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Medicinal Plants Alternative to Pharmacological Agents Used in the Treatment of Anaemia

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ABSTRACT

Medicinal plants have long been recognized for their therapeutic potential and serve as valuable alternatives to pharmacological agents in managing various health conditions, including anaemia. This paper aims to elucidate the diverse array of medicinal plants employed in the treatment of anemia. The exploration encompasses a comprehensive analysis of plant-based remedies across different cultures and traditions, highlighting their bioactive compounds, mechanisms of action, and efficacy in ameliorating anemia. Additionally, emphasis is placed on the utilization of these botanical sources as natural supplements or adjuncts to conventional therapies, focusing on their safety profiles and potential adverse effects. Furthermore, the paper evaluates the scientific evidence supporting the efficacy of these medicinal plants through in vitro, in vivo, and clinical studies, while also discussing the challenges associated with standardization and quality control. By synthesizing this knowledge, the review underscores the importance of integrating traditional herbal medicine into evidence-based healthcare practices, fostering a holistic approach for managing anemia and paving the way for future research and therapeutic advancements in this domain.

Keywords: medicinal plants; pharmacological agents; treatment; anaemia

INTRODUCTION

Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal. Haemoglobin is needed to carry oxygen and if you have too few or abnormal red blood cells, or not enough haemoglobin, there will be a decreased capacity of the blood to carry oxygen to the body's tissues [1-4]. This results in Symptoms such as fatigue, weakness, dizziness and shortness of breath, among others. The optimal haemoglobin concentration required to meet physiologic needs varies by age, sex, elevation of residence, smoking habits and pregnancy Status [5-9]. Anemia can be caused by blood loss, decreased red blood cell production, and increased red blood cell breakdown. Causes of bleeding include bleeding due to inflammation of the stomach or intestines, bleeding from surgery, serious injury, or blood donation [10-14]. Causes of decreased production include iron deficiency, vitamin B12 deficiency, thalassemia and a number of bone marrow tumors. Causes of increased breakdown include genetic disorders such as sickle cell anemia, infections such as malaria, and certain autoimmune diseases. Anemia can also be classified based on the size of the red blood cells

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and amount of hemoglobin in each cell. If the cells are small, it is called microcytic anemia; if they are large, it is called macrocytic anemia; and if they are normal sized, it is called normocytic anemia [15-18].

The use of medicinal plants for the treatment of diseases dates back to the history of human life, that is, since human beings have sought a tool in their environment to recover from a disease, the use of plants was their only choice of treatment [19-21]. More than a tenth of the plant species (over 50 000 species) are used in pharmaceutical and cosmetic products [22-24].

Medicinal plants also called medicinal herbs; synthesize hundreds of chemical compounds for various functions, including defense and protection against insects, fungi, diseases, and herbivorous mammals [25-27].

Human settlements are often surrounded by weeds used as herbal medicines, such as nettle, dandelion and chickweed [28-31]. Humans were not alone in using herbs as medicines: some animals such as non-human primates, monarch butterflies and sheep ingest medicinal plants when they are ill [32-35].

Plant medicines are in wide use around the world [36]. In most of the developing world, especially in rural areas, local traditional medicine, including herbalism, is the only source of health care for people, while in the developed world, alternative medicine including use of dietary supplements is marketed aggressively using the claims of traditional medicine. As of 2015, most products made from medicinal plants had not been tested for their safety and efficacy, and products that were marketed in developed economies and provided in the undeveloped world by traditional healers were of uneven quality, sometimes containing dangerous contaminants [37-41].

ANAEMIA

Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal. The optimal haemoglobin concentration required to meet physiologic needs varies by age, sex, elevation of residence, smoking habits and pregnancy status [42-43]. **Anemia** can be **caused** by blood loss, decreased red blood cell production, and increased red blood cell breakdown. Causes of blood loss can include bleeding due to inflammation of the stomach or intestines, bleeding from surgery, serious injury, or blood donation. Causes of decreased production include iron deficiency, vitamin B12 deficiency, thalassemia and a number of bone marrow tumors. Causes of increased breakdown include genetic disorders such as sickle cell anemia, infections such as malaria, and certain autoimmune diseases. Anemia can also be classified based on the size of the red blood cells and amount of hemoglobin in each cell. If the cells are small, it is called microcytic anemia; if they are large, it is called macrocytic anemia; and if they are normal sized, it is called normocytic anemia [44].

