A preface study on exploring the pharmacodynamics of *Curcuma neilgherrensis* Wight - A folklore medicine

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*Curcuma neilgherrensis* Wight is an unexplored drug in the current scientific world. Leaves of the plant are claimed to be effective in the management of diabetes mellitus. Pharmacodynamics and pharmacology of medicinal herbs used in Ayurveda can be identified in terms of *Rasa* (taste), *Guna* (inherent property), *Veerya* (Potency), *Vipaka* (post digestion property) and *Prabhava* (target oriented unique effect). To assess the status of *Rasa*, *Guna*, *Veerya* and *Vipaka* of *Curcuma neilgherrensis* Wight, based on its pharmacological actions, the powdered drug was orally administrated in a dose of 5 gm twice a day with lukewarm water for duration of one week. *Rasa* was assessed also by the immediate taste perception. The study revealed the *tikta* and *kashaya rasa* of drug, whereas *lagu, ruksha, vishada* and *ushna* were the chief properties inherent to this drug. *Curcuma neilgherrensis* wight comes under the category of *ushna veerya* drugs and the *Vipaka* arises after the digestion of this particular dravya is *katu*. The application of *Curcuma neilgherrensis* wight for the management of diabetes mellitus can be justified based on these findings.

**Keywords:** Folklore medicine, *Curcuma neilgherrensis*, Pharmacodynamics

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Ayurvedic Science furnish due weight to every matters in the universe and its medicinal exploitation and the Science is very particular in concerning the unexplained herbs and its exploration. Acharya Sushruta has sincerely acknowledged the tribal/folk sources of *Ayurvedic Materia Medica* by suggesting that information concerning drugs should be collected from cowherds, ascetics, hunters, tribes and others who roam in the forests, who are known as *Bheshaja vyakti* (knower of drug)1. Charaka gives stress for the accurate appliance of information of herbal drug collected from tribal source2. Narahari, the author of *Rajanighantu* suggests to analyze the information collected from folk/tribal pockets, through the light of Ayurvedic pharmacodynamic principles3. During the diverse epoch of evolution of Ayurvedic Science, many of the scholar scientists like Vrinda, Kaiyvadeva, Bhavamishra, etc. have fruitfully incorporated new drugs like Aliphena (*Papaver somniferum* Linn), Chopachini (*Smilax china* Linn), etc. to the classical *Ayurvedic Materia Medica*4,5.

The acquaintance of medicine, which is being transformed verbally; from generation to generation and not in the course of written certification is generally known by the name ‘folklore medicine’ and was the solitary means through which our ancestors fulfilled their medicinal needs. Even though the folklore medicines give immense deal of therapeutic benefits, for the good quality use of this in Ayurvedic practice; the issues related to Ayurvedic drug discovery methodologies has to be followed6.

Drug discovery is not always confined to the discovery of active chemical principle, rather isolation of bio-activity in terms of pharmacological and clinical evidences may offer much in the field of drug research. When the therapeutic active principles of herbal drug are unidentified, the technique of measuring activity will play a triumphant role in herbal drug discovery.

As the folklore medicines are evolved by the individual and ethnic experiences, it needs further investigations in stipulations of diverse branches of medical science to endeavor the issues like that of identification, standardization, pharmacology, etc. As far as Ayurveda is concerned, the pharmacodynamics and pharmacology of each and every medicinal herb can be identified in terms of *Rasa* (taste), *Guna* (inherent property), *Veerya*
SHYAM et al.: PHARMACODYNAMICS OF CURCUMA NEILGHERRENsis WIGHT

Curcuma neilgherrensis Wight (Fam: Zingiberaceae); known as Kattukalvazhai in Tamil, is a folklore medicine widely used by the tribes of Western Ghats for the management of diabetes mellitus. The leaf is considered as the useful part for countering the ill effects of diabetes mellitus. The plant is extensively distributed in the southern part of India, especially over high altitudes (Fig. 1). Curcuma neilgherrensis wight is a rhizomatic, small rhizome are conical, white inside, ending in root tubers, fusiform and leaves are green, lanceolate/oblong-lanceolate, measuring about 25x8cm (Fig. 2).

In spite of its reputation in curing the ailments it has not yet been investigated scientifically for identifying the rasa, guna, veerya and vipaka. When an innovative drug is establishing in to the Ayurvedic clinical practice, it requires a smart scientific validation, principally where and how the mechanisms of action are concerned. To elucidate these issues, the current study is planned.

