Preparation of darvyadi loha churna: An ayurvedic formulation for iron deficiency anemia

Dr. Visal S Kumar, Dr. Prathviraj Puranik and Dr. Nagaratna S Jartarghar

Abstract
Iron deficiency anemia (IDA) is considered to be one of the most prevalent forms of malnutrition which affects over 30% of the world population. Choorna Kalpana is one among the most predominantly used Ayurvedic pharmaceutical preparations. It is a fine powder of herbs or group of herbs and sometimes added with processed mineral or metal, salt or sugar. Darvyadi Loha is a herbo mineral preparation mentioned in Ayurvedic classics for the management of Pandu Roga. On analyzing the clinical features for Pandu, it can be correlated with Iron deficiency anemia mentioned in the contemporary sciences. The formulation Darvyadi Loha contains Darvi (Berberis aristata DC.), Haritaki (Terminalia chebula Retz.), Vibhitaki (Terminalia bellirica Roxb.), Analamaki (Emblica officinalis Gaertn), Pippali (Piper longum Linn.), Maricha (Piper nigrum Linn.), Shunti (Zingiber officinalis), Vidanga (Embelia ribes Burm.) and Loha Bhasma (incinerated iron). This formulation was prepared according to the principles of preparation of Choorna Kalpana and by using modern pharmaceutical equipment. In this article, details of the individual drugs of Darvyadi Loha Choorna and the method of preparation of the formulation have been detailed.

Keywords: Choorna, darvyadi loha, pharmaceutical, iron deficiency anemia, pandu roga

Introduction
Pandu Roga is one among the Rasa Pradoshaja Vikara [1] mentioned in the Ayurvedic classics and is associated with Rakta palita and Panduata of the body, where the lustre of the body is expalined as Ketaki Dhuli Samihba [2]. On analyzing the clinical features of Pandu Roga it can be correlated with the Iron deficiency anemia (IDA) mentioned in the contemporary sciences. IDA is a very common disease prevalent in the society and side effects of oral allopathic iron preparations are frequently encountered [3]. Darvyadi Loha is a herbo mineral compound preparation mentioned in Ayurvedic treatises for the management of Pandu Roga. The aim behind the administration of any formulation is to reach out the target tissue or organ for reversing the disease pathology. For this, various pharmaceutical preparations termed as “Kalpanas” and “Upakalpanas” were mentioned in Ayurveda. Choorna Kalpana is one such widely used preparation which is an Upakalpana of Kalka Kalpana [4].

Choorna is a fine powder of herbs or group of herbs and sometimes added with processed mineral or metal, salt or sugar [4]. They are the mixture of dry substances reduced to fine form and intimately mixed together. The method of mixing, greatly effect the miscibility of the powders. And in Choorna Kalpana, since the particle size is small, it produces rapid dissolution in the body fluids than other solid dosage forms and thereby concentration of drug in the circulation is more in lesser time. Also it can be easily administered with the Anupana mentioned for the formulation, especially to the patients who cannot swallow solid dosage forms [5].

The formulation Darvyadi Loha contains one part each of 8 herbal drugs and Loha Bhasma and is an active amalgamation for the treatment of Pandu Roga or IDA. This article highlights the different ingredients and the method of preparation of Darvyadi Loha Choorna.

Materials and Methods
Ingredients of the formulation are:
1. Darvi (Berberis aristata DC.)
2. Haritaki (Terminalia chebula Retz.)
3. Vibhitaki (Terminalia bellirica Roxb.)
4. Amalaki (Emblica officinalis Gaertn.)
5. Pippali (Piper longum Linn.)
6. Maricha (Piper nigrum Linn.)
7. Shunti (Zingiber officinalis)
8. Vidanga (Embelia ribes Burm.)
9. Loha Bhasma (Incinerated iron)

Daru (Berberis aristata DC.)[8]
It is an erect glabrous spinescent shrub and belongs to the family Berberidaceae. It contains Berberine, oxyysterberine, berbamine, arimaline, karachine, palmitin, oxycanthine and taxilamine. Pharmacological activities of the plant includes antipyretic, hypoglycaemic, gastro irritant, local anaesthetic, anti cancerous, anti coagulant, anti bacterial, anti protozoal, anti inflammatory anti trachoma, CNS depressant and fresh berries are laxative in action.

