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Review Article

Herbal Approaches in Different Types of Anemia: A Review

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ABSTRACT

Anemia is a common hematological disorder characterized by reduced hemoglobin concentration, red blood cell count, or packed cell volume, leading to decreased oxygen-carrying capacity of blood. It results from underlying conditions such as nutritional deficiencies, chronic diseases, blood loss, and genetic disorders. Females are more commonly affected due to menstrual blood loss, pregnancy, lactation, and increased iron requirements, with approximately 29.4% of women of reproductive age affected globally. Anemia is classified morphologically into microcytic, normocytic, and macrocytic types, and etiologically into impaired red cell production, increased destruction, and blood loss. Proper classification aids in diagnosis and treatment selection. Iron supplementation remains the primary therapy for iron deficiency anemia, with oral preparations such as ferrous sulphate, ferrous fumarate, and ferrous gluconate helping restore iron stores and promote erythropoiesis. Herbal drugs have gained attention as complementary therapies due to their safety and traditional use. Medicinal plants including Phyllanthus niruri, Emblica officinalis, Withania somnifera, Boerhaavia diffusa, and Zingiber officinale show potential anti-anemic effects by improving iron absorption and stimulating red blood cell production. This review highlights anemia classification, iron supplementation mechanisms, and the therapeutic potential of herbal drugs in anemia management.

INTRODUCTION

Anemia is defined as a condition in which the hemoglobin concentration, red blood cell count, or packed cell volume of blood falls below normal levels, resulting in decreased oxygen-carrying capacity of the blood. According to standard medical textbooks, anemia is not a disease itself but a manifestation of an underlying disorder such

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as nutritional deficiency, blood loss, chronic disease, or genetic abnormalities. It is one of the most common hematological disorders worldwide and affects individuals of all age groups, with a significantly higher prevalence observed among females.

In 2025, anemia continues to remain more common in females compared to males, with an estimated female-to-male ratio of approximately 4:1 in many populations. Women are particularly vulnerable due to physiological factors such as menstrual blood loss, pregnancy, and lactation, which increase iron requirements and may lead to iron deficiency. Additionally, gynecological bleeding, inadequate dietary intake, frequent dieting, and socioeconomic factors further contribute to the high prevalence among females. Reports indicate that approximately 29.4% of women of reproductive age are affected by anemia globally, emphasizing the seriousness of this condition. Increased iron demand during adolescence, pregnancy, and lactation also makes females more susceptible to anemia.

In contrast, anemia in males is comparatively less common and is mainly associated with chronic diseases, occult blood loss, and nutritional deficiencies, particularly among elderly individuals. These gender-based differences highlight the importance of understanding anemia classification and exploring effective management strategies, including the role of herbal drugs in different types of anemia.

Classification of Anemia

Anemia can be classified based on morphological characteristics and etiological factors. These classifications help in identifying the underlying cause, guiding diagnosis, and selecting appropriate therapeutic management.

1. Morphological Classification of Anemia

Morphological classification of anemia is based on red blood cell (RBC) size and hemoglobin concentration, which are determined using red blood cell indices such as mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH).

- Microcytic Hypochromic Anemia

Microcytic hypochromic anemia is characterized by smaller than normal red blood cells with reduced hemoglobin content, resulting in pale-colored erythrocytes. The common causes include:

- Iron deficiency anemia
- Thalassemia
- Anemia of chronic disease (in some cases)
- Lead poisoning
- Sideroblastic anemia (in some cases)

2. Normocytic Normochromic Anemia

Normocytic normochromic anemia is characterized by red blood cells of normal size and hemoglobin concentration, but with reduced overall red blood cell count. Common causes include:

- Hemolytic anemias
- Anemia of chronic disease (some cases)
- Acute blood loss
- Renal disease
- Mixed nutritional deficiencies
- Bone marrow failure (e.g., post-chemotherapy, marrow infiltration by carcinoma, etc.)

3. Macrocytic Anemia

Macrocytic anemia is characterized by larger than normal red blood cells and is divided into two types:

Megaloblastic Macrocytic Anemia

- Vitamin B_{12} deficiency

- Folic acid deficiency
- Non-Megaloblastic Macrocytic Anemia
- Alcoholism
- Liver disease
- Myelodysplastic syndromes
- Aplastic anemia
- Hypothyroidism (in some cases)

2. Etiological Classification of Anemia

Etiological classification is based on the underlying cause of anemia and is broadly divided into three major categories:

A. Anemia Due to Impaired Red Cell Production

This type of anemia occurs when bone marrow fails to produce adequate red blood cells.

