



Review Article

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A REVIEW ON AVIPATHI CHOORNAM: A POTENTIAL BIOAVAILABILITY ENHANCER IN IRON MALABSORPTION ANAEMIA

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ABSTRACT

Iron deficiency anaemia is a widespread nutritional disorder, with impaired intestinal iron absorption being a major contributing factor. In such cases, conventional iron supplementation alone may be insufficient, necessitating therapeutic measures that enhance iron bioavailability. Ayurveda emphasizes the role of Agni (digestive and metabolic fire), Tridosha (bodily humours; Vata, Pitta, and Kapha) balance, and integrity of Srotas (bodily microchannels) in digestion and nutrient assimilation. Avipathi Choorna, a classical formulation described in Ashtanga Hridaya and indicated in Pandu (anaemia-like clinical condition), is known for its Deepana (digestive stimulant), Srothosodhaka (channel cleansing), and Tridosahara (Dosha balancing) properties, suggesting its potential role in improving intestinal absorption. This review explores the role of Avipathi Choorna as a natural bioavailability enhancer in iron deficiency anaemia due to malabsorption by correlating Ayurvedic principles with modern concepts of iron absorption. The formulation acts by restoring Jataragni (digestive fire), reducing Upalepathva (mucosal coating) caused by excess Drava (fluidity) and Snigdha (unctuousness) Guna of Pachaka Pitta and Kledaka Kapha, and facilitating proper absorption. The therapeutic efficacy of Avipathi Choorna can be understood through the pharmacodynamic attributes of its ingredients-Rasa (taste), Guna (qualities), Veerya (potency), Vipaka (post-digestive effect), and Karma (specific action). Additionally, reported phytochemical constituents such as piperine, ascorbic acid, flavonoids, terpenoids, amino acids, and scopoletin are known to enhance gastric secretion, improve intestinal permeability, chelate iron, and modulate iron metabolism, thereby supporting improved bioavailability. Several components of Avipathi Choorna, including Trikatu (combination of Zingiber officinale, Piper nigrum, and Piper longum), sugar, and honey, are well-recognized bioavailability enhancers. The synergistic action of the formulation aids in correcting digestive impairment and enhancing iron absorption. Avipathi Choorna thus appears to be a promising adjunct in the management of iron deficiency anaemia associated with malabsorption. Further clinical studies are required to validate its therapeutic efficacy.

Keywords: Avipathi Choorna, Iron deficiency anaemia, Bioavailability enhancer, Malabsorption of iron in intestine, Pandu

INTRODUCTION

Iron is a vital micronutrient necessary for human growth and development at every stage of life, playing a key role in oxygen transport through haemoglobin. Due to the widespread triple burden of malnutrition globally, iron deficiency anaemia has become increasingly common and affects a large portion of the population,¹ often resulting from inadequate absorption of iron in the gastrointestinal tract. Studies, including those by Goddard et al., report that about 5–10% of such cases are due to malabsorption.² Since the gastrointestinal tract is the primary site of micronutrient absorption, any structural or functional defect can significantly reduce iron uptake, leading to anaemia.² Conventional management often focuses on supplementing iron stores; however, when absorption pathways are impaired, supplementation alone fails to adequately correct the deficiency.

In Ayurveda, proper digestion, absorption, and metabolism are governed by the balanced functioning of the Tridosha within the Koshta (Gastrointestinal tract) and the normal activity of both Jataragni (digestive fire) and Dhatwagni (tissue-specific metabolic fire). Imbalance in these factors can lead to compromised nutrient assimilation, manifesting as various

deficiency disorders. Therefore, the Ayurvedic approach emphasizes correcting the underlying dysfunction at the level of Jataragni and Dhatwagni rather than only replenishing the nutrient.

Avipathi Choorna,³ a classical Ayurvedic formulation known for its Pittapradhana Tridosahara property, may hold potential therapeutic significance in such conditions. By pacifying aggravated Pitta, supporting digestive functions, and enhancing nutrient absorption, Avipathi Choorna may serve as a promising remedy for iron deficiency anaemia caused by low intestinal absorption.