Useful part: root, stem, fruit, extract (Rasanjana)

Ayurvedic properties
Rasa: Tikta, Kashaya (Rasanjana – Katu)
Guna: Raksha, Laghu
Veerya: Ushna
Vipaka: Katu
Doshaghnata: Kapha Pitta Shamaka

2. Haritaki (Terminalia chebula Retz.) [9]
It is one of the ingredients in Triphala and belongs to family Combretaceae, well known by name Chebulik myrobalan. Preliminary studies for photochemical screening suggest the presence of Antharquinone glycoside, chebulinic acid, and commonly called as Belliric myrobalan. Chemical constituents present in this drug includes Chebulagic acid, ellagic acid and its ethyl ester, gallic acid, fructose, galactose, mannotol and rhamnose, B- sitosterol and bellerican (fruits), protein and oxalic acid (seed), oxalic acid and tannins (bark), palmitic, oleic and linoleic acids (kernel and its oil). It is known for Purgative, blood pressure depressant, antifungal, antimistaminic, activity against viral hepatitis and vitiligo, antiasthmatic, broncho-dilatary, antispasmodic, antibacterial, CNS stimulant, amoebicidal, antistress and endurance promoting activity.

Useful part: fruit rind, seed, seed kernal

Ayurvedic properties
Rasa: Kashaya
Guna: Raksha, Laghu
Veerya: Ushna
Vipaka: Madhura
Doshaghnata: Tridosha Shamaka
Rogaghnata: Shotha-Vedanayukta Vikara,Charma Roga, Granthi Visarpa, Agnimandya, Shvitra, Paliitya, Pratishyaya, Kasa, Shwasa, Swarabhagna, Hridroga, Vrana, Vatavvyadi

Amalaki (Emblica officinalis Gaertn.) [11]
It belongs to family Euphorbiaceae and popularly known as Indian gooseberry. It is a large deciduous tree and is one of most famous and commonly used herb in Ayurveda. Chemical constituents are; carotene, nicotinic acid, riboflavine, D-glucose, D-fructose, myoinositol and a pectin with D-galacturonic acid, phyllembic acid and phyllembin (Fruits) and fatty acids (Seed oil); 1,2,3,6 trigalloyl glucose, terchebin, corialgin, ellagic acid, alkaloids, phyllantidine and phyllantine (Leaves & fruits). It is also a good source of vitamin C.

Useful part: fruit

Ayurvedic properties
Rasa: Amla, Madhura, Kashaya, Tikta, Katu
Guna: Guru, Raksha, Sheeta
Veerya: Sheeta
Vipaka: Madhura
Doshaghnata: Tridosha Shamaka

5. Pippali (Piper longum Linn.) [12]
This aromatic slender climber belongs to the family Piperaceae, and popularly known as Indian long pepper. Chemical constituents present in it are two alkaloids; piper longumine and piper longuminine, major alkaloid piperine and sesamin piperidine (stem and fruits). Pippali is one of the commonly using herbs of Ayurveda having the poroperties of Antibacterial, antiinflammatory, insecticidal, antimalarial, CNS stimulant antitubercular, anthelmintic, hypoglycaemic, antispasmodic, anti-giardial, antinarctic and anti ulcerogenic.

Useful part: fruit, root

Ayurvedic properties
Rasa: Katu
Guna: Laghu, Snigdha, Tikshna
Veerya: Anushna Sheeta
Vipaka: Madhura
Doshaghnata: Kapha Vata Shamaka
Karma: Raktotkleshaka, Medhya, Vatahara, Deepana.
Vatunolomana, Shoolaprashamana, Jantughna, Balya, Rasayana, Mutrala, Shirovirechana

Maricha (Piper nigrum Linn.) [12]

Maricha belongs to the family Piperaceae, well known by the name Black pepper. It is a branching and climbing perennial shrub with rooting at the nodes. The chemical constituents include Piperide, pipericine, derunapine, dihydroferupenine, piperonal, pipericine, piperolenine. It possess the properties of Antioxidant, anticonvulsant, CNS depressant, muscle relaxant, antipyretic, anti-inflammatory, hepatoprotective, antimicrobial, antiulcer, antibacterial, lipolytic, Ciclo oxygenase inhibitorty activity.