1. Nutritional Deficiencies

Deficiencies Affecting Hemoglobin Synthesis

- Iron deficiency anemia

Deficiencies Affecting DNA Synthesis

- Vitamin B_{12} deficiency
- Folic acid deficiency

Other Nutritional Deficiencies

- Vitamin C deficiency

2. Immune-Mediated Injury to Progenitor Cells

- Aplastic anemia
- Pure red cell aplasia

3. Primary Hematopoietic Neoplasms

- Acute leukemia
- Myelodysplastic syndromes
- Myeloproliferative neoplasms

4. Miscellaneous Causes

- Anemia of chronic disorders
- Bone marrow suppression due to drugs

B. Hemolytic Anemia Due to Increased Red Cell Destruction

Hemolytic anemia occurs when red blood cells are destroyed prematurely.

A. Intracorpuscular Defects

a) Hereditary Hemolytic Anemias

1. Red Cell Enzyme Deficiencies
- Glucose-6-phosphate dehydrogenase (G6PD) deficiency
- Pyruvate kinase (PK) deficiency
2. Red Cell Membrane Disorders
- Hereditary spherocytosis
- Hereditary elliptocytosis
3. Hemoglobin Abnormalities

Deficient Globin Synthesis

- Thalassemia syndrome

Structurally Abnormal Globins

- Sickle cell disease

b) Acquired Genetic Defects

- Paroxysmal nocturnal hemoglobinuria

1. Extracorpuscular Defects
- Immunohemolytic anemia
- Fragmentation syndromes
- Hypersplenism

2. Anemia Due to Blood Loss

Acute Blood Loss

- Trauma
- Surgery
- Accidents

3. Chronic Blood Loss
  - Gastrointestinal bleeding
  - Genitourinary tract bleeding
  - Menstrual blood loss

Symptoms of Anemia

The clinical manifestations of anemia vary depending on the severity and duration of the condition.

Symptoms of anemia are commonly classified into mild, moderate, and severe categories.

1.Mild Symptoms

Mild anemia is often asymptomatic; however, some patients may present with non-specific symptoms such as fatigue, weakness, mild dizziness, headache, and reduced physical endurance. Patients may also experience pale skin, irritability, and difficulty in concentration. These symptoms are usually gradual in onset and may go unnoticed in early stages.

2.Moderate Symptoms

As anemia progresses, symptoms become more pronounced and may interfere with daily activities. Moderate anemia is characterized by increased fatigue, shortness of breath during mild exertion, palpitations, pale mucous membranes, cold hands and feet, hair loss, brittle nails, and reduced appetite. Some individuals may also experience dizziness, leg cramps, and sore or swollen tongue.

3.Severe Symptoms

Severe anemia is associated with serious clinical complications and requires immediate medical attention. Patients may experience severe shortness of breath, chest pain, rapid or irregular heartbeat, fainting, extreme fatigue, and marked pallor. In some cases, severe anemia may lead to heart complications, reduced oxygen supply to vital organs, and impaired physical functioning.

Mechanism of Action of Iron Supplementation

Iron supplementation is the primary therapeutic approach for the treatment of iron deficiency anemia. Iron plays a crucial role in hemoglobin synthesis, oxygen transport, and red blood cell production. Supplementation with elemental iron helps restore depleted iron stores, increase hemoglobin synthesis, and promote erythropoiesis in the bone marrow.

When oral iron supplements are administered, iron is absorbed mainly in the duodenum and upper jejunum. The absorbed iron binds to transferrin in the plasma and is transported to the bone marrow, where it is utilized for hemoglobin synthesis and red blood cell formation. Additionally, excess iron is stored in the liver, spleen, and bone marrow in the form of ferritin and hemosiderin, which serve as iron reserves for future use. Thus, iron supplementation corrects iron deficiency by replenishing iron stores and improving oxygen-carrying capacity of blood.

