Critical review on the pharmaceutical vistas of Lauha Kalpas (Iron formulations)

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ABSTRACT

Iron is one among the major metals present in the earth’s crust and is essential for sound sustenance of human body. Its deficiency leads to various health ailments. Contemporary medicine advises iron supplements in iron deficiency anemia. Ayurvedic classics also quote significant information about administration of iron. Lauha Kalpas are the unique compound herbo-mineral formulations where iron (Lauha) is used as a major ingredient. Relevant literature (Bhaishajya Ratnavali, Charaka Samhita, Rasendra Sara Samgraha etc.) reviewed to gather information about Lauha Kalpas. Critical analysis of these Lauha Kalpas reveals that ancient seers administered iron in a better acceptable form. Unlike popular understanding these are not only Khalviya preparations; but Churna (powders), Avaleha (confectionaries), Rasakriya (solidified decoctions), and Putapaka (incinerated) form of preparations are also found. Apart from solid dosage forms, semisolid dosage forms mentioned in classics are very much useful. Unfortunately most of the formulations are not found in the market. Hence Pharmaceutical firms may bring these unique dosage forms in to the market to supply the healthcare needs of the community. It is interesting that iron preparations are used in Ayurveda in different medical conditions apart from anemia (Pandu). This leaves a scope for further researches on different dosage forms of iron and their indications.

Key words: Ayurveda, Bhasma, Hematinics, Iron, Lauha Kalpa, pharmaceutics, Rasaushadhi

INTRODUCTION

Ayurveda is a well-documented Traditional system of Indian Medicine (TIM). Rasa Shastra, an offshoot of Ayurveda popular from medieval period, mostly deals with therapeutic utilization of metals and minerals.[1,2] Hundreds of formulations are explained in classical texts with the permutation combination of Bhasmas along with herbal ingredients. Careful review shows that there are around 30 types of Bhasmas, which are frequently used. A simple change in the method of preparation and ingredients can bring a change in the action, indication, and efficacy. Hence, it is the need of the hour to critically analyze the formulations and the rationality behind it. This may be a guideline for further research to unravel Ayurveda. Iron is a noncontroversial metal for therapeutic use since centuries in east as well as west. Iron containing drugs are widely used in modern medicine as hematinics. These drugs are known to induce some adverse drug reactions -- gastro intestinal symptoms (nausea, vomiting, epigastric pain, eructation, pyrosis, meteorism, borborygami, colic pain, flatulence, constipation, black feces, and diarrhea). The hematinics market in India is currently worth around Rs. 900 crore and is growing at 15% per annum. Hence it is the need of the hour to search some alternative from other systems of medicine like Ayurveda. Lauha Kalpas can be a better alternative from Ayurveda. Till date, no scientific comprehensive review has been done on Lauha Kalpas. Hence this study is undertaken.

Lauha Kalpas (LK) are formulations which possess Lauha Bhasma (calc of iron) as the major ingredient along with the other herbal ingredients. These formulations have “Lauha” as suffix in their name. Some Lauha Kalpas possess other mineral ingredients including mercury along with Lauha as main ingredient.

Background
Charaka Samhita quotes the nonexistence of any entity
which is not a medicine (*Nananshodhi*) in the universe. Acharya Charaka further elucidates that every object can be a medicine if used wisely with a logical thought (*Yukthi*). Considering this fact, the three forms of natural materials -- herbal, mineral, and animal origins were subjected to trials and their therapeutic values were established. Due to the toxic nature of the minerals and metals, they were less used for the internal administration compared to herbs. Conversion of metals into suitable consumable medicinal form is found in the preparation of *Lahadi Ratayana* and *Ayaskriti*. In the *Sambhita* period, iron (*Ajas-Lauha*) was used in the form of fine powder. Later *Rasa shastra* classical texts explained the *Shodhana* and *Marana* methods.

Some researches have been carried out on individual *Lauha Kalpas* like *Navayasa Lauha*, *Nayanamrita Lauha*, *Sapthamrita Lauha*. According to Ayurvedic Formulary of India, *Lauha Kalpas* are the formulations of *Lauha Bhasma* (*LB*) as main ingredient added to other drugs. The drugs are reduced to fine powder and mixed with *Lauha Bhasma*. The *Bhavana* process is carried out with prescribed liquids if mentioned. When well protected from moisture and heat, they preserve their potency for a period of about 10 years. Preparations containing mercury or its compounds preserve their potency indefinitely.