Objectives
To analyze the pharmacodynamics (rasa, guna, veerya and vipaka) of Curcuma neilgherrensis wight.

Methodology
Both conceptual and clinical materials were used to analyze the pharmacodynamics of Curcuma neilgherrensis wight. In conceptual accept, Ayurvedic literature related to the current focus was scrutinized with the classics such as Charaka samhita, Susruta samhita and Ashtanga hridaya; and a proforma was geared up, incorporating the most applicable subjective criteria of different types of rasa, guna, veerya and vipaka. The whole plant with the leaves of Curcuma neilgherrensis wight were collected in the month of June from the natural habitat of Thalkavery forests of Kodagu district (Karnataka, India), a tail of Western Ghat. The prior informed consent was taken from the knowledge providers as per the CBD guidelines. The drug was accurately identified in consultation with different floras at the department of Pharmacognosy, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurveda University, Jamnagar. The matured leaves were separated from the plant, cut in to pieces, shade dried, coarsely powdered and used for the study. To assess the rasa of Curcuma neilgherrensis (based on direct contact with the tongue), 20 healthy volunteers were selected from the campus of Institute for Post graduate Teaching and Research in Ayurveda, Jamnagar; and asked to wash the mouth. After 5 minutes, 2 gm of drug served to the each volunteers. The volunteers were requested to record the immediate appraisal of taste and also taste perceived after five minutes for detection of associated taste. To assess the status of rasa, guna, veerya and vipaka, the same powdered drug was orally administrated in a dose of 5gm twice a day with lukewarm water for duration of one week. The subjects were observed daily and thoroughly interrogated after one week. The biological changes
obtained in this scrutiny were recorded in the specially designed proforma.

**Criteria for selection of volunteers**

Volunteers of either sex, irrespective of religion, caste, creed, prakriti, koshta, etc. between the ages of 16-35 yrs were selected. General health of the volunteers was assessed before starting the trial.

**Observations and Result**

When the drug was given initially for the estimation of rasa, based on the direct contact with the tongue momentary loss of taste perception followed by feeling of dryness and cleanliness in the mouth was the major subjective reaction reported by maximum number of volunteers (17 out of 20); and these 85% of volunteers stated the pradhana rasa of Curcuma neilgherrensis wight as tikta (bitter). The remaining 3 members could also perceive a feeling of tongue getting dull to taste sensation for a short time but this subjective feeling was not associated with dryness in mouth rather they reported that the drug produces stiffness over the tongue. According to this in 15% of the volunteers, the chief rasa of Curcuma neilgherrensis wight was identified as kashaya (astringent) (Table 1). While the sensation of taste perceived after 5 minutes asked to document; 80% of the volunteers could appreciate kashaya rasa as the secondary taste (Anurasa) of the trial drug. In 10% of the subjects tikta was the expressed flavor. Katu rasa has been reported as uparas rasa by 5% of the people. The residual 5% could not appreciate any specific sensations related to taste after 5 minutes of drug contact with the tongue.

Determination of rasa was also tried to be detected based on the pharmacological activities of the drug. As a part of it, the drug was administered for one week orally in a dose of 5 gm twice a day. The unpalatable taste of the drug was been reported by all the 100% of people. The status of general appetite and capacity of digestion has improved in 95% of them. According to this observation in 95% the taste of drug is recognized as tikta. In 5% of the subjects; along with the unpleasant taste the drug is producing stiffness of tongue and dryness in the oral cavity which are the characteristics of kashaya rasa.

The inherent properties of drug were assessed mainly based on its action over the Agni and Koshta. This was also been assessed when the drug was given for one week orally. Improvement in both digestion and assimilation can be attributed to the property of Ushna. The drug induced the formation of sweda (sweat) in about 60%. One of the causes for elevated perspiration is raise in the metabolic rate. This once again is indicative of Ushna guna of the substance. As per the reporting of 90% of the volunteers, the drug is able to trim down the unctuousness in the body leading to a few degree of dryness. Above findings are suggestive of ruksha guna of drug mainly. It can also be assumed that the drug possesses the qualities of ushna also. The reduction in moisture content is also indicative of lagu guna and vishada guna of the substance.

Assessment of veerya was tried to be made in terms of both eight fold and two fold veerya categories. The internal administration of drug showed its peculiar pharmacological actions to exhibit ushna veerya in 100% of individuals in current study populace as all of them felt improvement in digestive capability and 60% of them had more sweating than usual. 20% of the volunteers also reported the drying effect of the drug which is suggestive of lagu/vishada veerya.

