Oral Iron Syrup Formulation For The Management Of Iron Deficiency Anemia

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***Abstract*—The WHO has recognised iron deficiency anaemia (IDA) as the most common nutritional deficiency in the world, with 30% of the population being affected with this condition. Although the most common causes of IDA are gastrointestinal bleeding and menstruation in women, decreased dietary iron and decreased iron absorption are also culpable causes. Patients with IDA should be treated with the aim of replenishing iron stores and returning the haemoglobin to a normal level. This has shown to improve quality of life, morbidity, prognosis in chronic disease and outcomes in pregnancy. Iron deficiency occurs in many chronic inflammatory conditions, including congestive cardiac failure, chronic kidney disease and inflammatory bowel disease. This article will provide an updated overview on diagnosis and management of IDA in patients with chronic conditions, preoperative and in pregnancy. We will discuss the benefits and limitations of oral versus intravenous iron replacement in each cohort, with an overview on cost analysron Deficiency Anemia (IDA) remains one of the most prevalent nutritional disorders globally, disproportionately affecting women, children, and adolescents. Although conventional iron supplements such as ferrous sulfate and ferrous fumarate effectively restore iron levels, their use is frequently limited by gastrointestinal irritation, metallic aftertaste, and poor patient compliance. is between the different iron formulations currently on the market.**

***Index Terms*—syrup,anemia,beetroot powder,iron supplyment**

I. Introduction

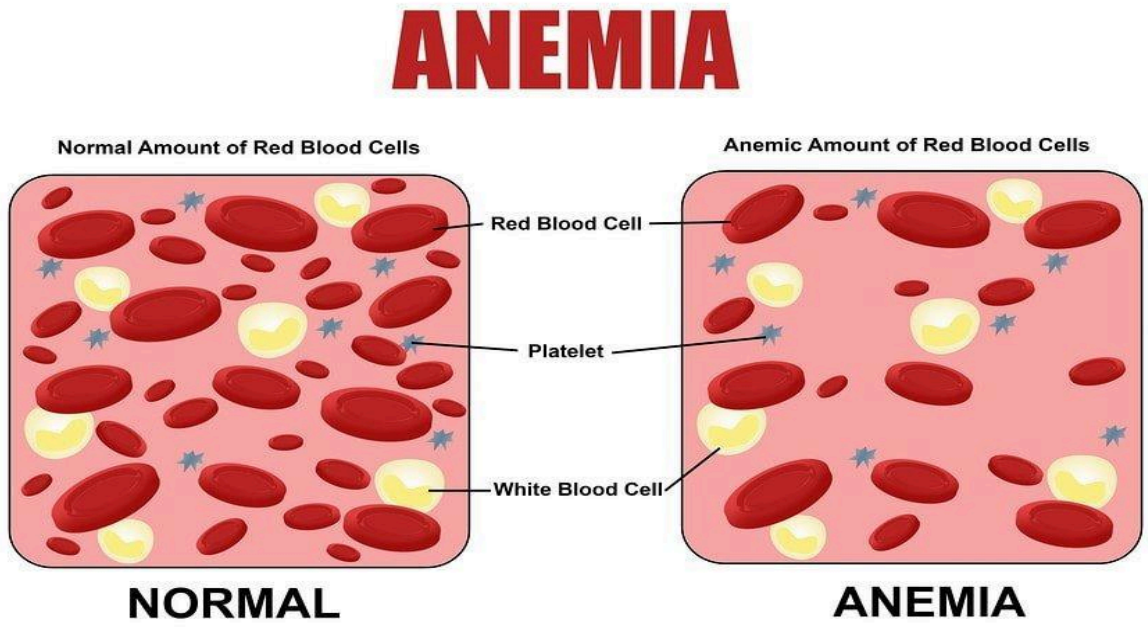
The WHO has recognised iron deficiency anaemia (IDA) as the most common nutritional deficiency in the world, with 30% of the population being affected with this condition. While IDA is more prevalent in children and women, adult men are also susceptible depending on their

socioeconomic status and health conditions. Although the most common causes of IDA are gastrointestinal (GI) bleeding and menstruation in women, decreased dietary iron intake and absorption are also culpable causes.

Iron is required for various cellular functions, including but not limited to enzymatic processes, DNA synthesis, oxygen transport and mitochondrial energy generation. As such, the symptoms of IDA can vary over a wide range. Shortness of breath, fatigue, palpitations, tachycardia and angina can result from reduced blood oxygen levels. This resultant hypoxemia can subsequently cause a compensatory decrease in intestinal blood flow, leading to motility disorder, malabsorption, nausea, weight loss and abdominal pain. Central hypoxia can cause headaches, vertigo and lethargy as well as cognitive impairment with several studies

showing an improvement in cognitive functions once anaemia has normalised. It is well known that IDA significantly affects quality of life (QoL) with recent evidence demonstrating that treating IDA improves QoL, regardless of the underlying cause for anaemia.

In this review, we will discuss the pathophysiology, diagnosis, treatment and complications in the management of IDA. The investigative criteria for IDA are beyond the scope of this article and have been comprehensively outlined in the recent British Society of Gastroenterology guidelines.



II. MATERIAL AND METHOD

Material :-

1} Beetroot powder :- (Beta vulgaris)

Role: Beetroot is rich in iron, folate, potassium, and betaine, contributing significantly to blood formation and detoxification.