According to recommendations from the Centers for Disease Control and Prevention (CDC), patients with iron deficiency anemia should receive 150–180 mg of oral elemental iron per day, administered in divided doses two to three times daily. This dosing strategy improves absorption and reduces gastrointestinal side effects.

Various iron salts are commonly used for oral iron supplementation. These preparations differ in the amount of elemental iron they provide, which determines their therapeutic effectiveness.

Table 1 Common Oral Iron Preparations

Iron Salt	Dose per tablet	Elemental iron
Ferrous Fumarate	200 mg	65 mg

Ferrous Gluconate	300 mg	35 mg
Ferrous Sulphate (dried)	200 mg	65 mg
Ferrous Sulphate	300 mg	60 mg
Ferrous Feredetate (Sytron)	190 mg / 5 ml elixir	27.5 mg / 5 ml

Among these preparations, ferrous sulphate, ferrous fumarate, and ferrous gluconate are the most commonly prescribed due to their effectiveness, availability, and cost-effectiveness. Ferrous sulphate is widely used as a first-line therapy because of its high elemental iron content and good absorption profile.

Iron supplementation typically results in reticulocytosis within 5–10 days, followed by an increase in hemoglobin levels within 2–3 weeks. However, treatment should be continued for at least 3 months after normalization of hemoglobin levels to replenish iron stores completely.

Despite its effectiveness, oral iron therapy may cause side effects such as nausea, constipation, abdominal discomfort, and dark-colored stools. These adverse effects can be minimized by administering iron in divided doses, taking supplements after meals, or using alternative formulations such as liquid preparations.

Thus, iron supplementation remains a cornerstone in the management of iron deficiency anemia, improving hemoglobin levels, restoring iron stores, and enhancing overall patient health.

Allopathic treatment of anemia primarily focuses on correcting the underlying cause and restoring hemoglobin levels. Iron supplementation is the first-line treatment for iron deficiency anemia, while vitamin B_{12} and folic acid are used for megaloblastic anemia. In severe cases, blood transfusion may be required to rapidly improve hemoglobin levels. Additionally, erythropoietin therapy is used in anemia associated with chronic kidney disease, and management of underlying conditions such as infections, chronic diseases, or bleeding disorders is essential for effective treatment.

Table 2 Traditional Medicinal Plants for Anemia

Botanical Name and Family	Part used	Anemia	Other Uses
Phyllanthus niruri L. Euphorbiaceae	The aerial parts and leaves, roots	Euphorbiaceae is traditionally Used for conditions including anemia, with some studies showin It possesses antioxidant properties that may protect against iron induced liver damage.	Liver disease, jaundice, ulcers, diabetes, kidney and urinary problems, and respiratory issues like asthma and bronchitis.

Eclipta alba L. Asteracea e	Leaves, whole plant, and aerial parts	Traditional medicine used for various ailments, including anemia, although its primary use is for hair related issues	Used for hair growth and strengthening, treating dandruff, hair fall, and premature graying
Emblica officinalis Gaertn. Euphorbiaceae	Fruit leaves and bark	Used to treat anemia because its high Vitamin C content enhances iron absorption and dualizability, making it an effective dietary supplement for iron deficiency anemia	A rejuvenate and immunomodulator to promote longevity, to treat diabetes and hyperacidity, to support liver function, as a natural source of Vitamin C with antioxidant and antiinflammatory properties, to relieve coughs and asthma, and for skin and digestive disorders.
Cuminum cyminum L. Apiaceae	The seeds	Has been used as a traditional remedy for anemia. Cumin seeds are a good source of iron, which is essential for producing hemoglobin to transport oxygen in the blood.	Treating digestive issues, inflammation, and metabolic disorders like diabetes. It is also used for its antioxidant properties, to relieve cough and headaches, and for its effects on the immune system
Glycyrrhiza glabra L. Fabaceae	Roots and rhizomes	Has shown anti-anemic potential, particularly in treating anemia induced by phenyl hydrazine in rats.	Digestive issues like stomach ulcers and colic, respiratory problems such as coughs and bronchitis, inflammatory conditions like arthritis and allergic reactions, and skin disorders like eczema and psoriasis
Zingiber officinale Roscoe Zingiberaceae	Zingiber rhizome	Iron deficiency anemia (IDA). Its polyphenolic compounds, such as gingerols and shogaols, may enhance iron absorption, reduce oxidative stress, promote gut health, and support red blood cell (RBC) production, making it a promising complementary therapy for anemia.	Nausea and vomiting, indigestion and bloating, arthritis and inflammation, and blood sugar regulation