The most reliable and adoptable criteria for the judgment of vipaka is action of drug on elimination of urine and feces. With the current trial drug none of the subject had reported to have an easy or increased elimination of urine and feces. Rather nearly 65% of the volunteers had a relative suppression in the passage of bowels and urine when compared to their routine pattern. So the vipaka of the drug can be interpreted as katu.

In miniature level it is the Panchbhoutik constitution which decides the karma (the specific action) of any substance in the universe. As far as the drugs related to the Ayurvedic therapeutics is concerned; the panchbhoutik constitution of a new drug can be determined only at gross level, i.e. by followed the standard methodology elucidated in the science in terms of rasa, guna, veerya, and vipaka.

<table>
<thead>
<tr>
<th>Table 1—Results of Rasa estimation</th>
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<tbody>
<tr>
<td>Based on direct contact with tongue</td>
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<tr>
<td>Pradhana rasa</td>
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<tr>
<td>n=20</td>
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<tr>
<td>Madhura</td>
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<tr>
<td>Amla</td>
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<tr>
<td>Lavana</td>
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<td>Tikta</td>
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<tr>
<td>Katu</td>
</tr>
<tr>
<td>Kashaya</td>
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<tr>
<td>No taste</td>
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</tbody>
</table>
Combination of *akasha* and *vayu* mahabhuta results in formation of *tikta* rasa, while *prithvi* and *vayu* mahabhuta dominates in kashaya rasa. Whereas *dravya* attains *katu* rasa when there is presence of *agni* and *vayu* mahabhuta. For the assessment of molecular constitution of the study material the *guna*, *veerya* and *vipaka* were also considered (Table 2).

Combination of *vayu* and *agni* mahabhuta produces *lagu* guna. *Agni* is responsible for *ushna* guna and *vayu* for *ruksha* guna. To create *vishada* guna in a substance combination of *prithvi*-vayu-agni and *akasha* is needed.

Since dominance of *vayu* mahabhuta is seen in both *tikta* and kashaya rasa and also in *guna* like *ruksha*, *lagu* and *vishada*, and in *katu* *Vipaka*. Thus it is clear and evident that *vayu* is the chief *mahabhuta* present in the study substance. Next to *vayu* mahabhuta; *akasha* plays an important role in the creation of this drug. *Akasha* takes part in the composition of *tikta* rasa. As drug exhibits *ushna* guna and *ushna* veerya the significance of *agni* mahabhuta can not be ruled out. *Prithvi* is present in the elemental composition of kashaya rasa and also in *vishada* guna; so the same is also included in the elemental composition of *Curcuma neilgherrensis*. As the drug is possessing *gandha* (smell) the *parthiva* dominance should also be considered. Thus the *panchabouthik* constitution of the *dravya* can be understood as *akasha*, *vayu*, *agni* and *prithvi*.

**Discussion**

The assessment of *rasa*, *guna*, *veerya* and *vipaka* assists in understanding the absolute pharmacological outcome of a substance. The diverse kinds of *rasa*, *guna*, *veerya* and *vipaka* may fabricate a variety of effects over *Dosha*, *Dhatu*, *Mala*, *Agni*, *Indriya*, *Manas*, etc. These special effects have been evaluated in the current study to describe the pharmacodynamic facets of *Curcuma neilgherrensis*. In addition to this, the above mentioned factors may also aid in evaluating the *panchabouthic* foundation, the constitutional and molecular aspect of matter.

*Rasa* (taste) refers to the initial subjective experience which is recognized by tongue, when a matter or drug is placed in mouth. The occurrence of *rasa* is absolutely based on its *panchabouthic* organization, and the six principal tastes namely *Madhura* (sweet), *Amla* (sour), *Lavana* (salt), *Katu* (pungent), *Tikta* (bitter) and *Kashaya* (astringent); will generate definite subjective feelings and objective modifications over tongue and oral cavity. The present study sample experienced that the tasting of *Curcuma neilgherrensis* produces dryness over tongue and mouth; and subjective feeling of mouth becoming clean, along momentary loss of taste perception which are the explicit signs of *tikta rasa*\(^1\). In addition to this, a major set of volunteers noticed that the tasting of study material produces a sensation of stiffness over tongue which is the specific feature of *kashaya rasa* and the feeling of brief period of dull taste sensitivity of tongue is also; indicating the same *rasa*\(^2\). The appraisal of *katu* as secondary taste in 5% of the subjects (merely 1 out of 20) may be due to the cleansing property of the drug when kept over the tongue. But this cleanliness can be attributed to *tikta rasa* as it was the subjective feeling obtained in major percentile. For receiving an advanced sensitiveness in the identification of *rasa*, the drug was administered orally for one week, and its pharmacological activities on the body were observed. The unpleasant taste of the drug was the first and major feedback given by all the study subjects. The palatability of *rasa* becomes worse mainly when the substance possesses bitter or astringent tastes. It is an established fact that the high amount of tannin and alkaloid are responsible for the bitter and astringent tastes in a substance and can produce dryness in the oral cavity\(^3\). Based on all the above data it can be finalized that the *pradhana rasa* of trial drug is *tikta* and *kashaya* is the *apradhanas* or *anuras* taste.

