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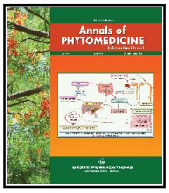

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Herbs that heal: A review update on nutritional, medicinal values, healing, and pharmacological properties of green leafy vegetables

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Abstract

Green leafy vegetables, often referred to as 'herbs that heal', are a vital part of a balanced diet due to their rich nutritional profile, medicinal values, healing properties, and pharmacological properties. They are typically low in calories and fat, but high in dietary fiber, essential vitamins, minerals, and bioactive compounds. Nutritionally, these vegetables are packed with fiber and antioxidants, which are known to prevent type 2 diabetes. They are also rich in vitamins A, C, K, folate, and minerals like calcium, iron, magnesium, phosphorus, and potassium. Some examples of these nutrient-dense vegetables include kale, collard greens, spinach, and cabbage. Medicinally, these vegetables have been associated with numerous health benefits. They have antidiabetic properties, can prevent cardiovascular diseases, and improve gut health. They also contain bioactive compounds that reduce oxidative stress and inflammation. The healing properties of these vegetables are linked to their high content of antioxidants and bioflavonoids, such as chlorophyll and sulfur compounds, which have diuretic, depurative, and protective health properties. Pharmacologically, these vegetables have demonstrated significant advantages, including wound-healing, antibacterial properties, memory-enhancing capacity, antioxidant activity, and cardioprotective, antihypertensive and antianaemic properties. They also contain compounds like sulforaphane, which may lower a person's risk for cancer. In conclusion, green leafy vegetables, with their rich nutritional content, medicinal values, healing properties, and pharmacological properties, play a crucial role in promoting health and preventing diseases. Further research is encouraged to explore their full potential.

1. Introduction

According to the Indian Council of Medical Research (ICMR), it is recommended that every individual should consume at least 300 g of vegetables daily. This includes 50 g of green leafy vegetables, 200 g of other vegetables, and 50 g of roots and tubers. The ICMR's dietary guidelines also suggest that fresh seasonal fruits (100 g) should be consumed regularly (National Institute of Nutrition, 2011). These recommendations are designed to ensure a balanced intake of essential nutrients for maintaining good health. Green leafy vegetables are an essential part of a healthy diet due to their high nutritional value and numerous health benefits. Green leafy vegetables are typically rich in vitamins, minerals, and fiber, and low in calories and fat. They provide essential nutrients like vitamin K, vitamin A, vitamin C, calcium, iron, and folate. Consuming leafy greens can offer numerous health benefits, such as reducing the risk of obesity, heart disease, high blood pressure, and mental decline. Certain compounds in these vegetables may also lower the risk of cancer. They are also good source of dietary fiber, which aids in digestion and helps maintain a healthy weight. Leafy greens contain antioxidants like lutein and beta-carotene, which may reduce the risk of diseases caused by oxidative stress. They can be included in the diet in various ways, such as in salads, soups, and stir-fries, making them easy to incorporate into daily meals.

Some studies suggest that the dietary fiber and other compounds in leafy greens can helps to manage blood sugar levels, offering antidiabetic effects. The fiber, potassium, and vitamin K in leafy

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greens support heart health. Certain nutrients in leafy greens, like potassium, may helps to reduce high blood pressure. Some leafy greens contain compounds like sulforaphane, which have been associated with a reduced risk of certain types of cancer. Leafy greens like spinach are high in iron, a nutrient necessary for preventing and treating anemia. The dietary fiber in leafy greens can helps to promote a healthy gut by supporting a healthy digestive tract and promoting the growth of beneficial gut bacteria (Tahreem Aslam *et al*., 2020). Some studies suggest that leafy greens may have neuroprotective effects, potentially slowing cognitive decline (Sarma and TR, 2024). Keeping the importance of the green leafy vegetables in view, the present review aimed at providing comprehensive update on nutritional profile, medicinal values, healing properties, and pharmacological properties of green leafy vegetables.

2. Leafy vegetables as a source of human nutrition

Leafy green vegetables are indeed a significant source of human nutrition. They are typically low in calories and carbohydrates while being rich in vitamins, minerals, and dietary fiber (Table 1) (Deepak *et al*., 2020).

Table 1: Leafy green vegetables and their nutritional benefits

Leafy vegetable	Nutritional benefits
Arugula	Folate and vitamins C and K
Beet greens	Vitamins A, C, and K
Kale	It is rich in nutrients, including fiber and antioxidants, vitamins and nutrients, including iron, magnesium, phosphorus, folic acid, and calcium
Collard greens	They are rich in vitamin A, vitamin C, folate, vitamin K, and calcium
Spinach	Vitamins and nutrients, including iron, magnesium, phosphorus, folic acid, and calcium; helps delay Alzheimer's disease. Contains carotenoids prevents eye diseases and maintains eye health
Cabbage	Contain sulforaphane which lowers risk of cancer
Microgreens	Microgreens are rich in micronutrients like vitamins C, E, and K. They are also packed with biological phytochemicals that could play a big role in improving general health and preventing diseases

3. Leafy vegetables as source of phytochemicals

Leafy green vegetables are rich in phytochemicals (Table 2), which are compounds produced by plants that have various health benefits. Spinach, cabbage, lettuce, and mustard greens are the popular leafy greens, which contain a variety of phytonutrients beneficial to human health. The bioavailability of these nutrients, their functional properties, and the changes they undergo during harvest and post-harvest processing are all important factors to consider.

Table 2: Nutrients in some of the leafy vegetables

Nutrients	Leafy vegetable	Nutrient content per 100 g edible portion
Beta carotene	Ambat chukka, coriander Carotene leaves, ponnaganti, spinach,	
	leaves, mint, radish leaves	2-6 mg
	Agathi, amaranth, curry leaves, fenugreek leaves and gogu	7-15 mg
Folic acid	Amaranth, ambat chukka, mint and spinach	120 mg
Iron	Amaranth, bengalgram leaves, cauliflower greens and radish leaves	18-40 mg
Calcium	knol-khol leaves, Amaranth, curry leaves, cauliflower greens	500-800 mg
	Agathi	1130 mg
	Colocasia leaves	1540 mg
Vitamin C	Drumstic leaves, cabbage, knol-khol greens, agathi, coriander leaves	120-220 mg
Riboflavin	Spinach, gogu, Fenugreek, curry leaves, colacasia leaves,	
	amaranthus, carrot leaves, mint and radish leaves	0.25 mg

Source: National Institute of Nutrition (NIN), 2011.

Leafy vegetables are packed with biological phytochemicals that could play a big role in improving general health and preventing diseases. These may include ascorbic acid, β-carotene, and phenolic antioxidants, among others. Many leafy vegetables contain phytochemicals such as cardiac glycosides, flavonoids, alkaloids, terpenoids, saponins, tannins, and phlobatannins. These contribute to their therapeutic properties. Some more leafy vegetables are rich in essential oils, glycosides, and pigments. These phytochemicals have been linked to a range of health benefits, including antimicrobial, antihistaminic, hypolipidemic, anticarcinogenic, and antidiabetic properties.

