A Critical Review on Haratala (An Arsenical Compound)

Nilima N Wadnerwar¹, Dhiraj Singh Rajput², Akhilesh A Deshmukh³, Apurva Gaikwad⁴

ABSTRACT

Background: Haratala is described as the Dhatu visha and it contains arsenic and sulfur. Arsenic is a heavy metal that may lead to acute or chronic heavy metal toxicity. Although Haratala is effective and popular as Rasamanikya, it is not used as Rasayana or therapeutic drug in routine practice either in pure or in Bhasma form. It is used as a main drug or an auxiliary drug to prepare formulation.

Aim: To focus on the various utilities of Haratala, so that it can be safely used in the clinical practice in a wide range of indications.

Review results: In the literature available, it is observed that along with therapeutic utility of Haratala, Haratala Bhasma is used as Rasayana. But arsenic present in Haratala may cause toxicity if shodhana and marana of Haratala are not conducted properly. It is observed from the previous research that shodhana may enhance the synergistic effect of Haratala in cellular apoptosis for the treatment of leukemia. Marana may provide safer bioassimilability before their use in most of the formulations in which it may act as an antagonist and subside the toxicity of the formulations.

Conclusion: Haratala Bhasma is indicated in various disease conditions. Hence, it can be used as Avasthika Rasayana. But during its use, safety of the drug should be ensured by following proper shodhana and marana procedures.

Clinical significance: Studies should be conducted to observe its efficacy in healthy individuals as Rasayana and in patients of acute promyelocytic leukemia (APL) as an adjuvant drug.

Keywords: Avasthika Rasayana, Critical review, Dhatu visha, Haratala, Marana, Shodhana.


BACKGROUND

Somala, Haratala, and Manahshila are the three arsenic compounds mentioned in Ayurveda. Dhatu visha is described in Ayurveda by Sushruta with its two examples as Phenashma and Haratala. It is categorized in sthavara visha as it is originated from soil. Haratala is orpiment or arsenic trisulfide (As₂S₃). Rasadraya are classified as Maharasa, Uparasa, and Sadharana Rasa. Haratala is included in Uparasa and described as one of the seven Upadhatu mentioned in Rasa Grantha.¹ This mineral is in therapeutic use since Charaka Samhita period. Books of Rasashastra have explained about it in details. Among all Visha Dravya, Haratala is the only mineral mentioned in the treatment of various acute and chronic diseases.² Haratala is enlisted in schedule E(I) of poisonous drugs under Drugs and Cosmetic Rules 1945.

Haratala is identified as arsenic trisulfide also known as yellow sulfide, orpiment, jarda, and senko. It is a yellow solid opaque mass. It takes its name from the Latin auripigmentum (aurum—gold + pigmentum—pigment) because of its deep yellow color.

It was an important item of trade in the Roman Empire and was used as a medicine in China, though it is highly toxic. It was also used as a fly poison and to poison arrows. Because of its striking color, it was also a favorite with alchemists searching for a way to make gold, both in China and in the West.³

Orpiment was ground, processed, and used for centuries as a pigment in painting, being one of the few clear, bright yellow pigments available to artists up until the 19th century. Orpiment presented problems, however, such as its extreme toxicity and its incompatibility with other common pigments such as lead and copper-based substances. The use of orpiment as a pigment matter ended almost entirely with the advent of the cadmium yellows and the various dye-based colors of the 19th century. It is presently used in the production of infrared-transmitting glass, oil cloth, linoleum; in semiconductors and photoconductors, as a pigment; for depilating hides and in fireworks.

Although Haratala is a toxic substance, it can be used for various therapeutic purposes with the help of shodhana procedures mentioned in Ayurveda. Hence, the article aims to highlight the therapeutic uses of Haratala.

REVIEW RESULTS

Haratala is mentioned as one of the seven Upadhatu mentioned in Rasa Grantha.¹ For the first time in Charaka and Sushruta Samhita, Phenashma (arsenic trioxide) and Haratala (As₂S₃) are mentioned in the context of Sthavara Dhatu Visha.⁴ Haratala is a combination of arsenic and sulfur. It is a natural mineral just like

