



Research Article

PHARMACEUTICAL STANDARDIZATION OF RAJATA YOGA

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ABSTRACT

Rasa Shastra is a branch of *Ayurveda* which deals with the processing of minerals and metals having therapeutic importance. *Rajata* comes under the group of metals having high therapeutic values. Minerals and metals are mostly used in the form of *Bhasma*. There is no specific *Anupana* mentioned for *Rajata*, it depends upon *Dosha* and disease. *Rajata bhasma* when given with proper *Anupana* is indicated in all types of diseases. *Rajata Yoga* is one such formulation mentioned in *Rasa Tarangini*, indicated in *Prameha*. *Rajata bhasma*, *Twak churna*, *Ela churna* and *Patra churna* are the main ingredients. The present study has been planned to standardize the method of preparation of a Herbo-mineral formulation i.e., *Rajata Yoga*. *Samanya Shodhana* and *Visesha Shodhana* procedures were adopted for *Rajata patra* (50g). After *Visesha Shodhana*, 48g of obtained coarse *Rajata patra* were subjected to *Marana* with equal quantity of *Kajjali* (48g) and sufficient quantity of *Kumari Swarasa* as *Bhavana dravya*. Totally 25 *Putas* were given to attain *Rajata bhasma* (90g) which passed all *Bhasma lakshanas* as mentioned in our classics. *Rajata bhasma* (45g) was mixed with *Trijataka churna* (*Twak churna*-300g; *Ela churna* -300g and *Patra churna* - 300g) to form homogenous 945g of *Rajata Yoga*. Thus it can be concluded that '*Supaka*' i.e. neither less nor more heat is desirable and is essential for making a drug safe and efficacious.

KEYWORDS: *Rajata Yoga*, *Rasa Tarangini*, Standardization, *Prameha*.

INTRODUCTION

Many studies on human civilization reveal that metals were first identified just after the Stone Age. They were used for making house hold utensils, hunting tools, knives etc. After recognition of their therapeutic properties, various processing techniques were developed in order to make them suitable for human body and for the treatment of various ailments. Different manufacturing processes like *Shodhana*, *Marana*, *Jarana*, *Mardana* (trituration), *Bhavana* (soaking with liquid and triturating till drying), *Nirvapana* (heating and quenching), *Prakshalana* (washing), *Bharjana* (frying), *Pruthakkarana* (separation), *Galana* (filtration) etc, are adopted for this processing. All these procedures play a significant and vital role in converting these metals & minerals into safe, non-toxic and efficacious form. *Prameha* as a disease itself is having a peculiar type of *Samprapti*. A great deal of work has also been done by *Ayurvedic* research scholars on

various herbal and mineral drugs to find an effective treatment for *Prameha*. So to fulfill the expectations from *Ayurvedic Rasa Shastra* field and to find out more effective and safe therapy for *Prameha*, the formulation '*Rajata Yoga*' was selected for present work. *Rajata Yoga* is mentioned in *Rajata Vignaniyam adhyaya 71st* slokha pp.367 in *Rasa Tarangini*.

AIM OF THE PRESENT STUDY:

- Pharmaceutical Standardization of various steps involved in the preparation of *Rajata Yoga*.

MATERIAL AND METHODS:

Chief reference: *Pandit Kashinath Shastry, Rasa Tarangini by Pranacharya Sri Sadananda Sharma, Motilal Banarasidas; New Delhi. Reprint: 2014; pp.367; Rajata Vignaniyam- Slokha No:71.*

Table 1: Total Pharmaceutical study was carried out in five stages

Stage I	<i>Samanya</i> (R.R.S 5/13) and <i>Visesha Shodhana</i> of <i>Rajata Patra</i> (R.T 6/16) <i>Shodhana of Parada</i> (R.T 5/34-35) <i>Shodhana of Gandhaka</i> (R.S.S 1/125-126)
Stage II	<i>Kajjali Nirmana</i> with <i>Shodita Parada</i> and <i>Shodita Gandhaka</i> .(R.R.S 8/52)
Stage III	<i>Marana</i> of <i>Visesha Shodita Rajata Patra</i> . (R.T.26-28/16)
Stage IV	<i>Twak</i> , <i>Ela</i> and <i>Patra churna nirmana</i> . (Sh.M.Kh.6/12)
Stage V	Preparation of <i>Rajata Yoga</i> by mixing of fine <i>churnas</i> of <i>Twak</i> , <i>Ela</i> and <i>Patra</i> with <i>Rajata bhasma</i> in a <i>Khalwa yantra</i> thoroughly until homogenous mixture is obtained. (R.T. 71/16)

