Validation of rasapanchaka of varieties of buttermilk (Takrabhedas) mentioned in Bhavaprakasha

Amritha MS, Dr. N Manojkumar, Dr. AK Beena, Sudhakar Bhatt and Dr. Jyolsna G Krishna

Abstract
Takra is having a significant role in the history of Indian population in social, religious and cultural aspects since Vedic times. Takra is the one of the major probiotics in Ayurveda, which is having main action on improving the digestive and metabolic capacities. The concept of classification of Takra based on dilution factor is unique to Ayurveda. But even though a number of studies have been conducted in buttermilk no researches have been conducted in the concept of Takrabhedas. Even though Acharya Bhāvaprakāśa mentioned five different varieties of takrabhedas based on dilution factor, there is a lacuna in description regarding rasapanchaka of each variety of Takra. The present study validates the rasapanchaka of the takrabhedas explained in the Bhāvaprakāśa with the aid of physicochemical parameters.

Materials and Methodology: Total 5 samples of takra were taken for the study, which includes Ghōlam, Mathitam, Takram, Udaśvīt and Caccika. Physical analysis includes rūpa, rasa, gandha, sparśaparīkṣa, rūpa, madhura, lavana, sita, rūpa. Chemical analysis was done for pH, titratable acidity, specific gravity, moisture, total solids, and per the standard procedure available. The assessment criteria was based on one way ANOVA followed by Turkey Krammer test as post Hoc with a level of significance of $P < 0.05$ using SPSS 16.0 software.

Result: The study shows the variation in the rasapanchaka among the different varieties of Takra.

Keywords: Takrabhedās, rasapanchaka

Introduction
In Ayurveda, takra is considered under a varga which itself is named Takravarga which is under Drava Drvaya group of āhārakalpana [1]. In Bhāvaprakāśa [2], Yōgaratnākara [3] etc. relevance of Takra is highlighted. Numbers of indications are attributed to Takra in Samhitas and Nighaṇḍus. The concept of classification of Takra based on dilution factor is unique to Ayurveda. It is interesting to note that, the indication of Takrabhedās varies with dilution factor. But in literatures, there is a lacuna in description regarding guṇa of each variety of Takra. In Bhōjanakutūhala [4] its indication is not only limited to āmaśaya but extended to broad spectrum which includes prameham, vṛṇagna etc. Number of researches in this area is limited. It’s the need of the hour to validate the Takrabhedās explained by our acharyas. The present study validates the rasapanchaka of the Takrabhedās explained in the Bhāvaprakāśa [5] with the aid of physicochemical parameters.

Table 1: Rasapanchaka of takrabhedas mentioned in Bhāvaprakāśa

<table>
<thead>
<tr>
<th>Takrabhedas</th>
<th>Rasa</th>
<th>Guna</th>
<th>Veerya</th>
<th>Vipaka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghōlam</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mathitam</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Takram</td>
<td>Kashaya, Amla</td>
<td>Laghu</td>
<td>Ushna</td>
<td>Madhura</td>
</tr>
<tr>
<td>Udaśvīt</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Caccika</td>
<td>Lavana</td>
<td>Sita, Laghu</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* In Bhāvaprakāśa nighandu mentioning of rasa pancaka is limited to Takra and Caccika variety of Takrabhedas.

Materials and Methodology

Standardisation of Procedure for Preparation of Takrabhedas
a. Collection of milk
b. Standardization of the procedure for the preparation of the Takrabhedās.
a) Collection of milk

The milk used for the preparation of the Takrabhedas was procured from the Safa Farm, Chudalapaara, and Kottakkal. One cow was selected and milk was collected from the farm every day at same time (3 pm) and it was boiled in vessels by keeping it over water in a sterilizer and was allowed to cool down to 37°C. At that particular temperature the milk was inoculated with the 5 ml of lactobacillus acidophilus and 5 ml of yogurt culture for 1000 ml of milk. It was stirred well and kept for 15 hours and pH of the buttermilk was continuously observed with pH meter and when the pH became 4.5, the curd obtained was taken and churned using Mathana Yantra. The churning time was standardized as 30 minutes, (as after 30 minutes of churning when buttermilk samples were analysed for fat content it was nearly 0.1-0.2%).

Ghōla: churned for 30 minutes without addition of water and butter was not removed.

Mathita: churned for 30 minutes without the addition of water and removed the butter.

Takra: churned for 30 minutes by adding 25 ml of water for 100 ml of curd and removed the butter.

Udaśvit: churned for 30 minutes by adding 50 ml of water for 100 ml of curd and removed the butter.