4. Green leafy vegetables as source of minerals

Green leafy vegetables are excellent sources of various essential minerals (Table 3). These minerals play crucial roles in various bodily functions, including bone health, heart health, muscle function, and nerve function. Consuming a variety of leafy green vegetables can help ensure a balanced intake of these essential minerals.

Table 3: Green leafy vegetables as source of minerals

Leafy vegetable	Mineral content
Spinach	Magnesium and iron
General leafy vegetables	Calcium, copper, iron, potassium, magnesium, manganese, and zinc
Dark green vegetables	Iron, calcium, potassium, magnesium and vitamins K, C, E, and B vitamins

5. Leafy vegetables as source of fibres

Leafy green vegetables are excellent sources of dietary fiber (Table 4 and Figure 1), which is essential for healthy digestion.

6. Green leafy vegetables as source of folate

Green leafy vegetables are a great source of folate, also known as vitamin B9 (Table 5 and Figure 1). Folate is essential for many bodily functions, including DNA synthesis and repair, cell division, and cell growth. A deficiency of folate can lead to anemia in adults and slower development in children.

7. Green leafy vegetables as source of iron content

Green leafy vegetables are a great source of iron (Table 6 and Figure 1). Iron is an essential nutrient that plays a major role in many bodily functions, including the production of hemoglobin, a protein that carries oxygen from our lungs throughout our bodies.

Table 4: Leafy vegetables as source of fibres

Leafy vegetable	Fibre content
Spinach	1 cup (30 g) of raw spinach contains 0.7 g of fiber
Kale	1 cup (118 g) of cooked kale contains 4.7 g of fiber
Collard greens	1 cup (190 g) of cooked chopped collards contains 7.6 g of fiber
Broccoli	1 cup of cooked broccoli provides about 2.4 g of fiber
Carrots	1 cup of cooked carrots provides about 5 g of fiber
Beet greens	1 cup of cooked beet greens provides about 4 g of fiber

Table 5: Leafy vegetables as source of folate

Leafy vegetable	Folate content
Spinach	One cup of cooked spinach provides 263 mcg of folate, which is more than half of your daily requirement
Turnip greens	One serving of cooked turnip greens contains about 170 mcg of folate
Kale	One serving of kale contains about 26 mcg of folate
Romaine lettuce	One serving of romaine lettuce contains about 30 mcg of folate
Mustard greens	One serving of cooked mustard greens contains about 13 mcg of folate
Asparagus	A half-cup (90 g serving of cooked asparagus contains about 134 mcg of folate
Beets	One cup of raw beets contains 148 mcg of folate
Lentils	One cup of cooked lentils provides 358 mcg of folate

Table 6: Leafy vegetables as source of iron

Leafy vegetable	Iron content
Spinach	Spinach offers 4 mg of iron per 150 g serving
Fenugreek	Fenugreek contains 5.69 mg of iron per 100 g serving
Amaranth	Amaranth contains 4.6 mg of iron per 100 g serving
Black salsify	This thin, green root vegetable contains 5.5 mg of iron per 250 g serving
Curry leaf	The curry leaf contains 8.67 mg of iron per 100 g serving
Mint leaves	Mint leaves contain about 8.56 mg of iron per 100 g serving
Coriander	Coriander contains 5.3 mg of iron per 100 g serving
Kale	Kale contains about 1.5 mg of iron per 100 g serving
Turnip greens	Turnip greens contain about 1.5 mg of iron per 100 g serving

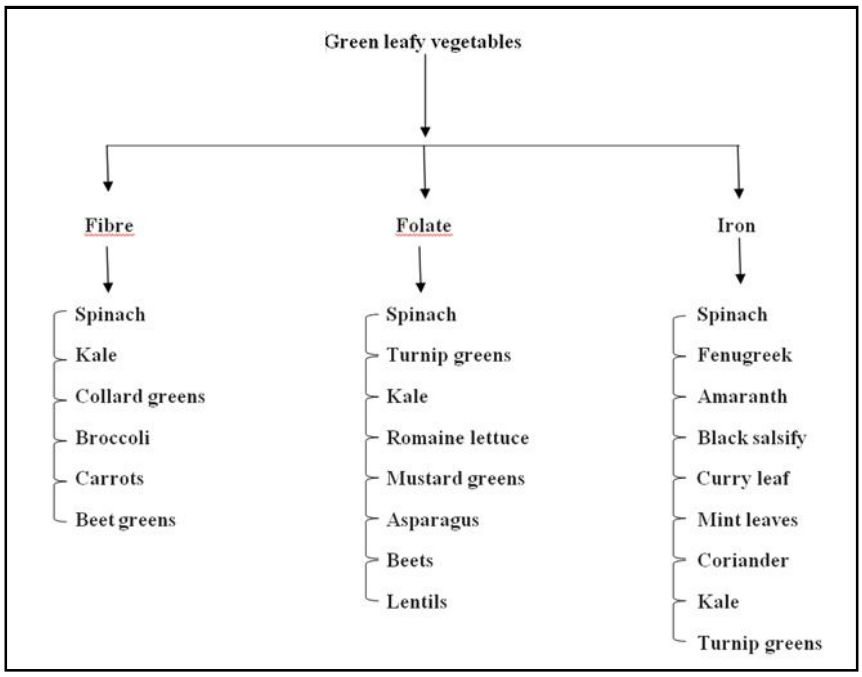

Figure 1: Green leafy vegetables as sources of fibres, folate and iron.

8. Leafy vegetables as source of nutraceuticals

Leafy vegetables are rich in nutraceutical compounds, which are bioactive compounds that offer health benefits beyond their basic nutritional value. These compounds include vitamins, minerals, dietary fiber, and various phytochemicals such as antioxidants and polyphenols. Some examples of leafy vegetables and their nutraceutical potential:

8.1 Spinach

Spinach is rich in vitamins, minerals, and antioxidants. It also contains bioactive compounds like lutein and beta-carotene

8.2 Chard, lettuce, borage, and chicory

These are a source of fatty acids, vitamin C, carotenoids, polyphenols, antioxidant activity, and tocopherols.

8.3 Microgreens

Microgreens are rich in micronutrients like vitamins C, E, and K and packed with biological phytochemicals that could play a big role in improving general health and preventing diseases. Therefore, consuming a variety of leafy vegetables can help ensure a balanced intake of these beneficial compounds.

9. Therapeutic properties of certain green leafy vegetables

Certain green leafy vegetable possesses therapeutic properties (Figure 2).

