

The Iron Boost: A Nutritional Snack with *Lepidium Sativum* and *Oryza Sativa*

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ABSTRACT- Anaemia occurs when tissues cannot maintain a normal haemoglobin concentration, *Lepidium sativum* is rich in protein, fatty acid, vitamin, minerals, and various bioactive compounds. Combined with rice flakes flour, jaggery and dry fruits they serve as an excellent iron source. This study aims to develop and standardize snacks using these ingredients and to assess the sensory characteristics. The study was conducted to develop a product from garden cress seeds and rice flake flour, jaggery and dry fruits. Garden cress seeds and rice flakes were dry roasted and churned into a fine powder and combined into a dough using remaining ingredients. Sticks were made with the help of a Sev making machine and baked in the oven. Formulation of sticks and the optimization of the product based on sensory properties. For sensory evaluation, the product was used in different variations. In T1- garden cress seeds (20g), rice flour (50g), jaggery (20g), almonds (2.5g), raisins (2.5g). In T2, garden cress seeds (25g), rice flour (50g), jaggery (20g), almonds (2.5g), raisins (2.5g), respectively. The sensory evaluation was done by using a 9-point hedonic scale. The study revealed that T2 was the most acceptable product in various parameters. This study concluded that sample T2 can be used for anaemic population as it's nutritional composition after testing included 9.83g moisture, 2.97g ash, 7.5g protein, 5.8g fibre, 11.2g fat, 13.6mg iron. It improves bioavailability, aids in public health initiatives, and offers sustainable, natural alternatives to synthetic supplements

KEYWORDS- Anaemia, *Oryza sativa*, *Lepidium sativum*

1. INTRODUCTION

Anaemia is a condition in which the number of red blood cells or the haemoglobin attention within them is lower than normal. Haemoglobin is required to carry oxygen and if you have too many or abnormal red blood cells, or not enough haemoglobin, there will be a decreased capacity of the blood to carry oxygen in the body [1]. This results in symptoms similar to fatigue, weakness, dizziness and briefness of breath. The optimal haemoglobin attention needed to meet physiological requirements varies by age, sex, smoking habits and gestation status. Anaemia may be caused by several factors nutrient scarcities through poor diets or poor immersion of nutrients, infections (e.g. malaria, parasitic infections, tuberculosis, HIV), inflammation, habitual conditions, gynaecological and obstetric conditions and inherited red blood cell diseases The most common nutritive cause of anaemia is iron insufficiency, although scarcities in folate, vitamins B12 and vitamin A are also common causes. Anaemia is a serious global public health problem that particularly affects youth, children, menstruating adolescent girls and women, and pregnant and

postpartum women. WHO estimates that 40% of children 6 – 59 months of age, 37% of pregnant women, and 30% of women 15 – 49 years of age worldwide are anaemic. Iron deficiency is the most widespread cause of anaemia globally.

Lepidium sativum seeds, traditionally used in Ayurvedic medicine in India, offer numerous health benefits and are considered a potent functional food due to their high nutritional value *Lepidium sativum* are also most commonly known as garden cress seeds or halim seeds. These seeds are readily available across the globe and are especially rich in iron, making them highly effective in treating iron-deficiency anaemia. In addition, they are abundant in folate, calcium, vitamin C (ascorbic acid), vitamin E (tocopherol), and beta-carotene. *Lepidium sativum* seeds also contain a good amount of protein along with essential fatty acids like linoleic and arachidonic acid [2]. Regular consumption of just two teaspoons per day has been shown to significantly improve haemoglobin levels within one to two months. This study aims to raise awareness about incorporating *Lepidium sativum* seeds into daily diets.

Snacks prepared using these seeds can serve as an excellent, low-cost iron source to help prevent and manage iron-deficiency anaemia. The naturally strong aroma of the seeds can be reduced by soaking, roasting, or powdering them. Even small quantities included in meals can serve as an effective remedy against anaemia [3].

Other health benefits:

- a) **For Anaemia:** Garden cress seeds are one of the richest sources of non-heme iron, the form of iron found in haemoglobin that is essential for dietary intake. Regular consumption can help raise haemoglobin levels and effectively reduce anaemia. To enhance iron absorption, it is recommended to consume vitamin C about 30 minutes after eating the seeds [9].
- b) **For the Digestive System:** Garden cress supports digestion by purifying the blood and stimulating appetite. It is also used as a natural remedy for constipation, acting as both a laxative and a purgative [9].
- c) **For Diabetes:** Research indicates that the seeds of garden cress can help reduce the glycemic response when consumed with meals, making them beneficial for blood sugar management.[9]
- d) **For Cancer Prevention:** Rich in antioxidants such as vitamins A and E, garden cress seeds help protect body cells from oxidative damage caused by free radicals, potentially reducing cancer risk [9].
- e) **Other Benefits:** These seeds also contribute to improved memory due to their content of arachidonic and linoleic acids. Additionally, being a great source of iron and protein, they support the development of lean body mass [9].

