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MEDICINAL PLANTS AS A WONDROUS REMEDY FOR IRON DEFICIENCY ANAEMIA - A REVIEW

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Abstract: Anaemia is a major public health concern that affects population in both wealthy and poor countries, with serious consequences for human health. Iron Deficiency Anaemia is a micronutrient deficiency that is very common in developing countries. Organic supplements are chosen as alternative medicine. Herbal medicines are widely used and regarded as convenient treatments due to their safety, efficacy, and cost-effectiveness, as well as their compatibility. Medicinal plants comprising munga(Moringa oleifera), amla(Phyllantus emblica), chukander(Beta Bulgaria), and mango (Mangifera indica), can also be used to cure anaemia. The purpose of this review is to discuss these herbal plants and their influence on iron deficiency anaemia.

Index Terms- Anaemia, iron deficiency anaemia, moringa oleifera (munga), phyllantus emblica (amla), beta vulgaris (chukander), mangifera indica (mango).

1. INTRODUCTION

Anaemia is described as a low degree of RBCs, unusual morphology, or insufficient haemoglobin in red blood cells, which outcomes in an unsatisfactory fund of oxygen in the body(Lopes et al, 2018). There are several types of anaemia. Anaemia can be caused by a variety of red cell defects, including production defects (aplastic anaemia), maturation defects (megaloblastic anaemia), defects in haemoglobin synthesis (iron deficiency anaemia), genetic defects of haemoglobin maturation (thalassaemia), or defects in the synthesis of abnormal haemoglobin (haemoglobinopathies, sickle cell anaemia, and thalassemia), as well as by physical loss of red blood cells (haemolytic anaemias) (Soundarya et al., 2016). Anaemia is mainly consequenceof diminished erythropoiesis, elevated destruction of RBCs, blood loss, or a combination of these factors.Anaemia is a primary health problem. it impacts people of all ages, largely pregnant ladies and children(Cotoraci et al, 2021). According to the WHO, 42% of children under the age of five and 40% of pregnant women globally are anaemic.Anaemia is infectiously spread in both developed and developing countries(Singh et al, 2022).

Iron deficiency anaemia is still the strong basis of anaemia(Canaschella, 2015).
In the manufacturing of blood iron is needed. It is also required for haemoglobin formation, carrying oxygen, brain function, body temperature regulation, and muscle functioning and iron deficiency anaemia is the most harmful impact of iron deprivation(Resni et al, 2017). Iron reserves may also be drained as a give-up result of blood loss, low iron consumption, trouble with absorption, or high demand(Cotoraci et al, 2021).
There are two main forms of iron deficiency: Functional and Absolute. Functional iron deficiency is a condition when the bone marrow does not receive enough iron despite overall body iron storage being normal or increasing. Absolute iron deficiency occurs when the body's iron reserves are low or depleted. Deficits that are both absolute and functional are also possible(Lopez et al, 2015).
Low iron deposits and haemoglobin two standard deviations under average are proof that supports the prognosis of iron deficiency anaemia. Women should endure screenings at some stage in pregnancy, and kids must bear screenings at age of 12 months(Short et al, 2013).
The most usual single nutrient deficiency disease in the world, iron inadequacy affects 35% of women and 43% of younger children. It affects 15% of the world's population(Singh et al, 2022). Iron deficiency anaemia is most vast in low-income nations, where ineffective diet and excessive illness rate blend to constantly impede absorption(Prentice et al, 2016).
An iron-rich diet, iron, and vitamin complements are used to tackle anaemia. If taken in excess, commercially available iron supplements can evolveconditions like iron overload, neurogenic diseases, and possibly even cancer (Saha et al, 2018).

Medicinal plants are usually a top source for overcoming many ailments in the world. In India, the most ancient medical system is ayurveda and it encompasses numerous drugs that have been utilised counting that historical times. There is a goal that medicinal herbs can help out with anaemia(Shrivastava and Sikarwar, 2022).
Below is a list of several plants which can be used to treat anaemia due to iron deficiency.

2. MORINGA OLEIFERA

2.1 Family - M. oleifera comes from a family of moringceae(Kou et al, 2018, Mohanty et al, 2020, Shrivastava et al, 2022).