9.1 Green leafy vegetables in cardioprotection properties

Green leafy vegetables are known for their potential cardioprotective benefits (Barnard *et al*., 2019). Consuming just one cup of nitrate rich vegetables each day can significantly reduce the risk of heart disease. Leafy greens like spinach and lettuce are high in nitrates, which can improve blood flow and decrease blood pressure. Many leafy greens are rich in antioxidants, which help reduce oxidative stress. This is important because oxidative stress can lead to inflammation and damage in the arteries, contributing to heart disease. Leafy greens are high in dietary fiber, which can help lower LDL cholesterol levels. High levels of LDL cholesterol can lead to a buildup in the arteries and increase the risk of heart disease. Leafy greens like Swiss chard are high in vitamin K, which has been linked with improved heart health. Low levels of vitamin K are associated with increased calcification in the arteries, a process that makes them stiff. A review of plant-based diets for cardiovascular safety and performance in endurance sports suggests that such diets may offer performance advantages. According to a study from the International Journal of Epidemiology, eating leafy green and cruciferous vegetables helps to reduce your risk of cardiovascular disease and even mortality (Edith Cowan University, 2021).

9.2 Green leafy vegetables with antidiabetic properties

Green leafy vegetables are known for their potential antidiabetic properties. Spinach is an excellent non-starchy and diabetic-friendly vegetable. It contains a good amount of fiber that helps to prevent a spike in blood sugar levels. The vitamin C and polyphenols found in spinach have antioxidant properties that helps to regulate blood sugar levels (Das and Saha, 2020). A study focused on the trace elements, acting as antidiabetic and immunomodulatory agents, available in green leafy vegetables in West Bengal. The major leafy green vegetable families in West Bengal that contains the significant phytoconstituents with antidiabetic activity and immunity-boosting properties are apiaceae, convolvulaceae, acanthaceae, brassicaceae, amaranthaceae, and rutaceae (Das and Saha, 2022).

9.3 Green leafy vegetables with antihypertension properties

Green leafy vegetables are known for their potential antihypertensive properties. A cup of nitrate-rich vegetables a day can significantly reduce the risk of heart disease. Leafy greens like spinach and lettuce

are high in nitrates, which can improve blood flow and decrease blood pressure. Many leafy greens are rich in antioxidants, which helps to reduce oxidative stresses. This is important because oxidative stress can lead to inflammation and damage in the arteries, contributing to high blood pressure. Leafy greens are high in dietary fiber, which can help lower LDL cholesterol levels. High levels of LDL cholesterol can lead to a buildup in the arteries and increase the risk of high blood pressure. Leafy greens like Swiss chard are high in vitamin K, which has been linked with improved heart health. Low levels of vitamin K are associated with increased calcification in the arteries, a process that makes them stiff. Erucin, glucosinolates, and nitrates lowers blood pressure and are rich in polyphenols, carotenoids, and antioxidant activities. They possess anti-inflammatory properties, which can help in managing hypertension (Gunathilake *et al*., 2018).

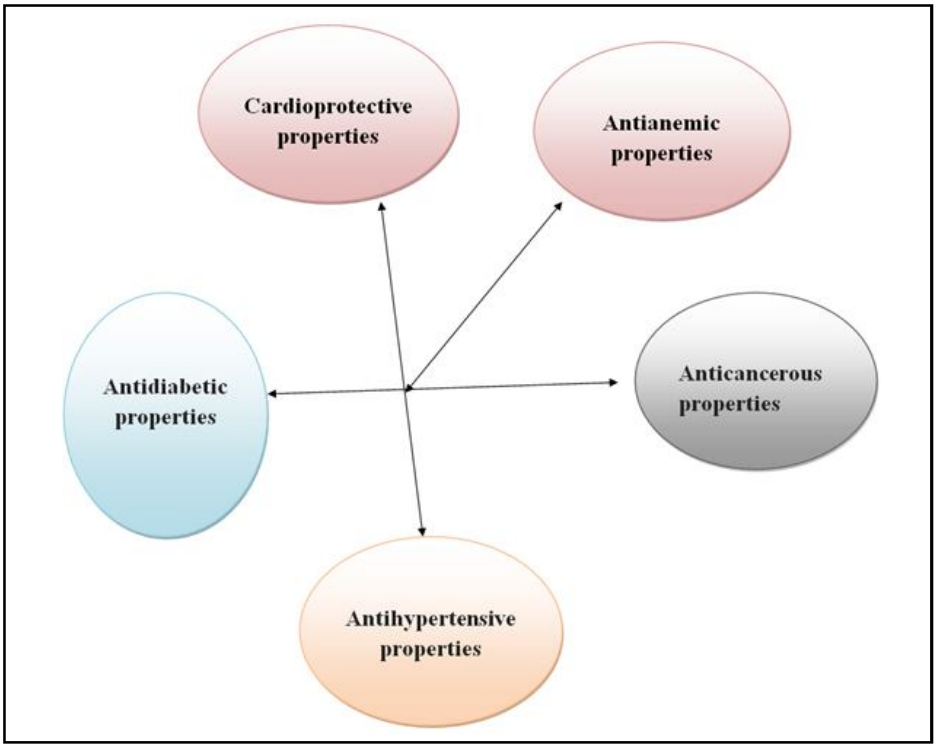

Figure 2: Some therapeutic properties of green leafy vegetables.

9.4 Green leafy vegetables with antianemia properties

Green leafy vegetables are known for their potential antianemia properties. One cup (30 g) of raw spinach provides 16% of the DV for vitamin A and 12 % of the DV for manganese. It is also packed with folate, which plays a key role in red blood cell production. Amaranth leaves are commonly consumed iron-rich leafy vegetables. They are rich in iron, a nutrient necessary for preventing and treating anemia. Turnip greens are the leafy tops of the turnip plant, often overlooked but packed with nutrients. Fenugreek is prized for its medicinal properties. It aids digestion, lowers cholesterol, and is rich in antioxidants. Green leafy vegetable powder of egg plant and amaranthus are rich in iron, zinc and beta-carotene and thereby, reduces anemia and vitamin A deficiency.

9.5 Green leafy vegetables with anticancerous properties

Leafy vegetables, particularly cruciferous ones like broccoli, cabbage, kale, and Brussels sprouts, may play a role in combatting COVID-19. This is due to a chemical called sulforaphane that is found abundantly in these vegetables. Researchers at Johns Hopkins Children's Center have found evidence from lab experiments that sulforaphane can inhibit the replication of SARS-CoV-2, the virus that causes COVID-19, and another human coronavirus in cells and mice (Jordon *et al*., 2021). Sulforaphane has been shown to have anticancer effects and can interfere with certain cellular processes. Sulforaphane is unique chemical structure enables it to activate antioxidant and antiinflammatory pathways. In terms of its potential health benefits, sulforaphane has anticancer properties in a number of test-tube and animal studies, reducing both the size and number of various types of cancer cells.

10. Breeding for nutraceuticals leafy vegetables

Breeding for nutraceuticals leafy vegetables involves enhancing the nutritional content and health-promoting properties of these vegetables. This can be achieved through various methods, including conventional breeding, molecular markers, next-generation sequencing, RNA interference (RNAi), and genetic engineering.

10.1 Conventional breeding

This approach can be used to develop new vegetable varieties or integrate favorable genes for nutraceuticals, bioactive compounds, and edible color into cultivated varieties. However, progress can be slow due to the complex nature of quality traits.

10.2 Molecular markers and next-generation sequencing

These modern biochemical and molecular analytical tools and techniques have great potential to handle complex traits with

shortened breeding cycles. They can identify specific genes associated with desirable traits, such as high antioxidant content or specific colors.