(R.T – *Rasa Tarangini*, R.R.S – *Rasa Ratna Samuchaya*, R.S.S – *Rasendra Sara Sangraha*, Sh. M.Kh – *Sharangadhara Madhyama Khanda*)

Rajata Yoga preparation

Reference	<i>Rasa Tarangini – Rajata Vignaniyam 71/16.</i>
Materials	<i>Rajata bhasma– 45g, Trijataka churna – 900g</i>
Method/ Principle	<i>Shodhana, Marana and Churna nirmana</i>
Apparatus	Gas Stove, Iron ladle, Steel vessel, <i>Khalwa yantra</i> , Knife, cloth, Multani mitti, measuring jar, wide mouthed earthen pot, cow dung cakes, spoon, <i>Sharava</i> , sieve.

Procedure

- *Samanya Shodhana* of *Rajata Patra* was carried out by heating the *Rajata Patra* to red hot and quenching them subsequently into *Tila Taila*, *Takra*, *Gomutra*, *Kanji* and *Kulattha Kwatha* for seven times in each. After every *Nirvapa*, the liquid medium was changed.
- *Visesha Shodhana* was carried out by placing the *Samanya Shodhita Rajata patra* in an iron ladle and heating to red hot and then dipping them in a vessel containing *Agastya patra Swarasa*. This process was repeated for 2 more times by taking fresh *Agastya patra swarasa* each time.
- *Parada* was mixed with equal quantity of *Sarja kshara*, *Yava Kshara* and *Tankana* and *Mardana* was carried out by addition of sufficient quantity of *Ardraka swarasa* and *Nagavalli swarasa* for 3 days. After trituration for three days, the mixture was washed with hot water to obtain *Shudha Parada*.
- *Shodhana* of *Gandhaka* was done by pounding it in a *Khalwa yantra* to form coarse powder. Cow's milk was poured in the wide mouthed earthen pot.
- The mouth of pot was covered with double layered cotton cloth and *Gandhaka* was spread evenly over it. Earthen lid was placed over the pot and sealed with fuller's earth. The pot was buried up to the neck level in a pit and 8 Cow dung cakes were arranged above it.
- After ignition of Cow dung cakes, *Gandhaka* melted and dropped into milk through the cloth. After self-cooling, the apparatus was removed out of the pit and opened. Purified *Gandhaka* was collected at bottom of the pot in form of small pellets and washed in hot water and dried.
- Equal quantity of *Shudha Parada* and *Shudha Gandhaka* were taken in a *Khalwa yantra* and triturated till *Siddha Lakshanas* of *Kajjali* are attained.
- *Marana* of *Visesha Shodhita Rajata Patras* was done by triturating *Visesha shodhita Rajata patra* in a *Khalwa yantra* with equal quantity of *Kajjali* and sufficient quantity of *Kumari Swarasa* as *bhavana dravya*.
- *Chakrikas* of uniform size were prepared and dried well. They were kept in *Sharava* and subjected to *Sandhibandhana*. *Sharavasamputa* was kept in sunlight for drying.
- After drying it was subjected to *Laghu Puta* (8 *upalas*). Whole procedure was repeated until it attains *Bhasma lakshanas*. Totally 25 *Putas* were given during the whole procedure to attain *Rajata bhasma*.
- Dried *Twak*, *Ela* and *Patra* were thoroughly checked for any external impurities, worms and insects. Later they were taken in *Khalwa yantra* and pounded separately. The pounded material was sieved through a cloth to obtain very fine powder.

- *Trijataka churna* was prepared by taking equal quantities of *Twak*, *Ela* and *Patra churnas* in a *Khalwa yantra* and mixing well to form a homogenous mixture.
- *Trijataka churna* (900g) & *Rajata Bhasma* (45g) were taken in *Khalwa Yantra* mixed properly to form a homogenous mixture (*Rajata Yoga*).

