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Review Article

Benefits of Lepidium Sativum- A Review

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Abstract

Iron-deficiency anaemia remains one of the most prevalent nutritional disorders globally, particularly affecting women, children, and adolescents. With growing interest in natural and food-based interventions, Garden Cress Seeds (*Lepidium sativum*) have emerged as a promising solution due to their high iron content and rich nutritional profile. This review critically examines the nutritional composition of Garden Cress Seeds, focusing on benefits. The paper synthesizes evidence from existing in-vitro studies, clinical trials, and population-based research, demonstrating the seeds' effectiveness in improving health. Furthermore, the paper highlights the seeds' affordability, accessibility, and cultural acceptability, making them suitable for integration into community nutrition strategies. Overall, this review concludes that Garden Cress Seeds hold significant potential as a natural, sustainable, and effective dietary intervention for the prevention and management of iron-deficiency anaemia.

Keywords: Anaemia; Garden Cress Seeds; *Lepidium sativum*

Introduction

Lepidium sativum (Garden Cress Seeds)

The growing interest in using medicinal plants to manage various ailments is fuelled by their diverse advantages, which encompass nutritional value, bioactive compounds, functional properties, and pharmacological effects [2].

Of all the medicinal plants, *Lepidium sativum*, is one of the valued nutritional and medicinal plants in India from the Vedic era based on its supposed health benefits. As a member of the Cruciferae family, *Lepidium sativum* is an annual, herbaceous plant with close ties to mustard and watercress. They are grown as an edible plant all over Asia. In India, commonly it's termed as "Garden Cress Seeds" or "Common Cress," "Land Cress," "Haliv," "Asalio," and "Chandrasur." Even though it is primarily a winter crop, *Lepidium sativum* is produced across India throughout the year [1].

These seeds are a powerhouse of high mineral contents and so are widely utilized in developing various functional foods and drinks. An abundant supply of calcium, phosphorus, and magnesium is present in these seeds. *Lepidium sativum* are an excellent source of iron, which is easily absorbed and helps boost blood haemoglobin levels. Acknowledged for its health-boosting attributes and nutrient richness, it has been an integral part of India's medicinal heritage since ancient times. *Lepidium sativum* contribute to health by offering anti-asthmatic, anti-diabetic, diuretic, hypotensive, anti-carcinogenic, and antibacterial properties, contributing to their effectiveness in inflammatory bowel disease management. Predominantly its phytochemical parts consist of carbohydrates, alkaloids, amino acids, proteins, and flavonoids [9].

Taxonomy of *Lepidium sativum*

Lepidium sativum, commonly known as garden cress, is a fast-growing annual herbaceous plant belonging to the family Brassica-

ceae. This species is characterized by small, white to pinkish flowers and Is broadly cultivated due to the edibility of its seeds and leaves. Native to Southwest Asia and Egypt, garden cress has been naturalized and cultivated globally because of its nutritional and medicinal properties. Renowned for their rich iron levels, these seeds play a supportive role in managing iron deficiency anaemia. Additionally, they are rich in other micronutrients and phytochemicals, contributing to its therapeutic potential [4].

Kingdom	Plantae
Division	Angiospermae
Class	Dicotyledonae
Sub Class	Polypetalae
Series	Thalamiflorae
Order	Parietales
Family	Cruciferae (Brassicaceae)
Genus	Lepidium Linn

Table 1: Taxonomic classification (*Lepidium sativum Linn*) [5].

Morphology of *Lepidium sativum*

Lepidium sativum are small, have an oval shape, and end in a pointed triangle. They appear reddish-brown and measure about 3-4 mm in length and 1-2 mm in width [10].

The endosperm makes up the seed and consists of 80-85% polygonal cells with thick walls. The embryo, surrounded by endosperm cells, comprises 2-3% of the seed, while the seed coat accounts for 12-17%. When placed in water, the seed quickly absorbs the liquid. Additionally, the mucilage on the seed coat swells and completely engulfs the seed, forming a colourless, translucent covering [2].

Physical Properties of Garden Cress Seeds

When developing medicines or supplements, physical properties like color, smell, thickness (viscosity), and how light passes through (refractive index) are important for product quality.