Withania somnifera (L.) Dunal Solanaceae 2	Root and leaf parts	Ashwagandha, particularly the root, contains significant amounts of iron, making it beneficial for iron-deficiency anemia. Suggest that can help to increase hemoglobin levels in the blood, which is crucial for treating anemia.	Various therapeutic effects such as anti-cancer, anti-inflammatory, anti- microbial, anti-diabetic, and hepatoprotective activity.
Asparagus racemosus Willd. Asparagaceae	Root	Research indicates that the root extract of this Ayurvedic herb, which contains iron and other essential nutrients, may help combat anemia	Improving female reproductive health, aiding digestion, boosting immunity, treating ulcers, and reducing stress. Its roots contain bioactive compounds like steroidal saponins and flavonoids that give it properties such as anti- inflammatory, antioxidant, and adapto genic effects.
Boerhaavia diffusa L. Nyctaginaceae 2	Roots and seeds	Traditionally used for treating anemia, and scientific studies and traditional medicine systems like Ayurveda support its use for various conditions, including anemia	Heart diseases, jaundice, hypertension, kidney problems, and inflammation. It is also used as a hepatoprotective (liver-protective) agent, for diabetes, and as an immunomodulator. The plant has a long history of use as a dietary vegetable and in traditional medicine across various cultures.
Piper betle L. Piperaceae	Leaves	Leaves contain beneficial nutrients like iron and vitamins, but their use in betel quid, which also includes areca nut and tobacco, has been linked to increased anemia risk in pregnant women. The tannins found in areca nut, a component of betel quid, can interfere with nutrient absorption, contributing to reduced hemoglobin (Hb) levels.	Cough and asthma, for digestive problems, skin ailments, and has demonstrated antibacterial, antifungal, and woundhealing properties. Its essential oil also acts as an insect repellent and has antiseptic qualities.

Ipomoea digitata L. Convolvulaceae	Tuberous root	Its specific role in treating anemia is not explicitly stated.	Traditional uses include treating diabetes, wounds, respiratory problems like common cold and tuberculosis, and as a rejuvenative health supplement
Dioscorea bulbifera L. Dioscoreaceae	Aerial yam (bulbil) and tuber	Not directly used to treat anemia, and its consumption can lead to poisoning. While D. Bulbifera contains various phytochemicals with potential therapeutic properties	A range of ailments beyond anemia, including diarrhea, dysentery, goiter, coughs, skin diseases, and sore throats. It is also employed for its reported antidiabetic, antimicrobial, antiinflammatory, anthelmintic (antiparasitic) properties, and to treat issues such as cancer, cardiovascular disease,
Rubia cordifolia L. Rubiaceae	The roots	A direct link or documented use of Rubia cordifolia for treating anemia is not explicitly stated in the provided text; however, its role in improving overall blood circulation and having a general blood-purifying effect suggests a	. Skin diseases, inflammation, and gynecological issues like abnormal uterine bleeding
		potential indirect benefit for bloodrelated conditions	
Hemidesmus indicus (L.) R. Br. Ex Schult. Asclepiadaceae	Roots and root bark	A plant traditionally used in Indian medicine for various ailments, including skin diseases, fever, and as a general blood purifier, which indirectly relates to its traditional use for anemia. While it has not been directly cited as a treatment for anemia, its use as a blood purifier implies it helps improve blood quality, a concept linked to addressing anemia.	Skin diseases, diabetes, urinary disorders, rheumatism, snakebites, dysentery, and to promote wound healing. It is also recognized for its anti- inflammatory, antioxidant, antiulcer, and hepatoprotective properties along with potential benefits for memory and immunomodulation