• Acts as a natural hematinic and antioxidant.

• Enhances nitric oxide production, improving tissue oxygenation.

• Reduces inflammation and oxidative stress, thereby supporting erythrocyte survival

2} **Orange juice :-**

Role:- Vitamin C can improve absorption of iron in the body and is commonly found in fruit juices—specifically orange juice, according to study authors, so the absorption of nonheme iron may improve when taken with orange juice. Additionally, when nonheme iron and vitamin C are digested together, they form a compound that can be easily absorbed. A deficiency of vitamin C may be associated with a deficiency in iron because of reduced absorption.

3}Glycerine:-

Role: A simple amino acid with antioxidant, anti-inflammatory, and detoxifying effects.

• Reduces oxidative damage induced by iron therapy.

• Aids in protein synthesis and hemoglobin production.

• Improves tolerance by minimizing side effects such as gastric irritation or constipation.

4} Honey:-

Source: Apis mellifera and other bee speciesConstituents: Dextrose, sucrose, dextrin, enzymes, and minerals. Role: Functions both as a sweetening and therapeutic agent.

• Serves as a natural humectant, antibacterial, and antioxidant component.

• Masks the metallic taste of iron and improves palatability.

• Promotes gastrointestinal health, enhances nutrient absorption, and provides mild energy Support

Formulation of iron deficiency syrup:-[100ml]

INGREDIENT	ROLE AND FUNCTION	QUANTITY PER 100 ML
Beetroot powder	**Natural colorant ,iron booster ,antioxidant**	**5 g**
Orange juice	**Flavoring agent, vitamine c**	**25 ml**
Glycerine	**Flavor enhancer, antioxidant**	**5 ml**
Honey	**Sweetening ,soothing, antioxident**	**20 ml**
Citric acid	**Stabilizer**	**0.3g**
Sodium benzoate	**Preservative ,prevent microbial growth**	**0.1g**
Purified water	**Vehical**	**q.s to 100 ml [about 44-45 ml]**

Method :- By hot process

1] Preparation sugsr syrup base :-Accurately weighed sucrose was dissolved in approximately 50 mL of purified water with continuous stirring and gentle heating (not exceeding 60°C) to form a clear syrup base.

2] Prepartaion of preservative solution :- sodium benzoate were dissolved in a small quantity of warm glycerin to enhance solubility and then added to the sugar syrup with constant stirring.

3] Dissolution of active ingredient :- beetroot poder was dissolved separately in a small volume of purified water. Orange juice was dissolved with mild heating.

4] **Mixing of Components:-** The drug solutions were gradually added to the syrup base with continuous stirring to ensure uniform distribution of active ingredients

5] **Addition of Excipients**

Citric acid was added to adjust the pH of the formulation in the range of 4.5–5.5. Flavoring agent was then incorporated to improve taste and acceptability.

6] **Make-up Volume:-**

The final volume was adjusted to 100 mL using purified water, and the solution was mixed thoroughly.

7] Filtration and Packaging:-

The prepared syrup was filtered to remove any particulate matter and filled into amber-colored bottles to protect light-sensitive components.

III. RESULT

The formulated iron deficiency anemia syrup containing Iron (as in beetroot ,orange juice), Vitamin c , was successfully prepared using the solution method. The formulation was subjected to various physicochemical evaluations to assess its quality, stability, and suitability for oral administration. The results obtained are discussed in detail below.

1: Organoleptic Properties

The prepared syrup was evaluated visually for color, clarity, odor, and taste, which are important parameters for patient compliance, especially in pediatric and geriatric populations.

Table 1: Organoleptic Evaluation

Parameter	Observation
Color	**Reddish-brown**
Clarity	**Solution is clear**
Odor	**Pleasant**
Taste	**Sweet**

2: Quality control test

1] Visual inspection

2]PH measureme

3]Light transmittance

1]Visual inspection:-

Take the syrup in transparent bottle and observe carefully

It should be-

1.good looking

2.elegance in appearance

2]PH measurement :-

2 methods

IV. By using ph paper
V. By using ph meter **:- 4.5**

3]Light transmittance test:-

A syrup sample is checked for color by passing light through the sample.

NOTE:- No fingerprints on syrup test bottle Syrup sample has no bubbles or cloudiness

VI. CONCLUSION

The present study successfully demonstrated the formulation and comprehensive evaluation of a iron deficiency syrup containing Iron (as ferrous sulfate), Vitamin B12, and Folic Acid using a simple and reproducible solution method suitable for laboratory-scale preparation. The primary objective of this research was to develop a stable, palatable, and effective oral liquid dosage form capable of addressing nutritional deficiencies associated with anemia while ensuring patient compliance and ease of administration.

The formulation strategy adopted in this study proved to be effective in overcoming common challenges associated with iron deficiency syrups, particularly issues related to solubility, stability, taste masking, and compatibility of active ingredients. The use of sucrose as a sweetening and viscosity-enhancing agent significantly improved the organoleptic properties of the formulation, making it more acceptable for oral administration. Glycerin acted as an efficient co-solvent and humectant, facilitating the dissolution of preservatives and contributing to improved mouthfeel. The incorporation of sodium benzoate ensured microbial stability of the aqueous formulation, which is critical for maintaining product safety during storage.

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