THERAPEUTIC POTENTIALS OF SUDHA VARGA DRAVYAS VIS-À-VIS CALCIUM COMPOUNDS: A REVIEW

Dasari Srilakshmi¹, T.V Shalini²

¹Ayurvedic Physician & Physiotherapist, S.G.S Hospital, Sri Ganapati Sachidananda Ashram, Mysore, India
²PG Scholar, Department of Rasashastra, JSS Ayurveda Medical College, Alahanahalli, Mysore, India

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*Dr. Dasari Srilakshmi B.P.T, B.A.M.S, M.D (Ayu), Ayurvedic Physician & Physiotherapist, S.G.S Hospital, Sri Ganapati Sachidananda Ashram, Ooty road, Mysore-570025, India Email: drdasari24@gmail.com

ABSTRACT

Rasashastra is an integral part of Ayurveda that deals chiefly with mercury, metals, minerals and animal origin drugs having therapeutic and alchemical importance. Use of mineral and metallic preparations for health care is a unique feature of Rasashastra. Sudha varga dravyas are group of drugs that possess high calcium content in them. Calcium is the most abundant mineral in human body, which plays a pivotal role in human physiology. Though the mention of therapeutic utility of calcium compounds in Ayurveda dates back to samhita period; the references of these compounds are found scattered under different context in literature of samhitas (Ayurveda classics) and Rasashastra. For the first time all calcium compounds were exclusively categorized in a single group based on their chemical composition as “sudha vijnaneeyam” by rasamritam the text of 20th century. Though introduced by recent authors, sudha varga dravyas (calcium compounds) have gained therapeutic importance in clinical practise. This article attempts to screen Rasashastra classics for references emphasizing the “Therapeutic potentials of sudha varga dravyas vis-à-vis calcium compounds” and related alchemical aspects of these drugs.

KEY WORDS: Sudha varga, Rasashastra, Calcium compounds.

INTRODUCTION

Rasashastra includes various drugs of metals and mineral origin along with details of their varieties, characteristics, processing techniques, properties, therapeutic values, precise dose, probable adverse effects, their management and various alchemical procedures in a comprehensive way. Sudha varga dravyas have attained its importance in prevention and cure of the conditions like amlapitta (~acid peptic disease), grahani (~irritable bowel syndrome), parinamamula (~duodenal ulcers), swasa (~dyspnoea), kasa (cough), hrudroga (cardiac disorders), supplementation of calcium and also various alchemical processes like ~ parada bandha and melana. All the drugs enlisted under the sudha varga dravyas have calcium in compound form, as salts. Calcium has very essential role in physiology related to bone structure, muscular movement, regulation of gastro intestinal secretions and cardiac physiology.

Sudha Nirukthi

The literal meaning of the word “sudha” is ambrosia, nectar, honey of flowers, comfort, water, milk, good drink, beverage of god’s etc.¹

Antiquity of sudha varga

In charaka samhita and susruta samhita (classical texts of Ayurveda), sudha (lime) has been included under “parthiva dravyas”. Both rasaratnakara and rasarnava have enumerated in shukla varga.² Rasamritam has included these drugs under “sudha vijnaneeyam” based on chemical composition.²

Enumeration of sudha varga dravyas

Table 1: Sudha Varga Dravyas

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name</th>
<th>Common name</th>
<th>Origin</th>
<th>Chemical constituents</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sudha</td>
<td>Lime</td>
<td>Mineral</td>
<td>CaO</td>
<td>Oxide</td>
</tr>
<tr>
<td>2</td>
<td>Khatika</td>
<td>Chalk</td>
<td>Mineral</td>
<td>CaCO₃</td>
<td>Carbonate</td>
</tr>
<tr>
<td>3</td>
<td>Godanti</td>
<td>Gypsum</td>
<td>Mineral</td>
<td>CaSO₄.2H₂O</td>
<td>Sulphate</td>
</tr>
<tr>
<td>4</td>
<td>Sankha</td>
<td>Conch shell</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>5</td>
<td>Shambuka</td>
<td>Australian snail</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>6</td>
<td>Mukta shukti</td>
<td>Pearl oyster shell</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>7</td>
<td>Kaparda</td>
<td>Cowrie shell</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>8</td>
<td>Kurnmaprista</td>
<td>Turtle shell</td>
<td>Marine</td>
<td>Calcite</td>
<td>Phosphate</td>
</tr>
<tr>
<td>9</td>
<td>Samudraphena</td>
<td>Cuttle fish bone</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>10</td>
<td>Pravala</td>
<td>Coral</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>11</td>
<td>Mukta</td>
<td>Pearl</td>
<td>Marine</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>12</td>
<td>Mrigashringa</td>
<td>Deer antlers</td>
<td>Animal</td>
<td>Ca₃(PO₄)₂</td>
<td>Phosphate</td>
</tr>
<tr>
<td>13</td>
<td>Kukkutanda twak</td>
<td>Hen’s egg shell</td>
<td>Animal</td>
<td>CaO</td>
<td>Carbonate</td>
</tr>
<tr>
<td>14</td>
<td>Ajashti</td>
<td>Goat’s bone</td>
<td>Animal</td>
<td>Calcium, Phosphorus etc.</td>
<td>Phosphate</td>
</tr>
</tbody>
</table>