- **Color**: Garden Cress Seeds are usually reddish-brown. The oil extracted from them is yellowish due to natural pigments like chlorophyll and carotenoids.

Characteristics	
Height	47-50cm
Leaves	Lobed shape with linear segments
Flowers	Small, white to pinkish in colour
Pods	Obovate,5 mm length
Harvesting time after sowing seeds	90 days

Table 2: Botanical Description of *Lepidium sativum* [4].

- **Viscosity**: The thickness of the seed oil ranges between 53.08 to 64.3. Cold-pressed oil is thicker, and viscosity decreases with higher temperatures [7].
- **Refractive Index**: A higher refractive index shows the presence of unsaturated and special components like hydroxyl groups.
- **Specific Gravity**: With a value of 0.91, *Lepidium sativum* oil is light and may work well as a nutrient booster in food and health products [7].

Parameters	
Colour	Reddish-brown
Shape	Oval
Taste	Peppery, pungent taste with hot mouth feel
Dimensions	
Length (mm)	2.60
Width (mm)	1.20
Thickness (mm)	0.94
Sphericity (%)	54.59
Bulk density (kg/m3)	729.74
True Density (kg/ m3)	1230
Porosity (%)	40.67
Angle of repose (o)	20.59
Weight of 1000 seeds (g)	1.89

Table 3: Physical Characteristics of *Lepidium sativum* [4].

Nutritional Composition of *Lepidium sativum*

Chemical composition

Owing to its rich nutritional composition, garden cress is recognized as a superfood. The carbohydrate content of the *Lepidium sativum* is primarily non-starch polysaccharides, accounting for 90%, while the remaining part is starch. This crop is one of the preferred ones showing prebiotic characteristics and hence useful in the regulation of digestion within the intestinal tract. It can function as a non-viable additive in food products through fermentation by anaerobic bacteria present within the gut. The seed bran is rich in dietary fiber, comprising 75.0% of its content, and exhibits a high water-holding capacity of 4.51 ml/g. The protein content of *Lepidium sativum* is 22.5%, which is relatively comparable to linseed (28-30%), but higher than commonly consumed cereals [10].

Elevated ash content in Garden Cress Seeds (GCS) reflects their richness in minerals. A lower moisture percentage serves as an indicator of enhanced stability, superior quality, and extended storage potential of the seeds. Additionally, the seeds' high levels of protein and lipids contribute to their significant caloric value [10]. Different seed processing methods can be used to enhance the seed nutrient composition for instance, soaking of the seed improves ash content of the seed by 2.48%, improves protein content by 2.1%, and boosts retention of amino acids and fatty acids [3]. *Lepidium sativum* contains moisture by 2.9 %. Seeds with reduced moisture levels exhibit enhanced stability, improved nutritional retention, and an extended shelf life [25].

Component	Amount per 100g	Key Benefits
Carbohydrates	30-34%	Energy source
Proteins	25-39%	Muscle building, repair
Fats	23-25%	Essential fatty acids
Calcium	377 mg	Bone health
Iron	100 mg	Helps treat anaemia
Magnesium	430 mg	Supports nerve & muscle function
Thiamine (B1)	0.59 mg	Supports metabolism
Riboflavin (B2)	0.61 mg	Energy production, cell function
Niacin (B3)	14.3 mg	Supports digestion & skin health
Vitamin E	258.74 mg	Anti-aging, skin protection
Potassium	1635.62 mg	Good for high BP & athletes
Sodium	36.25 mg	Low-sodium content

Table 4: Macro and Micronutrient Composition Distribution in *Lepidium sativum* [20].

Natural antioxidants in the *Lepidium sativum* helped to prevent rancidity in oil and oxidation. These seed contained a good amount of vitamins and minerals [12]. The seeds of *Lepidium sativum* consist of 24% yellowish semi-drying oil that comprises linoleic acid and α-linoleic acid. It is more stable in terms of reaction because of phytosterols and antioxidant content [13].

However, the nutrient composition of the seed differs due to differences in seed varieties, variation in agronomic practices, climatic and geographical conditions of the seed grown [3].