**MATERIALS AND METHODS**

Important texts of *Ayurveda* commencing from Charaka *Sambhita* (CS) to *Rasa Ratna Samuchaya* (RRS), Rasendra Sara *Samgraha* (RSS), and *Bhaishajya Ratnavali* (BR) have been the sources for *Lauha Kalpas*. BR being a comprehensive source for *LK*s was the main source and the other important formulations are selected from other classics and enumerated according to the method of preparation.

Only the formulations having suffix as *Lauha* are considered for the study. The other *Lauha Bhasma* containing dosage forms such as *Asava* and *Arishta* (alcoholic formulations) are excluded from the study.

Quantity of *Lauha Bhasma* in few formulations is quoted as “*Sarva dravya samam Lauham*” which means 50% of the formulation will be *Lauha Bhasma*. In other formulations the quantity is calculated in accordance with the solid constituents, where in the ingredients like decoctions (*Kwathas*), fresh juices (*Swarasas*), ghee (*Ghirita* - clarified butter), and honey (*Madhui*) are not taken into consideration. Calculation is based on the raw ingredients taken prior to the pharmaceutical processes. Hence the percentage in the final product may change except in *Churnas*.

**Method of calculation**

Percentage of $LB = \frac{100}{weight of \ LB/weight of \ total}$ solid ingredients (including *LB*). E.g., in *Mahamrityunjaya Lauha* (BR 41/136-45) total weight of all ingredients (mineral and herbal) is 17 *Tola* (i.e., $17 \times 12 = 204$ g out of which 2 *Tola* (24 g) is *LB*). *Bhavana Dravya*, *Guduchi*, and *Ardraka Swarasa* are not considered for calculation.

Percentage of $LB = \frac{100}{24} \times 204 = 11.76$, i.e., approximately 12%

**Churna Lauha Kalpa (Powder mixtures)**

*Churnas* (powder mixtures) are prepared by pounding the dry drugs and then sieving through a fine cloth or sieves. *Lauha Kalpa* in *Churna* form are prepared by adding the fine powder of the herbal drugs to the *Lauha Bhasma* and triturated (dry) until homogenous mixture is obtained [Table 1].

**Khalviya Lauha Kalpa**

Herbal juices advocated are added to mixture of the metals-minerals (*Bhasmas*) and herbs and then triturated till the liquid portion is totally dried. The liquid added should be optimum to form soft or soggy mass [Table 2].

Some formulations do not contain herbal ingredients. The mineral ingredients are triturated with advocated herbal juices [Tables 3-6].

**Lauha Rasakriya Kalpa**

When primary liquid dosage forms are boiled until thicker consistency is attained, so that they can be rolled as pills, it is called *Rasakriya*. Here *Lauha Bhasma* is boiled along with different herbal juices and decoctions until it converts to solid dosage form [Table 7].

**Lauha Avaloha Kalpa**

Literally, *Lehya* refers to that which is consumed by licking. It is a semisolid dosage form, prepared by solidifying the decoctions, etc., primary liquid dosage forms by boiling along with sugar-, jaggery-like sweetening agents and after it attains proper consistency fine powders of drugs (*Prakshetra Dravya*), ghee, and honey are added [Table 8].

**Putapaka Lauha Kalpa**

The formulations which are prepared by the incineration method (*Puta Paka*) are included under this group. *Puta* indicates the specific quantum of heat required for conversion of a particular metal--mineral into an assimilable medicine using the suitable incineration method [Table 9].

**DISCUSSION**

Ancient *Ayurveda* even after centuries is an inspiration
### Table 1: Churna Lauha Kalpas