10.3 RNA interference (RNAi) and genetic engineering

These techniques can be used to modify specific genes in order to enhance the nutritional content of the vegetables. For example, CRISPR/Cas-9 has been used to improve lycopene content in tomatoes.

10.4 *In vitro* propagation

This method can be used for efficient mass multiplication and sustainable cultivation of plants. It can also be used to augment the yield of high-value secondary metabolites through callus suspension cultures in leafy vegetable crops. It is important to note that while these techniques can enhance the nutritional content of leafy vegetables, they should be used responsibly to ensure the safety and sustainability of the food supply.

The detailed nutritional profiles, medicinal values, healing properties, and pharmacological properties of various green leafy vegetables are dealt in detail below (Figures 3, 4 and 5).

11. *Murraya koenigii* (Curry leaf)

Curry Leaf, scientifically known as *Murraya koenigii*, is a plant with significant nutritional, medicinal, and pharmacological properties. Curry leaves are rich in various nutrients. A 100 g serving of curry leaves contains energy (108.000 kcal), carbohydrates (18.700 g), protein (6.100 g), fat (0.02 g), fiber (6.400 g), calcium (830 mg), phosphorus (1.67 mg), Iron (0.93 mg), omega 3 fats (8.34 mg), sodium (0.37 mg), potassium (11.68 mg), vitamin C (0.12 mg), magnesium (3.64 mg), folate (vitamin B9) (2.34 mcg), vitamin A (25.54 mcg), beta-carotene (153.26 mcg). Curry leaves contain various phytochemicals such as alkaloids, flavonoids, terpenoids, and polyphenols. They are also rich in essential oils, phenolic compounds, carbazole alkaloids, and phenols (Rupali and Kusum, 2018). Curry leaves have strong anti-inflammatory properties that helps to treat conditions like arthritis and heal minor injuries. They are also high in antioxidants, which helps combat against common cold, flu, and stave off several common infections. Curry leaves have been reported to have antidiabetic, antiasthmatic, anti-inflammatory, anticancer, antifertility, antiallergic, antipyretic, wound healing, analgesic, central nervous system activity, and hepatoprotective activities (Satish Chand and Reddy *et al*., 2019).

12. *Amaranthus* species (Amaranth)

Amaranthus, commonly known as Amaranth. Amaranth is rich in fiber and protein, as well as many important micronutrients. In particular, amaranth is a good source of manganese, magnesium, phosphorus, and iron. One cup (246 g) of cooked amaranth contains 251 calories, 9.3 g of protein, 46 g of carbohydrates, and 5.2 g of fiber (Sable and Saswade, 2017). Amaranth contains various photochemical such as 7-p coumaroyl apigenin, 4-O-beta-D-glucopyranoside, spinosidexylofuranosyl uracil, beta-D-ribofuranosyl uracil, beta-D-ribofuranosyladenine, beta sistosterol glucoside, hydroxycinnamates, quercetin and kaempferol glycosides, betalains, betaxanthin, betacyanine and isoamaranthine gomphrenin, betanin, b-sistosterol. Amaranth has been reported to have antidiabetic, antipyretic, antiinflammatory, antioxidant, and hepatoprotective properties (Tanisha Dutta *et al*., 2020). The boiled leaves and roots are traditionally used as a laxative, diuretic, antidiabetic, antipyretic, antisnake venom, antileprotic, antigonorrheal, expectorant and to relieve breathing in acute bronchitis (Anjali and Nishikant, 2019; Abbas *et al*., 2023; Sarker *et al*., 2022, 2020).

13. *Moringa oleifera* (Drumstick)

Drumstick, scientifically known as *Moringa oleifera.* Drumstick is rich in various nutrients. A 100 g serving of drumsticks contains energy (64 kcal), protein (9.4 g), carbohydrates (8.2 g), fat (1.4 g), dietary fibre (2.0), vitamin B3 (niacin) (2.2 mg), vitamin C (51.7 mg), iron (4 mg), sodium (9 mg) and potassium (337 mg). Drumstick contains various phytochemicals such as flavonoids, phenolic compounds, glucosinolates, and carotenoids. It also includes secondary components like hexacosone, pentacosane, phytol, carotenes, tocopherols, isothiocyanates, myricetin, quercetin, kaempferol, rutin, chlorogenic acid, ferulic acid, sinalbin, and gallic acid (Singh *et al*., 2023). Drumstick has strong antiinflammatory properties that help treat conditions like arthritis and heal minor bone fractures. It is also high in vitamin C and antioxidants, which helps combat against common cold, flu, and stave off several common infections (Deepika *et al*., 2023). Drumstick has been reported to have antidiabetic, antiasthmatic, antiinflammatory, anticancer, antifertility, antiallergic, antipyretic, wound healing, analgesic, central nervous system activity, and hepatoprotective activities (Klimek-Szczykutowicz *et al*., 2024).

14. *Mentha arvensis* (Mint)

Mint, scientifically known as *Mentha arvensis*. Mint is rich in various nutrients. A 2 tbsp serving (3 g) of mint contains calories (2), protein (0.2 g), carbohydrates (0.2 g) and fiber (0.2 g). Mint is also known to contain potassium, iron, phosphorus, vitamins A & C, along with calcium and magnesium in lesser amounts (Balakrishnan *et al*., 2020). Mint contains various phytochemicals such as menthol (40.7%), menthone (23.4%), methylacetate (0.7-23%), eucalyptol (1-13%), carveol (0.31%), piperitone (3.20%) and fiber (1.75% ± 0.1). It also includes secondary components like hexacosone, pentacosane, phytol, carotenes, tocopherols, isothiocyanates, myricetin, quercetin, kaempferol, rutin, chlorogenic acid, ferulic acid, sinalbin, and gallic acid (Brown *et al*., 2019). Mint has been reported to stimulate growth and repair, reduce inflammation, prevent certain chronic diseases, boost bone strength, and lower blood pressure. It also helps to improve the immune system, reduce the appearance of varicose veins, maintain healthy hair, and ease weight loss efforts. Mint has been reported to have antidiabetic, antipyretic, antiinflammatory, antioxidant, and hepatoprotective properties (Sabhat Abbas *et al*., 2022). The boiled leaves and roots are traditionally used as a laxative, diuretic, antidiabetic, antipyretic, antisnake venom, antileprotic, antigonorrheal, expectorant and to relieve breathing in acute bronchitis.