Vitamins and minerals profile

Garden cress is packed with vitamin C, known as ascorbic acid, a water-soluble nutrient derived from glucose processing in the body. Its rich vitamin C content helps garden cress support the immune system and fight infections. A Research study showed that L. sativum leaves hold between 54 to 74 mg of ascorbic acid in every 100 g fresh sample. While potassium and phosphorus are abundant in garden cress, it has only trace amounts of manganese. It contributes valuable amounts of minerals such as magnesium, calcium, and iron to the diet. Calcium (377 mg/100g) and magnesium

(430 mg/100g) contents of L. sativum supports Proper muscle contraction and cardiovascular health. The seeds of garden cress are loaded with iron (100 mg/100g), making them useful in treating anaemia in young individuals. With 723 mg of phosphorus per 100 g, garden cress helps maintain essential metabolic activities in the body [23].

Fatty acids

Garden Cress Seeds hold about 20-25% of a pale-yellow oil that is semi-drying in nature. Garden cress seed oil contains a high concentration of essential fatty acids like linolenic (26-34%), linoleic (7.5-11.8%), and arachidic (2-3.5%), all known to support cognitive health. Beyond the brain-boosting fatty acids, Garden Cress Seeds offer palmitic, stearic, and oleic acids for additional health benefits. Variations in geography, weather, and the method of seed cultivation can influence their fatty acid composition [10].

Amino acids profile

Our body relies on both essential and non-essential amino acids to grow and function properly. Since we can't produce all of them on our own, we rely on natural food sources to get them [22]. Garden Cress Seeds offer high-quality protein loaded with key amino acids required by the body like lysine (6.26 g) and phenylalanine (6.26 g). These seeds provide complete protein with fundamental amino acids required for body repair and growth. Methionine, though present, is in a smaller quantity in Garden Cress Seeds. Alongside essentials, non-essential amino acids like glutamic and aspartic acids are found in high levels. Oilseed results confirmed high amounts of two non-essential amino acids in Garden Cress Seeds.: Glutamic (19.3%) and aspartic acid (9.7%) [23].

Garden Cress Seeds are composed of approximately 47% essential amino acids, with notable amounts of lysine (6.26%) and a smaller proportion of methionine (0.97%), the most limiting amino acid. While data on tryptophan and cysteine wasn't available, the essential amino acid score stood at 28.53% [24].

These nutrients are necessary for promoting the body's overall nutritional needs. Lysine, an essential amino acid, is key to preserving the body's nitrogen balance. Methionine, another important amino acid, functions as a precursor to choline, which is indispensable for optimal brain function. Additionally, methionine supports digestive health, promotes fat metabolism, and contributes to the detoxification of harmful substances. It is also necessary for synthesizing other amino acids, such as cysteine and taurine [26].

Amino Acids Composition in Garden Cress Seeds

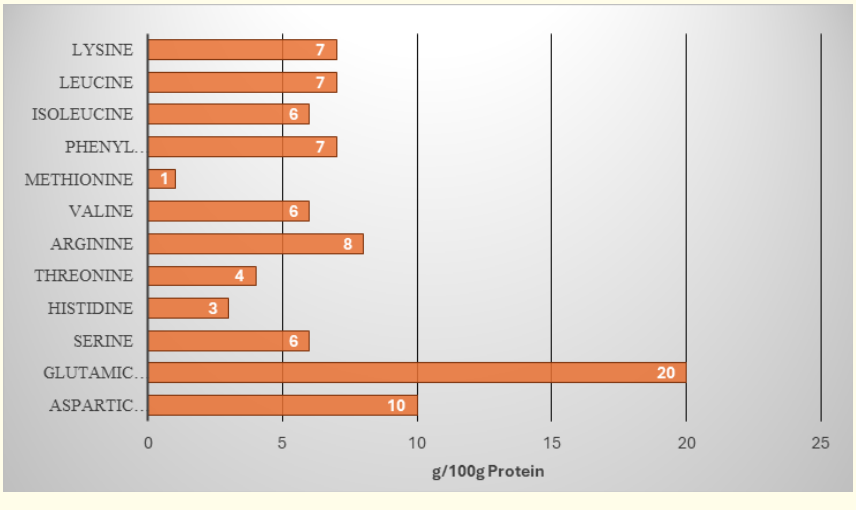

Figure 1: Amino Acid Profile showing the distribution of major and minor components in *L. sativum* [22].