*Guna* is the subsequent tool elaborated in Ayurvedic science for comprehending the supplementary pharmacoactivity of a drug and is defined as the intrinsic property of a substance. The identification of *guna* can be made in a number of means. To a certain extent or to say in a plain level, the evaluation of *rasa* gives a suggestion of specific *guna*, as each and every *rasa* embraces one or other particular *guna* with it. Apart from this

<table>
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<tr>
<th><strong>Parameter</strong></th>
<th><strong>Rasa</strong></th>
<th><strong>Guna</strong></th>
<th><strong>Veerya</strong></th>
<th><strong>Vipaka</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tikta, Kashaya</td>
<td>Tikta, Ushna, Lagu, Vishada</td>
<td>Vayu, Agni</td>
<td>Prithvi, Akasha, Prithvi</td>
<td>Agni, Agni, Vayu</td>
</tr>
<tr>
<td>Elemental composition</td>
<td>Vayu, Akasha, Prithvi</td>
<td><em>Akasha</em>, <em>Veerya</em>, <em>Guna</em>, <em>Vipaka</em></td>
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every guna is supposed to show specific actions in various levels of physiology. The elementary composition of substance, is the another marker pinpointing the property of a matter. The present study was focused in these aspects to get a clear picture on approximately all major guna displayed by Curcuma neilgherrensis.

In general Tikta and kashaya rasa dravya are ruksha and lagu by nature. In the same way tikta and kashaya are considered as soumya (relatively mild and cool potent) as per the classical references. But it is not a mandatory that each and every substance with the above mentioned rasa should be sheeta in guna and potency. Creation of dryness in the mouth and oral cavity is typical and straight forward sign of ruksha guna of a drug. Diminution in moisture content of the body and resultant dryness can also be expected in case of lagu and vishada guna. Another major response received was increased perspiration than usual in many of the subjects. Most of the volunteers felt that their general capacity of appetite and digestion were augmented after one week of intake of the trial drug. Both these findings are pointing towards the uzhna guna and uzhna veerya of Curcuma neilgherrensis.

The herbal medicines undergo certain bio-transformation during the process of its digestion and are ascertained from the actions it generates in the body. These post- digestive bio-changes are termed as Vipaka. During the course of digestion in the different levels of gastro-intestinal tract, six rasas are resynthesised into three vipakas. With respect to each vipaka, specific Doshas are generated with its impact over Dathus and Malas, especially feces, urine and seminal fluid. As a general rule madhura and lavana rasa endure madhura vipaka, amla rasa results in to amla vipaka, and the rest of three tastes turn in to katu vipaka. The madhura vipaka, endorsing seminal fluid, facilitates easy elimination of feces and urine, and increases Kapha Dosha. In contrast to this, amla vipaka increases pitta dosha, diminishes semen, and promotes the easy evacuation of feces and urine. The katu vipaka causes vata dosha, decreases seminal fluid, and also leads to suppression of feces and urine.

Vipaka of Curcuma neilgherrensis was assessed mainly on elimination of bowels and urine. The vipaka of the drug can be assessed after the completion of digestion and metabolism. So the most dependable criteria for the consideration of vipaka is the effect on evacuation. In present study populace none of the volunteers felt any sort of improved easiness in their routine nature of micturition and defecation. In contrary to this, a major percentile could felt suppression in the evacuation process when compared to their habit. This is suggestive of katu vipaka of the dravya. The textual information in this regard also supports the obtained findings, that the tikta and kashaya dravya usually exhibit katu vipaka. Katu vipaka can result in vata vridhi at the time of post digestion which is not pathological, but can cause reduction in the elimination of urine and feces due to the ruksha guna. But none of the subject came under this work showed any specific symptoms or complaints related to Vata vridhi or Vata prakopa during or after the one week period of this work.