Sudha varga includes both khaniya dravyas (mineral drugs) like khatika, sudha, godanti and pranija dravyas (products obtained from animal) like samudraphena, sanka, shukti, kaparda, kurnmaprista, mrigashringa, kukkutanda twak, mukta, pravala, etc. Among these kaparda has been grouped under “sadharana rasa”⁴ (group of minerals depending on their role in alchemical processing of mercury) whereas pravala and mukta were grouped under “ratna varga” (group of gems).⁵
The sudha varga dravyas are different in number by different authors. Mukta and pravala were included by recent authors in Ayurvediya rasashastra\(^6\) and Rasashastra-the mercurial system\(^7\) along with badarashtra (silicate of lime), vamshalochehana (Phyllostachys edulis) and swetanjana (surma safed), hastidanta (elephant’s tusk) respectively.

Utility of Sudha Varga Dravyas

The utility of sudha varga dravyas may be classified as Loha-vedha and Deha-vedha.

Loha-vedha

Loha-vedha is the science exclusive in Rasashastra to convert lower metals to higher metals. Bandha or bandhana is the process by which the properties of parada (mercury) such as mobility (chanchala) and inability to contain (durgrahya) are conquered. It is claimed in the texts that badhha parada produces emancipation. It can eradicate the diseases and work wonders like thwarting senility and even makes the man immortal.\(^8\) Jara is heating the mercurial product with the desired minerals, metals, and alkalis or salts so that they are fully digested or assimilated.\(^9\)

- Shukla varga dravyas are used for jarana and bandha process. Ksharabandha is achieved by processing parada with sanka, shukti and kaparda. Such ksharabandha parada enhances the appetite. It nourishes the body as well as reduces pain in abdomen (shula).\(^10\)
- Diamond (vajra), though carbon in composition is the hardest material with hardness 10. In the preparation of bhasma (product of incineration process) of such hardest material (vajra marana), turtle shell facilitates incineration (marana) process.
- They aid in softening the harder materials (mrudukarana) and in dwandvamalana of mineral drugs (rasa dravyas).
- Other uses of shukla varga dravyas includes sankha drava,\(^11\) it helps in liquefying the metals like gold and in shodhana (purification) process of haratala\(^12\) (arsenic tri sulphide-As$_2$S$_3$) with churnodaka (water prepared with ash of lime).
- ‘Jwala pareeksha’ of sudha varga was enumerated by Acharya Patanjali in loha shastra mentions, as raktajwala for sudha or churna.

Deha-vedha

Deha-vedha is the science that helps in making the body strong like loha (iron/metal), by preparing various rasoshadhis (metal and mineral based medicines) using the lohas (metals) to attain the chaturvidha purusharthas (righteous path, wealth, desires and salvation). Utilization in therapeutics includes external application and internal administration and few illustrations indicating the therapeutic potentials of sudha varga dravyas are as follows.

External application

- Churnodaka is used in different forms and modes of administration like lepa (application like pack) and prakshalana (wash).\(^13\)
- Collyrium (anjana) prepared from fine powder of samudraphena, pippali (Piper longum Linn) and samudraphena lava in (rock-salt) is indicated in shukla dosha.
- Netra roga like pothaki (trachoma) is treated with application of netra varti prepared with samudraphena 1 part, tuttha (copper sulphate) 1/6 th part and 1/6 th part of hareetaki (Terminalia chebula Retz.) fruit powder as ingredients.
- Powder of samudraphena is blown into ear, though a pipe in condition of ear discharge (shruti srava/ karna sarva) of chornic in nature.
- For faster healing of wounds (vranaropana), lepa of equal parts of samudraphena and mruddara shringa (PbO) with honey is indicated.\(^14\)