Lepidium sativum: Garden cress is a highly nutritious plant that provides a well-balanced mix of macronutrients and micronutrients. It is rich in high-quality proteins, essential fatty acids, and vital minerals such as iron, magnesium, and zinc. Recognized as one of the many valuable medicinal plants [2,4]. *Lepidium sativum* belongs to the Cruciferae or Brassicaceae family and is widely used across various cultures. This fast-growing annual herb typically reaches a height of 15–25 cm and is cultivated in regions such as India, Asia, Europe, much of Africa, and the United States, primarily as a leafy vegetable or salad green [7] The plant is characterized by its sessile leaves, small white flowers, and broad, obovate pods—all of which are edible. Although it can be grown year-round, garden

cress thrives best during the winter season. Due to its exceptional nutritional profile, it is often classified as a superfood [4].

Physicochemical properties of garden cress seeds: The proximate macronutrients contents of garden cress seed powder are illustrated in Table (1). The results showed that there is a difference between for each macro nutrients contents. Moisture, protein, fat, ash and fiber contents of garden cress seed powder was (7.72, 18.86, 14.0, 4.20 and 17.80 g/100g respectively. Table (1) revealed that the TPC of ethanolic garden cress seed extract was 950.30 mg/100g. While the TFC of ethanolic garden cress seed extract was 490.48 mg/100g.RSA (%) of ethanolic garden cress seed extract was 90.46 %, These results agree with that previously reported [2, 4].

Table (1) Chemical composition, Total phenolic, flavonoid contents and radical scavenging activity of garden cress seed powder

Parameter	Value (Mean ± SD)
Moisture	7.72 ± 0.07
Total Protein	18.86 ± 0.06
Fat	14.00 ± 0.02
Ash	4.20 ± 0.08
Fiber	17.80 ± 0.04
Total Phenolic Content (mg/100g)	950.30 ± 64.00
Total Flavonoid Content (mg/100g)	490.48 ± 20.40
Radical Scavenging Activity (%)	90.46 ± 1.30

Garden cress is particularly noted for its high vitamin C (ascorbic acid) content- a water-soluble vitamin derived from glucose metabolism. As a powerful antioxidant, vitamin C plays a critical role in protecting the body against free radical damage and is essential for collagen synthesis through the hydroxylation of proline and lysine. Humans cannot produce this vitamin internally because they lack the enzyme gluconolactone oxidase. Owing to its rich ascorbic acid content, garden cress is highly effective

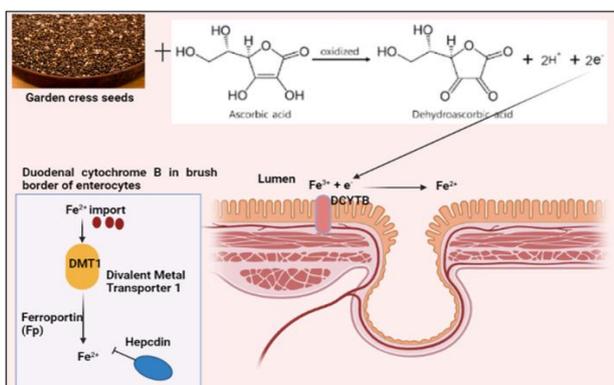
in strengthening the immune system and fighting off infections. The ascorbic acid content in *L. sativum* leaves ranges between 54 and 74 mg per 100 grams of fresh weight. Vitamin C levels in different parts of the plant, revealing 11.74 mg in the stem, 7.4 mg in the leaves, 12.5 mg in the whole plant, and 9.68 mg in the seeds. Furthermore, garden cress seeds contain significant amounts of other essential vitamins, including thiamine (0.59 mg), riboflavin (0.61 mg), and niacin (14.3 mg) [4, 5]

1.1 MECHANISM OF ACTION IN HUMAN BODY

Vitamin C supplementation helps improve iron absorption. It also boosts the digestive system's ability to absorb iron. Vitamin-C and iron-rich seeds of garden cress may be used to treat anemia or iron insufficiency without the need for additional supplements [3]. In the stomach, L-ascorbic acid helps to increase iron absorption by building a chelate with ferric iron at an acidic pH. This makes the iron more soluble at the alkaline pH of the duodenum, where it is more easily absorbed. Improves hemoglobin levels and cures anemia by consuming Garden Cress seeds on a long-term basis.

