasa* (taste) in Ayurveda

Despite being literally translated as "taste," "*Rasa" refers* to more than just the sense of taste. According to Ayurveda, there are six "*Rasa*," each of which is distinguished by the responses that are immediately triggered when something is in contact with the tongue. [2,3] The 6 Rasa in Ayurveda are: *madhura* (sweet), *amla* (sour), *lavana* (saline), *katu* (pungent), *tikta* (bitter), and *kashaya* (astringent)[4]. According to Acharya Charaka the other pharmacological factors (*Guna, Vipaka, Virya and Karma*) can be prospectively speculated on the basis of *Rasa*.[5] The balance of the three humors (*Tridosas)* which manifest

and synchronize the structural, functional, and regulatory systems of the human body are maintained by "*Rasa.*"[6] It goes on to say that food consisting of all the six Rasa nourishes the body and maintain harmony of dosas if administered properly ; otherwise, they vitiate the dosa. Most diseases result from multiple dosa vitiation and hence a poly herbal formulation is recommended as it is composed of the qualities of different *Rasas* (taste)[7]. *Rasa vikalpa chikitsa* is a treatment method, which requires choosing medications and diet possessing a particular combination of *Rasas or* a specific *Rasa* based on *Dosha* vitiation. *Rasa vikalpa* is ideally the key to perfectly curing a sickness and maintaining health[7].

The hundreds of medicinal plants and minerals forming the crux of Ayurveda medicine are grouped based on the Rasa predominant in them into 6 groups called *Rasa Skandha*.[8,9,10] This grouping makes selection and utilization of drugs based on *Rasa* easy thereby facilitating treatment and recommendation of ideal diet unchallenging. The Ayurveda classical textbooks especially the lexicons (Nighantu) are dedicated to description of properties, actions and indications of Ayurveda drugs. There are various contexts in which the classical literature stresses on importance of *Rasa* vis-a-vis *Rasapanchaka* in quality testing and standardisation of Ayurveda medicine [11,12]. Thus, knowledge of *Rasa* is a predictor of properties and action of herb or mineral thereby helping assume its applicability as food and medicine. *Rasa* identification can facilitate selection of "*Rasa* based substitutes". *Rasa* assessment helps in quality testing and standardisation of Ayurveda medicine.

Ayurveda method of identifying a Rasa:

When any substance comes in contact with the tongue, it produces a unique set of effects in an individual. This "*asadharana dharma*" or characteristic feature portrayed by each Rasa is termed as "*Rasa Lakshana.*" The action produced by each *Rasa* upon consumption of the substance is called "*Rasa karma*". A detailed literary review shows that Charaka Samhita [13], Sushruta [14] Samhita, Ashtanga samgraha[15], Ashtanga hridaya[16], Rasavaiseshika[17], Harita Samhita [18], Bhava Prakasa nighantu [19], Sodala Nighantu [20], Madanapala Nighantu [21], and Raja Nighantu [22] all go into detail in their descriptions of each Rasa's characteristics. The characteristic effects or response evoked by each *Rasa* in an individual are well-depicted in the classics of Ayurveda, and a strong systematic approach is evident in the identification of the traits and behaviours. There is enough room for development of a tool to identify the "*Rasa*" of

raw drugs based on these scriptural references in Ayurveda.

Methods of Rasa assessment utilised in Ayurveda drug research:

There are few studies in which have attempted to revalidate the taste of Ayurveda crude drug using healthy volunteers [23,24,25,26,27]. In these studies, identification of the Rasa in research studies was performed by virtue of 2 methods:

1. Direct tasting and identification of the taste called the Direct method or "*Nipata*" method.
2. Using a structured proforma based on *Rasa Lakshana* which are Ayurveda principles for discriminating *Rasa*.

Procedure of Rasa assessment employed in the studies [23,24,25,26,27]**:** All the studies have employed healthy volunteers for analysis of the *Rasa* (taste) of Ayurveda crude drugs. **Inclusion criteria**: Healthy volunteers of either sex having knowledge of *Rasa* preferably postgraduates in Dravyaguna (Ayurveda materia medica and pharmacology) were participants. **Exclusion criteria**: Volunteers having health problems with hindered their perception of taste such as stomatitis, acute rhinitis and fever. Persons with addiction like smoking, chewing tobacco, or betel nut in which taste perception gets impaired were in exclusion.