Symptoms of anemia can come on quickly or slowly. Early on there may be few or no symptoms. If the anemia continues slowly (chronic), the body may adapt and compensate for this change. In this case, no symptoms may appear until the anemia becomes more severe. Symptoms can include feeling tired, weak, dizziness, headaches, intolerance to physical exertion, shortness of breath, difficulty concentrating, irregular or rapid heartbeat, cold hands and feet, cold intolerance, pale or yellow skin, poor appetite, easy bruising and bleeding, and muscle weakness. Anemia that develops quickly, often, has more severe symptoms, including, feeling faint, chest pain, sweating, increased thirst, and confusion. There may be also additional symptoms depending on the underlying cause [45].

Anemia is one of the most widespread disorders of blood which affect the populations of all ages throughout the world. It is a public health problem that affects populations both rich and poor countries. It is a pathologic condition, in which there is a decrease in red blood cell mass or a decrease in the amount of Hb. Anaemia diseases kill more than 36 million people each year.

However, the incidence of this disorder is higher in the developing countries than in the developed countries due to poverty and lack of hygiene. The situation is aggravated by factors such as nutritional deficiencies and high prevalence of parasitic gastrointestinal infections which cause loss of blood. Number of other conditions, such as malaria and haemoglobinopathies are also responsible, often in 2,3combination [46].

SOME PHARMACOLOGICAL AGENTS USED IN THE TREATMENT OF ANAEMIA

1. Epoetin alfa
2. Multivitamin with iron
3. Vitamin B6
4. Procrit
5. Reblozyl
6. Epogen
7. Integra
8. Integra Plus
9. Ferralet 90
10. Reblozyl
11. Iron-150

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12. Aminoxin
13. Fusion-Plus
14. Dialyvit
15. Lenalidomide
16. Retacrit e.t.c

ALTERNATIVE MEDICINAL PLANTS USED IN ANAEMIA TREATMENT JANTROPHA TANJORENSIS

Jatropha tanjorensis belongs to the family 'Euphorbiaceae' and is widely grown in southern Nigeria [47]. Euphorbiaceae is a large family of flowering plants with 300 genera and around 7500 species. Most are herbs but some, especially those distributed in the tropics, are shrubs or trees. They are used by man as food or for ornamental purposes [47]. There is a study that evaluated the toxicity of the methanol extract of *Jatropha tanjorensis* leaves employing a 24-h acute toxicity and 28 days repeated dosing regimen. The acute toxicity result showed that a dose of 5000 mg/kg body weight of *Jatropha Tanjorensis* orally administered to mice did not cause any signs of toxicity or mortality in the mice. If we consider the reports of that substances with LD₅₀ higher than 5000 mg/kg when orally administered may be deemed non-toxic, we could presume that the plant is safe for oral consumption [48-50]. Its primary use is for fencing while its secondary uses are as a source of edible leafy vegetable and as medicine [51]. The plant leaves were initially and popularly consumed in Nigeria as soups and as a tonic with the claim that it increases blood volume [51].

Jatropha tanjorensis is a plant that has been traditionally used for various purposes, including potential medicinal applications, in some regions of West Africa. While there is limited scientific research on its specific benefits in relation to anemia, some of its properties may have potential relevance for individuals with anemia such as:

1. **Iron Content:** *Jatropha tanjorensis* may contain iron, which is an essential mineral for the production of hemoglobin in red blood cells. Consuming iron-rich foods can help address iron-deficiency anemia.
2. **Vitamins and Minerals:** Like many plants, *Jatropha tanjorensis* may contain vitamins and minerals that are important for overall health. Nutritional support is crucial in addressing anemia, especially when it is caused by nutrient deficiencies.
3. **Folate Content:** Folate is essential for red blood cell formation. Plants like *Jatropha tanjorensis* that contain folate can be beneficial for individuals with certain types of anemia, such as megaloblastic anemia.
4. **Phytochemicals:** Some plants, including *Jatropha tanjorensis*, may contain phytochemicals that have potential health benefits. While specific compounds and their effects would require further research, these phytochemicals could play a role in overall health [51].