Aloe gel and juice Xanthorrhoeaceae family.	Aloe vera gel and juice	Aloe vera juice may help with anemia by increasing mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH), which are measures of red blood cell size and hemoglobin content.	Including skin conditions like burns, psoriasis, and acne, digestive issues such as constipation and heartburn, managing diabetes, and promoting wound healing
Bitter melon Cucurbitaceae family	The whole fruit, especially the leaves and seeds	May help prevent iron-deficiency anemia because it contains iron and folate, both of which are essential for healthy red blood cell production.	Its antidiabetic properties. Other traditional uses include treating cancers, including breast cancer, malaria, gout, rheumatism, and various skin problems
Betel nut Arecaceae family	No specific part of the betel nut is traditionally used	Betel nut use is associated with increased risk of anemia through multiple pathways, including nutrient malabsorption from tannins and polyphenols, chronic blood loss due to gastrointestinal tissue damage, and the potential for reduced food intake from appetite suppression	Beyond any potential connection to anemia, including as a traditional remedy for intestinal parasites, a way to combat bad breath, a culinary ingredient for its peppery taste, and as an ingredient in Ayurvedic and Chinese traditional medicines.
Chilli solanacea e	The entire chilli pepper	Can refer to anemia in humans caused by iron deficiency, which can be influenced by the consumption of chili peppers, or to iron deficiency in the chili plant itself, where young leaves turn yellow due to a lack of iron	They can have a positive effect on metabolism and potentially help manage blood sugar levels and prevent chronic diseases like some cancers and obesity.

St John's wort Hypericace ae; Juss.	Stem, petals, and flowers.	Can indirectly affect iron absorption, potentially worsening anemia, because it can interfere with the body's ability to absorb iron and other minerals	Depression and mood disorders.
Liquorice egume	The root of the licorice plant	Liquorice is actually chock-full of iron	For eczema, swelling of the liver, mouth sores, and many other conditions,
Psyllium plantaginaceae	Seeds, particularly their husks	Generally not directly linked to treating or causing anemia	It also helps with weight management by increasing satiety, can soothe the respiratory and urinary tracts, and has been traditionally used for cancer prevention and inflammatory bowel diseases
Adansonia digitata L. *Bombacaceae*	Stem bark	Its fruit pulp is rich in Vitamin C, while seeds contain iron and other minerals, contributing to its medicinal value.	Including the treatment of fever, malaria, diarrhea, dysentery, microbial infections, toothache, and inflammato ry conditions. Its leaves are applied to insect bites, and extracts from the fruits and seeds have antimicrobial properties
Amaranthus spinosus L. *Amaranthaceae*	Whole plant	The plant contains iron-rich compounds, making it a potential remedy for anemia, as evidenced by its use as a haematinic (a substance that increases hemoglobin) in traditional practices	It also serves as an anti-inflammatory agent, a laxative, a diuretic, and has been used to prevent swelling and promote wound healing.

Anogeissus leiocarpus (DC.) Guill. & Perr. Combretaceae	Stem bark, leaves	It also has antibacterial and antifungal properties, being used for bacterial infections, wound treatment, and oral hygiene.	Treating parasitic infections (helminthiasis, trypanosomiasis, schistosomiasis), microbial infections (bacterial and fungal), skin conditions (psoriasis, eczema, wounds), respiratory illnesses (asthma, cough, tuberculosis), metabolic disorders like diabetes, and even for dental hygiene as a chewing stick
Bridelia ferruginea Benth. Euphorbiaceae	Leaves	Is traditionally used in some cultures to treat anemia.	Including arthritis, dysentery, constipation, diabetes, skin diseases, bladder and intestinal disorders, oral infections, and as an antidote for poisons and bites.
Cajanus cajan (L.) Fabaceae Millsp. Fabaceae	Leaves and stem	A plant with reported anti-anemic properties	Pigeon pea (Cajanus cajan) seeds have been studied for their potential to improve hematological parameters in anemia
Detarium microcarpum Guill. & Perr. Caesalpiniaceae	Leaves	Detarium microcarpum is not directly associated with causing "Caesalpin anemia"	Used for a wide range of conditions beyond anemia, including malaria, diabetes, epilepsy, tuberculosis, syphilis, skin infections, wounds, inflammation, and even as a dietary supplement due to its high nutritional content. The plant also has non-medicinal uses, such as being a source of fuel wood
Detarium senegalense J. F. Gmel. Caesalpiniaceae	Leaves	As a treatment for diabetes, malaria, wounds, inflammation, and even cancer. This study emphasizes	Detarium microcarpum is not directly associated with causing "Caesalpin anemia"