¹Department of Agadantana, Mahatma Gandhi Ayurved College Hospital and Research Centre, Wardha, Maharashtra, India
²Department of Rasashastra and Bhaishajya Kalpana, Mahatma Gandhi Ayurved College Hospital and Research Centre, Wardha, Maharashtra, India; Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India
³Vimaladevi Ayurved Mahavidyalaya, Chandrapur, Maharashtra, India
Corresponding Author: Nilima N Wadnerwar, Department of Agadantana, Mahatma Gandhi Ayurved College Hospital and Research Centre, Wardha, Maharashtra, India; Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India, Phone: +91 8275399319, e-mail: dr.nilima_wadnerwar@rediffmail.com


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yellow prism. Its synonyms are Haritala, Taal, Talok, Nagabhushana, Natamandanaka, Shailushabhushana, Bidalaka, Chiragandhaka, Pinjara, Vanshapatraka, Aala, Pitanaaka, Mallagandhoja, 5 Taalmala, Maala, Pinjaka, Romanarana, and Pita. 6 It is of two types: Patra (Bark) Haratala and Pinda Haratala. 7

In Siddha, Haratala is of four types: Bagadadi, Godanti, Taboki, and Pandu. They are less potent, respectively. Vansha Patri Haratala is poisonous. It is lustrous, smooth, and yellow like gold. One sheet of Haratala is arranged on another. Sheets can be separated easily. It is also known as Bagadadi Haratala and it is found in Iran and it is best for medicinal use. Haratala is Katu, Snigdha, Kashaya, and Ushna. It is used in Visha, Pama, Kotha, Kushtha, Rakta Vikara, Kapha, Pitta Roga, and Roma diseases. It is indicated in all the diseases and it rejuvenates the body. It increases vigor and vitality. Haratala is soluble in acid, ammonia, and Dhumapana ingredient of in various skin disorders and in the subject of triturated together. Then they are kept on fire in and two parts of. It is also known as is best for medicinal use. is poisonous. It is lustrous, smooth, and yellow like gold. One sheet Ushna and Haratala is poisonous. It is lustrous, smooth, and yellow like gold. One sheet is best for medicinal use. is best for medicinal use.

In Charaka Samhita, Haratala is used as an external application in various skin disorders and in the subject of Shirovirechana as an ingredient of Dhumapana. Haratala is indicated for skin diseases apart from Unmada (insanity), Bikka (hiccups), Shwasa (dyspnea), Kasa (cough), and in Visha Chikitsa (toxicosis) in the form of oil and Sura. It is also used for Pradha, Pralpa (the external applications), Dhumapana (smoking), Anjana (collyrium), and in the form of powder and Agada for internal uses.

In Sushruta Samhita, Haratala is indicated for Vrana Sodhana (wound cleaning), Pandu Karma (coloring the skin after scars of wounds), Arsha (piles), various skin disorders, Grantha (nodules), Upadamsa (syphilitic pimples), Visarpa (spreading poisonous wounds), and as a hair remover in different Yogas and in Lutadansh Chikitsa. It is also used for worms, eye diseases, skin diseases, and several pediatric disorders in the form of oil, powder, and Dhumapana. In Sangraha Granthas, Vagbhata has applied Haratala mainly on Nasa Rogas (nasal diseases), Sotha (edema), Vrisika Dansa (scorpion sting), for Vidarana action, i.e., self-opening of the abcesses.

Bhela Samhita, Kasyapa Samhita, etc., have described the indications of Haratala. From the age of Nagarjuna, the description of orpiment with regard to its properties, indications, and contraindication, sodhana, marana, satvapatana, etc., are more elaborately described. He has utilized this drug for various alchemical processes for converting basic metal into noble one.

Though Haratala is a toxic substance, it can be used for various therapeutic purposes with the help of following shodhana procedures mentioned in Ayurveda (Table 1).

Shuddha Haratala is not used as a single drug in treatment. Rather it is used as a main ingredient or as an auxiliary ingredient in various Ayurvedic formulations. The formulations of Haratala are Rasamanikya, Talokeshara Rasa, Kasturbinhara Rasa, Taladinsura Rasa, Samirapannaga Rasa, Smritusraga Rasa, Nityananda Rasa, Vatagajankusha Rasa, Talakodyala malehora, Navajware Bhanuksha Rasa, Haritaladi Yoga, etc. Haratala Bhasma is used in the treatment of various diseases. Different methods of preparation of Haratala Bhasma are mentioned. Acharya has also described a qualitative test to ensure the best quality of Haratala Bhasma. Haratala Bhasma is said to be the best when it is put on fire, with no fumes appearing. Acharya may be expecting complete evaporation of sulfur which is responsible to produce fumes, resulting in the conversion of arsenic trisulfide into arsenic oxide.