Useful part: fruit

Ayurvedic properties:
Rasa: Katu
Guna: Laghu, Teeksha, Raksha
Veerya: Ushna
Vipaka: Katu
Doshaghnata: Kaptha Vata Shamaka
Karma: Kaphakrit, Pitta Vardhaka
Katu Ushna
Laghu, Ruksha

Shunti (Zingiber officinalis) [14]

It belongs to the family Zingiberaceae. It is a small plant with horizontal jointed tuberous rhizomes. Chemical constituents present in this drug are Heptane, Octane, camphene, casinine, cineol, sabinene and cinene. It has the properties like Anti inflammatory, hypolipidemic, antiatherosclerotic, antiemic, antioxidant, antibacterial, antitumoural, hypoglycaemic, inotropic, inhibition in prostaglandin release (dose dependent), Antipyretic, appetiser, uterotonic and anti bacterial.

Parts used: rhizome

Ayurvedic properties:
Rasa: Katu
Guna: Laghu, Raksha, Teekshna
Veerya: Ushna
Vipaka: Katu
Doshaghnata: Vata Kapha Shamaka, Pitta Vardhaka.
Rogaghnata: Shotha, Switr, Shleepada Amavata, Nadi Dauurbalya, Vata Vyadhi, Ajeern, Chardi, Ajeeerna, Koshta Vata, Grani, Gulma, Anaha, Vibandha, Hridroga

Vidanga (Embelia ribes Burm.) [15]

It is a large scandent shrub which belongs to the family Myrsinaceae. Chemical constituents are Embelin, quercitol, tannin, christembine, embelic acid, fatty ingredients, resinoid, volatile oil and vilangin (fruit), potassium embatele, 4-benzoquinone (plant). Presence of embelin has highlighted by the action of anthelmintic, antibiotic, antitubercular, antiimplantation, antioucvulatory, antifeertility, antiinflammatory, hypotensive.

Useful part: fruit

Ayurvedic properties:
Rasa: Tikta, Katu
Guna: Laghu, Raksha Teekshna
Veerya: Ushna
Vipaka: Katu
Doshaghnata: Kapha Vata Shamaka
Rogaghnata: Shipuruga, Akshepaka, Krimiroga
Apasarna, Paksha, Krimidanta, Dantashoola, Agnimandya, Ajeerna, Vanana, Udarashoola, Arsha, Mutakrichr, Gangamala
Karma: Jantughna, Kushtaghna, Shirovirechana, Nadibalya, Deepana, Pachana, Anulomana, Shirovirechana

Loha Bhasma (incinerated iron) [16]

Iron is mentioned third among the Shuddha Loha. Iron is a chemical element with the symbol Fe (Latin: ferrum) and is the fourth most common element in the Earth’s crust. Chemical and physical properties:
Atomic number: 26
Atomic weight: 55.85
Density: 7.874
Melting point: 1535 °C
Boiling point: 3000 °C
Conductivity: relatively poor conductor of heat and electricity
Dissolution: dissolves in water but process takes many months
Atmospheric exposure: reacts with oxygen and form iron oxide (Fe2O3)
Chemical response: turns into iron salts when exposed to acids. Remains unaffected by alkalies.

Ayurvedic properties [17]:
Rasa: Tikta, Madhura, Kashaya
Guna: Sheeta, Sara, Guru, Raksha
Veerya: Sheeta (Ushna according to Rasa Kamdhenu)
Doshakarma: Kaphahara, Tridoshahara

Collection and authentication of raw drugs

All the above mentioned drugs were collected from the GMP certified Sri Dharmasthala Manjunatheshwara Pharmacy, Kuthpady, Udupi, Karnataka, India. The drug analysis and standardization was done at SDM centre for research in Ayurveda and allied sciences, Kuthpady, Udupi, Karnataka, India.