Caccika: churned for 30 minutes by adding 100 ml of water for 100 ml of curd and removed the butter.

Five varieties were taken in five sterile bottles and were transported to College of Diary Science and technology Mannuthy in ice box filled with ice packs, for Analytical study.

Physical analysis
Rupa, Rasa, Gandha, Sparsha

Rasa analysis
Taste perception method: taste with tongue is the criteria for determining the rasa or the anurasa of a drug. The following procedure for taste with tongue was adopted.

1) Healthy volunteers, preferably Ayurveda students who may not make mistakes in expressing the Rasa were selected. They were asked to wash their mouth and five minutes gap was allowed between washing of mouth and tasting of drug.
2) 5ml of Ghōla was served to volunteers. Chit paper was given to them and they were requested to record the rasa and anurasa they perceived. Likewise Mathita, Takra, Udaśvit and Caccika were given to the volunteers in a gap of one hour.

Guna assessment: considering the physicochemical parameters guna of the drug can be assessed. Methodology incorporated for physicochemical analysis are as follows, Specific gravity was assessed by Specific gravity bottle, and total ash.

Determination of veerya: 5 conical flask were taken and 100ml of distilled water was taken in each and temperature of water was noted with the help of industrial thermometer. 10 ml of samples of gholam, mathitam, Takram, udasvit and caccika were added in above 100 ml of distilled water, after the addition temperature was noted with the help of industrial thermometer. This procedure was repeated for three times to avoid human error.

Vipaka assessment: Albino rats weighing between 150-180 gm were be selected for each study and divided into different groups of six animals each.

The study performed in two phases.
A - Phase – I: Preliminary Phase: Duration – 5 days.
B - Phase – II: Experimental Phase: Duration – 10 days.

Preliminary study was carried out prior to the experimental phase to understand and obtain base line data about the normal amount of food consumption and water intake of the experimental animals.

Preliminary Phase
Initial weights of the rats were recorded and they were placed in separate metabolic cages. Metabolic cages have special arrangements for keeping food and placing water. This arrangement also prevents admixture of food with fecal matter. As the urine is drained out the fecal matter can be collected easily from the cages and urine can be collected in the plastic glasses placed below the funnel. In this phase, daily weight, food intake, water intake, fecal output, urine output, were measured on routine basis. The procedure continued up to 5 days.

Experimental Phase: In this phase animals were administered with the selected drugs as per the calculated doses. All the previously mentioned parameters were recorded daily for ten consecutive days.

Determination of vipaka was based on the consumption of food and water and quality of faecal matter and urine. The total consumption of food and water in the test group was compared with the control group. The total quantity of faecal matter in the test group was compared with the control group. Along with that weight gain of the rat in each groups and the consistency of faecal matter was taken into consideration for virya assessment. The parameters recorded were water ingestion, faecal output, faecal water urine output food conversion ratio.

Observation

Table 2: Final conclusion on rasapancaka of takrabhedas

<table>
<thead>
<tr>
<th>Takrabhedas</th>
<th>Rasa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gholam</td>
<td>Madhura Pradhāna Amlarasa,</td>
</tr>
<tr>
<td>Mathitam</td>
<td>Amla Kashaya rasa</td>
</tr>
<tr>
<td>Takram</td>
<td>Amla Kashaya rasa</td>
</tr>
<tr>
<td>Udaswith</td>
<td>Kashaya-amlarasa</td>
</tr>
<tr>
<td>Caccika</td>
<td>Kashaya Pradhana Amla rasa</td>
</tr>
</tbody>
</table>

Guna
Comparison of Specific Gravity
Specific gravity decrease with increase in addition of water, where caccika showed statistically significant decrease when compared to gholam, mathitam and Takram. (Graph no.1)
Comparison of Moisture
Moisture content increases with increase in addition of water where gholam showed statistical significance when compared to mathitam, Takram, udasvith and caccika. Mathitam showed statistically significant decrease when compared to udasvith and caccika. Takram showed statistically significant decrease when compared to caccika. (Graph no.2).

Comparison of Total Solids:
Total ash decreases with increase in addition of water where gholam showed statistical significance increase when compared to mathitam, Takram, udasvith and caccika. Mathitam showed statistically significant increase when compared to udasvith and caccika. Takram showed statistically significant increase when compared to caccika. (Graph no.3)

Veerya
Observation on veerya:
Veerya was assessed by endothermic and exothermic reaction. They showed increase in temperature by 1degree Celsius, thus veerya of the drug can be considered as ushna veerya.