Phytochemical composition

The presence of phenolic compounds is significant in every herb because they help protect the body by removing harmful substances, thanks to their special chemical groups. In Garden Cress Seeds, the types and amounts of these compounds can change depending on how they are extracted and which solvents are used. Among these, gallic acid and protocatechuic acid are the most prevalent and are recognized for their potent antioxidant properties. This makes Garden Cress Seeds a valuable ingredient in healthy foods [23].

Lepidium sativum (garden cress) seeds contain several health-promoting plant compounds such as phenolics, alkaloids, flavonoids, glycosides that support heart health, saponins, tocols, phytosterols, tannins, and triterpenes. These bioactive substances contribute to the seed's nutritional value and traditional medicinal use. Extracts from these seeds have shown potential in easing pain, asthma, inflammation, oxidative stress, blood clotting issues, urinary problems, and more [9].

Health Benefits of Lepidium sativum

Lepidium sativum (Garden Cress Seeds) are a highly regarded medicinal herb recognized for their impressive nutritional content. Packed with protein, calcium, dietary fiber, iron, phosphorus, and vitamins A and C, these small seeds are vital in promoting overall health. Their nutrient profile contributes to the prevention and management of several conditions, such as asthma, diabetes, cancer, anaemia, and menstrual irregularities [21].

Category	Specific Benefit	Details
Hepatoprotective Effects [9]	Antioxidant Activity	Rich in antioxidants like vitamin E and flavonoids Neutralizes free radicals that cause damage to liver cells Maintains liver function
	Anti-Inflammatory Effects	Reduces liver inflammation caused by chronic conditions Contains bioactive compounds that protect liver cells and reduce tissue damage
	Support for Detoxification	Activates liver enzymes Enhances detoxification pathways Reduces toxin accumulation in the liver
	Liver Regeneration	Promotes the regeneration of liver tissue Supports growth of new liver cells and repair
	Lipid Metabolism Regulation	Helps manage fat metabolism Prevents fat accumulation in liver, lowering risk of fatty liver disease
Anti-Diabetic Effects [9]	Blood Glucose Regulation	Controls blood sugar by affecting glucose metabolism May influence insulin signaling
	Increased Insulin Sensitivity	Improves body's response to insulin Reduces insulin resistance
	Inhibition of Gluconeogenesis	Prevents excessive glucose production in liver Helps maintain blood sugar balance
	Modulation of Gut Health	Rich in dietary fibre Promotes healthy gut microbiome which supports glucose regulation
	Low Glycaemic Index (GI)	Fibre slows glucose absorption Prevents sudden blood sugar spikes
Anti-Inflammatory, Antipyretic, and Analgesic Activities [10]	Anti-Inflammatory Activity	Contains flavonoids and alkaloids Reduces inflammation and modulates inflammatory pathways
	Antipyretic Activity (Fever-Reducing Effect)	Tannins and flavonoids lower body temperature Reduces heat production
	Analgesic (Pain-Relieving) Activity	Sterols, triterpenes, and alkaloids provide pain relief May act through neurotransmitter pathways

Anti-Anaemic Effect [9]	Rich in Iron and Folic Acid	Essential for the production of red blood cells and the synthesis of haemoglobin. Prevents iron-deficiency anaemia
	Boosting Haemoglobin Levels	Supports oxygen transport in blood Reduces fatigue and weakness
	Enhancing Iron Absorption	Vitamin C boosts the absorption of iron from plant-based sources. Increases bioavailability of non-haeme iron
Value-Added Food Products [10]	Functional Food Use	Garden Cress Seeds are incorporated into a variety of functional foods. Improve overall nutritional value of products

Table 5: Therapeutic health benefits of *Lepidium sativum.*

Methods of Improving Bioavailability of Lepidium Sativum

Incorporating *Lepidium sativum* seeds into daily diets can be achieved through various methods:

- **Soaking:** The process of soaking increases the seed's nutritional benefits by enhancing iron availability. Scientific studies indicate that these seeds significantly affect the body's nutritional intake. Known for their high iron levels, *Lepidium sativum* seeds are an excellent dietary supplement. Processing techniques such as soaking for about 3 hours, drying it at 60°C, and roasting has been found to boost the nutritional quality of the seeds. The combination of soaking, drying, and roasting optimizes the seed's mineral content, iron absorption and bioavailability. Iron-rich preparations made from *Lepidium sativum* can be used in nutritional programs to prevent anaemia [18].
- **Infusion:** Consuming 3 grams of boiled seeds in half a cup of milk may provide relief from bloating and Vata-related issues. Taking 2 grams of seeds mixed with buttermilk before meals, twice daily, can help manage diarrhoea and dysentery. Consuming finely ground *Lepidium sativum* **s**eeds with ghee or jaggery may aid in digestive discomfort and nausea. These seeds are powdered and consumed with ghee or jaggery for their digestive and health benefits. This mixture supports better digestion, helping to reduce nausea, bloating, and frequent burping. Incorporating these seeds into the diet can assist in healthy growth and puberty-related development [14].
- **Incorporating Vitamin C** also enhances the iron absorption, further aiding the treatment of anaemia. With addition to the usual foods or nutritional supplements rich in vitamin C, these seeds are highly beneficial against the condition of anaemia. The vitamin C-rich foods can even enhance the intestinal absorption of iron from its major non-haeme sources that the plant source and *Lepidium sativum* seeds can boast of. Taking these seeds with vitamin C-rich foods such as citrus fruits, berries, or vegetables significantly enhances the utilization of iron and therefore maximizes the rises in haemoglobin levels [9].

Iron is one among the very efficient sources available with Lepidium sativum seeds. Being a part of the process where iron stores restart, this grows healthy red cells in the bloodstream. Iron deficiency is one of the primary causes of this type of anaemia. More importantly, these seeds are a recognized source of folic acid (vitamin B9) which is used as a significant element in the treatment of anaemia. Folic acid plays a vital role in DNA synthesis and the production of red blood cells, and prevents various forms of anaemia like megaloblastic anaemia. *Lepidium sativum* seeds contain iron and folic acid, which increase haemoglobin concentration in the bloodstream. Haemoglobin is responsible for transporting oxygen from the lungs to the body's tissues and organs. Anaemia develops when haemoglobin production is impaired due to inadequate levels of iron and folic acid in the body [9].

Therapeutic applications

Lepidium sativum seeds serve a therapeutic role in treating several diseases. It is a functional food constituent with nutritional, phytochemical, antibacterial, toxicological, and therapeutic properties. It is primarily utilized for managing respiratory conditions like asthma, bronchitis, and persistent coughing. The seeds possess laxative properties and are used to relieve inflammation, muscle pain, and rheumatic conditions [9].

Hepato-Protective Effect

Hepatic disease has become a major health concern due to the rising rates of obesity in people of all age groups. Traditional treatments for liver problems like cirrhosis, hepatitis, fatty liver, and both acute and chronic liver diseases often fall short because many chemical-based medicines can damage the liver. Several medicinal plants containing natural liver-protecting compounds have undergone extensive study for their effectiveness in treating liver conditions [23].

Garden Cress Seeds (*Lepidium sativum*) have attracted significant attention for their liver-protective effects, thanks to their ability to support liver function and guard against liver damage. Numerous studies have investigated the active compounds present in Garden Cress Seeds and their modulatory effects on liver physiology [27].

Powerful antioxidant defence

Garden Cress Seeds are rich in antioxidants such as vitamin E, flavonoids, and a range of phenolic substances. These antioxidant compounds combat free radicals, thereby minimizing oxidative stress and protecting liver cells from potential harm. By lowering oxidative damage, Garden Cress Seeds help protect the liver and support its healthy functioning [28].

Natural anti-inflammatory action

Chronic inflammation often worsens liver diseases. Garden Cress Seeds contain natural anti-inflammatory agents that help reduce liver inflammation. This not only protects liver tissues but also minimizes cell damage, contributing to better liver health overall [29].

Boost to liver detoxification

The liver is essential in detoxifying harmful substances and metabolizing medications. Garden Cress Seeds are established to enhance the liver's detoxification capacity by stimulating key detoxifying enzymes. This helps prevent toxin buildup and supports optimal liver function [30].