15. *Coriandrum sativum* (Coriander)

Coriander is scientifically known as *Coriandrum sativum.* Coriander is rich in various nutrients. A 100 g serving of coriander contains energy (23 kcal), protein (2.13 g), total fat (0.52 g), total carbohydrate (3.67 g), dietary fiber (2.8 g), sugar (1 g), vitamin C (27 mg), vitamin A (337 µg), vitamin B6 (0.1 mg), vitamin B9 (62 µg), potassium (521 mg), calcium (67 mg), iron (1.77 mg) and magnesium (26 mg). Coriander contains various phytochemicals such as cardiac

glycosides, terpenoids, steroids, saponin, tannin, flavonoids, and alkaloids. It also includes secondary components like tocopherols, carotenoids, chlorophylls, sugars, ascorbic acid, phenolics, flavonoids, tannins, and anthocyanins (Sharma *et al*., 2019). It also helps to improve the immune system, reduce the appearance of varicose veins, maintain healthy hair, and ease weight loss efforts. Coriander has been reported to have antidiabetic, antipyretic, anti-inflammatory, antioxidant, and hepatoprotective properties. The boiled leaves and roots are traditionally used as a laxative, diuretic, antidiabetic, antipyretic, antisnake venom, antileprotic, antigonorrheal, expectorant and to relieve breathing in acute bronchitis (Mallik *et al*., 2020).

16. *Trigonella foenum-graecum* (Fenugreek)

Fenugreek, scientifically known as *Trigonella foenum-graecum*. Fenugreek is rich in various nutrients. One tsp (3.7 g) serving of fenugreek seed contains calories (12), total fat (0.2 g), saturated fat (0.1 g), total carbohydrate (2 g), dietary fiber (0.9 g), protein (0.9 g), iron (1.2 mg), magnesium (7.1 mg), calcium (6.5 mg), vitamin C (0.1 mg), vitamin A (0.1 µg), potassium (28 mg) and sodium (2 mg). Fenugreek contains various phytochemicals such as alkaloids, flavonoids, saponins, steroids, tannins, free amino acid, crude protein, and phenolic compounds. It also includes secondary components like hexacosone, pentacosane, phytol, carotenes, tocopherols, isothiocyanates, myricetin, quercetin, kaempferol, rutin, chlorogenic acid, ferulic acid, sinalbin, and gallic acid (Visuvanathan *et al*., 2022; Kilambi and Shah, 2021). Fenugreek has been reported to have anti-diabetic, antipyretic, anti-inflammatory, antioxidant, and hepatoprotective properties. The boiled leaves and roots are traditionally used as a laxative, diuretic, antidiabetic, antipyretic, antisnake venom, antileprotic, antigonorrheal, expectorant and to relieve breathing in acute bronchitis (Tewari *et al*., 2024).

17. *Basella alba* (Malabar spinach)

Basella, commonly known as Malabar spinach. Basella is rich in various nutrients. A 100 g serving of Basella contains energy (23 kcal), protein (2.0 g), total fat (0.3 g), total carbohydrate (3.0 g), dietary fiber (0.9 g), ash (2.2 g), calcium (128.0 mg), phosphorous (40.0 mg), iron (4.9 mg), vitamin A (456.0 µg), thiamine (0.04 mg) and riboflavin (0.12 mg). Basella contains various phytochemicals such as betacyanin, carotenoids, bioflavonoids, â-sitosterol, and lupeol. It also includes secondary components like hexacosone, pentacosane, phytol, carotenes, tocopherols, isothiocyanates, myricetin, quercetin, kaempferol, rutin, chlorogenic acid, ferulic acid, sinalbin, and gallic acid (Ajay Chaurasiya *et al*., 2021). The boiled leaves and roots are traditionally used as a laxative, diuretic, antidiabetic, antipyretic, anti-snake venom, antileprotic, antigonorrheal, expectorant and to relieve breathing in acute bronchitis (Kumar and Patwa, 2018; Poonia and Upadhayaya, 2015; Singh *et al*., 2023; Kaur and Kaur, 2018; Ramaiyan *et al*., 2020; Premakumara *et al*., 2020; Sridhar and Pavithra, 2021).

Coriandrum sativum

Trigonella foenum-graecum

Sesbania grandiflora

Solanum nigrum

Amaranthus species | *Ipomoea aquatica*

Figure 3: Some green leafy vegetables (*Coriandrum sativum*, *Trigonella foenum-graecum*, *Sesbania grandiflora*, *Solanum nigrum*, *Amaranthus* species and *Ipomoea aquatica*).

18. *Sesbania grandiflora* (Agathi)

Agathi is scientifically known as *Sesbania grandiflora.* Agathi leaves are rich in various nutrients. 100 g serving of Agathi leaves provides energy (93 kcal), protein (8.4 g), total fat (1.4 g), phosphorus (80 mg), iron (4 mg) and calcium (1130 mg). The leaves are also rich in vitamin C, zinc, plant sterols, quercetin, myricetin, and kaempferol. Agathi leaves contain various phytochemicals such as alkaloids, flavonoids, tannins, saponins, sterols, *etc*. The seeds comprise powerful chemoprotective agents like leucocyanidin and cyanidin. Besides these, seeds also contain saponins and sesbanimide, which possess strong antibacterial and antimicrobial properties and detoxify the system. Agathi has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. The whole plant of Agathi is medicinally used in Ayurvedic formulation like medicinal preparation Grahani Kapata rasa, Ratnagiri rasa, and Pittakasantaka rasa, *etc*. (Deepthi *et al*., 2024).

19. *Sauropus androgynus* (Chekkurmanis)

Chekkurmanis is scientifically known as *Sauropus androgynus*. Chekkurmanis leaves are rich in various nutrients. A 100 g serving of Chekkurmanis leaves provides energy (93 kcal), protein (6-8 g), vitamin A (More than mangoes and papayas), vitamin B, C (Nicotinic acid), mineral matters, phosphorous and iron (Kumar *et al*., 2022). Chekkurmanis leaves are rich in various micro nutrients and phytochemicals having antioxidant properties, which offer protection against heart disease and certain types of cancer. For example, beta-carotene prevents lung and skin cancer, niacin. Chekkurmanis leaves have been reported to possess strong antioxidant properties, probably owing to the vitamin C and E contents. A decoction of its roots is often recommended in case of fever in rural areas. Pounded roots and leaves are reported to be used as a poultice for ulcers in the nose. In some areas of South India, the juice of the leaves pounded with the roots of pomegranate and the leaves of jasmine is used in eye troubles.

20. *Solanum nigrum* (Black nightshade)

Black nightshade is scientifically known as *Solanum nigrum.* Black Nightshade berries are rich in antioxidants and vitamins A and C. They also contain dietary fiber, calcium, iron, magnesium, phosphorus, and potassium. The leaves are rich in micronutrients such as â-carotene, folic acid, protein, vitamins C and E, minerals (iron, calcium, and zinc), and dietary fiber. Black nightshade contains compounds such as solanine, solasonine, and solamargine which have been found to have antitumor, antifungal, and antioxidant properties. It also contains phytonutrients that are in different parts of the plant which serve various medicinal functions. The plant is abundant in bioactive compounds, minerals and phytochemicals such as anthocyanins, flavonoids, tannins, vitamin C, vitamin E, iron, zinc, and selenium. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Traditional uses suggest diuretic effects, aiding in the elimination of excess fluids from the body. Black nightshade has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, antiinflammatory, hepatoprotective, diuretic, and antipyretic agent (Ashwani Kumar *et al*., 2012).