MORINGA OLEIFERA

Moringa oleifera also known as the drumstick tree, the miracle tree, the ben oil tree, or the horseradish tree. The drumstick tree (*Moringa oleifera* Lam.) member of the *Moringaceae* family is widely spread from India to Africa and numerous other tropical and arid countries, mainly utilized as food and medicine [52]. Its drought resistance properties, i.e., water-logging of roots, make this plant grow well in drier regions. *Moringa* plants can grow on different soil types, but well-drained loamy and sandy soil with a pH of 5–9 is best suited for its growth [53]. *Moringa oleifera* is viewed as a most valuable plant because all parts can be utilized for food, medication, and other industrial and household purposes [54-55]. The leaves, in particular, may be consumed as a salad, roasted, or stored as dried powder for a long period without losing nutritious content. Besides utilizing its leaves for food and feed, because of inborn phytochemicals like phenolic acids, flavonoids, carotenoids, and glucosinolates, they also have potential applications as functional foods nutraceuticals [56-57]. Generally, herbal preparations are considered safe and without adverse effects because they are considered natural products. *Moringa* leaves are highly recommended as natural dietary supplements because of their high nutritional value and low anti-nutritional factors. No adverse effects of *moringa* leaves have been observed in human studies so far. Moreover, many different formulations and preparations of leaves have been used worldwide as food, and no ill effects have been reported. The daily consumption of 70 g *moringa* leaf extract was considered safe with no toxicity [58]

BENEFITS OF MORINGA LEAVES IN RELATION TO ANAEMIA

- *Moringa* leaves are a rich source of essential nutrients, including iron, which is a key component for the production of hemoglobin. Anemia is often caused by iron deficiency, so incorporating iron-rich foods like *moringa* into the diet may help address this deficiency.
- *Moringa* leaves also contain vitamin C, which enhances the absorption of non-heme iron (the type of iron found in plant-based foods like *moringa*) in the digestive tract. The combination of iron and vitamin C in *moringa* can be helpful for individuals with anemia.
- *Moringa* is a good source of folate, which is essential for red blood cell formation. Folate deficiency can lead to a type of anemia known as megaloblastic anemia.

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- The chlorophyll in moringa leaves may have a role in supporting the production of hemoglobin in red blood cells, which can be beneficial for those with anemia.

Including moringa in the diet can contribute to overall improved nutritional status, which is important for preventing and managing anemia. Anemia can be related to a lack of various nutrients, so a balanced diet can be beneficial.

Moringa contains many essential compounds, such as:

- vitamin A
- vitamin B1 (thiamine)
- vitamin B2 (riboflavin)
- vitamin B3 (niacin)
- vitamin C (ascorbic acid)
- calcium
- potassium
- iron
- magnesium
- phosphorus

It is also low in fat and contains no harmful cholesterol.

TELFAIRIA OCCIDENTALIS (UGU):

It is a tropical vine grown in West Africa as a leaf vegetable and for its edible seeds [59]. Also known as fluted pumpkin. It is a leafy green vegetable that is popular in Nigerian cuisine and other parts of West Africa. The scientific name for fluted pumpkin is *Telfairia occidentalis*. It belongs to Cucurbitaceae family and is an indigenous to southern Nigeria. Fluted pumpkin has haematinic properties with high levels of protein and iron, hence extracts from the leaves can be used to boost blood for anaemia patients [60]. The protein in fluted pumpkin leaves also helps in the improvement and maintenance of the body tissues which includes the connective tissues, muscles and the nervous systems. Fluted pumpkin leaves contains the amount of protein needed for hormone balancing; tissue repairs and regulates the acidities of body cells and organ [60]. The plant contains high amounts of phosphorus making it useful for keeping off onset of kidney diseases like kidney stone. It consists of seed part that has high oil content, high amounts of characterized of resulted in anti-oxidative properties such as oleic acid, vitamin A, alkaloids, tannins and linoleic acid which makes it capable of treating infertility in males by boosting the functionality of the testicles for an increased sperm count [60]. Pumpkin seed has been highly recommended for nursing, lactating and mothers due to its lactating properties. Antioxidants property of pumpkin seed is rich in alkaloids, resins, hydrocyanic acid, tannins and flavonoid [60].

AGED GARLIC EXTRACTS (ALLIUM SATIVUM)

Garlic is a perennial bulb with a tall, erect flowering stem that grows up to 1.2 m in height. The leaf blade is flat, linear, solid, and approximately 1.25 to 2.5 cm wide, with an acute apex. The plant may produce pink to purple flowers that bloom from July to September in the Northern Hemisphere. The bulb is odiferous and contains outer layers of thin sheathing leaves surrounding an inner sheath that encloses the clove. The bulb often contains 10 to 20 cloves that are asymmetric in shape, except for those closest to the center. Sickle-cell anemia is one of the most prevalent hereditary disorders with prominent morbidity and mortality. Oxidative phenomena play a significant role in the disorder's pathophysiology. A formulation of garlic (*Allium sativum*), Aged Garlic extracts has been reported to exert an antioxidant effect in vitro [61]. Thus, Aged garlic could be useful in sickle cell management because it has been found to suppress hemolysis and prevented reduced membrane deformability [61]. The antioxidant effect of aged garlic extracts on sickle red blood cells (RBCs) was evaluated. Five patients (two men and three women, mean age 40+/-15 years, range 24-58 years) with sickle-cell anemia participated in the study. Aged garlic extracts were administered at a dose of 5 mL daily. Whole blood samples were obtained at baseline and at 4 wk, primarily for Heinz body analysis. In all patients, the number of Heinz bodies decreased over the 4-wk period (58.9+/-20.0% at baseline to 29.8+/-15.3% at follow-up; P=0.03). These data suggest that aged garlic Extracts has a significant antioxidant activity on sickle RBCs. It may be further evaluated as a potential therapeutic agent to ameliorate complications of sickle-cell anemia [61].