The potent bioactive component of herbal drug is expressed as veerya. There are eight types of veerya and out of which much emphasis has been given to two types, namely Ushna and Sheeta. Mridu, Teekshna, Snigdha, Ruksha, Ushna, Sheeta, Guru and Lagu are the eight kinds of veerya as elucidated in literature. This diverse kind of veerya expresses the overall pharmacodynamics and precise affinity of herbal drugs to specific guna; and hence the biological potency of herbal drugs evidently correlates with its pharmacological activity. To get a comprehensive feedback on veerya of Curcuma neilgherrensis, all the eight types have been assessed.

Dravya is the superior one than rasa, guna, veerya, vipaka and karma. Because all these features are dependents of dravya and they are inert or nonexistent in the absence of substance. Curcuma neilgherrensis is fairly a new drug to the Ayurvedic Pharmacopeia. So, it was quite impossible to determine the panchbhootic composition of the drug initially. Here rasa, guna, veerya and vipaka worked as the tools for finding out the elemental composition. As per the obtained results rasa of the trial drug is tikta and kashaya; suggestive of role of vayu, akasha and prithivi in the formation of dravya. Lagu, ruksha, and vishada are the features of vayu, akasha and agni maha bhuta. Ushna guna and veerya are the properties of agni mahabhuta. Katu vipaka shows the presence of agni and vayu in molecular constitution. Every dravya in this cosmos are made out of panchmahabhuta, viz Prithivi, tejas, vayu, jala and aakash. The classification as parthiva, apya , etc. is however based on the predominance of one of the mahabhuta.
As the drug under the study is possessing specific odour (Gandha) and attractive colour (Rupa), it can be securely accomplished that prithvi and agni mahabhuta are dominant in Curcuma neilgherrensis (Table 3). According to the expression of volunteers the taste perception tikta and kashaya rasa reflects the presence of vayu, aakasha and prithvi mahabhuta. The biological effects recorded on oral administration clearly indicate that the drug is presenting with ushna veerya (Aagneya). As a general rule, tikta and kashaya rasa dravya should possess sheeta veerya and katu vipaka. But in the present study the physiological effects observed are clearly indicative of katu vipaka and ushna veerya of the trial drug. Basing on this elucidation of action, it can be concluded that Curcuma neilgherrensis can be categorized under Vichitra pratyarabalha dravya.

The herculean task done for the determination of rasa, guna, veerya, vipaka and panchbhouotic constitution are not going to provide any beneficial result to the health promoting and curative aspects of the ayurvedic scientific system unless and until the result to the health promoting and curative aspects of constitution are not going to provide any beneficial rasa, guna, veerya, vipaka definitely have alleviating action on morbid kapha dosa. As the general rule, tikta and kashaya rasa dravya should possess sheeta veerya and katu vipaka. But in the present study the physiological effects observed are clearly indicative of katu vipaka and ushna veerya of the drug. Basing on this elucidation of action, it can be concluded that Curcuma neilgherrensis can be categorized under Vichitra pratyarabalha dravya.

The wide usage of this folklore medicine in the management of diabetes mellitus seems to be appropriate with the results obtained through the present study. Diabetes mellitus considered under the huge sunshade of Prameha /Madhumeha in Ayurvedic parlance is primarily an ailment caused due to the aberration in kapha dosa, medo dhatu and kleda bhava. So the administration of the drug Curcuma neilgherrensis wight for the management of Madhumeha is justifiable.

**Conclusion**

The accessible textual information regarding the herb Curcuma neilgherrensis wight is very minimum and inadequate. The drug is extensively used in managing the illness like diabetes mellitus by folklore practitioners, but to accept it in current Ayurvedic clinical practice it is essential to recognize the basic pharmacodynamics of the same. By knowing the pharmacodynamics the physician can safely use the drug on apt conditions. The current study revealed the tikta and kashaya rasa of drug, where as lagu, ruksha, vishada and ushna are the chief guna inherent to this dravya. Curcuma neilgherrensis wight comes under the category of ushna veerya drugs and the vipaka arises after the digestion of this particular dravya is katu. The application of Curcuma neilgherrensis wight for the management of diabetes mellitus can be justified based on these findings. Hope that the present study and specific pharmacological approach pursued here for the differentiation of bio-active facets of Curcuma neilgherrensis wight, may offer a strong lead in new herbal drug discovery process.

**Acknowledgement**

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14 Ibidem 2, Charaka samhita, Sutra sthana, 26th chapter, 58th Shloka, 146.