

## Ayurvedic preparations for the treatment of iron deficiency anemia: A short review

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### ABSTRACT

Iron deficiency is one of the most common causes of anemia. The main etiologies of iron deficiency were blood loss due to menstruation and due to gastrointestinal bleeding. Beyond anemia, lack of iron has protean manifestations such as fatigue, hair loss, and restless legs. Serum ferritin is the most efficient test for the diagnosis of iron deficiency anemia (IDA). Iron replacement can be done orally or contraindicated with intravenous iron. This study was designed to describe the IDA in patient populations of different age groups, its impact during pregnancy, and the general population. In this review, we demonstrated the causes, symptoms, prevention, and treatments of IDA. We conducted the study using the electronic databases PubMed, Google Scholar, the selection of research papers was restricted to the English language and humans. Research papers were included published from 2000 to 2021 for this review. The different types of formulation mainly *Lauha bhasma* are used for patient populations of different age groups (infant, elderly), pregnant women, and general patient populations, which were described well in this review. This review aims to acknowledge the ayurvedic medications for IDA in different patient populations.

**Keywords:** Etiologies, Contraindicated, Intravenous, Iron deficiency anemia (IDA).

Anemia can be defined as a decrease in hemoglobin levels in the blood. Iron deficiency anemia (IDA) is a form of anemia due to the lack of sufficient iron to form normal red blood cells. As per the World Health Organization's report, half of the total anemia is IDA. This is the first cause of anemia and can be described as an imbalance of iron intake, absorption, and iron loss. Iron is an important dietary mineral associated with many body functions like oxygen transport in the blood. IDA can be characterized by incomplete hemoglobin synthesis which results in microcytic and hypochromic red blood cells. Due to inadequate hemoglobin, the ability of blood to deliver oxygen to the other body cells and tissues is reduced [1].

IDA has a very high global occurrence. It poses serious health problems because it causes general weakness, lethargy, lassitude, sub-optimal work performance, and in certain situations mental retardation, poor intelligence, an abnormal immune response [2]. IDA is a global public health crisis, so also in India. WHO has estimated that the

prevalence of anemia in pregnant women is 14% in developed and 51% in developing countries, and among them, 65–75% are in India. The occurrence of anemia in all age groups is higher in India as compared to other developing countries [3]. India contributes to about 80% of maternal deaths due to anemia in South Asia [4].

The high prevalence of anemia in pregnancy can cause serious adverse consequences in both mother and baby, treatment of anemia in pregnancy was accorded a very high priority both in obstetric and public health practice. IDA is a common nutritional disorder worldwide and is known to affect approximately one-third of the global population. While its incidence in affluent countries is low, the incidence of IDA in India is very high. According to National Family Health Survey (NFHS) III data, the cases of anemia in urban children is 71%, rural is 84%, and overall is 79%. Nutritional iron deficiency is the most common cause of anemia in India [5]. IDA is a common disease prevalent in society, and its side effects of oral allopathic

iron preparations are encountered frequently. With the aim that herbomineral medicines may be effective to manage childhood IDA without any side effects [6].

### METABOLISM OF IRON

Iron is a trace element, required for many cellular metabolic functions of the body. As iron is toxic when present in abundance, it can have extremely adverse effects like liver swelling and damage. Therefore, tight regulation is required to avoid iron deficiency or iron overload [7]. The body absorbs 1 to 2 mg of dietary iron a day, which is balanced through body processes such as menstruation sloughed intestinal mucosal cells, and other blood losses [8]. Dietary iron comprises heme iron (animal sources) and non-heme iron (vegetable and cereal sources). Heme iron bound to Hb and myoglobin is responsible for delivering oxygen to the tissues. Pancreatic enzymes digest heme to release it from the globin molecule in the intestinal lumen.

The absorption of heme iron takes place into the enterocytes as metalloporphyrin, it is further degraded by heme oxygenase-1 leading to the release of non-heme iron [9]. While the non-heme iron is absorbed by intestinal luminal cells in less quantity through a specific transporter and released into the circulation wherein the binding of transferrin occurs [10]. Transferrin receptors on erythroblasts accept iron-transferrin complexes, which then undergo the process of endocytosis leads to the incorporation of iron into Hb [11]. Dietary ascorbic acid, stomach acidity, and luminal reductase are reported to improve iron absorption in the body [12].