Observations

1. During *Samanya shodhana*, the metallic glaze was decreased in *Rajata patra*. *Rajata Patra* looked dull white and became brittle after *Samanya Shodhana*.
2. During *Visesha Shodhana* in *Agastya patra swarasa*, hissing sound was noticed and *Patra* became soft and fragile after *Visesha Shodhana*.
3. During *Shodhana* of *Parada*, 25ml each of *Ardraka* and *Nagavalli swarasa* were consumed on first day, whereas on the second and third day 50 ml each of *Nagavalli* and *Ardraka swarasa* were consumed.
4. Initially the mixture was creamy white in colour, later it turned to dark green colour.
5. By the end of first day, *Parada* was completely mixed with the *Sarja kshara*, *Yava kshara* and *Tankana* and the mixture turned into paste. After *Shodhana*, shining of *Parada* increased.
6. After *Shodhana* colour of *Gandhaka* turned to bright yellow. *Gandhaka* was collected as fine pellets.
7. In *Kajjali Nirmana*, mixture turned black after three hours of *Mardana*. After 15 hours *Kajjali* was checked for shine under the sun and small globules of mercury could be clearly observed. It took 42 hours for complete loss of shine and other characters of *Kajjali* to develop.
8. In *Rajata marana*, *Nischandratva* (lusterless) of *Rajata bhasma* was attained after whole process.
9. *Laghutva* (lightness) and *Mrudutwa* for *Rajata bhasma* were attained after the whole process. *Varitaratva* attained partially after 12th *Putu* and completely after 23rd *Putu*.
10. *Rekhapurnatwa* was attained after 8th *Putu*. Maximum temperature (514 °c) was attained after 30 minutes.

Precautions

- The quantity of *Dravadravyas* taken for each *Nirvapa* should be sufficient to immerse the *Rajata patra* completely. Heating should be intense so as to make the *Rajata patra* red hot. In each quenching the *Dravadravya* should be changed.
- During *Shodhana* of *Parada*, triturating should be done with utmost care to prevent spillage. Washing should be done carefully to avoid loss of *Parada*.

- During the *Shodhana* of *Gandhaka*, temperature should be maintained around the melting point of *Gandhaka*.
- Milk level in vessel should be sufficient to accommodate sedimentation of *Gandhaka*.
- *Gandhaka* pellets should be washed properly with warm water and dried.
- In *Kajjali nirmana*, *Mardana* should be done carefully to avoid spilling.
- During *Marana* of *Rajata*, *Sandhi bandhana* should be done properly. Temperature should be noted at regular intervals. *Sharava* should be kept at the centre of the pit.

Result

Table 1: Showing the changes in weight of various practical's in the preparation of Rajata Yoga

Name of the practical	Initial weight (g)	Final weight (g)	Loss in weight (g)
<i>Rajata Shodhana</i>	50	48	2
<i>Parada Shodhana</i>	250	223	27
<i>Gandhaka Shodhana</i>	250	240	10
<i>Kajjali Nirmana</i>	400	390	10
<i>Twak churna Nirmana</i>	1000	980	20
<i>Ela Churna Nirmana</i>	1000	900	100
<i>Patra churna Nirmana</i>	1000	980	20
<i>Rajata Yoga Nirmana</i>	<i>Trijataka- 900g, Rajata bhasma-45g</i>	945	0

Table 2: Showing the Heating pattern of Laghu Puta

Time (in minutes)	Temperature (in Degrees Celsius)
0	36
10	119
20	240
30	514
40	442
50	270
60	180
70	136
80	86
90	54
110	44
120	36

Table 3: Showing change in weight of Rajata with respect to Puta

Putra No.	Weight of Chakrikas (g)		Weight Loss (g)	Loss %
	After Bhavana	After Puta		
1	96	94	2	2.08
5	132	130	2	2.08
10	162	156	6	3.7
15	128	115	13	10.15
20	118	106	12	10.16
25	98	90	8	8.16

