

Herbal Remedies and Nutraceuticals: A Natural Approach to Anemia Management

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ABSTRACT

About one-third of people around the globe experience anemia, with iron deficiency anemia (IDA) being the most prevalent type. The World Health Organization defines anemia as having low hemoglobin levels, which can lead to serious health complications, especially in vulnerable groups such as pregnant women and children. While iron deficiency is the primary cause of anemia, other nutritional deficiencies, including vitamin B12 and folate, as well as dietary choices, can also contribute. Iron supplements are commonly used in standard treatment; however, there is a growing interest in herbal therapies and nutraceuticals due to their natural origins and lower risk of side effects. This review explores the use of various herbal and nutraceutical compounds in treating anemia. Plants like *Elephantopus scaber* and *Hibiscus sabdariffa* enhance iron absorption, while sources of vitamin B12, such as soy milk, are used to address deficiency anemia. Other plants, including *Withania somnifera* and *Echinacea purpurea*, may help treat aplastic anemia by promoting blood cell production and immune function. Additionally, treatments like *Zanthoxylum zanthoxyloides* are recognized for their ability to stabilize red blood cells and alleviate symptoms of sickle cell anemia. This approach illustrates how alternative therapies can complement conventional treatments, paving the way for their effective integration in anemia management.

Keywords- Anemia Management, Iron Deficiency, Herbal Remedies, Nutraceuticals, Hematopoiesis

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INTRODUCTION

About one-third of the global population experiences anemia, with iron deficiency anemia (IDA) being the most prevalent type. Anemia poses a serious health issue worldwide. The World Health Organization (WHO) defines anemia as having hemoglobin (Hb) levels that fall below normal and are insufficient to meet the body's physiological needs. Approximately half of all anemia cases are attributed to iron deficiency, making it the leading cause of this condition. Even mild anemia can have detrimental health effects, and it is often diagnosed only after iron deficiency has progressed. This highlights the importance of early detection and timely intervention [1-3].

Several laboratory tests, including hemoglobin measurements, red blood cell (RBC) counts, and blood smear evaluations, can help identify anemia. Specifically, nutritional anemia arises from a deficiency in haematological nutrients like iron, vitamin B12, and folate. Factors such as dietary habits, aging, or physiological conditions that hinder nutrient absorption can exacerbate these deficiencies. Historically, as societies transitioned from foraging to agriculture,

nutritional anemia has increased due to diets becoming less rich in essential nutrients [4-7].

Anemia can manifest through various symptoms, including fatigue, pallor, dizziness, and shortness of breath. If left untreated, anemia can weaken the immune system, impair cognitive function, and potentially lead to higher mortality rates, especially among vulnerable populations like young children and pregnant women. The management and prevention of anemia are critical public health issues due to its significant impact on global health [8-9].

Iron Deficiency Anemia

Increased iron losses, reduced iron absorption, or higher iron requirements can all contribute to iron deficiency anemia. This condition is particularly prevalent among women and children, especially in low- and middle-income countries (LMICs). According to the Global Burden of Disease Study conducted in 2016, IDA ranked as the fourth most common cause of years lived with disability. The serious health impacts of this condition include poor birth outcomes, decreased productivity in adults, and delays in cognitive and developmental progress in children [11].

Table-1 Herbal Remedies and Nutraceuticals for Iron Deficiency Anemia

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	<i>Elephantopus scaber</i>	Herbal medicine	Various studies suggest that <i>Elephantopus scaber</i> may assist in treating iron deficiency anemia. Its phytochemicals, such as flavonoids, could potentially provide iron directly or enhance its absorption. The plant's antioxidant and anti-inflammatory properties likely support the hematopoietic system, promoting the production of red blood cells. Additionally, its components may improve the body's ability to absorb and utilize iron effectively.	30mg/kg 100mg/kg	12,13

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2.	<i>Hibiscus sabdariffa</i>	Herbal medicine	<i>Hibiscus sabdariffa</i> is rich in vitamin C, which aids in the absorption of non-heme iron, leading to the belief that it could help treat iron deficiency anemia by enhancing iron uptake. Its antioxidant properties likely protect red blood cells from oxidative damage, potentially increasing their numbers, promoting haematopoiesis, and elevating the body's iron levels.	100-250 mg	14,15
3.	<i>Zingiber officinale</i>	Herbal medicine or Nutraceutical	Ginger, or <i>Zingiber officinale</i> , has been believed to aid in the treatment of iron deficiency anemia by enhancing iron absorption through its bioactive compounds, such as shogaols and gingerols. These compounds may improve the digestive system, leading to better absorption of iron and other essential nutrients. Additionally, ginger's anti-inflammatory and antioxidant properties likely support the production of red blood cells and protect against oxidative damage.	250 mg	16,17
4.	Spinach	Nutraceutical	Spinach is known for its high levels of non-heme iron, which can aid the body in replenishing its iron stores when eaten, making it a popular choice for addressing iron deficiency anemia. Moreover, the significant amount of vitamin C in spinach enhances the absorption of non-heme iron in the digestive system. The folate present in spinach also supports the production of red blood cells, further assisting in the treatment of anemia.	30-60 g	18

Vitamin B-12 Deficiency Anemia

A deficiency in Vitamin B12 can lead to anemia when the body lacks enough of this essential nutrient to produce healthy red blood cells. This condition may manifest through symptoms such as weakness, fatigue, a pale complexion, shortness of breath, and neurological issues like tingling sensations in the hands and feet. The progression of the illness is often gradual and is commonly associated with malabsorption, insufficient dietary intake, or conditions like pernicious anemia. In severe cases, it can also lead to difficulties with concentration and memory [19].