Apparatus used for the preparation

Impact pulverizer: it is used for size reduction of the drugs. Tray driers: for drying the herbs and powder. Mass mixers: for mixing the powders

Method of preparation

Darvyadi Loha Choorna was prepared by using different parts of medicinally important herbal drugs such as heart wood of Darvi (Fig.1), fruit pulp of Haritaki (Fig.2), fruit pulp of
Vibhitaki (Fig.3), fruit pulp of Amalaki (Fig.4), fruit of Pippali (Fig.5), fruit of Maricha (Fig.6), rhizome of Shunti (Fig.7), fruit of Vidanga (Fig.8) and Loha Bhasma (incinerated iron – Fig 9).

All the herbal drugs were taken in equal quantity and was cleaned and dried properly. Later they were weighed and made into fine powder separately (Fig: 10). To this Loha Bhasma was added in quantity equal to each of the herbal ingredient. The whole mixture is mixed homogeneously in a pulverizer and was filtered through sieve number 85. The final product (Fig.11) was carefully packed and was made ready for dispensing. This method of preparation of Choorna is according to the Ayurvedic Formulary of India.

Precautions taken; [18, 19]

a. All the ingredients were dried and powdered separately.
b. The fineness of the powder was preferably 80 mesh size per square inch or still finer.
c. Powders tend to deteriorate soon due to their hygroscopic nature, hence was preserved in air tight containers. Powders which are not packed air tight will lose their potency in 2 months while well packed and preserved powders can be kept active for 1 year.

Duration of preparation: 1 day
Organoleptic parameters of finished product:
Colour: light brown
Consistency: fine powder
Smell: specific odour
Taste: Pungent with slight bitter taste

Discussion
Iron deficiency anemia is currently the most wide spread micro nutrient deficiency in the world and the WHO estimates that roughly 50% of anemia prevalence can be attributed to iron deficiency. The signs and symptoms of Pandu Roga mentioned in Ayurvedic classics resemble with IDA. Pandu is a Pitta Pradhana Tridoshaja Vyadhi where Panduta or paleness is the Pratyatma Lakshana of this disease.

In Ayurvedic therapeutics, drugs are used in both forms, crude as well as processed and converted into different pharmaceutical forms. Such preparations should not only be effective but also easy to dispense, administer and agreeable to the patient. Choorna is one such form which is an allied Kalpana of Kalka. For the preparation of Choorna with multiple drugs it is advised to powder the drugs individually, because each drug differs from the other in its constituency and constituents. Hence, they are to be separately powdered and mixed together at the end only, to avoid pharmaceutical problems. Individual powdering also helps in obtaining homogenous mixture as it facilitates through miscibility of the components.

Choorna does not require any special technique for preparation; hence it is economical compared to other pharmaceutical forms. It can be easily administered to patients who cannot swallow solid dosage forms especially in small children, who refuse to swallow solid forms and also will reduce the risk of choking. As the particle size is very minute, Choorna will get easily dissolved in the body fluids, thereby facilitating greater and quicker absorption in lesser time.

Darvyadi Loha Choorna with its unique combination of various herbal drugs and Loha Bhasma, by virtue of the properties and action of the individual drugs, could be used efficiently in the management of Pandu Roga (IDA). The Anupana mentioned for the medicine are Madhu and Ghrita.
Plants have been used for the medicinal purposes by man ever since he started to care himself. Choorna is one of the pharmaceutical preparations in Ayurveda which is convenient to prescribe in required amount. Ayurveda has been always acknowledged as providing holistic care through safer drugs and more compatibility with the physiological flora of human body. Today, according to the increasing demands, new technologies are being adopted for preparing drugs in large scale using less time and manual work. So, it is absolutely necessary to prepare and standardize the formulations mentioned in the Ayurvedic classics using modern equipments and technologies. To keep this ancient science in pace with the modern period, is essential for the propagation of Ayurveda and also in providing better health care.

**Conclusion**

Plants have been used for the medicinal purposes by man ever since he started to care himself. Choorna is one of the pharmaceutical preparations in Ayurveda which is convenient to prescribe in required amount. Ayurveda has been always acknowledged as providing holistic care through safer drugs and more compatibility with the physiological flora of human body. Today, according to the increasing demands, new technologies are being adopted for preparing drugs in large scale using less time and manual work. So, it is absolutely necessary to prepare and standardize the formulations mentioned in the Ayurvedic classics using modern equipments and technologies. To keep this ancient science in pace with the modern period, is essential for the propagation of Ayurveda and also in providing better health care.
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