Notably in all these studies the volunteers were instructed to abstain from meals, tea, and coffee for at least half an hour before the taste assessment. They were requested to thoroughly rinse their mouth with water. In all the research the test drugs were authenticated, washed, shade-dried, powdered, sieved through Mesh no. 85, stored in the airtight containers and administered in powder form. The amount of drug for tasting ranges from 1 gm to a maximum dose of 3 gm. After tasting the sample, the participants are required to directly note the taste and to answer the proforma.

The structured proforma commonly in use now is the one developed by Dr. Nisteshwar, a specialist in ayurveda pharmacology and Materia medica[23]. This proforma is based on "*Rasa Lakshana*" the traits of each Rasa (taste) as described in classical Ayurveda literature. Dr Nisteshwar's Standardized Question format (Annexure 4) is a questionnaire that is being used for Rasa assessment presently. The distinctive qualities (*Lakshana*) of each taste (*Rasa*) from the four main Ayurvedic textbooks: Charaka Samhita, Susrutha Samhita, Ashtanga Samgraha, and Astanga hrdiya was used as construct to develop the "Rasa assessment proforma" by Dr Nishteshwar. This proforma has 15 questions to which every participant has to

answer by a "yes" or "no" as a direct response with respect to his perception of the taste of the given sample. The table below represents the questions in the proforma and the respective *Rasa* to which it was attributed for purpose of analyses.

Table 1 Symptoms in Dr Nisteshwar's proforma and attributed corresponding Rasa [24]

Sl no	Symptoms in Dr Nishteshwar's Porforma for Rasa Nirdharana	Corresponding Rasa
1	Besmears the mouth	*Madhura*
2	Feeling of unctuousness	*Madhura*
3	Pleasurable sensation in body	*Madhura*
4	Abundant saliva secretion thereby cleansing the mouth	*Amla/Lavana*
5	Tingling sensation and horripilation in teeth	*Amla*
6	Shrinking of eyebrows and lids	*Amla*
7	Tongue and mouth gets moistened and soft	*Lavana*
8	Burning sensation in buccal cavity and throat	*Lavana*
9	Stimulation of tongue tip	*Katu*
10	Burning sensation on tongue	*Katu*
11	Watering from mouth, eyes and nose	*Katu*
12	Cleansing and drying the mouth	*Tikta*
13	Feeling of temporary loss of taste perception	*Tikta*
14	Feeling of stiffness in tongue and tongue becomes dull to taste perception	*Kasaya*
15	Choking feeling in throat	*Kasaya*

In a study published in 2014 by the same author that assesses taste of *Leonotis nepetifolia* (L.) R. Br , it is seen the questionnaire was modified[25]. All the Rasa characteristics which produce local or reflex reactions experienced on the tongue, buccal cavity, throat, palate, nose and eyes described in the context of characteristics of Rasa in *Caraka saṃhitā*, *Suśruta saṃhitā*, *Aṣṭāṅga saṅgraha*, *Aṣṭāṅga hṛdaya* and *Bhāva prakāśa*

were incorporated into a structured questionnaire. The questionaire having Respondent experiences of *lakṣaṇas* and attributed corresponding Rasa is given as Table 2

Table 2 Respondent experiences of *lakṣaṇas* in proforma and attributed corresponding Rasa[25]

Sl no	Symptoms inPorforma for Rasa Nirdharana	Corresponding Rasa
1	Besmears the mouth/causes stickiness in mouth	*Madhura*
2	Pleasant or soothing sensation to the nose, mouth, throat, lips and tongue	*Madhura*
3	Causes salivation	*Amla/lavana/katu*
4	Cleanses the mouth	*Amla, tikta*
5	Tingling sensation of teeth	*Amla*
6	Leads to constriction of eyebrows and lids	*Amla*
7	Softens the buccal cavity	*Lavana*
8	Burning sensation in buccal cavity and throat	*Lavana*
9	Instant irritation to tongue tip	*Katu*
10	Irritation in throat and buccal cavity	*Katu*
11	Lacrimation	*Katu*
12	Secretion from nose	*Katu*
13	Distasteful	*Tikta*
14	Dryness of mouth	*Kasaya*
15	Stiffness in tongue	*Kasaya*
16	Obstructive feeling in throat	*Kasaya*

Each volunteer was given 3 g of the test drug and asked to record their inputs in the questionnaire. The study concludes that *Leonotis nepetifolia*[25] has Rasa as predominant in *Tikta* followed by *Kaṣāya* based on the responses elicited using a structured questionnaire. Another study documents the pharmacognostic standard of Lagerstroemia speciosa (L.) Pers of Lythraceae

family[26]. The study included taste assessment using the above discussed questionnaire.