21. *Amaranthus cannabinus* (Saltmarsh water-hemp)

Amaranthus cannabinus is also known as Saltmarsh water-hemp. *Amaranthus cannabinus* is rich in fiber and protein, as well as many important micronutrients. In particular, amaranth is a good source of manganese, magnesium, phosphorus, and iron. One cup (246 g) of cooked amaranth contains the following nutrients calories (251), protein (9.3 g), carbs (46 g), fat (5.2 g), manganese (105 % of the RDI), magnesium (40 % of the RDI), phosphorus (36 % of the RDI) and iron (29 % of the RDI). *Amaranthus cannabinus* contains various phytochemicals such as alkaloids, flavonoids, saponins, tannins, cardiac glycosides, and sterols. It also includes secondary components like hexacosone, pentacosane, phytol, carotenes, tocopherols, isothiocyanates, myricetin, quercetin, kaempferol, rutin, chlorogenic acid, ferulic acid, sinalbin, and gallic acid. *Amaranthus cannabinus* has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent.

22. *Hibiscus cannabinus* (Kenaf)

Hibiscus cannabinus is also known as Kenaf. One cup (246 grams) of Kenaf provides energy (93 kcal), protein (6.7 g), total fat (1.4 g), carbohydrates (7.3 g), dietary fiber (6.1 g), vitamin C (61.3 mg (102.2%)), iron (3.9 mg (21.7%)), calcium (143 mg (14.3%)), magnesium (85 mg (20.2%)) and phosphorus (112 mg (16%)). *Hibiscus cannabinus* contains various phytochemicals such as phytosterols, flavonoids, polyphenols, tannins, steroids, alkaloids, saponins, lignans, essential oils, glucosides such as cannabiscitrin, cannabiscetin and anthocyanin glycoside. The juice of the flowers, mixed with sugar and black pepper, is used in the treatment of biliousness with acidity. The seeds are aphrodisiac. They are added to the diet in order to promote weight increase. Externally, they are used as a poultice on pains and bruises. The leaves are purgative. *Hibiscus cannabinus* has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Ammar *et al*., 2020; Halilu *et al*., 2023).

23. *Ipomoea aquatica* (Water spinach)

*Ipomoea aquatic*a is also known as Water spinach. *Ipomoea aquatica* is rich in various nutrients. A 100 g serving of Ipomoea aquatica provides energy (19 kcal), protein (2.2 g), total fat (0.3 g), carbohydrates (3.4 g), dietary fiber (1.2 g), vitamin C (55 mg), vitamin A (6300 IU), iron (1.77 mg), calcium (113 mg). *Ipomoea aquatica* contains various phytochemicals such as alkaloids, flavonoids, saponins, tannins, cardiac glycosides, and sterols. It also includes secondary components like carotenes, flavonoids, phenolic and polyphenolic compounds. *Ipomoea aquatica* has high vitamin C and zinc content play a pivotal role in the body's wound healing process. Vitamin C is essential for the synthesis of collagen, a key protein in skin regeneration and wound repair. Zinc contributes to cell division and proliferation, speeding up the healing process of damaged tissues. *Ipomoea aquatica* has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent.

24. *Centella asiatica* (Gotu kola)

Centella asiatica is also known as Gotu kola. *Centella asiatica* provides 44 kilo calories of energy per 100 g. It contains 1.8 g of protein, 0.9 g of fat, 7.1 g of carbohydrates, 2.6 g of fiber, 146 mg of calcium, and 30 mg of phosphorus. It also contains 3.9 mg of iron, 10,962 IU of vitamin A, 0.24 mg of vitamin B1, 0.09 mg of vitamin B2, 0.8 mg of niacin and 4 mg of vitamin C. *Centella asiatica* contains various phytochemicals such as triterpenoids, flavonoids, and phenolic acids. The major bioactive components that are responsible for their therapeutic activity are asiaticoside, madecassoside, triterpenes, and madecassic acid (Zhang Chengfei *et al*., 2020; Gray *et al*., 2018). *Centella asiatica* has wound-healing abilities and has been used orally and topically to repair wounds. Compounds in *Centella asiatica*, including madecassoside, madecassic acid, asiaticoside and asiatic acid, may help wounds heal by increasing the amount of collagen and cell layer fibronectin in the skin (Torbati *et al*., 2021). *Centella asiatica* has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Sun Boju *et al*., 2021; Kandasamy *et al*., 2023).

25. *Lactuca sativa* (Tree lettuce)

Tree lettuce is also known as *Lactuca sativa*. Tree Lettuce is rich in various nutrients. A 100 g serving of Tree lettuce provides energy (21 kcal), carbohydrates (2 g), protein (2 g), moisture (93 g), calcium (50 mg), phosphorous (28 mg), iron (2 mg), mineral (1 g). Tree lettuce contains various phytochemicals. These molecules, which include glycosylated flavonoids, phenolic acids, carotenoids, vitamin B groups, ascorbic acid, tocopherols, and sesquiterpene lactones, are vital bioactive nutritional components (Shi *et al*., 2022; Sabaragamuwa and Perera, 2023). Tree lettuce has a tranquilizing effect. It helps to calm the nerves, control palpitations and to sleep better at nights, avoiding insomnia. The leaves are said to be medicinal as they possess wound healing properties. Tree Lettuce has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent.

26. *Brassica oleracea* var. *capitata* (Cabbage)

Cabbage is scientifically known as *Brassica oleracea* var. *capitata*. Cabbage is rich in various nutrients. A 1 cup (89 g) serving of raw green cabbage contains calories (22), protein (1 g), fiber (2 g), vitamin K (56% of the daily value (DV)), vitamin C (36% of the DV), folate (10% of the DV), manganese (6% of the DV), calcium (3% of the DV), potassium (3% of the DV) and magnesium (3% of the DV). Cabbage contains various phytochemicals such as glucosinolates, polyphenols, and vitamins. It also includes secondary components like carotenes, flavonoids, phenolic and polyphenolic compounds (Liang and Zhang, 2019; Do Manh Cuong *et al*., 2022). It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Cabbage has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotec-tive, diuretic, and antipyretic agent (Šamec *et al*., 2017).

27. *Spinacia oleracea* (Palak)

Spinacia oleracea is also called as Palak and also known as Spinach. A 100 g serving of Palak provides energy (23 kcal), carbohydrates (3.6 g), dietary fiber (2.2 g), sugars (0.4 g), protein (2.9 g), fat (0.4 g), vitamin A, vitamin C, vitamin K, magnesium, manganese, iron, folate, calcium, potassium and dietary fiber. Palak contains various phytochemicals such as alkaloids, flavonoids, steroids, glycosides, terpenoids. It also includes secondary components like phitobatamin, saponins, phenol, tannins, glycosides, flavonoids, steroids, terpenes and cardenolides. It is rich in vitamin C and E contents. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Due to its high fiber and water content, Palak helps cure indigestion and constipation. Palak has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Kumar and Patwa, 2018).

Rheum rhabarba

Lactuca sativa

Sauropus androgynus

Crambe maritime

Allium ampeloprasum

Asparagus officinalis

Figure 4: Some leafy vegetables (*Rheum rhabarbaru, Lactuca sativa*, *Sauropus androgynus*, *Crambe maritime*, *Allium ampeloprasum* and *Asparagus officinalis*).