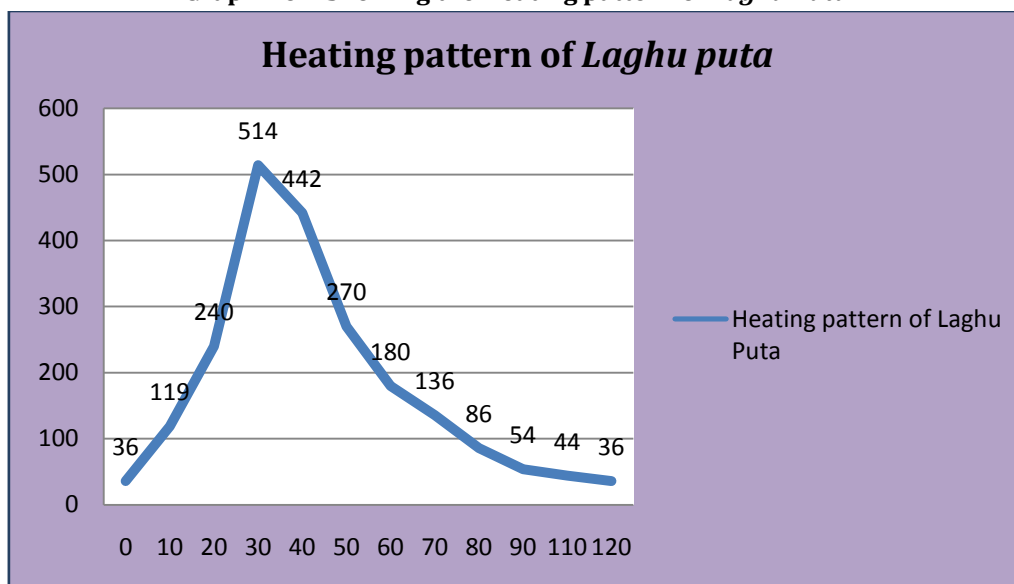
Table 4: Showing Varitaratva

Putra	Varitaratva
12	+
15	++
18	+++
23	++++

Table No. 5 Showing Rekhapurnatwa

Putra	Rekhapurnatwa
3	+
4	++
5	+++
8	++++

Graph No.1 Showing the Heating pattern of *Laghu Puta*



DISCUSSION

The pharmaceutical procedures adopted in this study are *Shodhana*, *Marana* and *Churna nirmana*. *Shodhana* is done for *Rajata*, *Parada* and *Gandhaka*. *Shodhana* is done to convert materials into suitable form for further procedures, to remove visible & invisible impurities, to reduce the toxicity and to enhance the therapeutic properties^[1]. *Marana* of *Rajata* was done with *Sama guna gandhaka kajjali* and *Kumari swarasa (Bhavana dravya)* to make it adaptable, absorbable and assimilable in body. *Churna Nirmana* is done for *Twak*, *Ela* and *Patra*.

Parada Shodhana

- Substances having *Ushna*, *Tikshna*, *Kshara*, *Amla* and *Lavana* property are considered as purifiers (*Sarva malaharah Kshara*).^[2] *Kshara* is an alkaline substance; it may be helpful in removing external and internal impurities of Mercury.
- *Kshara traya* includes *Sarja Kshara*, *Yava Kshara* and *Tankan*.^[3]
- Because of alkalinity, these substances help in the corrosion of unwanted material from the *Dravya*.
- *Nagavalli* possess *Kshara guna* by which it might be helpful in minimizing the toxic qualities of Mercury.^[4]
- *Swarasa* of *Ardraka* is used in the *Swedana Samskara* of *Parada* by which it can be said that it may be useful in the "*Mala Saithilya Karana*" of *Parada*.^[5]

Gandhaka Shodhana

- *Gandhaka Shodhana* includes melting and dropping of *Gandhaka*.
- Sulphur turns into liquid at 115.21°C. However, at that temperature, arsenic sulphides (Orpiment M.P 310°C, Realgar M.P 360°C) which are the chief impurities of Sulphur stay back in cloth and liquid sulphur flows freely through fine pores.
- Agni by cow dung cakes ensures uniform spreading of temperature and prevents Sulphur to get in contact with external oxygen, which otherwise causes oxidation and considerable weight loss.

- *Gandhaka* is highly *Pitta vardhaka*. Milk is *Vata Pitta shamaka Dravya*, *Vishahara* and *Rasayana*^[6]. It can remove *Visha doshas* of *Gandhaka* and enhance *Rasayana* property of *Gandhaka*. Final cleaning with hot water removes greasy remnants of milk.

Kajjali

- *Kajjali* was checked for loss of shine at various stages of preparation and *Mardana* was done until it turned lusterless.