BENEFITS OF AGED GARLIC EXTRACTS IN RELATION TO ANAEMIA

Extracts of fresh garlic that are aged over a prolonged period to produce aged garlic extract contain antioxidant phytochemicals that prevent oxidant damage [61-70]. These include unique water-soluble organosulfur compounds, lipid-soluble organosulfur components and flavonoids, notably allixin and selenium. Long-term extraction of garlic (up to 20 months) ages the extract, creating antioxidant properties by modifying unstable molecules with antioxidant activity, such as allixin, and increasing stable and highly bioavailable water-soluble organosulfur

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compounds, such as S-allylcysteine and S-allylmercaptocysteine. The Extracts exerts antioxidant action by scavenging ROS, enhancing the cellular antioxidant enzymes superoxide dismutase, catalase and glutathione peroxidase, and increasing glutathione in the cells [71-74].

PAPAYA LEAF (CARICA PAPAYA)

Papaya leaves are believed to have potential anti-inflammatory and antioxidant properties. Some traditional practices use papaya leaf extract to alleviate pain and inflammation associated with sickle cell crises. The use of C. papaya in treating sickle cell patients has been described in several in vivo research studies. Moreover, the seed oil of C. papaya holds anti-sickling properties and likely to lessen suffering in sickle cell patients [63-64]. Papaya leaves have a very long history in terms of its medicinal uses and have been utilized in many countries for treating various ailments. Phytochemicals of papaya leaves have been reported to prevent bone marrow depletion and platelet destruction [65]. Juice of papaya leaf is quite helpful to elevate platelet count and red blood and white blood cells to normalize blood clotting and to repair the liver [61-70]. Various studies both with animal and human models have been conducted by researchers worldwide to confirm the anti-inflammatory effect and platelet count improvement after administration of simple papaya leaf extract [71-74].

ALOE VERA

Aloe vera was reported to increase the gelling time of sickle cell blood and inhibits sickling in vitro. This indicates that such plants may indeed have a great potential in the management of sickle cell disorder. The effect of *Aloe vera* extract on the gelling time of human HbSS erythrocytes was investigated. The results showed that *A. vera* extract increased the gelling time of HbSS blood and inhibited sickling *in vitro*. In addition, a linear relationship was found between extract concentration and gelling time, suggesting that *A. vera* extract may have great potential in the management of sickle cell disease [66].

FUTURE PERSPECTIVES

Despite the extensive experiences in use of medicinal plants in traditional medicine, scientific study and identification of active plant compounds and their effects can lead to the discovery of new therapeutic benefits and the production of nature-based products in the future. To achieve this purpose, extensive research is fundamentally important to control the quality of raw drugs and the formulation to justify their use in the modern medicine system; subsequently, animal studies and clinical trials are required to use the benefits of these plants. In addition, in the development of medicine from medicinal plants, among other things, a practical plan should be developed to preserve these resources [19]. To realize the effective integration of plants into a medical system, researchers and practitioners should be trained in both modern and traditional medicine in the use of plant compounds. Finally, several questions about safety, accurate dose, duration of treatment, side effects, acute and chronic toxicities as well as the standardization of herbal medicines and natural products should be answered. If these issues are resolved, medicinal plants can be used as a safe, effective, and affordable form of health care [19].

CONCLUSION

Anaemia is known to be one of the diseases ravaging most world populations cutting across nations and ethnic divide. Some bioactive ingredients present in some plants possess various therapeutic activity used in traditional practice and are mostly identified as traditional medicines for the treatment of the disease. Since most plants have medicinal properties, it is of utmost importance that their efficacy is utilized for the treatment of illnesses by standardizing and evaluating the use of active plant-derived compounds. Herbal drugs can help the emergence of a new era of the healthcare system to treat human diseases in the future. Awareness of traditional knowledge and medicinal plants can play a key role in the exploitation and discovery of natural plant resources.

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