In the context of global trends toward traditional and complementary systems of medicine, exploring Ayurvedic formulations as potential bioavailability enhancers has become increasingly relevant. 'Bioavailability enhancers' are drug facilitators, also termed as 'Absorption enhancers' which are functional excipients included in formulations to improve the absorption of a pharmacologically active drug.⁴ The term 'bioavailability enhancer' was first coined by Indian scientists at the Regional Research Laboratory, Jammu (RRL, now known as Indian Institute of Integrative Medicine, Jammu), who discovered

and scientifically validated piperine as the world's first bioavailability enhancer in 1979.⁴ In modern science the concept of Bioavailability enhancer is not yet flourished well. There lies the contribution of Ayurvedic medicine where several drugs which could enhance the bioavailability of iron are available. The present article intends to highlight the hidden potential of Avipathi Choorna as a natural bioavailability enhancer for iron, by examining the chemical constituents and pharmacological properties of its ingredients and their possible role in improving iron absorption in the intestines.

AVIPATHI CHOORNA

Avipathi choorna is an Important formulation mentioned in Ashtanga Hrdaya Kalpasthana under Virechana kalpa Adhyaya.³ Botanical identity of the drugs, parts used and the quantity of each drug required for the preparation are mentioned in Table 1. This information will help in collecting the authentic drugs for preparation. According to Ayurveda, the action of medicinal substances is determined by their intrinsic qualities, such as Rasa, Guna, Veerya Vipaka and Karma. So, these properties of each drug are explained in Table 2. The chemical constituents and modern pharmacological action are mentioned in the Table 3.

Table 1: Ingredients and Quantity

Ingredients	Botanical name/English name	Family	Quantity
Shunti ⁵	<i>Zingiber officinale</i>	Zingiberaceae	1 part
Maricha ⁶	<i>Piper nigrum</i>	Piperaceae	1 part
Pippali ⁷	<i>Piper longum</i>	Piperaceae	1 part
Twak ⁸	<i>Cinnamomum zeylanicum</i>	Lauraceae	1 part
Ela ⁹	<i>Elettaria cardamomum</i>	Zingiberaceae	1 part
Patra ¹⁰	<i>Cinnamomum tamala</i>	Lauraceae	1 part
Mustha ¹¹	<i>Cyperus rotundus</i>	Cyperaceae	1 part
Vidanga ¹²	<i>Embelia ribes</i>	Myrsinaceae	1 part
Amalaki ¹³	<i>Embelia officinalis</i>	Euphorbiaceae	1 part
Trivrt ¹⁴	<i>Operculina turpethum</i>	Convolvulaceae	9 parts
Sita ¹⁵	Sugar		9 parts

Table 2: Pharmacodynamics – Ayurvedic view

Sanskrit Name	Rasa	Guna	Veerya	Vipaka	Karma
Sunthi ⁵	Katu	Laghu Snigdha	Ushna	Madhura	Kaphavatahara Deepana Pachana, Anulomana, Amadoshahara, Vatakaphahara, Hrdaya
Maricham ⁶	Katu, Tikta	Laghu Rooksha Teekshna	Ushna	Katu	Kaphavatahara Deepana. Medohara, Mutra janana, krimihara, Chedana
Pippali ⁷	Katu	Laghu Snigdha	Anushna	Madhura	Vatakaphahara, Deepana Soolahara, Rasayana, Pandughna, Krimighna
Twak ⁸	Katu, Tikta Madhura	Laghu, Ruksha Teekshna	Ushna	Katu	Kaphavatahara, Ruchya
Ela ⁹	Katu Madhura	Laghu	Sita	Madhura	Rochana, Mutrala Deepana, Pachana, Anulomana, Hrdaya
Patra ¹⁰	Katu Madhura	Laghu Pichila Tikshna	Ushna	Katu	Kaphavatahara, Ruchya
Mustha ¹¹	Tikta Katu Kashaya	Laghu Rooksha	Sita	Katu	Pittakaphahara, Deepana Pachana, Grahi, Sothahara, Sthoulyahara,
Vidanga ¹²	Katu Tikta	Laghu Rooksha Teekshna	Ushna	Katu	Krimighna, Agni Dipana, Anulomana, Vatakaphahara
Amalaki ¹³	Amla, Kashaya Madhura Tikta Katu	Laghu Rooksha	Sita	Madhura	Tridosahara, Rasayanam
Trivrit ¹⁴	Katu Tikta Kashaya	Laghu Rooksha Teekshna	Ushna	Katu	Kaphapittahara, Rechana, Vranahara, Shothagna
Sita ¹⁵	Madhura	Guru Snigdha Sita	Sita	Madhura	Pittahara, Vatahara, Dhathuvardhaka, Hrdaya, Vrshya
Madhu ¹⁶	Madhura Kashaya	Laghu, Rooksha, Pichila, Yogavahi	Sita	Katu	Agnidipana, Pittaprasamana, Ropana, Sodhana, Tridoshaprasamana