Internal administration

- Churnodaka is also indicated for basti (enema), sevana (internal administration) and kavala (mouth gargling) apart from its preparation of kshara (alkali).\(^15\)
- In kapha pittaja jvara, internal administration of samudraphena with equal parts of samagina kajjali or hingulanvita samudraphena (HgS+CaCO$_3$) is beneficial.
- Samudraphena churna with kokilashka kashaya (decocition of Hygrophila auriculata Reine), katphala (Myrica esculenta), usheera (Vetiveria zizanioides Linn) and iksu (Saccharum officinarum Linn) for internal administration is indicated in shukra dhatu (last dhatu ~semen) shodhana. Only rasamritam included suramasaphed and considered as a substitute for godanti bhasma.\(^14\)
- Godanti bhasma is sheeta (cold in potency), alleviates Pitta dosha, arrests bleeding and ameliorates hyperacidity. It helps in healing of ulcers in acid-peptic disease.
- In burning sensation of body, godanti bhasma is the choicest remedy. It arrests bleeding in diarrhoea and dysentery.
• Godanti bhasma works effectively in calcium deficiency disorders like rickets, intermittent claudications, and backache in osteoporosis. In children, it helps to promote their growth and strength teeth. In women it effectively controls bleeding in menorrhagia and curbs leucorrhoea at a dose of 1-3 guna (125-375 mg) with honey / cow’s milk / cow’s ghee as adjuvant.15

• Mriga shringa bhasma is indicated with cow’s ghee/ cow’s milk/ butter in shrit hara. Along with amaparga beca (seeds of Achyranthes aspera Linn) / pippali powder in hiccups and dyspnoea.16

• Kurma prista bhasma is indicated in post natal period (prasutha), kshaya peeditha, apasmara (~epilepsy), bala roga (paediatric disorders) at a dose of 250-500mg (2-4 ratti) with guduchi sattva (starch of Tinospora cordifolia Wild Meirs) as adjuvant.17

• Ajasthi was included by recent authors, chemical composition being predominant organic calcium along with other organic elements. Ajasthi bhasma is indicated in rickets, nursing mothers, prenatal period, hair fall, during dental eruptions, as natural supplement of calcium. It is recommended with honey, in a dose of 250-500mg thrice a day.18

• Kukkutanda twak was also included by recent authors, as it is rich in calcium content. It is useful in cases like rickets, facilitates dental eruption, as a calcium supplement in pregnancy and lactating women. It is also indicated in hair fall, cough, tuberculosis with cavitations, asthma, diarrhoea and menorrhagoe.19

Various formulations prepared with sudha varga dravyas indicated in diseases like amlapitta, grahani, atisara etc. are

i. Pravala panchamrutra ras in amlapitta.20

ii. Muktapanchamrita ras is indicated in jwara (fever) and rajayaksham (~tuberculosis).21

iii. Sudha khatika along with cold water (sheeta jala) is indicated in pravahika, pittasra and grahini.22

iv. Mukta pisti has appreciable properties (adhika gunakari), beneficial in unmade (insanity) due to intoxication, in raktatisara (diarrhoea with blood), acts as anti-dote to poison, expels the accumulated doshas, increases strength, virility and longevity, activates digestion and alleviates diseases of digestion and metabolism. It alleviates burning sensation.23

v. Pravala pisti is good for heart (hritya), sheeta guna, laghu (light), pittanashaka, chaksu khatika (very mild) and khatika (good for heart (hridya), atyanta –tuberculosis).24

vi. In asthimruduta (rickets) associated with kasa, equal quantities of pravala pisti with shrunga bhasma is indicated.25

**Table 3: Some Preparations containing Sudha Varga Dravyas**

<table>
<thead>
<tr>
<th>Sudhanarth</th>
<th>Churnodaka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Churna</td>
<td>Khatikadi churna, Dashana samskara churna, Hridya churna, Samadraphena churna, Loothavishanashaka agada</td>
</tr>
<tr>
<td>Drava</td>
<td>Sankha drava</td>
</tr>
<tr>
<td>Drava</td>
<td>Pravala and Mukta pisti</td>
</tr>
<tr>
<td>Vati/Gutika</td>
<td>Trirekha vati, Mahashanka vati</td>
</tr>
<tr>
<td>Peya</td>
<td>Khatikadi peya</td>
</tr>
<tr>
<td>Lepa</td>
<td>Samudrapfena shothagna lepa</td>
</tr>
<tr>
<td>Pracka</td>
<td>Sudha parpati</td>
</tr>
<tr>
<td>Pottali</td>
<td>Grahanakapata ras, Kapthakeu ras, Ratnagarbha pottali ras, Hiranyagarbha pottali ras</td>
</tr>
<tr>
<td>Bhasmas</td>
<td>Kasika godanti bhasma, Godanti bhasma, Sankha bhasma, mukta bhasma, kukkutanda twak bhasma, Pravala panchamrutra ras</td>
</tr>
</tbody>
</table>