| Compound name                  | Reference | Mineral ingredients |
|--------------------------------|-----------|---------------------|
| Chandanadi Lauha              | BR-(Jwara) 5/1145 | LB (50%) |
| Manasarunadaya Lauha           | BR-(Arsha) 9/212  | LB (50%) |
| Vidangadi Lauha-1             | BR-(Pandu) 12/31  | LB (50%) |
| Darvyadi Lauha                | BR-Pandu 12/37   | LB (50%) |
| Dhati Lauha                   | BR-(Pandu) 12/30  | LB (20%) |
| Navayasa (Lauha) Churna        | CS Pandu Chikitsa 16/70-1 | LB (50%) |
| Satamulyadi Lauha             | BR-(Rakta Pitta) 13/75-6 | LB (50%) |
| Shankaradya Lauha             | BR-(Rakta Pitta) 13/77  | LB (50%) |
| Raktapittantaka Lauha          | BR-(Raja Yakshma) 14/84-5 | LB (50%), Shilajit |
| Yakshmantakha Lauha            | BR-(Raja Yakshma) 14/86  | LB (50%), SMB, Shilajit |
| Shilajitvadi Lauha             | BR-(Raja Yakshma) 14/87-8 | LB (50%), RB, AB |
| Sama Shankarada Lauha (Kasa)   | BR-(Kasa) 15/116-20 | LB (2%) , AB, YK |
| Guduchyadi Lauha              | BR-(Vataraakta) 27/59 | LB (50%) |
| Tripaladi Lauha               | BR-(Amavata) 29/99-101 | LB (33%) |
| Triphala Lauha                | BR-(Shula) 30/128  | LB (50%) |
| Vaishvanara Lauha              | BR-(Shula) 30/337-9  | LB (50%) Shambhuka Bhasma, Saindava |
| Shilajitwadi Lauha             | BR-(Kasa) 15/121-26 | Saindava Lavana |
| Amla Pittantaka Lauha          | BR-(Amalapitta) 42/31-2 | LB (67%) |
| Varunadya Lauha                | BR-(Asmari) 36/44-47 | LB (2.75%), AB |
| Tryushanadya Lauha             | BR-(Medoraga) 39/26-29 | LB (50%), Chatur Lavana |
| Pippalyadi Lauha-2             | BR-(Udara) 40/130  | LB (50%), AB, Saindava Lavana |
| Rohitaka Lauha                 | BR-(Pliva Yakrit roga) 41/117 | LB (50%) |
| Shothari Lauha                 | BR-(Shotha) 42/133  | LB (50%), YK |
| Suvarchadala Lauha             | BR-(Shotha) 42/134  | LB (50%) |
| Pradarantaka Lauha             | BR-(Shitha) /119-22 Mutra kricra | LB (16.7), RS, TB, |
| Vaishvanara Lauha              | BR-(Shula) 30/337-9  | LB (50%) Shambhuka Bhasma, Saindava |
| Sama Shankarada Lauha (Kasa)   | BR-(Kasa) 15/116-20 | LB (2%) , AB, YK |
| Virdda darvyadi Lauha          | BR-Amavata (Parishishta) /110-1 | LB (50%) |
| Madhukandaya Lauha             | BR-(Netra Roga) 64/231 | LB (20%) |
| Trikatwadi Lauha               | BR-(Amavata) 29/99-101 | LB (33%) |
| Varunadya Lauha                | BR-(Asmari) 36/44-47 | LB (2.75%), AB |
| Tryushanadya Lauha             | BR-(Medoraga) 39/26-29 | LB (50%), Chatur Lavana |
| Pippalyadi Lauha-2             | BR-(Udara) 40/130  | LB (50%), AB, Saindava Lavana |
| Rohitaka Lauha                 | BR-(Pliva Yakrit roga) 41/117 | LB (50%) |
| Shothari Lauha                 | BR-(Shotha) 42/133  | LB (50%), YK |
| Suvarchadala Lauha             | BR-(Shotha) 42/134  | LB (50%) |
| Amla Pittantaka Lauha          | BR-(Amalapitta) 56/33 | LB (16.7), RS, TB, |
| Pradarantaka Lauha-2           | RT-20/118-22    | LB (11%), VB, Goinka, |
| Tapyadi Lauha-2                | AH-(Pandu.Ch)16/20-2 | SMB, RB, LB (12%), MB, Shilajit |

### Table 2: Khalviya formulations: Prepared by using water for Bhavana

| Compound name                  | Reference | Mineral ingredients |
|--------------------------------|-----------|---------------------|
| Sarvajwara hara Lauha          | BR-(Jwara) 5/1170-4 | LB (50%) |
| Varunadya Lauha                | BR-(Medo roga) 39/22-5 | LB (50%) |
| Chandramita Lauha              | BR-(Kasa) 15/121-26 | LB (50%) Saindava Lavana |
| Vishamajwarantaka Lauha-1      | BR-(Jwara) 5/1146-50 | LB (50%), AB, Rasaka Bhasma, Manashila |
| Yakridhari Lauha               | BR-(Pliva Yakrit roga) 41/129-31 | LB (22%), AB, TB, |
| Pradarantaka Lauha             | BR-(Udara) 66/79-83  | LB (3.3), TB, VB, AB, Haratala, Kapardika |

### Table 3: Khalviya formulations: Prepared by Bhavana with herbal juices having only mineral ingredients

| Compound name                  | Reference | Mineral ingredients |
|--------------------------------|-----------|---------------------|
| Vishamajwarantaka Lauha-2       | BR-(Jwara) 5/1152-4 | LB (50%), Kajjali, TB, SMB |
| Sarvajwarahara Lauha (Brihat-2) | BR-(Jwara) 5/1180-92 | KLB (33%), Kajjali, Swb, RB, TB, SMB, AB, Haratala |
| Yakrithodarari Lauha            | BR-(Pliva Yakrit roga) 41/162-66 | LB (50%), Swb, RB, TB, VB, AB, SMB |
| Vadavagni Lauha                 | BR-(Medoraga) 39/30-1 | LB (25%), RS, Haratala, TB |