### CAUSES AND SYMPTOMS OF IDA

The main reported causes for IDA are low iron bioavailability of the diet, decreased iron absorption, and blood loss [13,14]. Postsurgical gastrectomy and intestinal resection or bypass produce iron deficiency anemia and decreased iron absorption. Chronic blood losses through genitourinary, gynecological, or gastrointestinal tracts cause iron deficiency anemia. Gastrointestinal bleeding (acute or chronic) is the most common cause of IDA [15]. The most common etiology of iron deficiency anemia in women is excessive menstruation [10]. Symptoms associated with IDA were tachycardia headache, pallor skin, conjunctivae, fatigue, nail beds, vertigo, syncope, exertional dyspnea progressing to breathlessness at rest, and a cardiac systolic flow murmur [16, 17, 18, 19]. The patients also show dyspnoea at rest angina pectoris and hemodynamic instability in severe cases [18]. Patients may present with maroon-colored stools or blood in their stools [15].

### PREVENTION AND TREATMENT OF IDA

Some iron-containing allopathic formulations (oral/intravenous) are available in the market for treating IDA [21]. The ferrous forms such as ferrous sulfate, ferrous fumarate, ferrous glycine sulfate, ferrous calcium citrate, ferrous gluconate, and ferrous succinate make it unsuitable for use, ferrous have poor tolerability and a high adverse reaction rate (up to 40% in some cases) [22]. The most common complaints related to these formulations are nausea, abdominal pain, diarrhea, and constipation. The intravenous forms were reported to have better efficacy as compared to oral forms [23] but were found to be associated with various adverse effects. An alternative approach for the treatment of IDA is to enhance the absorption of dietary iron, rather than increase iron in the diet. A variety of substances have been marketed, viz. inorganic salts, amino acids, surface acting agents, carbohydrates, and ascorbic acid. None of these have become popular, although ascorbic acid seems to be promising [22]. Hence, there is a need to develop/ identify the newer formulations that are safe, efficacious, and cost-effective to treat IDA [24].

Despite the availability of modern allopathic formulations, Ayurveda offers several formulations for the treatment of IDA. In Ayurveda, these formulations were found to be practiced for centuries [20]. In Ayurveda, the disease Pandu roga can be compared with that of IDA, owing to the clinical manifestation of Panduta or pallor in the whole body [25]. Despite the availability of modern allopathic formulations, Ayurveda offers several formulations for the treatment of IDA. With this background information, an effort was made to review various types of Ayurvedic formulations that have proved efficient for the treatment of IDA during pregnancy, for the pediatric age group, for elderly persons, and the general population.

### DURING PREGNANCY

Among the many causes of IDA during pregnancy, the most common are menstrual loss, increased nutritional demand, early age of childbearing, short intervals between deliveries, repeated pregnancies, and poor access to healthcare facilities [26]. As per the Govt. India: National Health Policy (2017), high prevalence of anemia found among the Indian women (53%). Abhraloha is an Ayurvedic formulation, contains natural hematonic ingredients like Loha Bhasma (processed iron) and Abhraka Bhasma (processed mica) along with various herbs: Amalaki (*Emblica Officinalis*), Haritaki (*Terminalia chebula*), Bibhitaka (*Terminalia bellirica*), Shunthi (*Zingiber officinale*), Maricha (*Piper nigrum*), Pippali (*Piper*

*longum*), Chitraka (*Plumbago zeylanica*), Musta (*Cyperus rotundus*), Vidanga (*Embelia Ribes*), and Shatavari (*Asparagus racemosus*), reported as an ingredient in several classical anti-anemic Ayurvedic formulations [27,28]. A very recent preclinical study done by Gajbhiye *et al.* in 2021 on Abhraloha has reported rectified anemia in iron-deficient animals and an increase in hemoglobin (Hb) levels [29]. Lauha Bhasma and Mandura Bhasma (11 mg/kg) have shown significant hematinic and cytoprotective activity [30]. It could reverse anemia induced by phenylhydrazine in Wistar rats and showed positive results [31].