**Modern Review**

**Calcium Carbonate**

Calcium is essential for living organisms, in cell physiology where movement of the calcium ion Ca\(^{2+}\) in and out of the cytoplasm functions as a signal for many cellular processes. As a major material used in mineralization of bones and shells, calcium is the most abundant metal by mass in many animals. Recommended daily calcium intake of adult’s ranges from 1000 to 1500 mg. Calcium supplements are used to prevent and to treat calcium deficiencies and supplements are taken with food not more than 600 mg in divided doses throughout the day. It is recommended to take supplements with food to aid in absorption. Vitamin D is added to some calcium supplements because vitamin D is converted to a hormone in body which induces the synthesis of intestinal proteins responsible for calcium absorption. Calcium citrate can be taken without food and is the supplement of choice for individuals with achlorhydria or who are taking histamine-2 blockers or proton-pump inhibitors. It is used as an antacid to relieve the symptoms of indigestion and heart burn. It is also used to prevent osteoporosis, as a calcium supplement and to treat high phosphate levels in patients with kidney disease. Calcium carbonate is a calcium salt. Coral calcium is a salt of calcium derived from fossilized coral reefs, composed of calcium carbonate and trace minerals.

**Adverse effects of overdose**

Exceeding the recommended daily calcium intake for an extended period of time can result in hypercalcaemia and calcium metabolism disorder.

**DISCUSSION**

**Shukla varga**

As per the references of rasarnava and rasaratnakara, the sudha varga dravyas are included under shukla varga and the classification might be based on their colour. But, in shukla varga all the dravyas, except kurmaprasta, are white in colour. Hence the criteria for the classification may be one of the following

- Their colour (varna) – white (shukla)
- Used in the process of shuklikaranana
- Chemical composition – calcium

**Importance of sudha in the processing of mercury**

Purification of mercury is obtained by processing with sudha raja. Sudha is chemically calcium oxide that may help in removing the physical as well as chemical impurities of mercury.

**Amla dravya (sour group) for sodhana**

One of the purification methods of all sudha varga dravyas in common is by the amla varga dravyas. The sudha varga dravyas are all calcium compounds and may contain only physical impurities and has alkaline nature. The amla dravyas are acidic in nature and hence removes the excessive alkaline nature of calcium compounds, thus making the drug smoother and in assimilable form.

**Internal administration of parada along with khatika in bala (children)**

Mughda rasa, is a khalvi rasayana with equal quantities of khatika and parada as ingredients, is indicated in conditions like sahaja phiranga roga (congenital syphilis), balatisara (diarrhoea in children) and dantodvava janya vyadhi (disorders associated with tooth eruption) in bala for internal administration. In this yoga, mercury and calcium carbonate (khatika) are triturated till globules of mercury are
completely integrated without any lustre of mercury. This process suggests complete bonding of mercury with calcium carbonate with no possibility of existence of the free molecules of mercury and thus nullifies the evil effects of mercury. Indication of this drug in children is a matter of research to evaluate the toxicity if any as per the myth of heavy metal toxicity.

**Godanti as a variety of haratala (orpiment – As$_2$S$_3$)**

Godanti is considered as a variety of haratala by recent authors, but rasamritam included in sudha varga. The query being godanti’s chemical composition which is CaSO$_4$ 2H$_2$O (selenite) and does not contain any arsenic element to consider as variety of haratala.

**Mukta shukti and mukta**

Many drugs of plant origin like ashwagandha (*Withania somnifera* Dunal.) root is stoutening (stoulyakara) and leaves possess thinning (karshakara) properties, though both parts are from same origin. Similarly mukta shukti and mukta have same origin, chemically both are CaCO$_3$ and both possess similar properties like sheeta (cold potency), hridya (good for heart), jwara hara (anti-pyretic) and kasa swasa hara. Though they carry some similar properties, they vary in some of their pharmacological properties like mukta shukti is raktapittahara and mukta is not so.