The variations in the dose of shuddha Haratala and Haratala Bhasma according to different literature (Table 2).

### Table 1: Various methods of Haratala Shodhana

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Method</th>
<th>Yantra</th>
<th>Media</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Swedana 9</td>
<td>Dolayantra</td>
<td>Nimbu swarasa</td>
<td>One prahara (one yama)</td>
</tr>
<tr>
<td>2</td>
<td>Swedana 9</td>
<td>Dolayantra</td>
<td>Gruhadhoon jala</td>
<td>One prahara (one yama)</td>
</tr>
<tr>
<td>3</td>
<td>Swedana 10</td>
<td>Dolayantra</td>
<td>Kushmanda swarasa</td>
<td>One prahara (one yama)</td>
</tr>
<tr>
<td>4</td>
<td>Swedana 11</td>
<td>Dolayantra</td>
<td>Tila kshara jala</td>
<td>One prahara (one yama)</td>
</tr>
<tr>
<td>5</td>
<td>Swedana 12</td>
<td>Dolayantra</td>
<td>Shalmali moola swarasa</td>
<td>One prahara (one yama)</td>
</tr>
<tr>
<td>6</td>
<td>Bhavana 12</td>
<td>Khvala yanta</td>
<td>Shalmali moola swarasa</td>
<td>Seven times</td>
</tr>
<tr>
<td>7</td>
<td>Bhavana 13</td>
<td>Khvala yanta</td>
<td>Churna jala</td>
<td>Seven times</td>
</tr>
<tr>
<td>8</td>
<td>Swedana 14, 15</td>
<td>Dolayantra</td>
<td>Chuna and kanji, Kushmanda swarasa, tila taila, triphala kwatha</td>
<td>One prahara each separately</td>
</tr>
<tr>
<td>9</td>
<td>Swedana 16</td>
<td>Dolayantra</td>
<td>Kanji</td>
<td>One prahara (3 hours)</td>
</tr>
<tr>
<td>10</td>
<td>Swedana 17</td>
<td>Dolayantra</td>
<td>Kushmanda swarasa, Churnodaka and tila taila</td>
<td>One prahara each three or seven times</td>
</tr>
</tbody>
</table>

### Table 2: Dose of Haratala and Haratala bhasma

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Dose of Haratala</th>
<th>Dose of Haratala bhasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/4–1/2 Ratti (30–60 mg)</td>
<td>1/4–1/2 Ratti (30–60 mg)</td>
</tr>
<tr>
<td>2</td>
<td>One rice grain with sugar and Jiraka powder Pathya: Sathri rice and Godugdha</td>
<td>1/8th part of Ratti (15 mg) with Godugdha. In Khaya and old age 22</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>One Ratti (120 mg)</td>
</tr>
</tbody>
</table>

### Haratala as Rasayana

The use of Haratal Bhasma as a Rasayana is exclusively mentioned in Ayurved Prakash along with its dose, duration, and benefits. Haratal Bhasma ingested for 21 or 40 days in a dose equal to one rice grain or one Ratti with proper Anupana cures 18 types of Kushtha; 13 types of Sannipat; 8 types of Maharoga; 80 types of Vataroga; 40 types of Pitta Roga; 20 Kapha Roga, old age, Prasuti Roga, Apasvara, Paparoga, Bhagandara, Nadivrana, Vatarkata, Upadansa, Phiranga, Shelepada, Granthi, Sarvarga Shatha, and Madhumeha; and 20 types of Prameha, Vruddhi, Arbuda, Gandamala, Aamavata, Ghriddhro, Moodhavikara, Kshaya, and Shoshavikara. It improves strength, complexion, courage, vigor, sex power, and vision. Hence, Haratal Bhasma can be used in various diseases with different Anupana according to the diseases (Table 3).

Marich, Kajjali, Shuddha Vatsanabha, and Shuddha Haratala, each in equal quantity is triturated with water and made into a tablet of one ratti is indicated for Sannipatika Jwara Pralapa, Mohayukta Jwara, and Malaria. Shuddha copper sulfate one part,
Shanka Bhasma two parts, and Shuddha Haratala three parts are triturated with Kumari Swarasa, sealed in Sharawa Samputa, and Laghuputa is obtained. It is indicated in Vishama Jwara and Visha Krimijanya Jwara, in dose equal to one Yava. Tamra Bhasma, Kajjali, and Shuddha Haratala each taken in equal quantity is triturated 14 times with Nimba swarasa. It is consumed in one Ratti dose, 3 hours before malarial fever.