28. *Lactuca sativa* (Celery)

Celery is scientifically known as *Apium graveolens*. Celery is rich in various nutrients. A 100 g serving of celery provides energy (15 kcal), protein (0.69 g), total fat (0.17 g), carbohydrates (2.97 g), dietary fiber (1.6 g), vitamin a (22 µg), vitamin C (3.1 mg), vitamin K (29.3 µg), calcium (40 mg), iron (0.2 mg), magnesium (11 mg), phosphorus (24 mg), potassium (260 mg) and sodium (80 mg). Celery contains various phytochemicals including caffeic acid, p-coumaric acid, ferulic acid, apigenin, luteolin, tannin, saponin, and kaempferol. Celery major source of vitamin C and E contents. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Celery forms alkalines, helps in lowering cholesterol levels, moderating sleep, controlling anxiety, reducing inflammation, and may provide a constant supply of antioxidants. Celery has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Emad *et al*., 2022).

29. *Allium ampeloprasum* (Leek)

Leek is scientifically known as *Allium ampeloprasum* L. Leek is rich in various nutrients. A 100 g serving of Leek provides energy (74.65 kcal), carbohydrates (13 g), dietary fiber (1.6 g), sugar (3 g, protein (1.3 g), total fat (0.3 g), vitamin C (10.7 mg), vitamin B-6 (0.2 mg), iron (1.87 mg), magnesium (24.9 mg), calcium (52.5 mg), potassium (160 mg) and sodium (18 mg). Leek contains various phytochemicals including tannin, saponins, flavonoids, quinine, glycoside, cardiac glycoside, terpenoids, phenol, coumarins, steroids, alkaloids, anthocyanin and betacyanin. These nutrients give leeks their unique pharmacological properties. Leek has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Shelke *et al*., 2020).

30. *Asparagus officinalis* (Asparagus)

Asparagus is scientifically known as *Asparagus officinalis*. Asparagus is rich in various nutrients. A 100 g serving of Asparagus provides energy (20 kcal), protein (2.2 g), total fat (0.2 g), fiber (1.8 g), vitamin C (12 % of the RDI), vitamin A (18 % of the RDI), vitamin K (57 % of the RDI), folate (34 % of the RDI), potassium (6 % of the RDI), phosphorous (5 % of the RDI), vitamin E (7 % of the RDI). Asparagus contains various phytochemicals including glycosylated flavonoids, phenolic acids, carotenoids, vitamin B groups, ascorbic acid, tocopherols, and sesquiterpene lactones. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Asparagus has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepaticand antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Ali and Al-Shafi, 2015; Singh, 2016).

31. *Rheum rhabarbarum* (Rhubarb)

Rhubarb is scientifically known as *Rheum rhabarbarum*. Rhubarb is rich in various nutrients. A 100 g serving of Rhubarb provides energy (26 kcal), protein (0.9 g), total fat (0.1 g), carbohydrates (5.5 g), dietary fiber (2.2 g), sugar (1.3 g), vitamin K (26 % of the DV), calcium (15 % of the DV), vitamin C (6 % of the DV), potassium (3 % of the DV) and folate (1 % of the DV). Rhubarb contains various phytochemicals including anthraquinones, anthrones, stilbenes, tannins, polysaccharides, *etc*. These compositions show extensive pharmacological activities including regulating gastrointestinal, anticancer, antimicrobial, hepatoprotective, anti-inflammatory, protecting cardiovascular, cerebrovascular and so on (Kolodziejczyk-Czepas *et al*., 2021; Cao *et al*., 2017). Rhubarb has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Cao *et al*., 2017).

32. *Crambe maritime* (Sea kale)

Sea kale is scientifically known as *Crambe maritime*. Sea Kale is rich in various nutrients. A 100 g serving of Sea kale provides energy (35 kcal), protein (2.92 g), total fat (1.49 g), carbohydrates (4.42 g), dietary fiber (4.1 g), vitamin C (93.4 mg), calcium (254 mg), iron (1.6 mg), magnesium (33 mg) and potassium (348 mg). Sea kale contains various phytochemicals including vitamin C (ascorbic acid), which is one of the essential vitamins that can stimulate the immune system to increase its production of white blood cells. Therefore, it can optimize your immune system and help. Sea Kale has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, anti-hepatic, antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent.

33. *Brassica oleriaceae* var. *acephala* (Kale)

Brassica oleriaceae var. *acephala* is botanically Kale and also known as leaf cabbage. It is a nutrient-dense leafy green vegetable that is rich in vitamins, minerals, and bioactive compounds. A 36 g cup of raw kale contains calories (7), protein (0.65 g), fat (0.07 g), carbohydrates (1.35 g), fiber (0.6 g) and sugar (0.4 g). It is also a good source of vitamins and minerals such as vitamin K, vitamin A, vitamin C, magnesium, iron, potassium, and calcium. Kale is rich in phytochemicals including flavonoids like quercetin, kaempferol, rutin, and vitexin. It also contains carotenoids such as beta-carotene (Tan *et al*., 2023; Nemzer *et al*., 2021; Ortega-Hernández *et al*., 2021). Kale has several health benefits including treating anemia naturally, preventing cardiovascular disease, promoting digestion, boosting cognitive development, maintaining healthy hair, skin, and nails, improving muscle function, supporting eye health, helping manage and prevent diabetes, and helping prevent cancer. Kale exhibits several pharmacological properties such as Antioxidant activity: The phytochemicals present in kale exhibit strong antioxidant activity, neutralizing free radicals that can cause oxidative stress and cellular damage. The flavonoids in kale can help reduce inflammation, potentially offering relief from inflammatory conditions (Luèiæ *et al*., 2023). Kaempferol, a flavonoid found in kale, has been shown to have anticancer properties (Neela Satheesh and Solomon Workneh Fanta, 2020).

Spinacia oleracea

Brassica oleriaceae var. *acephala*

Cichorium endivia

Cichorium intybus

Beta vulgaris subsp. *vulgaris*

Centella asiatica

Figure 5: Some leafy vegetables (*Spinacia oleracea, Brassica oleriaceae* var. *acephala, Cichorium endivia, Cichorium intybus*, *Beta vulgaris* subsp. *vulgaris* and *Centella asiatica*).

34. *Atriplex genus* (Orach)

Orach, also known as Saltbush is a plant species in the *Atriplex genus*. It's a hardy plant that can grow in highly saline environments and is primarily found in Australia, North America, South America, and Eurasia in subtropical to temperate climates. Orach is a good source of carbohydrates, proteins, and dietary fiber. It contains significant levels of vitamin C, Vitamin K, vitamin A, and B group vitamins. Orach contains a variety of phytochemicals such as flavonoids, phenolic acids, and betalains, which possess antioxidant, anti-inflammatory, and antimicrobial properties. Orach has several health benefits including detoxifying the body, supporting healthy bones, and maintaining healthy blood levels. Orach exhibit strong antioxidant activity, neutralizing free radicals that can cause oxidative stress and cellular damage. The phytochemicals in Orach can help reduce inflammation, potentially offering relief from inflammatory conditions like arthritis and inflammatory bowel disease. Extracts from Orach have been shown to inhibit the growth of various bacteria and fungi. Orach has been traditionally used as a diuretic, promoting the production of urine and the elimination of excess fluids from the body (Lalrosangpui and, Lalrokimi, 2021).