Table 3: Pharmacological action – Modern view

Sanskrit Name	Scientific name/ English Name	Chemical constituents	Reported pharmacological actions
Sunti	<i>Zingiber officinale</i> ¹⁷	Zingerone 6-Gingerol Flavonoids, Amino acid, Vitamins, Ascorbic acid (Vitamin C)	Anti-oxidant, Anti inflammatory Stimulate Erythropoiesis, Improve bioavailability of Dietary Iron
Maricham	<i>Piper nigrum</i> ¹⁸	Piperene, Piperidine, Flavonoids, Amino acid, Ascorbic acid	Anti-inflammatory, Antifungal Antioxidant, Antibacterial Inhibit Hepcidin expression
Pippali	<i>Piper longum</i> ¹⁹	Piperene, Zingiberene, Flavonoids, Glycosides, Amino acids	Anti Inflammatory, Anti-oxidant, bioavailability enhancer of iron
Twak	<i>Cinnamomum zeylanicum</i> ^{20,21}	Cinnamaldehyde Flavonoids, essential oils, terpenoids, phenolic compounds, alkaloids and Ascorbic acid, Amino acid	Anti-oxidant and free-radical scavenging properties, Anti-nociceptive and Anti-inflammatory activity, Hepato-protective.

Patra	<i>Cinnamomum tamala</i> ²²	Cinnamaldehyde Flavonoids, Ascorbic acid, Polyphenols, Alkaloids, Flavonols, Carbohydrates, Amino acid, Proteins, Saponins, and Glycosides	Anti-inflammatory, Antioxidant, Hepatoprotective, Gastroprotective, Immunomodulatory
Ela	<i>Elettaria cardomomum</i> ²³	Essential oil, proteins, Cellulose, Pigments, Iron, carbohydrate, terpenoids, flavonoids	Antioxidant, Antibacterial, gastroprotective, Anti-inflammatory, Analgesic, Anti- spasmodic
Musta	<i>Cyperus rotundus</i> ²⁴	Cyperene, Cyperenone, Fatty acid like linoleic acid, Oleic acid, Rotundenol, Flavonoids, Terpenoids, Steroids, Carbohydrates, Fixed oils and Vitamin C (Ascorbic acid), Fructose Aminoacid conjugate	Anti-inflammatory, Antioxidant, Hepatoprotective, Analgesic, Anti-ulcer
Vidanga	<i>Embelia ribes</i> ²⁵	Volatile oil, Embelin, Embelinol, Embeliaribyl ester, Quercitol, Sitosterol, Daucosterol, Amino acid	Anti-inflammatory, Anti-oxidant, Hepatoprotective, Anthelmintic
Amalaki	<i>Emblica officinalis</i> ²⁶⁻²⁸	Saponin, Phenolic compounds, Phyllembin, Phyllembic acid, gallic acid, Quercetin, Ascorbic acid, Amino acid, Citric acid	Immunomodulatory, Antioxidant, Anti-inflammatory, Hepatoprotective, Gastroprotective
Trivrt	<i>Operculina turpethum</i> ^{29,30}	Scopoletin, Saponins, Turpethin, Sucrose, reducing sugar, glycoside, saponin, α -amino acid	Cytoprotective, Nephroprotective
Sita	Sugar ³¹	Flavonoids, Amino acid	Anti-inflammatory, Laxative, Hepatoprotective, Anti haemolytic, Anti-ulcer,
Madhu	Honey ^{32,33}	Glucose, Fructose, Zinc, Manganese, Copper, Flavonoids and Amino acid	Antioxidant, Bioavailability enhancer
			Bioavailability enhancer of Iron, Antioxidant