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Table 4: Khalviya formulations: Prepared with Bhavana of Sneha dravya (oil and ghee) and Madhura dravya (Sugars, Jaggery, and Honey) and Drava Dravya (Herbal juices and decoctions)

| Compound name                        | Reference          | Mineral ingredients         | Sneha dravya, Madhura dravya and Drava Dravya for Bhavana |
|--------------------------------------|--------------------|-----------------------------|----------------------------------------------------------|
| Ashtadashanga Lauha (Kiratadi Mandura) | BR-Pandu 12/34-36  | LB (50%)                    | Honey, Cow’s Ghee                                        |
| Yograja                              | C.S Chi. Pandu 16/78-86, BR-(Pandu) 12/109-15 | LB (12.8), SMB, Rajata Makshika Bh, Shilajit               | Sugar candy, Honey                                       |
| Maha Shwasari Lauha                  | BR-(Hikka Shwasa) 16/39-41 | LB (15.3%), AB, Vamsalochna  | Sugar candy, Honey                                       |
| a=Saptamrita Lauha                   | BR-(Shula) 30/120 64/234-36 | LB (50%)                    | Honey, Cow’s Ghee                                        |
| Yakshmari Lauha                      | BR-(Rajayakshma) 14/83 | LB (50%), SMB, Shilajit      | Cow’s Ghee                                               |
| Shularaja Lauha                      | BR-(Shula) 30/131-36 | KLB (3.7%), AB              | Sugar candy, Honey                                       |
| Trikatrayadi Lauha                   | BR-(Pandu) 12/38-43 | KLB (9%), MB                | Honey, Cow’s Ghee, five types of Sharkara (sugars)       |
| *Pippalyadi Lauha-1                  | BR-(Hikashwasa) 16/42-3 | LB (16%), TB, AB, Kajali (Dviguna), SMB, Manahshila, Shilajit | Honey, Cow’s Ghee                                        |

Table 5: Khalviya formulations: prepared by Bhavana of both mineral and herbal ingredients (solid dosage form)

| Compound Name                        | Reference          | Mineral ingredients         | Bhavana Dravya                                          |
|--------------------------------------|--------------------|-----------------------------|---------------------------------------------------------|
| Kamalantaka Lauha                    | BR-(Pandu) 12/44-51 | LB (23.5%), AB, MB, VB      | Kesarajra, Bringaraja, Somaraj (Bakuchi), Manduka parni |
| Kalamegha Navayasa Lauha[11]         | SYS-(Pandu)        | LB (50%)                   | Kalamegha (Bhavana 7days)                               |
| Langalyada Lauha                     | BR-(Vatarkota) 27/64-66 | LB (50%)                   | Nimbu Swarasa, Triphala Kwatha                          |
| ‘Dhatri Lauha(Shula)-1               | BR-(Shula) 30/149-58 | LB (28.5%)                 | Guduchi Kwatha                                          |
| Dhatri Lauha(Shula)-2                | BR-(Shula) 30/159-62 | LB (4%), MB, AB             | Yava, Satavari Swarasa, Amalaki Swarasa                 |
| Shlipadari Lauha                     | BR-(shilpada) 45/39-40 | KLB (20%), Shilajit         | Triphala Kwatha                                         |
| Karsyahara Lauha                     | BR-(Rasayana) 73/55-6 | LB (50%)                   | Bringaraja Swarasa                                      |
| Tandavari Lauha                      | BR (Tandava Roga) 80/4-5 | LB (75%), Shanka Pashana (Arsenic oxide), YB | Bhang, Kuplu, Arjuna Kashaya                            |
| Bala Yakruddhari Lauha[11]           | Bala roga          | LB (12.5%), 1000 Puti AB, RS, Ayurved Vignan | Guduchi Swarasa                                         |
| Nayanamrita Lauha[11]                | RSS 2-Netra roga/9-12 | LB (5%), AB                 | Triphala Kwatha, Bringaraja Swarasa                     |