Dhatrilauha Vati is another preparation composed of Lauha Bhasma, and natural herbs Amalaki (*Embelia Officinalis* Gaertn.), Amruta (*Tinospora cordifolia* Wall. ex Syringe.), Yastimadhu (*Glycyrrhiza glabra* L.). The cumulative effects of all these ingredients lead to the

correction of metabolism, iron absorption, and improved blood formation, thereby correcting anemia [32,33,34]. In studies carried out on Dhatri Lauha and Punarnava Mandura, both were given in the dose of 3 g/day, showed satisfactory results on IDA during pregnancy [35]. Therefore, these formulations were successfully used by Ayurvedic physicians for the management of IDA, and the Government of India has included them in the ASHA drug kit for National Reproductive Health Care Programme – 2017 [57]. In Dhatri Lauha, Dhatri was proved as an antioxidant, immunomodulator, and hepatoprotective agent [36]. Yastimadhu (*Glycyrrhiza glabra* L.) is an active bioavailability enhancer [37]. Amruta (*Tinospora cordifolia* W. Miers.) has hepatoprotective properties. Amalaki and Amruta are rich sources of vitamin C which enhances the absorption of Lauha Bhasma [38]

**Table 1 - List of classical formulations described in Ayurvedic literature for the treatment of IDA**

Formulation Name	Reference	Mineral Ingredients	
<b>Churna lauha kalpas</b> [Powder formulations]			
Vidangadi Lauha-1	BR-Pandu-12/31	LB (50%)	
Darvyadi Lauha	BR-Pandu-12/37	LB (50%)	
Dhatri Lauha	BR-Pandu-12/30	LB (20%)	
Navayasa (Lauha) Churna	CS-Pandu Chikitsa-16/70-1	LB (50%)	
Tapyadi Lauha-2	AH-Pandu Chikitsa-16/20-2	LB (12%), SMB, RB, MB, Shilajit	
<b>Khalviya formulations</b> [Prepared with bhavana of sneha dravya (oil and ghee) and madhura dravya (sugars, jaggery, and honey) and drava dravya (herbal juices and decoctions)]			<b>Sneha dravya, Madhura dravya and Drava dravya for bhavana</b>
Ashtadashanga Lauha (Kiratadi Mandura)	BR-Pandu-12/34-36	LB (50%)	Honey, Cow's Ghee
Yograja	CS-Pandu Chikitsa-16/78-86 BR-Pandu-12/109-15	LB (12.8%), SMB, Rajata Makshika Bh, Shilajit	Sugar candy, Honey
Trikatrayadi Lauha	BR-Pandu-12/38-43	KLB (9%), MB	Honey, Cow's Ghee, five types of Sharkara (sugars)
<b>Khalviya formulations</b> [Prepared by bhavana of both mineral and herbal ingredients (solid dosage form)]			<b>Bhavana dravya</b>
Kamalantaka Lauha	BR-Pandu-12/44-51	LB (23.5%), AB, MB, VB	Kesaraja, Bringaraja, Somaraji (Bakuchi), Manduka parni
Kalamegha Navayasa Lauha	SYS-Pandu	LB (50%)	Kalamegha (Bhavana 7days)
<b>Rasa kriya lauha kalpas</b> [Formulations prepared by boiling decoctions until solidification]			<b>Kwatha dravya</b>
Vidangadi Lauha-2	BR-Pandu-12/31	LB (50%)	Cow's urine
Tapyadi Lauha-1	AH-Pandu Chi-16/16-9	LB, Shilajit, SMB, RB, MB	Cow's urine
AH-Ashtanga Hridaya, BR-Bhaishajya Ratnavali, CS-Charaka Samhita, SYS-Siddha Yoga Samgraha, 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.			

In Punarnava Mandura, *Punarnava* is a diuretic, hepatoprotective and antioxidant agent [39]. Mandura Bhasma possesses significant hematinic and cytoprotective, hepatoprotective activity [30]. Triphala, an Ayurvedic Rasayana, is an antianemic and antioxidant. It contains Amalaki (*Emblica Officinalis Gaertn.*) which has a role in the digestion and absorption of food material. Amalaki is a rich source of iron and vitamin C and is considered a potent Rasayana enhancing the essence of all the Dhatus. Trikatu is a known bioavailability enhancer [40], Gomutra (cow urine) is an important ingredient of the drug and proved for its antimicrobial, antioxidant [41], and antianemic due to its erythropoietin stimulating factor [42]. Anupana of buttermilk is digestive due to the presence of probiotics and a rich source of minerals and vitamin B12 [43,44]. The cumulative effects of all these drugs lead to the correction of metabolism, increase iron absorption and improve blood formation in IDA during pregnancy.

### PEDIATRIC AGE GROUP

*Trikatrayadi Lauha* is a herbomineral formulation that contains *Triphala*, a rejuvenating; *Trikatu*, an appetizer; and *Trimada*, a digestive. These herbal ingredients increase the bioavailability of Mandura bhasma and Lauha bhasma are important contents of *Trikatrayadi Lauha*. During treatment of IDA in children, a significant improvement was observed in *Aruchi* (loss of appetite) [45]. The appetizing property of the *Trikatrayadi Lauha* suspension might have helped in better tolerance, absorption, and metabolism of iron. No complaint of any uncomfortable feeling, gastric disturbances, or constipation was observed during and after the administration of the drug [45]. The present clinical study indicates that the herbomineral formulation *Trikatrayadi Lauha* suspension is an effective, well-tolerated, and clinically safe formulation for the treatment of IDA in children.