**EXTERNAL USES OF HARATALA**

In Vrishchika Donsha, Lepa of Haratala and Nausadara Churna are applied. In Lingarsha, Lepa of Apamarga Moola Twaka and Hartala in water are applied. Talakodaya Malahara is used in Vicharchika, Dadru, Kushtha, Pama, Visphota, and Nadivrana.25

**ANTIDOTE FOR HARATALA POISONING**

As Haratala contains arsenic as a heavy metal, it can cause acute or chronic toxicity, if the formulations containing Haratala are not prepared properly or shodhana and marana are not performed according to classical texts. Symptoms of arsenic toxicity can be observed in such cases.

If poisoning occurs due to the consumption of Ashuddha Haratala or overdose of Shuddha Haratala or Haratala Bhasma, mishri (sugar) and jiraka powder in equal quantity in a dose of three masha with honey or Kushmanda Rasa (Benincasa hispida) three Tola with Mishri three times a day for 3 days should be consumed as an antidote.26 Madya, Thila thailo, and Paribadra Pushpa dala kashaya are described as Prativisha (antidote) for Haratala toxicity.27

**Table 3: Internal use of Haratala bhasma in various diseases with different Anupana26**

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Indication</th>
<th>Anupana</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shwasa (asthma)</td>
<td>Vasa swarasa/kantakari swarasa</td>
</tr>
<tr>
<td>2</td>
<td>Rakta Vikriti (blood disorders)</td>
<td>Amragandhi Haridra swarasa</td>
</tr>
<tr>
<td>3</td>
<td>Apsmara (epilepsy)</td>
<td>Vacha and jeeraka churna</td>
</tr>
<tr>
<td>4</td>
<td>Kushtha Roga (leprosy)</td>
<td>Decotion of Panchatikta kashaya</td>
</tr>
<tr>
<td>5</td>
<td>Vatarakta vikara upapadra (complications of gout)</td>
<td>Devadali swarasa</td>
</tr>
<tr>
<td>6</td>
<td>Visarpa (erysipelas)</td>
<td>Vyandhyakarkotaki rasa</td>
</tr>
<tr>
<td>7</td>
<td>Twacha Roga (skin diseases)</td>
<td>Kumari Swarasa</td>
</tr>
<tr>
<td>8</td>
<td>Arsha (haemorrhoids)</td>
<td>Haratki Churna</td>
</tr>
<tr>
<td>9</td>
<td>Pandu (anaemia)</td>
<td>Haridra Swarasa</td>
</tr>
<tr>
<td>10</td>
<td>Vatarakta (gout)</td>
<td>Guduchi Satwa</td>
</tr>
<tr>
<td>11</td>
<td>Kshaya roga (tuberculosis)</td>
<td>Tamool</td>
</tr>
<tr>
<td>12</td>
<td>Prameha (diabetes)</td>
<td>Tulasi Swarasa</td>
</tr>
<tr>
<td>13</td>
<td>Jalodara (ascitis)</td>
<td>Aja Mutra</td>
</tr>
<tr>
<td>14</td>
<td>Agnimandya</td>
<td>Pippali Churna and Madhu</td>
</tr>
<tr>
<td>15</td>
<td>Shukra prameha</td>
<td>Lavanga, Dalchini, Kesara</td>
</tr>
<tr>
<td>16</td>
<td>Pratishyaya (common cold)</td>
<td>Jatipatra, Kesara</td>
</tr>
<tr>
<td>17</td>
<td>Vatanad Shoola (nervine pain)</td>
<td>Trikatu Churna, Tamra Bhasma</td>
</tr>
<tr>
<td>18</td>
<td>Balavardhana (strengthening)</td>
<td>Jayaphala Churna</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Haratala (As$_2$S$_3$), Manahshila (As$_2$S$_2$), and Gauripashana (As$_2$O$_3$) are the arsenical compounds used in Ayurveda since thousands of years for various indications. In Bhaishajya Ratnavali alone, 91 formulations of Haratala, 61 formulations of both Haratala and Manahshila, one formulation of Haratala and Somala (Gauripashana) in combination, and 3 formulations of all three arsenicals are mentioned. Out of them, maximum formulations were used for the treatment of Jwara (Pyrexia).28 In Ayurved Prakash2 and Rasatarangini, Haratala is mentioned as Rasayana. It causes remission of high-grade fever due to infections. It is a great immunomodulator and helps in the formation of new red blood corpuscles and hence very useful in erythropoiesis and ultimately fights severe anemia. It is effective in a wide range of indications as Rasayana. It is popularly used in various blood and skin disorders. Still scientific research on Rasayana property is not conducted.