Iron Metabolism

Iron is essential for human life, playing a key role in oxygen transport, immunity, cell division and differentiation, and energy metabolism. At the same time the body also has to protect itself from free Iron, because it is highly toxic and generate free radicals. Thus, body has evolved elaborate mechanism for the efficient handling of this element. Dietary iron absorption is primarily performed through enterocyte cells on the duodenum and upper jejunum of the small intestine. Even though small amount of iron is excreted through sweating, menstruation, shedding of hair and skin cells, human body is not able to excrete excess amounts of iron actively, so intestinal iron absorption is critical for maintaining iron balance (homeostasis) in the body. Thus, efficient intestinal iron bioavailability is essential to reduce the risk of iron deficiency anaemia.^{1, 34,35}

Absorption of Iron

- Iron (Fe) of the food is broken down into ferrous (Fe⁺⁺) and ferric (Fe⁺⁺⁺) ions in the presence of pepsin and low pH (due to the presence of HCl) of the stomach
- Ferric is converted to Ferrous at the mucosal cell surface by the duodenal cytochrome B, as ferrous is the easily absorbable form of iron.
- Ferrous is transported across the cell membrane by divalent metal transporter 1 (DMT1). Ferroportin 1 helps in the transfer of Fe from mucosal cell into circulation.
- The Main Iron Regulating Hormone in liver is Hepcidin.
- Hepcidin acts by inhibiting the expression or activity of genes involved in intestinal iron absorption.
- This absorption process depends to a large extent on the requirement of iron by the body and is also controlled by the mucosal cells by the mucosal block mechanism.^{1, 34,35}

Factors Affecting Bioavailability of Iron

Inhibitory factors leading to reduced absorption are

- Non haem iron, Iron comes in two forms: haem iron (come from animal sources) is more easily absorbed by the body and non-haem iron (found in plant-based sources) is not easily absorbed by the body.
- Impaired gastric acid secretions.
- Ferric form of Iron.
- Lack of absorption enhancers in the diet.
- Regular use of drugs like Proton pump inhibitors

Apart from the causes like inhibitory factors leading to reduced absorption of iron, the other underlying conditions can also lead to iron deficiency anaemia

- Conditions that degrade the mucosa of the duodenum and also any inflammation in duodenum or jejunum will decrease absorption of iron. Decreased absorption may result from intestinal malabsorption (in diseases like Celiac disease, Crohn's disease, Duodenal ulcers etc.) Achlorhydria, Malabsorption from surgery (post gastrectomy) and Acute or Chronic inflammation.^{1, 34,35}

Bioavailability Enhancers of Iron

Bioavailability can be enhanced by,

- Increasing the gastric acid secretion.
- Inhibition of iron chelating with inhibitors of Iron Absorption (reduce binding of iron to inhibitors, thereby increasing bioavailability).
- Facilitating the chelation of Iron with enhancers of Iron Absorption, so that they form a soluble compound which are easily absorbable.
- Modulation of hepcidin level
- Reducing oxidative stress

The chemical constituents and substances with these properties are Ascorbic acid (Vitamin C), Citric acid, Amino acid, Hydrochloric acid of stomach, Sugars, Drugs with Anti-oxidant and Anti-inflammatory action.^{1, 34,35}

DISCUSSION

Concept of Iron (Loha / Ayas) Supplementation in Ayurveda

In the management of Pandu Roga, Ayurveda emphasizes the administration of Samana Chikitsa following appropriate Sodhana therapy, wherein formulations containing Loha (Ayas) can be seen. Hence in this context Iron deficiency anaemia can be considered under the broad spectrum of Pandu mentioned in Ayurveda.

Pandu is predominantly associated with Rakta Kshaya, and the close relationship between Loha and formation of Rakta was well recognized by the ancient Acharyas. The use of Loha preparations in the management of Pandu is consistently mentioned across almost all major Ayurvedic Samhitas. This practice is based on the principle of administering materials with Sajatiya Guṇa (homologous quality principle) in conditions of Kṣhaya

(tissue depletion), with the objective of restoring the affected Dhatu both quantitatively and qualitatively.