2.2 Common names - In English, drumstick(due to its slender, long, triangular seed pods), horseradish(the roots taste similar to that of horse radish)and benoil tree(as the benzoil is extracted from the tree), In Hindi- munga, In Sanskrit, mochaka, In odia- sajuna, shajina in Bengali, sohajana in Punjabi, sekato in Gujarati, shevaga and shegata in Marathi, manage in Telugu, sahajano in Malayalam (Kou et al, 2018, Mohanty et al, 2020, Shrivastava et al, 2022).

2.3 Parts used - Traditional medicine makes extensive use of seeds, leaves, oil, sap, bark, roots, and flowers of M. Oleifera(Stohs and Hartman, 2015).

2.4 Chemical constituent- The therapeutic efficacy of herbal plants cannot be determined solely based on available iron content because other factors influence the body's absorption of iron. Alkaloids, flavonoids, saponins, tannins, calcium, zinc, and vitamin C and K are examples of these factors. Additionally, beta-carotene, vitamin E, and polyphenols are also present(Kou et al, 2018, Saha et al, 2018, Stohs and Hartman, 2015, Moyo et al, 2011).

2.5 Medicinal properties- Moringa oleifera is used because of its anti-inflammatory, hypertensive, diuretic, anti microbial, antioxidant, anti-diabetic, antihyperlipidemic, antineoplastic, antipyretic, antiulcer, and cardioprotectant functions. Anti-depression, anti-atherosclerosis, anti-infertility, pain relief, and thyroid regulation are also included in its medicinal properties(Kou et al, 2018, Stohs and Hartman, 2015).

2.6 Antinutritional factors - oxalate, phytate, tannins, alkaloids, hydrogen cyanide are the antinutrients present in moringa leaves(Steven et al, 2015, Auwl et al, 2019).

2.7 Role in iron deficiency anaemia - 490 mg per kilogram is the value of iron which is the highest amount of micro-nutrients present in dried leaves of moringa(Moyo et al, 2011).
According to Suzana et al, (2017), it was discovered that the control group's haemoglobin, erythrocyte, hematocrit, mean corpuscle volume, mean corpuscle HB, and red cell distribution levels had increased after treatment with moringa oleifera compared to the previous results.

2.8 Clinical testing - 1) The objective of the research was to determine how AlCl3-induced anaemia in albino mice and rats will respond to an ethanolic leaf extract of Moringa oleifera. 24 rats were distributed into four groups: Group (A) received 0.5 mg/kg body weight of AlCl3, Group (AM) received AlCl3 and 300 mg/kg body weight of M. oleifera extract 10 minutes later, Group (M) received 300 mg/kg of M. oleifera extract alone, and Group (C) received only normal saline solution. The results revealed that ethanolic extract of M. oleifera, whether provided with AlCl3 or alone, increased red blood cells, haemoglobin, and mean corpuscular haemoglobin concentration and mitigated AlCl3-induced anaemia in albino rats(Osman et al., 2012).
2) In this study, Three groups of twelve adult albino rats were tested. They were given cyclophosphamide to make them anaemic. When M. oleifera leaf powder was added to the rats' feed as a supplement, they displayed superior traits to the control group. According to this study, dry M. oleifera leaf powder is effective in treating anaemia (Madukwe et al., 2012).
3)After receiving a dose of m. Oleifera and jaggery, the hb levels of women in the reproductive age range drastically enhanced, as per a recent survey (Saha et al, 2013).

3.PHYLLANTUS EMBLICA

3.1 Family - Phyllantus Emblica is from the family of Euphorbiaceae.(krishnaveni and Mirunalini, 2010; Swapna and Rani, 2020).