Ashuddha Haratala causes severe Daha, Kshobha, Sharr Kampa, Todo, pain, Rakta dushti, Kushtha, loss of beauty, and deadly diseases of Vata Kapha.30 It is life-threatening Mehakaraka and causes Tapta, Sphota, and Angasaanakocha.31 Hence, its shodhana is very much essential. Though Haratala is a toxic drug, it is used in the treatment after shodhana process with a number of acidic and alkaline media of organic origin. Rasamaniya prepared with Haratala processed in Kushmanda Swarasa is proved to be safe in rats when administered at therapeutic and at five times therapeutic exposure dose levels.32 Safety may be achieved as Kushmanda [Benincasa hispida (Thunb.) Cogn.] Swarasa is an antidote for Haratala poisoning. Studies have shown that cucurmosin is an active compound in Benincasa hispida (Thunb.) Cogn., a kind of ribosome-inactivating protein and has high rate of cell apoptosis.33 Hence, purification by the above agents may enhance the synergistic effect of Haratala in cellular apoptosis for the treatment of leukemia.

During Bhasmikarana process under high heat, sulfur gets evaporated from sulfur-containing arsenic minerals and sulfide of arsenic and trioxide of arsenic [As$_2$O$_3$] are formed.31 Palbag et al. proved that after Bhasmikarana of Haratala, apart from sulfur and arsenic, Haratala Bhasma also contains oxygen with wt% of 13.56, due to the formation of oxides of arsenic.34 On the basis of these research, it can be said that marana or Bhasmikarana of Haratala may provide safer bioassimilability before their use in most of the formulations in which it may act as an antagonist and subside the toxicity of the formulations. Bhasmikarana process may enhance the bioavailability of the drug and hence potentiate its action.

The US Food and Drug Administration has approved arsenic trioxide as the standard treatment of relapsed acute promyelocytic leukemia (APL). It is given in a dose of 5–10 mg intravenously for APL, but severe adverse effects like cardiac injury, such as QT prolongation, arrhythmias, cardiac arrest, skin lesions, gastrointestinal symptoms, neuropathy, and liver dysfunction are reported with long-term arsenic trioxide use.35 It is given in a dose of 5–10 mg intravenously for APL, but severe adverse effects like cardiac injury, such as QT prolongation, arrhythmias, cardiac arrest, skin lesions, gastrointestinal symptoms, neuropathy, and liver dysfunction are reported with long-term arsenic trioxide use.35
more beneficial to improve their immunity and strength as well as fever and other associated symptoms. Hence, there is a huge scope of the cellular apoptosis property of arsenic-containing Haratala Bhasma in combating leukemia.

Rasayana Dravya provides physical strength, youth, immunity, sharp memory, intellect and longevity, glow, skin luster, tolerance, adaptation, voice, stability of speech, complexion, and freedom from illness. Mode of action of Rasayana Dravya is a complex process. Hence, it can be explained in terms of properties such as antioxidant, immune-modulator, adaptogen activity, tissue protection, and regeneration, bactericidal and antimicrobial activity and cardiotoxic effect. Acharya Charaka has mentioned Rasayana effects in terms of properties such as Vayasthapan, Ayushkara, Medhakara, and Urjaskara. It indicates that the Rasayana Dravya may act at the level of Rasa by improving specific nutritional values of Poshaka Rasa to obtain excellent quality of Dhatu. The Rasayana Dravya possessing the properties such as Ushna, Laghu, Ruksha and Katu, Tikta, and Kashaya Rasa may act at the level of Agni, vitalizing the organic metabolism leading to an improved structural and function pattern of Dhatu. They may cause Srotoshodhana and production of the Rasayana effects. Rasayana Dravya which influences Oja is supposed to induce Bala and Vyadhikshamatva (immunity). Haratala is Katu, Snigdha, Kashaya, and Ushna. It may act at the level of Agni, improve metabolism, and Dhatvagni leading to production of good quality of Dhatu. It ultimately leads to improved Oja or immunity. Hence, it is helpful in various types of Jwara, infections, blood disorders, and leukemia where Agni, Dhatu, and Oja (immunity) are disturbed. Haratala Bhasma is described in various disease conditions. Hence, it can be used as Avasthika Rasayana.