Table-2 Herbal Remedies and Nutraceuticals for Vitamin B-12 Deficiency Anemia

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	Soy milk	Nutraceutical	By providing enriched Vitamin B12, which is absorbed in the ileum and plays a crucial role in the formation of red blood cells, soy milk helped to alleviate anemia caused by Vitamin B12 deficiency. Replenishing B12 levels was essential to prevent megaloblastic anemia, as it is necessary for the production of erythroblast DNA. Additionally, it supported the restoration of myelin formation, which is important for proper nervous system function.	240-280 ml	20
2.	Brewer's yeast	Nutraceutical	To treat vitamin B12 deficiency anemia, brewer's yeast provides readily available B vitamins, including fortified B12, which is absorbed by the ileum. It supports the DNA synthesis of erythroblasts, promoting the production of red blood cells and preventing megaloblastic anemia. Additionally, it contributes to the formation of myelin, helping to restore normal nerve function.	15-30 g	20
3.	<i>Trigonella foenum-graecum</i>	Herbal medicine or Nutraceutical	Fenugreek, also known as <i>Trigonella foenum-graecum</i> , has been shown to enhance the production of red blood cells and the synthesis of hemoglobin, aiding in the treatment of vitamin B12 deficiency anemia. Its bioactive components may improve digestion, potentially helping	5-10 g	21

			the gut to better absorb vitamin B12. Additionally, the anti-inflammatory and antioxidant properties of fenugreek contribute to overall blood cell production and help reduce fatigue.		
4.	Chlorella	Nutraceutical	Chlorella contributed to the treatment of vitamin B12 deficient anemia by providing bioavailable B12 that was absorbed in the intestine and utilized for red blood cell synthesis. It helped prevent megaloblastic anemia by enhancing the production of erythroblast DNA. Additionally, its antioxidant properties improved hematopoietic function by reducing oxidative stress.	2-3 g	22

Aplastic Anemia

Aplastic anemia is characterized by a deficiency of red blood cells, white blood cells, and platelets due to the bone marrow's failure to produce enough blood cells. This condition can arise from various factors, including autoimmune disorders, exposure to harmful substances, certain medications, or viral infections. Patients often experience symptoms such as fatigue, increased susceptibility to infections, and prolonged bleeding [23].

Table-3 Herbal Remedies for Aplastic Anemia

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	<i>Withania somnifera</i>	Herbal medicine	By influencing the hypothalamic-pituitary-adrenal (HPA) axis, reducing oxidative stress, and enhancing blood cell production through immune system support, ashwagandha (<i>Withania somnifera</i>) has shown benefits for aplastic anemia. It also increased the counts of red and white blood cells and promoted the development of bone marrow cells.	300-600 mg	24
2.	<i>Echinacea purpurea</i>	Herbal medicine	<i>Echinacea purpurea</i> supported the recovery of patients with aplastic anemia by enhancing	300-500 mg	24,25

			the innate immune system, which included increasing the activity of macrophages, natural killer (NK) cells, and cytokine production. Additionally, it improved bone marrow function by promoting white blood cell proliferation and regulating inflammatory responses.		
3.	<i>Asparagus racemosus</i>	Herbal medicine	<i>Asparagus racemosus</i> (Shatavari) supported the recovery of patients with aplastic anemia by enhancing haematopoiesis, promoting the proliferation of bone marrow cells, and regulating immune responses. Its antioxidant properties reduced oxidative stress in hematopoietic tissues, contributing to the maintenance of normal levels of red and white blood cells.	250-750 mg	26,27

Sickle Cell Anemia

Sickle cell anemia is characterized by the production of abnormal hemoglobin (HbS), leading to crescent-shaped red blood cells. These misshapen cells disrupt blood flow, causing pain, anemia, and organ damage. The condition primarily affects populations in regions where malaria is common. Symptoms worsen under stress or low oxygen levels, and the disorder is inherited in an autosomal recessive manner [28].