Rajata Samanya Shodhana

- According to *Rasa Tarangini*, *Ashudha Rajata Bhasma* when taken internally causes *Vidbandha*, *Angasadha*, *Virya nasha* and *Shakti nasha*.^[7]
- *Shodhana* procedure makes *Rajata* free from fat soluble and water soluble impurities and makes it suitable for next procedure i.e. *Marana*.
- Repeated heating and quenching in specific media in specific order (pH: acidic, acidic, basic, acidic and basic) disrupts the compression tension equilibrium in the internal structure of *Rajata* which leads to cracks on its surface (Griffith theory, Stress corrosion theory and Theory of thermal expansion).^[8]
- *Rajata patra* were cut into small pieces to facilitate more surface area to get exposed to the heat and liquids.

Visesha Shodhana of Rajata

- *Agastya patra Swarasa* was taken as a liquid media for *Nirvapa* in *Visesha Shodhana* process.
- It was found that the *Sesbania grandiflora leaves* extract contain flavonoids, saponins, tannins, diterpenes, triterpenoids, glycosides and phenols. The presence of these biologically active constituents shows the antidiabetic and anti oxidant properties in a study conducted in STZ induced experimental Diabetic rats.^[9]
- *Nirvapa* in *Agastya Patra swarasa* may enhance the *Pramehagna* property in *Rajata patras*.

Rajata Marana

- Metallic drugs should always be reduced to *Bhasma* form for internal use. Main aim of *Marana* is to make *Kajjali* react with *Rajata* and reduce it to *Bhasma* form.
- *Marana* makes *Shodhita dravyas* adaptable, absorbable and assimilable for the body. During this procedure, various physico-chemical changes take place gradually and after repeated processing metals change into such forms that are suitable for internal administration. [10]
- After *Visesha Shodhana*, *Rajata Patras* became more brittle. After completion of first 2 incinerations, *Rajata Patras* became coarse powder which later easily mixed with *Kajjali* while doing *Bhavana* with *Kumari swarasa* to form *Chakrikas*.

Role of Kumari swarasa bhavana

- Wet trituration facilitates particle size reduction and homogenization leading to modification of properties (*Gunantatradhana*) of the end product. *Bhavana* helps in increasing the therapeutic efficacy by converting the *Bhavya dravyas* into smaller particles and adding the trace elements in *Bhasma* and converting a metal into a Herbo-metallic compound [11].
- *Kumari* is having *Tikta Rasa*, *Katu Vipaka* and *Kapha-Vatahara* properties. It is also having properties like *Bhedana*, *Chakshushya*, *Rasayana* and *Vrushya*. [12] By virtue of its *Guna*, it helps in enhancing the *Pramehagna* property of *Rajata bhasma*.
- Aloe Vera can increase insulin sensitivity in the cells which reduce the level of blood glucose and insulin in serum. [13]
- After attaining *Subhavita lakshanas*, *Chakrikas* were prepared of uniform size and shape to facilitate uniform distribution of heat during the *Putapaka*. These *Chakrikas* were dried properly, subjected to *Sharava samputikarana*, and then subjected to *Laghu puta*.
- *Puta* is the heating system and heating schedule which indicates the quantum of heat required by the *Rasadi dravyas* for their conversion into suitable form (*Bhasma*).
- Neither less nor excess heat is desired i.e. the desired quantum of heat is needed to be applied for making it converted to desired form suitable for internal use [14].
- According to classics *Agni* mentioned for *Marana* of *Rajata* is *Kukkuta Puta* [15]. But in the present study *Laghu Puta* has been selected for preparation of *Rajata Bhasma*.
- The maximum temperature recorded during *Puta* was 514°C and it was maintained for a period of 3-4 minutes. After that, gradual fall in temperature was noted.
- The material turned to soft powder without any lusture after complete process, which indicates that the temperature was sufficient for the formation of the desired compound.
- Most of the reactions that happen between metals and Sulphur are Redox type. Redox is a kind of

reaction in which electrons are transferred, thereby oxidizing some atoms, and reducing others [16].