Although Haratala is effective and popular as Rasamaniyka, it is not used as Rasayana or therapeutic drug in routine practice either in pure or in Bhasma form. The doses are different and the duration of its consumption is not mentioned in the classical texts. The duration is mentioned only in the context of its use as Rasayana, i.e., 21 or 40 days. Hence, long-term use can cause chronic arsenic toxicity if not used under observation.

CONCLUSION

Although Acharya has described the uses of Shuddha Haratala and Haratala Bhasma, in various diseases, they are not used in practice in the current scenario. Shuddha Haratala is used to prepare various formulations as a main ingredient or as an auxiliary drug. As Bhasmikarana may improve bioavailability and potentiate the action of drug, Haratala Bhasma can be used as Avasthika Rasayana in disease conditions. As Haratala contains arsenic, to avoid arsenic toxicity due to formulations of Haratala, proper shodhana and marana methods mentioned in classical texts should be followed. Haratala is a toxic substance, hence precautions should be taken during its prescription as the doses are variable and duration of consumption is not mentioned.

CLINICAL SIGNIFICANCE

Studies should be conducted to observe its efficacy in healthy individuals as Rasayana and in patients of APL as an adjuvant drug.

REFERENCES


A Critical Review on Haratala (An Arsenical Compound)


33. Bhatta Gopal KR, Rasendra Sara Sangraha edited by Dr AD Satpute, Choukhamba Publisher Varanasi; 101.


हिंदी सारांश

हरताल (एक आर्सेनिक योग) की आलोचनात्मक समीक्षा

पृष्ठभूमि: हरताल को धातु विष के रूप में उल्लिखित किया गया है और इसमें आर्सेनिक और गंधक होते हैं। आर्सेनिक एक हेडी नेटल है जो कि एक्यूट अथवा क्रोनिक हेडी नेटल विषाक्तता कर सकती है। यद्यपि हरताल, रसमणिक्य के रूप में प्रभावी एवं लोकप्रिय है, दैनिक अभ्यास में इसका उपयोग रसायन अथवा चिकित्सकीय औषधि के रूप में शुद्ध अथवा शर्म रूप में नहीं किया जाता है। योग को तैयार करने के लिए इसका उपयोग एक मुहूर्त औषधि अथवा सहायक औषधि के रूप में किया जाता है।

उद्देश्य: हरताल की विभिन्न उपयोगिताओं पर ध्यान केंद्रित करना ताकि इसे नैदानिक अभ्यास में रोगों की विस्तृत घृंटिया में सुरक्षित रूप से उपयोग किया जा सके।

समीक्षा परिणाम: उपलब्ध साहित्य में यह देखा गया है कि हरताल की चिकित्सकीय उपयोगिता के साथ हरताल शर्म का उपयोग रसायन के रूप में किया जाता है। लेकिन यदि हरताल के शोधन और मारण को उचित रूप से संचालित नहीं किया जाता है तो हरताल में उपस्थित आर्सेनिक विषाक्तता का कारण बन सकता है। पूर्वशीर्ष शोध से पाया गया है कि शोधन ल्यूकेमिया के उपचार के लिए कोशिकीय एपोप्टोसिस में हरताल के सहक्रियताकी प्रभाव को बढ़ा सकता है। मारण अधिकांश योगों में उनके उपयोग से पहले सुरक्षित बायोएसिमिलिबिली प्रदान कर सकता है जिसमें यह एक प्रतिपक्ष के रूप में कार्य कर सकता है और योगों की विषाक्तता को कम कर सकता है।

निष्कर्ष: हरताल शर्म को विभिन्न रोगावस्थाओं में निर्देशित किया जाता है। इसलिए इसका प्रयोग आवश्यक रसायन के रूप में किया जा सकता है। लेकिन इसके प्रयोग के दौरान उचित शोधन और मारण प्रक्रियाओं का पालन करके औषधि की सुरक्षा सुनिश्चित की जानी चाहिए।

नैदानिक महत्व: स्वस्थ व्यक्तियों में रसायन के रूप में और एक्यूट प्रोमायोलोगितन ल्यूकेमिया (एपीएल) के रोगियों में एक सहायक औषधि के रूप में इसकी प्रभावकारिता का पता लगाने के लिए अध्ययन किए जाने चाहिए।

मुख्य शब्द: आवश्यक रसायन, आलोचनात्मक समीक्षा, धातु विष, हरताल, मारण, शोधन।