Promotes liver repair and regeneration

Some studies suggest that Garden Cress Seeds can assist in repairing damaged liver tissue. Certain bioactive compounds in the seeds may promote the growth of new liver cells, aiding the regeneration process and improving recovery from liver injuries [31].

Helps regulate fat metabolism

Disturbances in fat metabolism often lead to fatty liver and related disorders. Research shows that Garden Cress Seeds could assist in balancing lipid metabolism, potentially preventing fat build up in the liver and also reducing the likelihood of developing metabolic liver diseases [32].

It is advisable to consume vitamin C about 30 minutes after eating these seeds, as it helps improve iron absorption. L-ascorbic acid boosts iron absorption by forming a chelate with ferric iron in an acidic environment, converting it into a ferrous form. This ferrous iron stays soluble at the alkaline pH of the duodenum, making it easier for the body to absorb [16].

Anti-diabetic activity

Diabetes mellitus (DM) is a prevalent metabolic condition that impacts people worldwide. It arises either from insufficient insulin production (type 1 diabetes mellitus, T1DM) or from the body's inability to effectively use insulin (type 2 diabetes mellitus, T2DM). This disorder disrupts the normal metabolism of proteins, carbohydrates, and fats. Chronically elevated glucose levels can lead to both microvascular and macrovascular complications. Additionally, diabetes can negatively impact vital organs, impairing kidney and liver function and disturbing lipid profiles. Therefore, timely diagnosis and effective control of diabetes are essential to avoid serious health issues. Garden Cress Seeds (GCS), scientifically referred to

as *Lepidium sativum*, has demonstrated potential in medicine owing to its diverse therapeutic effects and pharmacological benefits [23].

Garden Cress Seeds extract has shown effectiveness in helping prevent and manage diabetes mellitus and its associated complications [3]. A 20% methanolic extract of *Lepidium sativum* was found to be most effective at a dose of 300 mg per kilogram of body weight for regulating blood glucose levels and treating hyperglycaemia. This methanolic extract effectively helped in regulating diabetes, boosting antioxidant levels, and improving the lipid profile of the subjects [10].

Anti-asthmatic activity

Bronchial asthma is a long-term inflammatory condition affecting the airways of the lungs, marked by heightened sensitivity to various triggers. Common symptoms include sudden episodes of shortness of breath, wheezing, coughing, and a feeling of tightness in the chest. Since ancient times, natural remedies are well known for their effectiveness in treating a range of illnesses, including bronchial asthma, coughs, and hiccups [15].

In traditional medicine, garden cress (GC) has been extensively utilized in treating various respiratory conditions, including asthma, cough, and bronchitis. In a clinical study, 30 patients aged between 15 and 80 years with mild to moderate bronchial asthma were administered garden cress seed powder orally at a *1-gram dose* of the powdered form, three times daily. The findings showed that GC seed powder helped improve several pulmonary function test indicators and reduced the severity and frequency of asthma symptoms. Notably, no participants experienced any negative side effects from the treatment. The Broncho dilatory effect of garden cress is believed to be driven by a combination of mechanisms, including anticholinergic action, calcium channel blocking, and phosphodiesterase inhibition [3].

Anti-cancer property

Cancer remains the foremost cause of mortality worldwide. Recently, there has been an increasing focus on using natural remedies to alleviate the side effects of conventional cancer treatments [15].

Growing evidence suggests that Garden Cress Seeds (*Lepidium sativum*) may have anticancer properties, making them a potential ally in cancer prevention. They protect cells against oxidative stress caused by free radicals, which can result in DNA mutations and trigger the onset of cancer and the initiation of cancerous growth. Garden Cress Seeds are particularly rich in antioxidants, including vitamins A and E. The antioxidants in Garden Cress Seeds help counteract free radicals and reduce oxidative stress, a major contributor to cancer progression. The seeds also contain active compounds capable of blocking certain enzyme activities involved in tumour formation [9].