- Sulphur readily reacts with metals (by reducing) because of its valency i.e. 2 and tends to gain electrons and becomes S-2. Metals oxidize by sharing its electrons of outer orbits. Rapidity of these reactions depends upon temperature and pressure. If metals are allowed to react with Sulphur in open air most of the sulphur reacts with atmospheric oxygen to form oxides.
- Blackish red colour of *Rajata Bhasma* may be due to presence of Cinnabar (HgS) & Silver Sulphide (Ag₂S). Since sulphur is an accompaniment to the metal in the *Bhasma* preparation, *Rajata* is converted to its sulphide form in major. Some part of *Kajjali* on subjecting to repeated *Putas* converts into Cinnabar (Mercuric Sulphide).
- So as a whole, *Rajata Bhasma* is the combination of sulphides of Silver and Mercury which gives Blackish red colour to it.
- *Nischandratwa*, *Varitaratwa* and *Rekhpurnatwa* for *Rajata Bhasma* were checked after every *Putas*. *Rajata Marana* was done till all the *Bhasma lakshanas* were obtained.
- *Nischandratwa*, *Laghutwa* and *Mrudutwa* was obtained after whole process, *Rekhpurnatwa* was obtained after 8th *Putas*, *Varitaratwa* was obtained after 23rd *Putas*.

CONCLUSION

- *Rajata Yoga* is one of the *Kharaliya Rasayana* in which *Rajata bhasma*, *Twak*, *Ela* and *Patra churnas* are the main ingredients.
- The combination of all these drugs synergistically acts together to pacify the symptoms of *Prameha* as all are having the *Pramehagna* property.
- Pharmaceutical standardization is the first step towards standardization of any drug. So it should be done with utmost accuracy. This leads to reproducibility of drug and production of safe and efficacious drug.

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IMAGES SHOWING THE PREPARATION OF RAJATA YOGA

PARADA SHODHANA



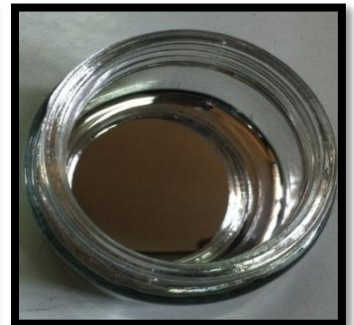
Ashudha Parada



Addition of Ksharatraya to Parada



Mardana with Nagavalli & Ardraka swarasa



Shudha Parada

GANDHAKA SHODHANA



Ashudha Gandhaka



Gandhaka is placed over cloth tied to the pot



Pot is sealed with Sharava



Ignited cow dung cakes over the Sharava



Shodhita Gandhaka

KAJJALI NIRMANA



Mardana of Parada with Samaguna Gandhaka



Kajjali

SAMANYA & VISESHA SHODHANA OF RAJATA PATRA



Small pieces of Rajata patra taken in iron ladle



Rajata Patra heated to red hot



Tila Taila



Takra



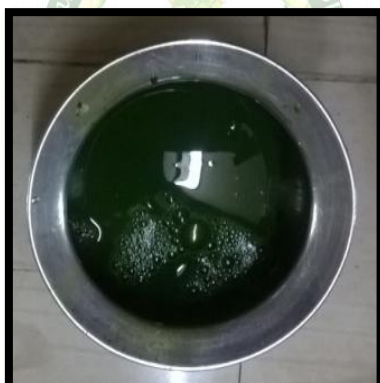
Gomutra



Kanji



Kulattha kwatha



Agastya patra swarasa



Nirvapana was done in above liquids

MARANA OF VISESHA SHODITHA RAJATA PATRA



Bhavana of Vishesha Shodhita Rajata & Kajjali with Kumari swarasa



Chakrika Nirmana



Sandhibandana



Laghu puta



Rajata bhasma



Varitaratva

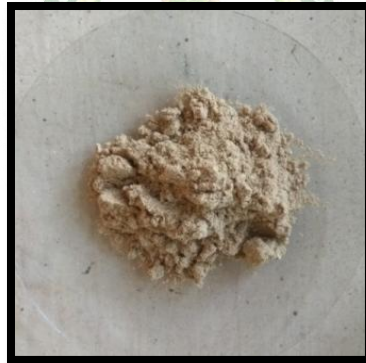


Rekhapurnatwa

CHURNA NIRMANA



Twak churna



Ela churna



Patra churna

RAJATA YOGA NIRMANA



Mixing of Trijatka churna with Rajata bhasma



Rajata yoga