35. *Beta vulgaris* subsp. *vulgaris* (Chard)

Beta vulgaris subsp. *vulgaris* is Chard and also known as Swiss chard, is a leafy green vegetable that is packed with nutrients and has several health benefits. A 36 g cup of raw Swiss chard contains calories (7), protein (0.65 g), fat (0.07 g), carbohydrates (1.35 g), fiber (0.6 g) and sugar (0.4 g). It is also a good source of vitamins and minerals such as vitamin K, vitamin A, vitamin C, magnesium, iron, potassium, and calcium. Chard is rich in phytochemicals including flavonoids like quercetin, kaempferol, rutin, and vitexin. It also contains carotenoids such as beta-carotene. Chard has several health benefits including treating anemia naturally, strong antioxidant properties promoting bone development, preventing cardiovascular disease, promoting digestion, boosting cognitive development, maintaining healthy hair, skin, and nails and improving muscle function. Chard exhibits several pharmacological properties such as phytochemicals present in chard exhibit strong antioxidant activity, neutralizing free radicals that can cause oxidative stress and cellular damage. The flavonoids in chard can helps to reduce inflammation, potentially offering relief from inflammatory conditions. Kaempferol, a flavonoid found in chard, has been shown to have anticancer properties.

36. *Brassica juncea* (Leaf mustard)

Leaf mustard (*Brassica juncea*), a member of the Brassica family, is a versatile plant that is used as a spice and has several health benefits. Seed and leaves of Mustard are good sources of omega-3 fatty acids, soluble fiber, protein, and essential minerals including calcium, iron, manganese, phosphorus, zinc, magnesium, and selenium. A 15 g serving of mustard contains approximately 9.2 calories, 0.5 g of fat, 0.6 g of protein, and 0.8 g of carbohydrates. Mustard contains numerous phytochemicals such as vitamins, minerals, dietary fiber, chlorophylls, glucosinolates (and their degradation products), polyphenols, and volatile components like allyl isothiocyanate, 3-butyl isothiocyanate, etc (Yan Tian Fangming Deng, 2020; Sarma and TR, 2024; Frazie *et al*., 2017). Mustard has been shown to provide relief from muscular aches and pains, dermatitis, and other health-related issues. It has also been shown to have antidiabetic properties and may improve Glucosinolates found in mustard have been shown to have antimicrobial, anti-pain, and anticancer properties, while omega-3 fatty acids are useful for their pharmacologic effects against sleep disorders, anxiety, cerebrovascular disease, neurodegenerative disease, hypercholesterolemia, and diabetes (Frazie *et al*., 2017).

37. *Cichorium endivia* (Endive)

Endive is scientifically known as *Cichorium endivia*. Endive is rich in various nutrients. A 100 g serving of Endive provides energy (17 kcal), protein (1.25 g), total fat (0.2 g), carbohydrates (3.35 g), dietary fiber (3.1 g), vitamin C (6.5 mg), vitamin A (108 µg), potassium (314 mg), calcium (52 mg) and sodium (22 mg). Endive contains various phytochemicals including glycosylated flavonoids, phenolic acids, carotenoids, vitamin B groups, ascorbic acid, tocopherols, and sesquiterpene lactones (Aldahak *et al*., 2021). It also contains kaempferol, a powerful flavonoid found in many vegetables and fruits. It is rich in vitamin C and E content. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Endive has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Boghrati, 2021).

38. *Cichorium intybus* (Chicory)

Chicory is scientifically known as *Cichorium intybus.* Chicory is rich in various nutrients. A 100g serving of Chicory provides energy (72 kcal), protein 91.4 g), carbs (18 g), fat (0.2 g), fibre 91.5 g), potassium (290 mg) and calcium (41 mg). Chicory contains various phytochemicals including inulin (a starch-like polysaccharide), flavonoids, coumarins, tannins, alkaloids, volatile oils, and many more. Inulin makes up to 68% of the total compounds of the chicory roots (Renée *et al*., 2013). It is a polymer of fructose and dietary fiber. It is also used for treating spleen diseases, soothing stomach ulcers, and relieving sore throat. Chicory has been reported to have antibiotic, anthelmentic, antitumor and contraceptive properties. It also has anticancer, antihepatic and antidiabetic properties. The plant is considered to be an antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic agent (Muhammad Saeed *et al*., 2017).

39. Future thrust

The future thrust for 'herbs that heal', focusing on the nutritional properties, phytochemical values, healing properties, and pharmacological properties of green leafy vegetables, could be directed towards the following areas:

39.1 Enhanced nutritional profiling

Further research is needed to comprehensively profile the nutritional content of various green leafy vegetables. This could lead to the discovery of new nutrients and their health benefits.

39.2 Phytochemical analysis

Advanced techniques should be employed to identify and quantify the phytochemicals present in these vegetables. Understanding the role of these phytochemicals in promoting health and preventing diseases could be a significant area of study.

39.3 Clinical trials

More clinical trials are required to validate the healing and pharmacological properties of these vegetables. This could lead to the development of new therapeutic agents and dietary recommendations.

39.4 Genetic engineering

With the advancement in genetic engineering techniques, efforts could be made to enhance the nutritional and medicinal values of these vegetables. This could also help in developing varieties that are more resistant to pests and environmental stresses.

39.5 Public awareness

There is a need to increase public awareness about the importance of including green leafy vegetables in their daily diet. This could be achieved through educational programs, workshops, and media campaigns.

39.6 Sustainable farming practices

Encouraging sustainable farming practices for the cultivation of these vegetables could ensure their availability and affordability, thereby promoting their consumption.

40. Conclusion

In conclusion, green leafy vegetables, often referred to as 'herbs that heal', are a powerhouse of nutrition and healing properties. Their rich nutritional profile, combined with a wide array of phytochemicals, makes them an essential part of a balanced diet. These vegetables are not only packed with essential vitamins and minerals but also contain bioactive compounds that have been associated with numerous health benefits. The healing properties of these vegetables are attributed to their high content of antioxidants and bioflavonoids, which have demonstrated significant health benefits, including anti-inflammatory, antidiabetic, and cardiovascular disease prevention. Furthermore, their pharmacological properties, such as wound-healing, antibacterial, memory-enhancing, antioxidant, and neuroprotective effects, underscore their importance in both diet and medicine. Therefore, the incorporation of green leafy vegetables into daily diets is highly recommended for their nutritional, healing, and pharmacological benefits. However, further research is encouraged to fully understand the potential of these 'herbs that heal' and to explore new ways to leverage their benefits for human health.

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Conflict of interest

The authors declare no conflict of interest relevant to this article.

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