Research involving both animals and humans has demonstrated that the fatty acids in garden cress (GC) seeds exhibit both chemopreventive and chemotherapeutic properties against different cancer types. Additionally, the impact of an aqueous extract of GC seeds on human breast cancer cells was tested at varying concentrations. The results showed that the seed extract triggered both apoptosis and necrosis in the cancer cells. Particularly, breast cancer cell growth was suppressed when treated with 25% and 50% extracts, resulting in apoptosis, while necrosis occurred at higher concentrations, such as 75% [3].

Anti-anaemic effect

Anaemia is a health condition marked by low levels of haemoglobin (Hb) in the blood. It remains a widespread global issue and, if left untreated, can lead to serious health problems such as impaired cognitive development, poor academic performance, weakened immunity, reduced physical capacity, increased maternal mortality, and low birth weight in new born. While anaemia can arise from various factors, the most common cause is nutritional deficiency-particularly a lack of iron. Iron plays a crucial role in the production of red blood cells, as it is a central component of haemoglobin, the molecule responsible for transporting oxygen throughout the body. Garden Cress Seeds (GCS) are an excellent source of non-haeme iron, the form of iron typically found in plant-based foods [19].

The body can absorb this form of iron efficiently. GCS contain about 28.8 mg of non-haeme iron per 100 grams, with a bioavailability of around 5%, similar to that of spinach (5-7%). However, when consumed with vitamin C (around 50 mg), the absorption rate can significantly increase to approximately 15% [23].

Garden Cress Seeds are a valuable source of non-haeme iron, which plays a crucial role in boosting haemoglobin levels in the blood and is commonly utilized to combat anaemia. A review study reported that administering 25 grams of garden cress seed powder, prepared into a sweet 'laddu' formulation using coconut kernel and molasses, to 30 young adult girls over a period of 7 days led to a significant increase in haemoglobin levels compared to the control group. Additionally, research findings indicated that school children who consumed biscuits enriched with roasted Garden Cress Seeds experienced an improvement in their haemoglobin concentration, rising from 10.63 g/dL to 11.06 g/Dl [3].

Cardio-protective role

Cardiovascular disease (CVD) remains a major global killer, primarily due to atherosclerosis - a chronic inflammatory disease marked by cholesterol buildup in arteries. Hyperlipidaemia, or elevated lipid levels (especially LDL), worsens oxidative stress and contributes significantly to plaque formation [17]. Polyunsaturated fats like α-linolenic acid and plant polyphenols help lower LDL levels and reduce CVD risk. Garden Cress Seeds (GCS) are rich in these compounds, containing 18-24% fat with 34% α-linolenic acid, offering a balanced omega-3 to omega-6 ratio beneficial for heart health. High copper content in GCS also aids in lowering blood cholesterol. GCS oil is abundant in phenolics, flavonoids, tannins, and glycosides, giving it strong antioxidant properties. The omega-3 PUFAs and tocopherols further enhance its ability to combat lipid peroxidation and manage high lipid levels. Oils like Garden Cress Seed Oil (GCSO) and purslane, high in α-linolenic acid, promote cholesterol excretion into bile, lowering liver cholesterol levels and improving lipid profiles [8].

Garden Cress Seeds (*Lepidium sativum*) contribute to heart health due to their rich vitamin C and vitamin K content. Vitamin C, known for its strong antioxidant properties, plays a crucial role in collagen synthesis, which helps maintain the strength and flexibility of blood vessels while also boosting immune function. By promoting collagen production, Garden Cress Seeds support arterial flexibility and protect against damage caused by high cholesterol. Additionally, vitamin K present in these seeds aids in cardiovascular health by preventing the accumulation of calcium in the arteries and heart valves. The vitamins in Garden Cress Seeds help prevent arterial calcification, reducing the risk of artery hardening and narrowing. While these seeds support heart health, maintaining overall cardiovascular wellness still requires a balanced diet, regular exercise, and medical guidance. Individuals should consult healthcare professionals before adding Garden Cress Seeds to their heart care routine [11].

Functional application of *Lepidium sativum*

With rising health awareness, more consumers are shifting toward nutritious and functional foods that support overall well-being. Garden Cress Seeds (GCS) have gained recognition as valuable components in the global superfood market, aligning with this health-focused trend. Rich in essential nutrients and available year-round at affordable prices, GCS are accessible to people across different income levels. They can be incorporated into a variety of food items to enhance their nutritional quality without significantly altering production processes. Thanks to their dietary and therapeutic benefits, GCS serve as effective fortifying agents in numerous food applications [6].