During adolescence, a person's physical and mental development accelerates. Adolescents with low iron levels may not be able to reach their full development potential because of a lack of iron in their diet [3]. The seeds of garden cress are said to have galactogenic and antioxidant characteristics, as well as a great deal of promise as a functional food [4] as mentioned in Figure 1.

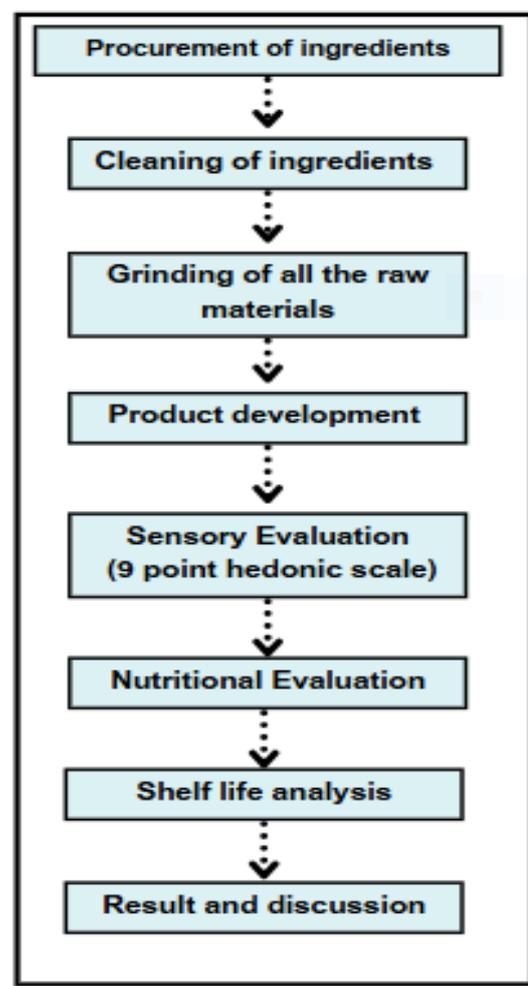
Fig1. Mechanism of action in the treatment of anaemia [4]



2. MATERIALS AND METHODOLOGY:

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Fig.2. Overview of sensory evaluation



The development and processing of the product was carried out in Manav Rachna International Institute of Research and Studies, Faridabad. All the raw ingredients were procured for the development of the snack and it was made in hygienic conditions. Sensory evaluation was also done by the semi-trained panellist by 9-point hedonic scale, nutritional evaluation and shelf life was also checked.

2.1 Procurement of raw ingredients

The procurement of raw ingredients involves the careful selection and sourcing of high-quality garden cress seeds, rice flake flour, nuts, and jaggery to ensure the final product's nutritional value and taste. All ingredients undergo cleaning and preprocessing to maintain hygiene and safety standards. Additionally, each raw material is characterized based on its nutritional composition, moisture content, and texture to ensure consistency and quality in the formulation process.

2.2 Preparation of product:

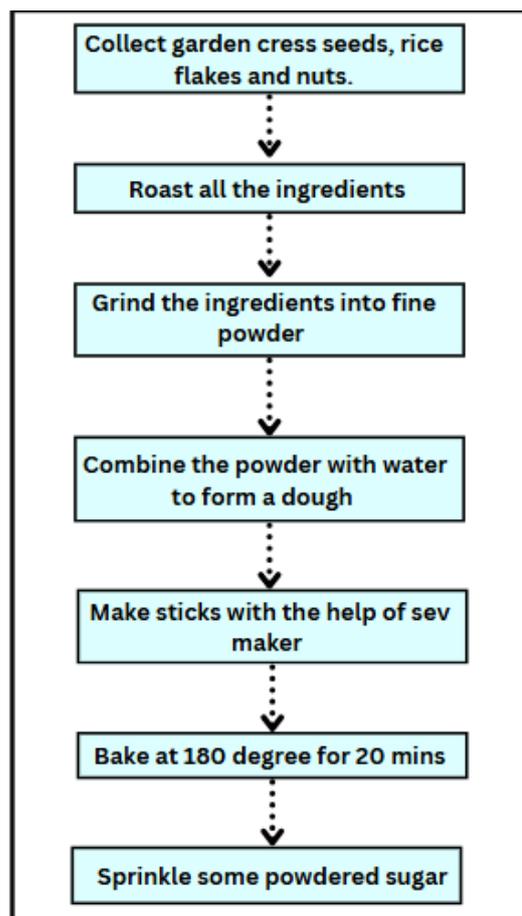
The development of the product was done in 3 variations where T0 (0% garden cress seeds), T1 (30% garden cress seeds) and T2 (40% garden cress seeds) samples were made by the involvement of standardizing the optimal ratio of garden cress seeds, rice flake flour, nuts, and jaggery to ensure a balanced blend of taste, texture, and nutritional value.