Table 6: Khalviya formulations: Prepared with mercurial ingredients (Kajjali and Rasa Sindhura) and Bhavana with herbal juices

| Compound name                        | Reference          | Mineral ingredients         | Bhavana Dravya                                          |
|--------------------------------------|--------------------|-----------------------------|---------------------------------------------------------|
| Sarvajwarahara Lauha (Brihat-1)      | BR-(Jwara) 5/3175-9 | LB (44.5%), Kajjali         | Ardraka Swarasa                                          |
| Jwarantaka Lauha (Brihat)            | BR-(Jwara) 5/3193-203 | LB (1.7%), AB, RB, Kajjali, SwB, Shilajit, Saindhava, Vida Lavana | Ardraka Swarasa                                          |
| Pittantaka Lauha                     | BR-(Vatarkota) 27/60-63 | LB (50%),Kajjali, AB, TB    | Guduchi Swarasa                                          |
| ΔYakritplihari Lauha                 | BR-(Pliha Yakrit Roga) 41/123-28 | LB (9%), Kajjali, AB, TB, Manahshila, Shilajit, Tankana | Danthimula, Trivrit, Chitraka, Sandhalu, Trikatu, Ardraka, Bringaraja swarasas |
| Yakridari Lauha (Brihat)             | BR-(Pliha Yakrit roga) 41/232-5 | LB (50%), Kajjali, AB      | Guduchi Swarasa                                          |
| Mahamritunjaya Lauha                 | BR-(Plihayakrit roga) 41/136-45 | LB (12%), Kajjali, AB, TB, Sarja, YK, Saindhava, Vida Lavana, Varatika, Shankha Bhasma, Manahshila, Haratala, Tuttha, | Ardraka Swarasa, Guduchi Swarasa                        |
| Sarveswara Lauha                     | BR-(Plihayakrit roga) 41/146-53 | LB (7.4%), Kajjali, AB, TB, SMB | Ardraka Swarasa                                          |

for the researchers to think beyond their imagination and knowledge. The same is true with pharmaceutical aspects. A better understanding of Ayurveda is adding up new things to the existent pharmaceutical excellence. Rasas are the formulations which are discussed in present era for right or wrong reasons. Even after this...
hue and cry it is impossible to discard them due to their effectiveness. Rasaśādhis (herbomineral formulations) are being prescribed by Ayurvedic physicians since long with a rare mention of toxicity. It is observed that herb–mineral complexes are more stable and more interactive compared to plain herbs as these result in faster therapeutic action and having a longer shelf life.\[25\] Compound name Reference Mineral ingredients Kwatha Dravya

| Compound name | Reference | Mineral ingredients | Kwatha Dravya |
|---------------|-----------|---------------------|---------------|
| Lakshmana Lauha | BR-(Pradara) | Kajjali, MB, KLB (20%), AB, MB, Pravala | Lakshmana |
| Pradarari Lauha | BR-(Pradara) | Kajjali, MB (50%), AB, | Kutoja Kwatha |

After careful review of Lauha Kalpas, it is found that unlike popular understanding they all are not only Khaliya preparations but can be classified based on the methods of preparation into Churna Lauha Kalpa, Khaliya Lauha Kalpa, Rasa Kriya Lauha Kalpa, Avaleha Lauha Kalpa, and Puta Paka Lauha Kalpa. Other than these listed formulations, special

Table 7: Rasa Kriya Lauha Kalpas: Formulations prepared by boiling decoctions until solidification

| Compound name | Reference | Mineral ingredients | Kwatha Dravya |
|---------------|-----------|---------------------|---------------|
| *Vidangadi Lauha-2 | BR-(Pandu) | Kajjali, Vajra, Pandaylaha Loha (25%), AB, MB | Cow's urine |
| *Tapyadi Lauha-1 | AH-(Pandu Ch) | Kajjali, Vajra, | Cow's urine |
| Vidangadi Lauha (Amavata) | BR-(Amavata) | Kajjali, MB (17%), AB | Satavari, Cow's milk |
| Panchanana Rosa Lauha | BR-(Amavata) | Kajjali, MB (50%), AB, Kankanusha, | Punarnava, Guduchhi, Chitraka, Indrayana, Mana Kanda, Shishra, Suryavarta, Arka Kwatha, Cow's Ghee, Arka, Snuhu Kshira, Guggulu, |
| Shothodarani Lauha | BR-(Udara) | Kajjali, MB (50%), AB, | Cow's urine |

Table 8: Avaleha Lauha Kalpas: Prepared by boiling decoctions with sugar or jaggery

| Compound name | Reference | Mineral ingredients | Kwatha Dravyas |
|---------------|-----------|---------------------|---------------|
| Amla Pittantaka Lauha-2 | BR-(Amalapitta) | Cow's urine, honey |
| Lakshmana Lauha | BR-(Pradara) | Cow's urine, honey |
| Pradarari Lauha | BR-(Pradara) | Cow's urine, honey |