Loha is classified under the Tikta Skandha (group of bitter drugs), and Tikta Rasa is specifically indicated in the management of Rakta Kshaya (tissue depletion). In this context, the statement of Acharya Vagbhata- "Pañda Sreṣṭham Ayah" (Iron as the best therapeutic agent in anaemia)-holds particular significance, emphasizing Loha as the foremost therapeutic agent in Pandu Roga. Furthermore, Rasaratna Samuccaya describes the pharmacological actions of Loha as Rudhirakṛt (haematinic) and Dhatu-vardhaka (tissue-promoting), further supporting its pivotal role in the treatment of Pandu.

Although classical Ayurvedic texts do not provide an explicit description of iron absorption in modern biochemical terms, a closer examination allows an implicit understanding of the factors influencing mineral absorption, including iron, from an Ayurvedic perspective.

According to Ayurveda, absorption depends on the proper functioning of Agni and the balanced state of Pachaka Pitta, Samana Vāta, and Kledaka Kapha. Balanced Pachaka Pitta ensures effective digestion³⁶, Samana Vata facilitates retention and absorption of food³⁷, and Kledaka Kapha aids digestion by moistening and binding the food bolus³⁸. Disturbance of these factors-particularly excessive Drava and Snigdha Guna dominated by Ap Mahabhuta (Water element - one of the five fundamental elements) - leads to Agnimandya and Upalepatva (coating or obstruction) in the gastrointestinal tract, resulting in impaired digestion and absorption.

A similar concept can be considered in the absorption of micronutrients such as iron also. From an Ayurvedic perspective, proper absorption of minerals, including iron, depends on the normal functioning of Agni and the optimal state of the Koshta. Excess Jaliyamsha (water component) reflecting Ap Mahabhuta predominance due to excess Kleda (pathological dampness) in the Koshta, impairs the absorptive process. This can be correlated with modern understanding that an optimal acidic environment is essential for effective iron absorption. Therefore, Upasosana (absorptive drying effect) of Kleda (pathological dampness) becomes essential for facilitating effective iron absorption. Drugs possessing Kleda Upasosana properties helps counter excessive moisture and Upalepathva (mucosal coating) and thereby promote effective absorption of micronutrients such as iron.

Role of Avipathi Choorna in Supporting Iron Absorption: Ayurvedic Perspective

Avipathi Choorna is a classical Virechana Yoga (therapeutic purgative formulation) with Pandu as one of its indications, predominantly acting on the Mahasrotas (Gastrointestinal tract) at the level of Jatharagni (digestive fire). Based on its Rasa-Guna-Veerya- Vipaka profile, Avipathi Choorna exhibits Tikta, Katu, and Madhura Rasa; Laghu and Ruksha Guna; Samasheeta-Ushna Veerya and Madhura Vipaka. It possesses pronounced Pittanirharana (elimination of morbid Pitta), Kaphahara (Kapha reducing), Vatanulomana (normalisation of Vata movement), Deepana, Pachana, and Srotoshodhaka (channel cleansing) properties, which collectively contribute to the restoration of digestive and absorptive functions. Avipathi Choorna, by virtue of its Ruksha (dry) and Laghu (light) Guna, counteracts excessive Drava (fluidity) and Snigdha (unctuousness) qualities in the Koshta, thereby removing Upalepathva and restoring mucosal clarity. Its Tikta Rasa promotes Pachana of vitiated Pitta due to predominance of Akashiya and Vayu Bhuta, it does Soshana of Jaliyaamsa of Pitta. Additionally, Tikta Rasa contributes to Srotoshodhana, enhancing functional patency of the digestive

channels. Katu Rasa facilitates Pachana of aggravated Kapha while Madhura Vipaka pacifies deranged Samana Vata and also has Pittaharatha action. The combined Deepana, Pachana, and Srotoshodhaka actions of Avipathi Choorna improve metabolic efficiency, facilitate effective nutrient absorption, and promote proper Dhatu Poshana (tissue nourishment and formation).

Role of Avipathi Choorna in Supporting Absorption of Iron: Modern Perspective

The major chemical constituents of Avipathi Choorna include amino acids, ascorbic acid, flavonoids, terpenoids, piperine, and scopoletin. These bioactive compounds act synergistically to enhance iron bioavailability through multiple mechanisms such as stimulation of gastric secretion, modulation of intestinal permeability, prevention of inhibitory chelation, facilitation of enhancer chelation, and reduction of oxidative stress and inflammation in the gastrointestinal tract.