3.2 Common names - Hindi - amla. Sanskrit - Aamalaki, dhartiphala, amraphalam, amalku, adiphala. English - lndian gooseberry, emblic myrobalan tree. Bengali - amlaki, ambolati, amlati, amulati, aunlah, yeonlah. Nepali - amala. Malayalam - Nellikka.Assamese - amlakhi, amlaki, amluki,sohmyrlain.Telugu - usirikaya, amala kamu, Amalaki, Nelli. Kannada - nellikaai. Kashmiri - ambali, amli aonla. Konkani - anvallo, dogravalli, dogranvallo. Malayalam - amlakam, nelli, nellikka. Marathi - anvala, aonli, avla, anola, bhuiawali. Punjabi - ambal, ambli, ambul, amla, only. Sinhalese - awusadavelli, nelli, nellika. Tamil - amlagam, andakoram, indul, kattunelli, nelli, perunelli, sirottam, tattiri, topunelli. Telugu - amalakamu, Amalaki, nelli, pullayusirika, usirika, usirikaya, usiriki. Tulu - nelli. Urdu - anwala. Uriya - khondona, onola (krishnaveni and mirunalini, 2010; Acharya et. al, 2021; Shrivastava and Sikarwar, 2022).

3.3 Parts used - Fruit, leaf, bark, seed, root (Archana et al, 2021; Krishnaveni and mirunalini, 2010).

3.4 Chemical constituents - In fruit, minerals, crude cellulose, albumin, gum, tannins, garlic acid, protein, fats, vitamins, nictotionic acid, phyllem- bellin, phyllembic acid, emblicol, ellagic acid, alkaloids, sterols (Khalid et al., 2021; Krishnaveni and mirunalini, 2010; Acharya et al., 2021).
In leaves, gallic acid, chebulic acid, ellagic acid, chebulinic acid, amlic acid, alkaloids phyllantidine, phyllantine, chebulagic, gallotannin(amlic acid).
In seeds, fixed oil, phosphatides and an essential oil (Khalid et al., 2021; Krishnaveni and mirunalini, 2010).

3.5 Medicinal properties - Anti-Diabetic, Antioxidant, Antiulcer, immune modulator, Antipyretic, Anti-Inflammatory, Analgesic Activities, Hepatoprotective Activities, Cardioprotective Activity, Anti-cancer, Antitumor, Gastroprotective, acts as Chelating agent, acts as snake venom neutralizer. It also helps in boils and spots, constipation, dental problems, gonorrhea, reducing cholesterol, headache, and wounds (Acharya et al., 2021; Krishnaveni and Mirunalini, 2010; Swapna and Rani, 2020).

3.6 Antinutritional factors - The fruit of phyllantus Emblica have anti-nutritional factors like oxalate, phytate and tannin (Rout and Basak, 2014).

3.7 Role in the IDA - Citric acid, gallic acid, malic acid, tartaric acid, and a number of other organic acids are known to increase iron bioavailability and are found in amla juice (venkatasubramanian et al., 2014).

3.8 Clinical Studies - 1) For 45 days, pregnant women with IDA were divided into two groups: IAS and IS.
In the first group (IAS), pregnant women with iron deficiency anaemia received supplements in the form of two oral amla capsules carrying 536 mg three times per day and an iron pill containing 200 mg of ferrous fumarate and 0.02 mg of folic acid. The second control group (IS), they were provided only iron tablets. As a result, the first group, which was treated with amla and iron supplements, showed greater enhancement of the serum level and iron status than the group that had only been treated with iron tablets (Akter and Akhter, 2019).
2) According to Reshmi et al. (2017), researchers found that only 8.7 mg of natural vitamin C from amla is equal to 100 mg of synthetic vitamin C.
3)In research by Venkatasubramanian et al., (2014) it was shown that Amla juice with FeSO4 increased iron absorption three times more than FeSO4 alone.

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4. BETA VULGARIS

4.1 Family - It belongs to the family Chenopodiaceae (Babarykin et al., 2019; Chauhan et al., 2020; Abdo et al., 2020).

4.2 Common names - are chukander (in Hindi), Beet, chard, spinach beet, sea beet, garden beet, white beet, table beet (Ceclu and Nistor, 2020; Chauhan et al., 2020).

4.3 Parts used - Beetroot(beta Vulgaris) is the taproot portion of the beet plant(Babarykin et al., 2019;). Its juice, peels, leaves, and pomace are used as potential source of bioactive compounds (Abdo et al., 2020). Its stem and root are also used (Ceclu and Nistor, 2020).