Table 9: Formulations prepared with Puta Paka method

| Name of the formulation | Reference | Mineral ingredients | Herbal drugs and method processing |
|-------------------------|-----------|---------------------|-----------------------------------|
| *Puta Paka | BR-(Arsha) | LB (30% to Kwatha Dravya), Shilajit | Trivrit, Chitraka, Nirgundi, Snuhi, Mundi/Mundtaksi, Bhuyamalki, Cow's Ghee, sugar |
| Vishamajwarantaka Lauha | BR-(Raktapitta) | LB (50% to Kwatha Dravya), Shilajit | Satavari, Vasa, Guduchi, Bala Mundi, Musali, Khadira, Triphala, Barangi, Pushkaramula, | Guda (Jaggery) |
| Sama Sharka Lauha | BR-(Raktapitta) | LB (80% to Prakshepa -Vidanga) | Cow's milk (4 times to LB), Cow's Ghee, (2 times to LB), Honey, Sugar candy |
| Chatuhsama Lauha | BR-(Shula) | LB (25% in mineral ingredients), Kajjali, AB, | Cow's Ghee, Cow's milk |
| Rasayanamrita Lauha | BR-(Gulma) | LB (44.5%), AB, Saindava Lavana | Sugar candy, Triphala Kwatha, Jambhiri Nimbhu, Cow's Ghee |
| Yakritplihodarahara Lauha | BR-(Pilha Yakrit roga) | LB (50% in mineral ingredients), AB, RS, Pancha Lavana, YK | Triphala Kwatha, Satavari Swarasa, Cow's Ghee |
| Amrithankura Lauha | BR-(Kushtha) | LB (12%), RS, Gandhaka, LB, AB | Triphala Kwatha, Cow's Ghee |

* - Formulations mentioned in AFI part sand, ∆- Formulations available in the market (source -Ayurvedline) AH-Ashtanga Hridaya, YR-Yoga Ratnakara, SYS-Siddha Yoga Samgraha, RT- Rasa Tarangini, LB-Lauha (Iron or Steel) Bhasma, KLB-Kanta Lauha (Magnetite or Lodestone) Bhasma, MB-Mandura (Iron rust) Bhasma, RB- Rajata (Silver) Bhasma, VB-Vanga (Tin) Bhasma, SMB- Swarna Makshika (Copper pyrite) Bhasma, SwB- Swarna (Gold) Bhasma, YK - Yava Kshara

* - Formulations available in the market (source -Ayurvedline) AH-Ashtanga Hridaya, YR-Yoga Ratnakara, SYS-Siddha Yoga Samgraha, RT- Rasa Tarangini, LB-Lauha (Iron or Steel) Bhasma, KLB-Kanta Lauha (Magnetite or Lodestone) Bhasma, MB-Mandura (Iron rust) Bhasma, RB- Rajata (Silver) Bhasma, VB-Vanga (Tin) Bhasma, SMB- Swarna Makshika (Copper pyrite) Bhasma, SwB- Swarna (Gold) Bhasma, YK - Yava Kshara

Table 9: Formulations prepared with Puta Paka method

| Name of the formulation | Reference | Mineral ingredients | Herbal drugs and method processing |
|-------------------------|-----------|---------------------|-----------------------------------|
| *Puta Paka | BR-(Jwara) | LB (9.6%), Parpati, SB, AB, BV, Gairika, Pravala, Mukta, Shankha, Bhukti | LAGHU PUTA |
| Shankara Lauha (Dumamari Lauha) | BP Madyama Khanda-(Arsha) | LB, RB (prepared applying Manashila, Parada, SMB for Shodhana) | Triphala, Ardaka, Bhringaraja, Manakanda, Sura, Bhumylaksha, Chitraka, Cow's Ghee LAGHU PUTA |

Rasa Kalpas are formulations which are safe, effective, and noteworthy compound formulations of iron. Prior to the period of Rasa Shastra, Lauha was used in the form of ultra fine powders (Anjana sadrīśa -- collyrium like). A number of references for internal administration of Lauha and noble metals like gold and silver are found in our classics, as they are relatively less toxic than other metals in elemental form.\[26,27\] In the medieval period, the internal administration of all metals and minerals became possible because of the invention of pharmaceutical technology of converting metals and minerals into Bhasmas, i.e., detoxification, (Shodhana) converting into powders (Jarana, causing decay of metals) and incineration (Marana, killing metallic properties) methods.
pharmaceutical preparations like *Parpati* (e.g., *Rasa Parpati*, *Panchamrita Parpati*), *Asava*, and *Arishta* are also described.