Enhancing Gastric Acid Secretion⁴⁰

Piperine, a key alkaloid present in Pippali and Maricha, has been shown to stimulate gastric acid secretion and increase gastrointestinal blood flow. Adequate gastric acidity is essential for the solubilization of non-heme iron and its conversion into the absorbable ferrous form. Piperine also induces alterations in gastrointestinal epithelial cell membrane dynamics, thereby increasing permeability and facilitating transcellular transport of micronutrients such as iron. Sunti (*Zingiber officinale*) exhibits bioavailability enhancing activity by stimulating digestive secretions, improving gastric motility, and maintaining mucosal integrity. It exerts regulatory effects on intestinal smooth muscle activity and mucosal absorption, thereby facilitating efficient iron uptake. Experimental studies have demonstrated that Trikatu (Vyosha) enhances the bioavailability of iron by increasing absorption kinetics and prolonging intestinal residence time.

Inhibiting Chelation of Iron with Inhibitors and Enhancing Chelation with Enhancers

Ascorbic acid and amino acids are well-established enhancers of non-heme iron absorption. Ascorbic acid reduces ferric iron to the ferrous state and forms soluble chelates that resist precipitation and inhibition by phytates and polyphenols. Avipathi Choorna contains ascorbic acid-rich ingredients such as Amalaki (*Emblica officinalis*), Pippali (*Piper longum*), Maricha (*Piper nigrum*), Sunti (*Zingiber officinale*) and Mustha (*Cyperus rotundus*).^{41,42} Amino acid, present in multiple ingredients including Pippali (*Piper longum*), Maricha (*Piper nigrum*), Twak (*Cinnamomum zeylanicum*), Ela (*Elettaria cardamomum*), Patra (*Cinnamomum tamala*)⁴³, Mustha (*Cyperus rotundus*), Vidanga (*Embelia ribes*), Amalaki (*Emblica officinalis*), Sugar (Sita), and Honey (Madhu), form low-molecular-weight iron complexes that enhance mucosal transport and intestinal uptake, thereby preventing interaction with dietary inhibitors.

Ingredients with Established Bioavailability-Enhancing Properties

Several ingredients of Avipathi Choorna are independently proven bioavailability enhancers. Trikatu enhances intestinal absorption by modulating membrane permeability, inhibiting drug-metabolizing enzymes, and improving digestive efficiency. Sugar (Sita) and honey (Madhu) promote iron absorption by increasing solubility and stimulating transporter-mediated uptake of iron in the intestinal epithelium. These components also improve palatability and compliance, indirectly supporting therapeutic outcomes. Most of the ingredients contains ascorbic acid and Aminoacid, which also help in enhancing the bioavailability.^{4,31-33}

Reduction of Oxidative Stress and Inflammatory Response

Oxidative stress and low-grade intestinal inflammation negatively influence iron absorption by impairing mucosal integrity and transporter function. The ingredients of Avipathi Choorna possess significant antioxidant and anti-inflammatory properties due to the presence of flavonoids, phenolic compounds, and terpenoids. These compounds reduce oxidative damage, protect intestinal epithelial cells, and maintain optimal gut environment, thereby favouring effective iron absorption.⁴⁴

Thus, Avipathi Choorna emerges as a promising Ayurvedic formulation for enhancing iron absorption and managing iron deficiency anaemia associated with intestinal malabsorption.

CONCLUSION

Iron malabsorption anaemia requires correction of the underlying digestive and absorptive dysfunction rather than mere iron supplementation. The present review highlights that Avipathi Choorna, indicated in Pandu Roga, restores Agni, alleviates excess Kleda and Upalepatva in the Koshta and promotes Srothosodhana, thereby facilitating effective iron absorption. Its bioactive constituents such as piperine, ascorbic acid, amino acids, and antioxidants support modern mechanisms such as enhancement of gastric acidity, improvement of intestinal permeability, chelation of iron into absorbable forms and reduction of oxidative and inflammatory barriers. Thus, Avipathi Choorna can be considered as a rational Ayurvedic bioavailability enhancer in the management of iron malabsorption anaemia. However, further clinical studies are required to scientifically validate these findings.

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