4.4 Chemical constituents -Nutritional constituents in 100 g of beetroot are vitamin A (20 I.U.), thiamine (0.02 mg), riboflavin (0.05 mg), niacin (0.4 mg), vitamin C (10 mg), calcium(277 mg), iron (1.0 mg), phosphorus (43 mg), total fibre (87.4 g), fat (1 g), carbohydrates(9.66 g), protein (1.6 g), and calories (42 kcal).
Various phytochemicals like alkaloids (128.8 mg), steroids (16.4mg),glycosides (0.652 mg), flavonoids (6.15 mg), terpenoids (115.5 mg), and saponins
(3.789 mg), beta-carotene (11.64 mg), vitamin A (2.6 mcg), vitamin K (3.2 mcg), and vitamin C (4.36 mg).vitamin E (0.18 mg), vitamin B3 (0.03 mg), vitamin B6 (90 mg), vitamin B2 (0.034 mg), and pantothenic acid(0.151mg), potassium (20 mg), and iron (0.76 mg) are present in 100 g of this plant. Calcium, magnesium, copper, phosphorus, sodium, and phenolic acids are also present.
Beetroot also comprises betalains, betaine and nitrates which are secondary metabolites. betalains which are bioactive pigments are categorised as either red-violet coloured betacyanins or betaxanthins pigments which are yellow-orange. (babarykin et al., 2019; Neha et al., 2018; Clifford et al., 2015).

4.5 Medicinal properties - It has antioxidant and anti-inflammatory effects, anti-carcinogenic and anti-diabetic activities, and effects on the gastrointestinal system, cardiovascular system, iron metabolism, liver detoxification, blood pressure regulation, and eye health. It also has hepatoprotective, hypotensive, and wound-healing properties (Mirmiran et al., 2020; Babarykin et al., 2019; Neha et al., 2018; Ceclu and Nistor, 2020).

4.6 Antinutrients - oxalic acid and saponins (Shrivastava and Singh, 2017).

4.7 Role in IDA - 100 g of beet plant contains 0.8 g of iron (Babarykin et al., 2019). The level of haemoglobin rises when beetroot juice is consumed.
Furthermore,taking 200 millilitres of beet juice daily for six weeks caused levels of HTC, Redblood cells, iron, and ferritin to rise (Cotoraci et al., 2021).

4.8 Clinical studies - 1) According to studies, research on women aged 22–24 shows that consuming 8 grammes of beetroot over 20 days raised ferritin levels and decreased transferrin levels. Serum iron levels also increased slightly (MA Nora, 2018).

2)Triana et al., (2020) research proved that supplementing to pregnant women with anaemia who were taking Fe pills for 14 days with 8 grams of beetroot powder helped raise their haemoglobin and hematocrit levels and erythrocyte counts.

5. MANGIFERA INDICA

5.1 Family - It is a member of the Anacardiaceae family (Swapna and Rani, 2020; Shah et al., 2010; Lebaka et al., 2021; Bally, 2006).

5.2 Common names- English - mango; Hindi - aam, am, and; Sanskrit - ambrah, Madhuulii, Madhuula, Madhuulaka; Tamil - ampleam, Ambiram, Mambazham, Mambalam, Mangai; Punjabi - amb; Gujrati - ambo, keri, marvo; Kashmiri- amb; Malyalam - amram, choothaphalam, manga, manpalam, mavu; Marathi - amchur, amba; French - mangot, mangue, manguier; Dutch - Manja, maggo, kanjanna, bobbie Manja; Indochina - ma Muang; Thailand -mamung; Spanish - manga, mango; Portuguese - manga; Malaysia -manga, mempelam, ampelam; Tagalog -Mangga; Indonesia -Mangga, mempelam; Ilokano - mango; New Guinea, Pidgin - mango; German - Mangobaum; Laos - mwàngx; Bisaya,Philippines - paho; Cambodia - svaay; Myanmar -tharyetthi; Vietnam-xoài (Swapna and Rani, 2020; Bally, 2006; Shah et al., 2010).

5.3 Parts used - leaves, stems, bark, kernel, seeds have been studied for their health benefits (Kumar et al., 2021). Bark and roots are also used (Shah et al., 2010). Mango pulp provides a variety of macro and micronutrients (Lebaka et al., 2021).

5.4 Chemical constituents - Macronutrients: proteins, amino acids, lipids, fatty acids, carbohydrates, and organic acids.