Table-4 Herbal Remedies and Nutraceuticals for Sickle Cell Anemia

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	<i>Zanthoxylum zanthoxyloides</i>	Herbal medicine	<i>Zanthoxylum zanthoxyloides</i> , commonly known as Fagara, helps combat sickling effects primarily by stabilizing red blood cell membranes and preventing hemoglobin from polymerizing. This plant extract promotes healthier erythrocyte shapes and reduces the formation of sickled cells in low oxygen environments, a hallmark of sickle cell disease.	200-400 mg	29,30

			Additionally, the roots contain compounds with antiprotease properties that further enhance membrane stability.		
2.	<i>Allium sativum</i> (Garlic)	Nutraceutical	The repetitive deoxycycling leads to the formation of elongated, sickle-shaped cells, while reactive oxygen species can inflict oxidative damage on the erythrocyte membrane. The activation of the calcium-activated potassium efflux channel and the formation of dense cells are inhibited because the erythrocyte membrane is protected from oxidative damage, preventing the membranes from leaking calcium ions.	150 mg/kg	31,32
3.	<i>Parquetina nigrescens</i>	Herbal medicine	<i>Parquetina nigrescens</i> has demonstrated effectiveness in reducing sickling by stimulating the production of red blood cells and supporting the integrity of erythrocyte membranes. Research indicates that its aqueous root extract can increase hemoglobin and red blood cell counts at lower doses (such as 50 mg/kg), while higher doses (like 100 mg/kg and 150 mg/kg) may lead to a decrease. The presence of bioactive compounds, including alkaloids and saponins, is likely contributing to the plant's beneficial effects, potentially aiding in the treatment of sickle cell anemia.	50 mg/kg	29,33
4.	<i>Carica papaya</i> leaf	Nutraceutical	<i>Carica papaya</i> leaf extract has shown effectiveness in preventing the formation of sickled cells and stabilizing red blood cell membranes in low oxygen conditions. This action helps to reduce oxidative stress, which is a significant contributor to the complications associated with sickle cell	400 mg/kg	29,34

			anemia. Additionally, the leaf extract can modify immune responses by enhancing the activity of antioxidant enzymes and decreasing inflammatory cytokines.		
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Folate Deficiency Anemia

Folate insufficiency occurs when the body fails to produce enough folate (vitamin B9) to form healthy red blood cells, which can disrupt DNA synthesis and lead to anemia. Common symptoms include shortness of breath, pale skin, fatigue, and irritability. This condition is often linked to poor nutrition, malabsorption issues, or increased needs during pregnancy. In severe cases, it can also result in neurological problems like depression and memory loss [35].

Table-5 Herbal Remedies and Nutraceuticals for Folate Deficiency

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	<i>Moringa oleifera</i>	Nutraceutical	<i>Moringa oleifera</i> plays a significant role in treating folate-deficient anemia by providing essential micronutrients such as folate, iron, and vitamins that boost hemoglobin levels and promote the production of red blood cells. Its high bioavailability and antioxidant properties also enhance nutrient absorption.	2-8 g	36
2.	Avocado	Nutraceutical	Avocado is rich in folate, an essential nutrient for DNA synthesis and the production of red blood cells, making it effective in alleviating folate deficiency anemia. It also offers healthy fats and antioxidants that enhance nutrient absorption and reduce oxidative stress. Consuming about 100–200 grams of avocados daily leads to a significant increase in folate intake, which helps maintain hemoglobin levels and prevents anemia symptoms. Therefore, it serves as a valuable addition to dietary plans aimed at addressing folate deficiency.	100-200 g	37

Haemolytic Anemia

When red blood cells are destroyed faster than they can be produced, it leads to haemolytic anemia, which reduces their capacity to transport oxygen. This condition can be triggered by autoimmune disorders or genetic conditions such as sickle cell disease. Symptoms may include fatigue, jaundice, and dark urine due to the excessive breakdown of hemoglobin [38].

Table-6 Herbal Remedies and Nutraceuticals

for Haemolytic Anemia

Sr No.	Name	Category	Mechanism of Action	Dose	References
1.	<i>Plastotoma africanum</i>	Herbal medicine	In experimental models of haemolytic anemia, <i>Plastotoma africanum</i> showed hemopoietic effects by promoting the production of red blood cells. The extract led to an increase in both red blood cell counts and hemoglobin concentration, suggesting it may aid in addressing deficiencies caused by anemia.	80 mg/kg	39
2.	<i>Amaranthus cruentus</i>	Herbal medicine or Nutraceutical	<i>Amaranthus cruentus</i> is reported to have anti-anaemic properties that could be beneficial for those with haemolytic anemia. It aids in increasing hemoglobin levels and enhancing the production of red blood cells, thereby promoting erythropoiesis. This effect is attributed to its rich content of iron, folic acid, and antioxidants. Preclinical studies have shown that the plant extract effectively normalized blood parameters at doses around 400 mg/kg.	400 mg/kg	40,41
3.	<i>Solanum aethiopicum</i>	Nutraceutical	African eggplant, also known as <i>Solanum aethiopicum</i> , helps treat haemolytic anemia primarily due to its antioxidant properties, which protect red blood cells from damage caused by oxidative stress. In studies involving animal	300-800 mg/kg	42

			models of phenylhydrazine-induced anemia, its aqueous leaf extract has been shown to enhance hemoglobin levels, increase red blood cell count, and stabilize cell membranes, thereby promoting erythropoiesis.		
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Conclusion

The article suggested that herbal and nutraceutical medicines could serve as supportive treatments for various types of anemia. These natural remedies enhance the body's ability to absorb, utilize, and retain essential nutrients, while traditional therapies focus on correcting deficiencies. With further research and clinical validation, these treatments may become complementary options, improving anemia management and potentially reducing the reliance on pharmaceutical interventions.

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