Possible Side Effects of *Lepidium sativum*

When consumed in excess, Garden Cress Seeds can act as an abortifacient and should be strictly avoided by pregnant women due to their strong and bitter properties linked to galactagogue compounds. These seeds also contain goitrogens, which may disrupt iodine levels uptake by the thyroid gland, potentially leading to hypothyroidism. Overconsumption may cause digestive discom-

Category	Food Product	GCS Inclusion	Nutritional/Functional Impact
Baked Goods	Cookies	5-15% GCS flour	High in protein, omega-3, and iron; beneficial for children and individuals with anaemia.
	Muffins	5-20% GCS flour	Boosts protein (14%), fiber (68%), ash (74%), and fat (45%). Shown to support heart and immune health in animal studies.
	Cakes	2.5-10% GCS flour	At 8% concentration, enhances protein and color without compromising texture or taste.
Snack Items	Pretzels	10-15% sprouted GCS flour	Enriched with essential amino acids and minerals; 10% blend preferred for nutty flavor.
	Laddus	5-15% GCS powder	Enhanced levels of protein, fat, calcium, iron, and heart-healthy fats (MUFA & PUFA).
	Chikki	10-15% GCS powder	15% GCS chikki rated best in taste tests; rich in protein (6.95%), fat (15.87%), fiber (3.95%); improved hemoglobin in anemic adolescent girls.
Savory Foods	Noodles	5-15% GCS flour	15% inclusion led to 13.06% protein and 76.80% fiber content; improved taste and texture.
	Cutlets	10-30% roasted GCS	Fortified cutlets showed higher fiber, protein, fat, iron, and calcium with no sensory drawbacks up to 30% addition.
Beverages	Health Drink	3-5% GCS powder	Best recipe with 3% GCS had 3.44% protein, 1.22% fat, and 65.63 kcal per 100 mL; scored 8.75 on acceptability scale.
	Drink Mix	5-10% GCS powder	Boosts carbohydrates, iron, and calcium; 5g GCS mix had top sensory ratings-ideal for combating micronutrient deficiencies.

Table 7: Functional Uses of Garden Cress Seeds (GCS) in Food Products [23].

fort in some individuals. Although the oil derived from garden cress is edible and suitable for cooking, its high potency might lead to indigestion in certain cases. People experiencing such effects are advised to either stop using the oil or blend it with other edible oils to lessen its intensity and side effects [16].

Conclusion

Anaemia remains a pressing global public health issue, affecting over 1.6 billion people worldwide, predominantly women and children in developing nations. Among the various types of anaemia, iron-deficiency anaemia (IDA) stands as the most prevalent and preventable. Over the years, numerous dietary interventions have been explored to combat this deficiency effectively, with a growing emphasis on sustainable, accessible, and natural alternatives to synthetic supplements. Within this framework, Garden Cress Seeds (*Lepidium sativum*), commonly known as "halim" or "chandrasura", have garnered considerable attention owing to their impressive nutritional profile, particularly their rich iron content and bioactive constituents that aid in haemoglobin synthesis.

The present review paper meticulously examined the nutritional and medicinal properties of Garden Cress Seeds, reviewed existing literature and experimental studies, and analysed their therapeutic potential in preventing and managing anaemia. The comprehensive data collected suggests that Garden Cress Seeds stand as a potent and reliable natural intervention against anaemia, particularly iron-deficiency anaemia, with added benefits from their complementary nutrient content.

In conclusion, this research underscores the multifaceted role of Garden Cress Seeds in combating anaemia. Their impressive iron content, enhanced bioavailability, rich nutrient composition, and adaptability to various dietary practices make them a highly promising food-based strategy to address iron-deficiency anaemia. Incorporating Garden Cress Seeds into daily dietary routines, especially among vulnerable groups such as pregnant women, menstruating adolescents, and children, could serve as a preventive and therapeutic measure against anaemia. As we continue to seek integrative approaches that combine traditional wisdom with scientific validation, Garden Cress Seeds stand as a shining example of nature's pharmacy-offering health, affordability, and accessibility in a single, humble seed.

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