A study published in 2019 with the objective to analyse the Rasa of Bridelia stipularis[27] (L.) Blume was carried out at in VPSV Ayurveda College, Kottakkal using the questionaire given in Table 3. The participants who volunteered for the study were explained about the study and their role in the study. Every volunteer was then asked to cleanse their mouth with water prior to the onset of the experiment. Five minutes after cleansing the mouth they were given 2 g of the test drug and asked to record their inputs in the questionnaire. The study concludes that the leaves of has Kasaya Tikta Rasa and Madhura anuRasa as reported from data obtained from questionnaire administration.

Table 3 Volunteer's experiences of lakṣaṇas of Rasa[29]

Sl no	Lakṣaṇa experienced	**Corresponding Rasa**
1	Besmears the mouth/causes stickiness in mouth (Vaktram upalimpati)	Madhura
2	Pleasant or soothing sensation to the nose, mouth, throat, lips and tongue ((ghranamukhakantaoshtajihwaprahladanō)	Madhura
3	Causes salivation ((āsyamaasrāvayati))	Amla/lavana/katu
4	Cleanses the mouth ((Viśadayativadanam)	Amla, tikta
5	Tingling sensation of teeth (daśanaan harṣayati)	Amla
6	Leads to constriction of eyebrows and lids (akṣibruvam samkōcayati)	Amla
7	Softens the buccal cavity (mārdavam caāpādayati)	Lavana
8	Burning sensation in buccal cavity and throat (kantakapolam vidāhati)	Lavana
9	Instant irritation to tongue tip (bhriṣamudvejayati jihwāgraṁ)	Katu
10	Irritation in throat and buccal cavity (chimichimayati kantakapōlaṁ)	Katu
11	Lacrimation (Srāvayatiakṣi)	Katu
12	Secretion from nose (Srāvayati nāsikāṁ)	Katu
13	Distasteful (Arociṣṇu)	Tikta
14	Dryness of mouth (Vaktrampariśōṣayati)	Kasaya
15	Stiffness in tongue (jadayati jihwāṁ)	Kasaya
16	Obstructive feeling in throat (kantaṁbadhnāti)	Kasaya

A study from 2021 examines the taste (*Rasa*) of *Cissus latifolia* Lam[28]. an extra-pharmacopoeial drug belonging to Vitaceae family which has been mentioned in Hortus malabaricus. This study refers and follows methodology of Dr Nishteshwar's research paper in developing the questionnaire. Firstly, the qualities of each taste (Rasa lakshana) from the 4 classical textbook books- Charaka samhita, Susruta samhita, Astanga samgraha, Astanga hrdaya and Bhava prakasa additionally were enumerated. Yet the final questionnaire simply asks 16 questions about taste attributes, which are based on responses or reactions felt on the eyes, nose, mouth, tongue, buccal cavity, throat, and palate. The technique used for the inclusion or exclusion of questions is not clarified. Each question is followed by a "Yes/No" response from the participants after they have tasted the herbal powder. The study reports that the taste of aerial portions of Cissus latifolia Lam. turned out to be *Kasaya* with *Tikta anurasa.*

The Ayurveda crude drugs that have been tested for their Rasa identification by this method are as follows:

Table 4. List of Ayurveda crude drugs that have been tested for their Rasa identification using proforma

Sl no	Botanical name	Rasa as per classics	Rasa identified using performa
1	Abutilon indicum [24]	*Madhura*	*Madhura, Kashaya*
2	Pueraria tuberosa [24]	*Madhura*	*Madhura ,Kashaya*
3	Solanum xanthocarpum[24]	*Madhura*	*Tikta katu*
4	Ricinus communis [24]	*Madhura*	*Madhura kasaya*
5	Tribulus terrestris [24]	*Madhura*	*Madhura tikta kasaya*
6	Tinospora cordifolia [24]	*Madhura*	*Tikta kasaya*
7	Desmodium gangeticum [24]	*Madhura*	*Madhura kasaya*