5.5 Micronutrients- vitamins (mostly A, C, and minorly B, E, and K), minerals (mostly K, P, and Ca, and minorly Na, Zn, and Fe).

5.6 Phytochemicals - phenolic compounds, phenolic acids, mangiferin, chlorophyll, carotenoids, flavonoids and flavanols. (Maldonado et al., 2019; Mwaurah et al., 2020; Lebaka et al., 2021).

5.7 Medicinal properties - Different parts of Mangifera indica are helpful in health benefits effects they are anti-oxidant, anti-diabetic, antiviral activity, anthelmintic, anti-allergic activity, anti-parasitic activity, anti-bone absorption, anti-tumor-anti-HIV, antispasmodic, antipyretic activity, immunomodulatory activity, anti-diarrhoeal, anti-inflammatory, antibacterial, antifungal activity, anti-microbial, hepatoprotective and gastroprotective (Shah et al., 2010).
Numerous parts of the plant are used as a dentifrice, antiseptic, astringent, diaphoretic stomachic, vermifuge tonic, laxative and diuretic and to treat diarrhoea, dysentery, asthma, bronchitis, cough hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles. Entirely the parts of M. Indica are used to treat abscesses, broken horns, rabid dog or jackal bites, snakebites, stings, datura poisoning, heat stroke, miscarriage, anthrax, blisters, wounds in the mouth, tympanitis, colic, diarrhoea, glossitis, indigestion, bacillosis, bloody dysentery, liver disorders, excessive urination, tetanus and asthma (Swapna and Rani, 2020).

5.8 Antinutritional factors - The total oxalate in the form of oxalic acid was estimated, phytate was estimated using the colorimetric method, and the levels of tannin, saponin, and alkaloids were also estimated using the recommended techniques of the Association of Official Analytical Chemists.

5.9 Clinical studies - 1)For this experiment, 40 albino rats were used, and the iron-deficient group was fed an iron-deficient diet for 8 weeks, which caused iron deficiency anaemia. Mangifera indica's stem bark was chopped, extracted with ethanol, followed by solvents such as n-hexane and ethyl acetate, and then concentrated. These fractions were then tested for the presence of phytochemicals. For two weeks, 1 ml of the ethyl acetate, n-hexane, and ethanolic solvent fractions diluted in distilled water were given to the iron-deficient animals.
When compared to the iron-sufficient and iron-deficient control groups, the results showed a significant ($P<0.05$) increase in the PCV, RBC, and serum ferritin levels of the groups administered with the extracts. Saponins were also discovered in the three extract fractions. It was determined that saponins may be the bioactive compound which helps in iron absorption (Abidakun et al., 2018).

2) This experiment made use of an in vivo animal model. 2,4-dinitrophenylhydrazine was used to produce hemolysis, and three different doses of the plant extract (25, 50, and 100 mg/kg b.wt) were employed for therapy. At doses of 50 and 100 mg/kg b.wt, Packed cell volume and Haemoglobin concentrations considerably (p 0.001) increased, however, no significant ($p > 0.05$) effect was seen at a dose of 25 mg/kg b.wt (Sani et al., 2015).

3)This investigation resulted in the creation of a biscuit product to prevent anaemia. In this study, the preparation of mango seed fl our and moringa leaf flour was used to make biscuit. In this study, three different formulations were used: F1 (30% mango seed fl our and 70% moringa leaf flour), F2 (50% mango seed flour and 50% moringa leaf flour), and F3 (30% mango seed flour and 70% moringa leaf powder).When the finished biscuits were nutritionally analysed, it was discovered that the biscuit of F2 contained 37.2 mg of iron. This shows that consuming biscuits made with mango seed flour and moringa leaf flour in a 50:50 ratio will help one acquire the iron one need (Hastuti et al., 2020).

6. CONCLUSION

Anaemia is characterised by a decrease in the number of circulating red blood cells. Iron deficiency anaemia is the most common nutritional disorder worldwide, affecting primarily women and children.
In this review, we compiled information on medicinal plants such as Moringa Oliefera, Phyllanthus Emblica, Mangifera Indica, and Beta Vulgaris and their efficacy in various nutritional and medical issues, especially in iron deficiency anaemia.

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