Punarnavadi Mandura also reported for the management of IDA in children. Punarnava is a diuretic, hepatoprotective and antioxidant agent [39] and Mandura bhasma possesses significant hematinic activity [30]. It is preferably administered with buttermilk which has acidic pH and contains lactic acid. Iron absorption is aided by decreased pH. Ayurveda has a view on the role of Punarnavadi Mandura in controlling anemia which was primarily directed toward Agni (digestive factors). However, this concept is indirectly related to the mechanism of absorption of iron in the gastrointestinal tract by the process of Deepana and Pachana [30]. This explanation of the action of Punarnavadi Mandura is not only applicable for the management of anemia among children but also in other age groups in which the mechanism remains the same.

### ELDERLY POPULATION

Anemia is common in old age and increases the risk of physical disability, associated with impaired performance and muscle weakness, and has been shown to affect older person's physical function [46]. Commonly anemia in old age is associated with various diseases like cancer, chronic kidney disease, and congestive heart failure due to malnutrition or iron deficiency. Punarnava Mandura is considered as an efficacious formulation, successfully prescribed by Ayurvedic physicians for the management of IDA in children as well as for the elderly population [47]. It acts as an anemia correcting agent in old age due to its several herbal components.

*Triphala*, *Trikatu*, *Chitraka*, *Vidanga*, and *Pippalimula* have an appetizing, digestive, and carminative property that improves digestive power and absorption of the drug. *Trivita*, *Haritaki*, and *Danti* act as a laxative that helps in relieving constipation. *Haridra*, *Amalaki*, *Pippali*, *Punarnava*, and *Trivrita* have immunomodulatory and antioxidant properties [48]. Punarnavadi Mandura is used as an anemia correcting agent at the community level promoted by National Rural Health Mission and included in the Accredited Social Health Activist's drugs kit [27].

### GENERAL POPULATION

IDA is a common phenomenon in both developing and industrialized countries among the general population and affects approximately 30 percent of the world's population [49]. The prevalence of IDA in developing countries is 36% and only 8% in developed countries [50]. For the management of IDA various herbal and herbomineral preparations are mentioned in Ayurveda. Some of them are Navayasa Lauha, Punarnavadi Mandura, Dhatri Lauha, Pradarantaka Lauha, Sarva-Jvara-Hara Lauha, Brihat Yakrdari Lauha, Dadimadi Ghrita, Trikatrayadi Lauha and claimed to have haemopoetic function [27]. Lauha bhasma was used along with natural plant extracts that contain ascorbic acid, sugars, amino acids, and organic acids for better absorption of iron [51].

In Dhatri louha and Novayaas louha the common active ingredients are *Emblica officinalis*, *Zingiber officinale* and Louha bhasma. *Emblica Officinalis* is widely used in Ayurvedic preparations to increase the defense mechanism of the body and it is the richest source of ascorbic acid that helps in iron absorption [52]. It is also useful as a general tonic, laxative, liver tonic, stomachic, restorative, and digestive. *Zingiber officinale* consists of calcium, iron, protein, fat, carbohydrate, thiamin, riboflavin, nicotinic acid, and phosphorus. Better absorption of iron is facilitated

by these components of ginger [53]. *Emblica ribes* are responsible for anti-helminthic activity [54] that can prevent anemia because worm infestation is one of the main causes of anemia in the Indian subcontinent. Vrihat Yakrdari Lauha contains Lauha bhasma and extract of ginger (*Zingiber officinale*). In this formulation, the ginger extract contains protein, fat, carbohydrate, vitamins, and mineral elements which helps in the absorption of iron and helps in the treatment of IDA [55,56].

## CONCLUSION

In Ayurvedic pharmacology, the maximum contents of both formulations have sheeta guna and sheeta virya and param raktavridhikar in karma that's why they are hematinic. *Lauha Bhasma* contains iron and herbal ingredients (*Triphala*, *Trikatu*, and *Trimada*). Herbal ingredients present in the trial drug may increase the bioavailability of iron. Hematinic action of suspension may be due to the presence of iron contents of good bioavailability.

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