The percentage of LB varies from as less as 2–75% ([Juvarntaka Lauha -- 1.7%], *Vidangadi Lauha -- 29%, Tandavari Lauha -- 75%) in *Lauha Kalpas*. Many formulations contain 50% of LB. Herbal ingredients found in maximum formulations are *Trika* *Traya*.[9]

*Khahriya Lauha Kalpas* are prepared by wet trituration (*Bhavana*, impregnation) with liquid ingredients, i.e., decoctions and herbal juices. In few formulations, water is used as a media for *Bhavana*. Wet trituration (*Toya Sannikarsha*) facilitates particle size reduction and homogenization leading to modification of properties (*Gunnannbaradhana*) of the end product.[28] In the pharmaceutical preparation of *Chauthastha Prabha Pippali*, it was observed that the number of *Bhavana* with *Pippali Kavatha*, was inversely proportional to the piperine content.[29] With this information inference can be drawn that reduction of piperine is anticipated in this particular formulation, justifying the significance of the *Bhavana* process. In another work, which was intended for the study of shelf life and interactions of *Vidangadi* with iron-in-iron containing formulations like *Vidangadi Lauha*, *Chandanadi Lauha*, and *Navayasa Churna* showed the reduction of embelin content observed in 6 months shelf life studies. *Navayasa Lauha* decreases less compared with other two formulations. This study concludes that iron can interact and can react with embelin and form a complex.[30]

*Triphala* mainly consists of tannin, gallic acid, ascorbic acid (vitamin c), and phenolics. Ascorbic acid increases the bioavailability of iron by converting Fe$^{3+}$ to Fe$^{2+}$, while phenolics can reduce the iron by binding to it. The presence of ascorbic acid or a lack of dietary tannins has both been considered as contributing to clinical/pathological iron storage disease. Too much iron is toxic. It can damage the liver, heart, and pancreas and irritate the stomach and gut, causing constipation and diarrhea. In other words, this may also be taken as the various constituents of *Triphala* have antagonizing activity. Thus, too much iron absorption is prevented.[31] *Triphala* is a mild laxative and thereby counteracts the constipating property of iron and thus be beneficial due to which *Acharyas* might have mentioned *Triphala* in maximum *Lauha* formulations.

The findings from one study suggested that *Triphala* and its individual constituents have an inhibitory effect on metabolic enzymes when consumed along with therapeutic products. Further the inhibitory effects were relatively comparable to all the constituents tested, despite the variability of the content of biomarker. *Triphala* and its ingredients are likely to inhibit drug metabolizing enzymes, but less likely to produce significant drug interactions. Certain major factors of metabolism such as competition between coadministered drugs, unspecific interactions with proteins, and enzyme induction due to chronic intake are not addressed in that *in vitro* assay. However, one study clearly suggested that herbal products containing gallic acid may have the potential to inhibit the metabolism of certain coadministered drugs.[32] Hence a conclusion can be drawn that the presence of *Triphala* is a facilitator in the formulations.

Many formulations are said to be triturated with honey and sugar, due to which it becomes difficult to store them in tablet form, as honey and sugar (as liquids added while preparation) are hygroscopic and they become semisolid. Hence they have to be stored and consumed in semisolid form. Same is the problem with formulations containing Cow’s ghee. *Sapthamrita Lauha* and *Madhukadi Lauha* both comprise *Triphala*, *Yashas* as ingredients. Honey and Cow’s ghee are ingredients in *Sapthamrita Lauha* but they are *Anupana* (vehicle, adjuvant) in *Madhukadi Lauha*. Ideally *Sapthamrita* *Lauha* has to be prepared by adding honey and ghee and should be in semisolid dosage form and *Madhukadi Lauha* should be solid dosage form. But *Sapthamrita Lauha*, which is available in the market, is in solid dosage form[33] and devoid of honey and ghee, hence it will be rational to name it as *Madhukadi Lauha*.

It is understood that many proteins play significant role in absorption of iron from intestine (such as hespidin, DMT-1, ceruloplasmin) and are also required for efflux of iron from enterocytes. Iron supplements require bioavailability enhancers to minimize the side effects. Herbomineral formulations can be used to reduce various side effects as the processing of various herbal juices with already processed and micro-fined minerals lead to the formation of herbomineral complexes. These complexes upon interaction with digestive juices adopt a colloidal form, for faster absorption. Sometimes they play a catalytic role facilitating absorption of other nutrients and correcting a disease process.[34]

Few *Khahriya Lauha Kalpas* comprise *Paraada* (Hg), *Gandhaka* (S) as ingredients. Initially *Kajjali* (HgS -- black) has to be prepared, later remaining powders are subjected for wet trituration and pills are to be made. These two types of formulations can be made into pills and stored; hence these are solid dosage forms. Few are prepared by adding mineral ingredients in decoctions, fresh juices and cow’s urine, etc. and boiled, after it obtains proper consistency the remaining herbal ingredients (*Prakshapa dravya*) are to be added and pills are to be made. Cow’s urine if taken has to be eight times to that of the quantity of LB.