Vipaka
Observation on Vipaka: Vipaka was assessed base on three parameters: the quantity of faecal matter expelled. Quantity of water expelled and change in the weight of the body.

i) Effect of Takrabhedās on urine output
The data shows that there is an increase in the therupetic value of urine output, of Gholam, Takram Udaśvith and Caccikā, when compared to the therapeutic phase of the control, the observed value is statistically very significant. The data shows that there is an increase in the therapeutic phase of urine output, of Mathitam when compared to the therapeutic phase of control group; the observed result is statistically significant. The data shows that there is an increase in the therapeutic phase of Ghola, takra when compared to the preliminary phase of the same group; the observed result is statistically non-significant. The data shows that there is a decrease in the therapeutic phase of Mathitam when compared to the preliminary phase of the same group the result is statistically very significant. The data shows that there is a decrease in the therapeutic phase of urine output Udaśvith and Caccikā when compared to the preliminary phase of the same group, the observed result was statistically non-significant. (Graph: 4)

ii) Effect of Takrabhedās on faecal wet weight
The data shows that there is an increase in the faecal weight wet of the therapeutic phase of ghola, when compared to the therapeutic phase of the control, the observed increase was found to be statistically very significant. The data shows that, there is a decrease in the therapeutic phase of the faecal weight wet of the mathtiam and takram, when compared to the therapeutic phase of the control group, the observed decrease is statistically non- significant. The data shows that there is a decrease in the therapeutic phase of faecal wet weight of udasith and chacika, when compared to the therapeutic phase of the control group, the observed result is statistically very significant. The data shows that there is an increase in the therapeutic phase of faecal weight wet of the gholam group as compared to the preliminary phase of the same group, the observed increase is statistically very significant. The data shows that there is a decrease in faecal weight wet therapeutic phase value as of mathtiam and takram, as compared with the preliminary phase of the same group, the observed decrease is statistically non-significant. The data shows that, there is decrease in the faecal weight wet of the udasith and caccika group, when compared with preliminary phase of the same group, the observed decrease is statistically very significant. (Graph: 5)
ii) Effect of Takrabhedas on body weight

The data shows that there is a decrease in the body weight of Mathitam and control group, which is statistically very significant. There is significant decrease in the takram and udasvit group when compared to the control. The data shows that there is decrease in the body weight of Caccika when compared to the control group which is statistically non-significant. (Graph 6).

Discussion

The physical analysis was done on the parameters - Rūpam, Rūpa, Ganda and Sparśa.

Rūpam: All samples were white in colour. Viscosity was more for Ghōlam, followed by Mathitam, Takram, Udāśvit and Caccika. Snighdata was more for Ghōlam, followed by Takram, Udāśvit and Caccika. According to Acharya susrutha “Snighha Rukshhau Cakshusya” [6] from Rupam it seems Ghola to be more Sniggha which goes in decreases with the addition of the water.

Rasam: According to Acarya Caraka,"Rasam Nipathe dravyanam” [7] on this principle rasa was assessed in the present study Ghōla showed Madhura pradhāna Amlarasa, Mathita showed Amla-kaṣāya rasa, Takra showed Amla-kaṣāya rasa, Udāśvit showed Kaṣāya-Amlarasa, Caccika showed Kaṣāya pradhāna Amlarasa.

Gandham: All the five varieties of takrabhedās showed pleasant, aromatic smell.

Sparśam: Snigdha decreases in the order Ghōlam, Mathitam, Takram, Udāśvit, and Caccika.

Discussion on Guna

Discussion on guru and laghu Guna

Specific gravity is the ratio of the density of the substance to the density of the reference substance. Specific gravity of the substance may be considered as an indication of Gurutwam and laghutwam. As gurutwam is defined as “the quality responsible for gravity or heaviness” In Prasastapada Vyakya it is said as, gururwam Jala Bhumyo patina karana. Rasavaisesika says Guru is Pardhivam Apyam when Pardhivamswam is comparatively more in a substance with equal quantity of water then more will be its Gurutwa. On comparative analysis of Takrabhedās Ghōlam is comparatively guru and Caccika is comparatively laghu.