8	Leptadenia reticulata [24]	*Madhura*	*Kasaya Madhura*
9	Asparagus racemosus [24]	*Madhura*	*Tikta Madhura*
10	Boerhavia diffusa [24]	*Madhura*	*Madhura, Kashaya*
11	Leonotis nepetifolia (L.) R. Br. [25]	Extra pharmacopeial	*Tikta kasaya*
12	Lagerstroemia speciosa [26]	Extra pharmacopeial	*Kasaya*
14	Bridelia stipularis (L.) Blume[27]	Extra pharmacopeial	*Kasaya, tikta, Madhura anuRasa*
13	Cissus latifolia Lam[28]	Extra pharmacopeial	*Kasaya tikta*

DISCUSSION:

This review finds that rasa (taste) assessment has been accepted in Ayurveda as a predictor of the pharmacological action and thereby therapeutic utility of the crude drug. The attempt to revalidate the rasa of Ayurveda crude drugs belonging to Madhura Skandha[24] (group of drugs with sweet taste) and also use of same technique to assess Rasa of extra-pharmacopeial drugs[25,26,27,28] reveals the relevance of this parameter in Ayurveda drug research. All these studies utilise the same questionnaire. The distinctive characteristic feature of each rasa as in Charaka Samhita, Susrutha Samhita, Ashtanga Samgraha, and Ashtanga Hridaya was used as construct to develop the "Rasa assessment proforma" by Dr Nishteshwar. Ironically there lies lacuna in the way the items have been identified and translated to English equivalents. For example, while tabulating qualities of *Madhura Rasa* by Susruta : "P*aritosam utpadayati"* has been translated to "generates pleasure", "*Prahladayat*i" as "brings cheerfulness" and *mukhaupalepam janayati* as "besmears the mouth". Acharya Charaka describes 2 characteristic features- "s*hadindriyapRasadana*" and *"ghrana-mukha-kantha-ostha-jihwa prahladana"* to describe Madhura Rasa and these have been translated to "soothing to six sense organs" and pleasant/ soothing sensation to the nose mouth, throat, lips and tongue respectivel. Astanga samgraha's description which includes

mukhamupalimpati , indriyani pRasadayti and *deham prahladayati* have been translated to "besmears the mouth", "soothing to body" and "soothing to sense organs" respectively. Lastly, "*Vaktra unulimpati", "Dehasya hladanah"* and *"Aksa-prasadana"* have been translated to "besmears the mouth", "soothing to sense organs" and "soothing to body" respectively.

The employment of suitable methods like focus group discussions would have ideal for item generation and selection. The subtle yet potent leads for taste assessment may have got lost by mere translation. It's seen that in research studies[24,25,26,27,28,29] the authors have stated that these all features are attributed to just one domain that is the "local or reflex reactions" experienced on the tongue, buccal cavity, throat, palate, nose or eyes. On comprehensive analysis of the enlisted qualities, it is quite obvious that there are at least two domains, including psychological reactions as well as local or reflex reactions. Also, qualities which might be denoting psychological and systemic effect like *"paritosam utpadayati"* and "*dehasya hladana*" are all presumably included as "pleasuarble to body". The proforma analysis reveals that some qualities which were common or overlapped for the Rasas were retained as such. If a person identifies a characteristic feature as "Abundant saliva secretion thereby cleansing the mouth", then it would denote both Amla and lavana. Its highly debatable as to why such symptoms were included in final performa.

Its undisputable that development and validation of a reliable tool for identifying *Rasa,* based on *Rasa* descriptions in Ayurveda scriptures will contribute to drug standardisation and quality assessment of raw drugs. Elaborate descriptions about each "*Rasa*"; distinguished by a subjective experience of the preceptory interactions of the substance immediately on contact with tongue is provided in various Samhitas and Nighantus in Ayurveda. This codified data could be used for tool development by following in the steps of qualitative research. Currently no validated and accurate tool is available for *Rasa* assessment of Ayurveda raw drugs. There is an urgent need of a reliable tool for identification of Rasa of a herb for exploring probable drug action and to establish quality standards.

CONCLUSION:

The application of the tool for Rasa assessment will help revalidate the knowledge of *Rasa* of Ayurveda herbs as per classical textbooks. It may open immense opportunities and possibilities in ayurvedic drug research for crude drug standardisation, quality evaluation,

identifying *Rasa*-based plant substitutes, understanding the taste variability of plants and water from different geographical locations and sources, all of which have important implications for ayurvedic practice.

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