Table 2. Amount of ingredients of the sample

Ingredient	T0 (standard)	T1	T2
Garden Cress Seeds	0g	30g	40g
Rice Flake Flour	70g	40g	30g
Jaggery	20g	20g	20g
Almonds	5g	5g	5g
Raisins	5g	5g	5g

Once the proportions are finalized, the ingredients are thoroughly mixed and blended to achieve a uniform mixture. This homogeneous blend is then shaped into edible sticks using suitable moulds and forming techniques. Finally, the shaped sticks are baked to attain the desired consistency, texture, and taste. After the product was made it was tested for energy, protein, fibre, fat, ash content and iron content making them convenient and ready-to-eat functional snacks.

Fig.3 Method of preparation of snack



2.3. Sensory analysis and evaluation

The developed product undergoes sensory evaluation based on key attributes such as appearance, odor, flavor, taste, and texture, using a 9-point hedonic scale conducted by semi-trained panelists to gauge overall consumer acceptability. In addition to sensory assessment, a proximate analysis in the lab was performed to determine the macronutrient composition, including levels of protein, fat, moisture, fiber, moisture content and iron ensuring the nutritional adequacy of the product. Shelf-life testing is also carried out under controlled storage conditions to evaluate the product’s stability, durability, and safety over time.

2.4 Data analysis

Data collected from the sensory evaluation is systematically analyzed to assess consumer responses to various product attributes. It is done to determine the significance of variations in sensory attributes and to evaluate the effectiveness of different formulations. The results are then interpreted to identify the most acceptable formulation, allowing for optimization of the product in terms of both sensory appeal and nutritional benefits.

3. RESULT AND DISCUSSION

T2 sample with 40g of *Lepidium sativum*, 30g of rice flakes flour, 20g of jaggery and 10g of raisin and almonds was the most accepted in terms of appearance, taste, texture, aroma and overall acceptability. Proximate analysis was done in the lab for the calculation of energy, carbohydrates, protein, fibre, moisture and iron content

Table 3. Proximate analysis of T0 and T2 sample

Nutrients	T0	T2
Energy	352 Kcal	382.2 Kcal
Carbohydrates	71g	52.6g
Protein	4.5g	7.5g
Fat	4g	11.2g
Fiber	3.2g	5.8g
Moisture	11.8g	9.8g
Iron	3.3mg	13.6mg

SHELF LIFE OF THE PRODUCT- The product was tested for total plate count, coliform, yeast & mould and enterobacteriaceae to see the shelf life of the product. According to the results it was concluded that it can be stored and consumed for 45 days at normal room temperature. If the product is stored in cool surroundings the shelf life will be upto 60 days. The Iron Boost offers a convenient and delicious way to support daily iron intake and overall health. With its nutrient-rich ingredients, it's an ideal choice for anyone seeking a wholesome, energy-boosting snack [10, 11]

Table 4. Shelf life reports (per 100g of product)

Test Name	Incubation Time	Temp. (°C)	No. of Colonies	Max. limit
TPC	72 hrs max	28–30 °C	120 cfu	10000 cfu/gm
		35°C	130 cfu	
Coliform	24 hrs max	30°C	Absent	Absent/gm
		35°C	Absent	
Yeast & Mould	120 hrs max	22–24 °C	60 cfu	1000 cfu/gm
		28°C	90 cfu	
Enterobacteriaceae	48 hrs max	22–24 °C	Absent	Absent/0.1g
		28°C	Absent	

4. CONCLUSION:

This research successfully formulated and assessed an iron-rich nutritional snack incorporating Garden Cress (*Lepidium Sativum*) and rice flakes, providing a natural and sustainable strategy for addressing iron deficiency anemia. Among the tested formulations, T2 with highest concentration of iron i.e. 13.6mg with a higher concentration of Garden Cress seeds, was the most preferred based on taste, texture, and overall sensory evaluation. The findings emphasize the high bioavailability of iron from Garden Cress, making it a valuable dietary alternative to synthetic supplements. Sensory assessments confirmed its acceptability, while statistical analysis reinforced its effectiveness. Highlighting the role of food-based interventions in public health, this research advocates for integrating iron-rich snacks into daily nutrition to help combat anemia. Future studies should focus on evaluating long-term health impacts, improving shelf life, and enabling large-scale production to ensure an affordable and natural solution for iron deficiency, particularly in at-risk populations

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