Discussion on Snigdha and Ruksha Guna:

It is the indication of total water content of the buttermilk. As the amount of water added during the preparation increases the moisture content also increases. This may be considered as an indication of Gurutwa and Laghutwa of a Dravya. Takra is more guru than jala as the specific gravity of water is 1000kg/m³ and specific gravity of ‘Takra’ is 1.038kg/m³. So when takra and water are mixed together, ‘Takra’ becomes more laghu with addition of water. While comparing the Takrabhedās, Ghōlam is most guru followed by Mathitam, Takram, Udāśvit and Caccika. It may also indicate the Snigdhatwa and Rukshatwa of the Takrabhedha with the addition of water into takra the oil droplet per unit volume decreases which in turn decreases the Snigdhamsa of the takra. Therefore Snigdhatwa decreases and rukshatwa increase in addition of water. Total solids may be an indicator of Snighdata and Rūkṣaṇa of the Takra. Total solids in milk include protein, lactose minerals and fats [8]. The viscosity of a substance increases with total solid content. More viscous the substance more will be its Snighdata. Rasa Vaisesika says, Bhautika constituent of the Snigdha Gaṇa is both Prithvi and Jala. In Takra, Pārthivimsa Constitue more Snehamsa is responsible for sneha. Therefore the Snighdata decreases with decrease in the total solids.

Veerya assessment: Veerya was assessed by endothermic and exothermic reaction. They showed increase in temperature by 1degree Celsius, thus veerya of the drug can be considered as ushna veerya.

Vipaka assessment: Vipaka assessment vipaka is defined as the final scholars as the final transformation of substance after digestion. Even though sad vidha, dividha and trividha vipaka vadas are explained in the classic the most accepted is the trividha vipaka vada. It includes madhura vipaka, Katu vipaka and amla vipaka. The action of the vipaka takes place at the level of dosa, dhathu and mala during the experimental study. Significant increase in the faecal output and urine output was observed and also the water content in the faecal matter was significantly observed. The total effect may be considered as sristavinmutrata [9] which may be considered as action of madhura vipaka and amla vipaka. Madhura vipaka is guru and sukrula [9] that is it is responsible for increase in weight and Sukra Dhatu on the other hand amla vipaka is opposite to it it is responsible for decreased weight and spermatogenesis. In this study after giving the test drugs the body weight was decreased therefore there is more chance for amla vipaka than Katu vipaka. Further studies have to be conducted in the spermatogenic property of takrabhedas to confirm its vipaka.
Table 3: Final conclusion on rasapancaka of takrabhedas

<table>
<thead>
<tr>
<th>Takrabhedas</th>
<th>Rasa</th>
<th>Guna</th>
<th>Veerya</th>
<th>Vipaka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gholam</td>
<td>Madhura Pradhâna Amlarasa,</td>
<td>Guru*** Snigtha*** ushna</td>
<td>Amla or Katu Vipaka</td>
<td></td>
</tr>
<tr>
<td>Mathitam</td>
<td>Amla Kashaya rasa</td>
<td>Guru*** Snigtha*** ushna</td>
<td>Amla or Katu Vipaka</td>
<td></td>
</tr>
<tr>
<td>Takram</td>
<td>Kashaya, Amla/amla Kashaya rasa</td>
<td>Laghu* Isad Snigdha* Ushna</td>
<td>Amla or Katu Vipaka</td>
<td></td>
</tr>
<tr>
<td>Udas with</td>
<td>Kashaya-amla rasa</td>
<td>Laghu** Isad Snigdha** ushna</td>
<td>Amla or Katu Vipaka</td>
<td></td>
</tr>
<tr>
<td>Caccika</td>
<td>Lavana/Kashaya Pradhana Amla rasa</td>
<td>Sita, Laghu*** Ruksha ushna</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
Rasapanchaka forms the basic pharmacology of Ayurveda. In the classics there exists great variation in the indication of takrabhedas where the difference is only in the dilution factor. Thus here it is noted that dilution factor can make variation in the Guna of each varieties of takra and thus creating wide variation in its indication.

Limitation
The vipaka of study mentioned by acarya was madhura but in this study contrary to acharyas view there is a possibility of amla vipaka also further study on spermatogenic property of takrabhedas have to be conducted to confirm the same.

Acknowledgement
1. Dr. R Remadevi, Rtd. Prof. and HOD, Dept. of Dravya Guna Vijnana, V.P.S.V Ayurveda College, Kottakkal.
2. Mrs. Aparna Sudhakaran, Assistant Professor, Department of Microbiology, CDST, KVASU, Mannuthy.
3. Dr. Vidhya Unnikrishnan, Assistant Professor, Dept. of Dravya Guna Vijnana, V.P.S.V Ayurveda College, Kottakkal.
4. Dr. Vivek. P, Associate Professor, Dept. of Dravya Guna Vijnana.

Reference
6. Sharma PV. Editor Susruta Samhita with English Translation of text and Dalhana’s commentary along With critical notes, Chaukamba Viswabharathi, Varanasi; Sutrastana, 2004; 1:3777