**Inclusion of jala shukti**

Jala shukti is considered as shambuka by rasatarangini. But amanda kanda has included mukta shukti, shambuka and jala shukti as three different drugs. The logic behind considering them as separate drugs is not very clear.

**Internal administration of samudraphena**

Samudraphena is administered externally as anjana, lepa or churna. Internal administration of samudraphena is indicated only in shukra dhatu shodhana. It is indicated in many external applications rather than internal administration, due to its properties like lekhana (scrapping quality), chakshushya (good for eyes), karnasrava hara and rujapaha. Hence in the texts only the process of purification is mentioned without any incineration procedure probably because only shodhana is sufficient to remove toxins. In shukra dhatu shodhana, it is administered only after processing with herbal drugs to potentiate the drug and non-toxin.

**Ajusthi as sudha varga dravya**

Ajusthi was included by the recent authors. It is used as substitute for deer horn probably due to its easy availability, similar composition and cost effective.

**Kukkutanda twak bhasma as sudha varga dravya**

Kukkutanda twak bhasma is an excellent ashi mamsa dhatu poshaka and vardhaka as well as rasayana and vajikarana. Bhasma is prepared by heating the kukkutanda twak in the medium of changeri (*Oxalis corniculata* Linn.) / nimbu (*Citrus acida*) juice and both are acidic in nature. It is easily absorbable and rich form of calcium which is useful in asthi kshaya (osteoporosis) developed after delivery as well as due to other reasons like leucorrhoea, menorrhagia, dysmenorrhoea, post-menopausal osteoporosis. It is indicated in khalita - paliata (premature greying or loss of hair), as kesha is mala of asthi dhatu. It is also vajeekara, so probably used effective in treatment of seventh dhatu, shukra dhatu which can be treated only if above six dhatu are nourished properly.

**As calcium supplements**

Pravala pisti, kukkutanda twak bhasma, ajasthi and other sudha varga dravays are mild organic form of calcium carbonate and are beneficial in rickets, osteoporosis as calcium supplement at minimal dose of 125 - 250 mg (1-2 ratti).

**Metabolism and absorption of bhasmas**

The calcium in cereals and green leafy vegetables are less utilized due to the presence of oxalates and phytates present in them respectively. Calcium compounds are alkaline in nature. The natural calcium preparations like bhasmas are more effective than synthetic calcium due to the reason that, they contain easily absorbable and assimilable form of oxide and they contain other trace elements such as magnesium, copper, zinc etc. Irrespective of the gastrointestinal condition they do exhibit their efficacy unlike synthetic molecules which cannot be absorbed in unhealthy gut conditions such as indigestion, chronic gut motility disorders and hormonal imbalances. The additional advantage of bhasmas of sudha varga dravay is that they exhibit other therapeutic actions such as correcting indigestion and properties like antacid, ulcer healing and anti-colic properties which cannot be expected with synthetic molecules.

The absorbability of calcium compound bhasmas which are in oxide form may be explained as below,

![Figure 1: Probable absorbability of calcium compound bhasmas](image)

The probable mode of action in amlapitta as antacid by all sudha varga dravays is

![Figure 2: Probable mode of action in amlapitta](image)
Ca\(^{2+}\) is most absorbable form in body and Cl\(^{-}\) nullifies the acidity along with properties of these drugs like sheeta veerya and has pitthahara action, may be explained as above to be effective in amlapitta. Acidity (low pH) is most favourable environment for calcium absorption. Therapeutic uses of calcium salts according to modern science is to prevent or correct calcium deficiency or osteoporosis, as an antacid, as phosphate binders, acute treatment of tetany, urticaria and nonspecific intestinal colic, hyperkalaemia and cardiac arrest. Calcium is used as supplement in fractures, osteoporosis, cardiac arrest. It is proven that coral calc improves bone mineral density and prevents bone loss in animal models especially estrogen deficiency bone loss. (Wide ref: Pharmacological research, 2003, vol. 48, no 6, pp. 593-599, 7 page(s) (article).

But Acharyas have not mentioned the use of sudha varga dravyas in bhagnas (fractures), the logic behind it is yet to be understood.

To conclude all calcium compounds used in Ayurveda are grouped under sudha varga by recent authors of 20th century. They have gained therapeutic importance as calcium supplements in calcium deficiency, to enhance normal growth and development. Apart from calcium supplements, it is also prescribed in conditions like amlapitta, grahani, parinamashula, swasa, kasa, hrudroga etc.

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