Most of the LKs do not comprise mercury as an ingredient...
Lauha disease conditions. That other ingredients of LK, processes and dosage have used iron as a part of formulations. It is evident Pandu hence pharmaceutical houses can manufacture and make market and but suits the present day healthcare demand. A number of formulations which are not available in the market. It is need of the hour for the pharmaceutical houses to work in this aspect and make these formulations available to the needy population.

Lauha by virtue of its potential can be administered in various dosage forms (Bahu Kalpam) and thus fulfilling the criteria of an ideal medicine. It is understood that iron and its salts produce gastric intolerance. Hence Acharyas have used iron as a part of formulations. It is evident that other ingredients of LK, processes and dosage forms explained are in line to improve the acceptability by patients of different body types and ages in indicated disease conditions.

Lauha Kalpas are mentioned for different ailments like Pandra (anemia), Arsha (hemorrhoids), Rakta Pitta (bleeding disorders), Shhula (pain of different origin), Jwara (fevers), Yakrit Pliha Roga (diseases of liver and spleen), Udara (dropsy), Avikata (rheumatic arthritis), Vata Rakta (gout), Kushta (skin disorders), Medo Roga (obesity), Tandava Roga, Gulma, Kaasa (cough) and Shwasa (dyspnoea). The role of Lauha in a specific formulation has to be ascertained by an erudite researcher in a respective disease condition. There are many LKs, especially semisolid dosage forms which are mentioned in classical texts but these are not available in the market. It is need of the hour for the pharmaceutical houses to work in this aspect and make these formulations available to the needy population.

CONCLUSION

From pharmaceutical viewpoint all Lauha Kalpas are not only Khaliya Anushadhis (prepared by Bhavana, impregnation -- wet trituration with simple water to different herbal juices). They are Churnas (mixtures -- prepared by dry trituration), Rasakriya (solidified formulations -- prepared by boiling of decoctions, herbal juices and even cows urine), Ayaleha (confectionery), and Puta Paka (calcination products) formulations. Based on the method of preparation, shelf life, pharmacological action, indication varies. There are number of formulations which are not available in the market and but suits the present day healthcare demand. Hence pharmaceutical houses can manufacture and make them available.

Herbs found repeatedly in the formulations irrespective of indication are Trika Traya. These might have some role (bio enhancer) in absorption, distribution, metabolism, and excretion of iron. This work may serve as preliminary data and can be a torch bearer for the further studies on Lauha Kalpas.

Notes:

i. Shodhana: It is a procedure, where the metal or mineral or other poisonous substances are subjected to specified pharmaceutical procedures like trituration etc. with required plant or animal products so as to remove unwanted properties, if any.

ii. Marana: Literal meaning of Marana is killing. In this process of Marana, minerals are incinerated to obtain Bhasma. The minerals which have undergone the process of Shodhana are ground with specified liquid to form a paste. This paste is flattened into small discs (Chakrikas) and dried. These discs are then kept in between two convex earthen plates (Sharave) and sealed with the help of mud soaked cloth strips. After complete drying this is kept in the pit of Puta, containing Vanyopala (cow dung cakes), and ignited. After self-cooling, it is taken out and the baked discs are removed and powdered. This whole process makes one Puta. It is repeated for several times to obtain the Bhasma.

iii. Tola: It is a measurement used in Ayurvedic classics (1 Tola=12 g).

iv. Bhasma: Bio-accessible forms of minerals and metals intended for internal administration obtained after Shodhana and Marana.

v. Kshara: Alkaline inorganic substances obtained from the ash of herbal drugs.

vi. Trikatrana: Formulation containing Triphala, Trikatu, Trimada.

vii. Triphala: Formulation containing Amalaki (Emblica officinalis) Vibhitaki (Terminalia bellierica), Haritaki (Terminalia chebula).

viii. Trikatu: Formulation containing Pippali (Piper longum), Shunthi (dry ginger- Zingiber officinale), Maricha (Piper nigrum).

ix. Trimada: Formulation containing Vidanga (Emblica ribes), Musta (Cyperus rotundus), Chitraka (Plumbago zyylanica).

x. Chatur Lavana (four salts): Formulation containing Vida Lavana (factious salt procured by boiling earth impregnated with saline particles), Andibida Lavana (fossil salt), Saindhava Lavana (rock salt), Sauvarchala Lavana (sochol salt, prepared by boiling down soda with embelic myrobilon).

xi. Pancha Lavana (five salts): Formulation containing Chatur Lavana and Samudra Lavana (sea salt).
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