Faidherbia albida (Delile) A. Chev. *Mimosaceae*	Leaves	Leading to low hemoglobin levels. While Faidherbia albida is a nutritious "famine food" and source of fodder that may indirectly support health, its seeds and pods require lengthy preparation and are not a recognized anemia treatment.	Including improving soil fertility and acting as an agroforestry tree due to its nitrogen-fixing ability and its tendency to drop leaves during the rainy season, making it beneficial for crops.
Ficus platypphylla Del. *Moraceae*	Stem bark, roots	Studies on F. Platyphylla stem bark extracts have shown an antianemic effect in mice infected with the malaria parasite Plasmodium berghei. The extract helped to prevent a drastic reduction in Packed Cell Volume (PCV), a measure of anemia, and cleared malaria pigments from liver tissues, validating its traditional use in treating malaria and associated anemia.	Including treating malaria, tuberculosis, fertility problems, pain, and inflammation, as well as having roles in managing central nervous system disorders like insomnia, epilepsy, and psychosis. The plant's stem bark, leaves, and roots are employed in various forms, such as decoctions, powders, and extracts, to achieve these medicinal effects.
Harungana madagascariensi s Lam. Ex Poir. Hypericaceae	Stem bark	Used in traditional medicine for anemia, with studies supporting its antianemic properties by increasing red blood cell counts and hemoglobin levels	The dragon blood tree, is used in traditional medicine for a wide range of conditions beyond anemia, including dysentery, diarrhea, typhoid fever
Hoslundia opposita Vahl. Lamiaceae	Leaves and stem	Ncluding malaria, wound healing, liver diseases, epilepsy, and to treat venereal diseases like gonorrhea. It also shows potential pharmacological effects such	Ncluding malaria, wound healing, liver diseases, epilepsy, and to treat venereal diseases like gonorrhea. It also shows potential pharmacological effects such

		as antioxidant, antiinflammatory, and anticancer properties.	as antioxidant, antiinflammatory, and anticancer properties.
Justicia secunda Vahl	Leaves and stem	A plant known in various	.Employed in folk medicine for conditions such as diabetes,
Acanthaceae		traditional African medicines for its use in treating anemia, often as a "blood tonic" decoction made from its leaves	hypertension, gastrointestinal issues, wounds, and inflammatory processes
Khaya senegalensis (Desv.) A. Juss. Meliaceae	Stem bark	Use in anemia	Used for medicinal purposes beyond anemia, including as an antidiabetic, anti-cancer, anti-inflammatory, antioxidant, antimicrobial, hepatoprotective (liver-protective), anti-ulcer, and anti-parasitic agent
Lannea acida A. Rich Anacardiaceae	Stem bark, roots	Scientific studies specifically on Lannea acida's efficacy against anemia are lacking, with current research focusing on its antiinflammatory, antiosteoporotic, and antioxidant properties.	Additionally, its extracts show potential anti-osteoporotic effects, and some studies suggest it has antimicrobial properties against bacteria and parasites.

FUTURE ASPECTS

Future research on anemia management should focus on scientific validation of herbal drugs with anti-anemic potential through experimental and clinical studies. Standardization of herbal formulations, identification of active phytoconstituents, and evaluation of safety profiles are essential for their wider acceptance. Additionally, development of novel herbal-based formulations and combination therapies with conventional treatments may improve therapeutic outcomes. Further studies are also required to explore bioavailability, mechanism of action, and long-term effectiveness of medicinal plants in anemia management. Integrating traditional herbal

medicine with modern healthcare approaches may provide safer, cost-effective, and accessible treatment options for anemia in the future.

CONCLUSION

Anemia is a common global health problem caused by nutritional deficiencies, chronic diseases, and blood loss, with iron deficiency being the most prevalent type. Proper classification of anemia is important for accurate diagnosis and effective treatment. Conventional therapies such as iron supplementation, vitamin B_{12}, folic acid, and blood transfusion are widely used but may have certain limitations.

Herbal medicines such as *Phyllanthus niruri*, *Emblica officinalis*, *Withania somnifera*, *Boerhaavia diffusa*, and *Zingiber officinale* show promising anti-anemic potential by improving iron absorption and stimulating red blood cell production. Therefore, herbal drugs may serve as a safe and effective complementary approach in anemia management. However, further research and clinical studies are required to confirm their efficacy and safety.

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