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# Spinacia oleracea (Spinach) Leaf Extract: A Natural Source of Antioxidants

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## Abstract:

Spinach, or Spinacia oleracea, is a member of the Chenopodiaceae family, which also includes beets and Swiss chard. The annual spinach plant grows quickly and produces a dense rosette of broad, smooth or wrinkled leaves. Spinach likes cool whether.This special protective carotenoid chemicals found in spinach have been associated with a lower risk of a number of illnesses, such as diabetes, obesity, and heart disease. Carotenoids, which include beta-carotene, lutein, and zeaxanthin, are among the phytonutrients found in spinach. Green leafy vegetables like spinach contain phytochemicals that protect cells from oxidative damage and control the expression and activity of particular genes linked to redox balance, metabolism, and immunological response. Vitamins, minerals, and antioxidants such as polyphenols, flavonoids, and carotinoids, which have been demonstrated to have anti-inflammatory, antimutagenic, anti-tumor, and chemopreventive properties, are abundant in spinach. By scavenging free radicals, avoiding damage to cell membranes, and limiting lipid peroxidation, antioxidants may provide some resistance to oxidative stress and delay the onset of chronic disease. The antioxidant properties of the phytochemicals found in our diet and in health food supplements are gaining attention.

**Keywords:** Spinach leaves, Antioxidant Activity, Carotenoids

## Introduction:

Many studies conducted recently have demonstrated the remarkable nutritional and practical advantages of green leafy vegetables, which may be successfully included in a human diet that is well-balanced. Spinach, also known as Spinacia oleracea Linn., is widely recognised as having a wide variety of nutritional composition and bioactive phytochemical components among the vegetables under study (1). One superfood is spinach. Green leafy veggies are low in calories and high in nutrients. Spinach is one of the dark, leafy greens that are essential for strong bones, hair, and skin. Iron, protein, vitamins, and vital minerals are also abundant in them. [2]. Due to their non-toxicity, affordability, and accessibility, natural materials do have advantages over synthetic ones (3).

Spinach, or Spinacia oleracea, is a member of the Chenopodiaceae family, which also includes beets and Swiss chard. The annual spinach plant grows quickly and produces a dense rosette of broad, smooth or wrinkled leaves. Spinach likes cool weather. Seeds can germinate at a minimum temperature of 2 C, a maximum temperature of 3 C, and an ideal range of 7 to 20 C. Young plants may tolerate temperatures as low as -90°C (4). The incredibly nutrient-dense green vegetable Spinacia oleracea is also known as spinach (English), chhurika (Sanskrit), palak (Hindi, Gujarati, and Marathi), Palakh (Kashmiri), Palang (Bangla), pasalai (Tamil), and mathubucchali (Telugu). The soft, edible leaves of spinach are the main reason it is Farm it is a popular and extensively consumed meal in India, particularly in the winter (5).

Vitamins, minerals, and antioxidants such as polyphenols, flavonoids, and carotinoids, which have been demonstrated to have anti-inflammatory, antimutagenic, anti-tumor, and chemopreventive properties, are abundant in spinach (6). Fresh, steamed, or briefly cooked spinach is particularly abundant in antioxidants and has a high nutritional value. Magnesium, manganese, folate, iron, vitamin A, vitamin C, vitamin E, and vitamin K are all abundant in it (7).

Special protective carotenoid chemicals found in spinach have been associated with a lower risk of a number of illnesses, such as diabetes, obesity, and heart disease. Carotenoids, which include beta-carotene, lutein, and zeaxanthin, are among the phytonutrients found in spinach.

Additionally, other veggies including broccoli, kale, and carrots contain these antioxidants. Flavonoids, a potent antioxidant that guards against disease by preventing free radical damage within the body, are another substance found in spinach (8). The availability of phytochemicals in vegetables and their pharmacological advantages are determined by the current investigation. Since ancient times, spinacia oleracea has been used as a food source. It has a lot of minerals and nutrients that help keep people healthy. (28)

Additionally, the crop has a hypoglycemic effect that can be utilised to treat pulmonary irritation and urinary calculi. The seeds can be used to treat liver inflammation, respiratory problems, and as a laxative. (29). The World Health Organisation (WHO) reports that due to the positive effects of traditional herbal plant products, over 80% of the world's population relies on them as their primary source of medical care. (30)

It is a significant leafy green vegetable. Because of its nutritional and medicinal properties, the leaf of this annual plant is a staple in Indian cooking. It has few calories. Spinach grows best in a chilly climate. (32) Based on morphological observations of the spinach leaf blade's green colour density (35), There are many different varieties of spinach, some of which have undergone extensive research. In the piece (36), The broad, smooth, ten-inch-long leaves of spinach are a great source of folic acid, especially when eaten raw. They are also high in the antioxidant vitamins C and E. (37) One of the nation's most urgent issues is how to manage and dispose of it in an economical and environmentally responsible way. (38).

## TAXONOMICAL CLASSIFICATION:

Kingdom : Plantae

Sub Kingdom : Trachiobionta

Superdivision : Spermatophyta

Division : Magnoliophyta

Class : Magnoliopsida

Subclass : Caryophyllidae

Order : Caryophyllales

Family : Chenopodiaceae

Genus : Spinacia L

Species : Spinacia oleracea L [15]

## BOTANICAL DESCRIPTIONS:

**Stem**: It stands upright at a height of 30-60 cm, featuring a round, smooth, and tubular structure. It is fleshy, sometimes exhibiting a reddish hue.

**Leaves**: Alternatively, the lower leaves have very long petioles and are variably lobed, with lobes having an acute triangular shape and a smooth texture on both sides.

**Flowers**

**Male**- The plant produces flowers in dense clusters at the tips of branches and in smaller clusters along the stem. The flowers are numerous and attached directly without stalks. The calyx is divided into four parts, and there are four stamens with large, paired anthers.

**Female**- The flowers grow in clusters along the stem, are closely packed, and lack stalks. The calyx has two pointed tips, each with a projecting horn that hardens into spines as the seed matures. There are usually four slender, white styles. The fruit is a single-chambered, one-valved capsule with two short, opposite horns and is topped with the remnants of the small calyx.(14)

## CHEMICAL CONSTITUENTS :-

**1. Flavonoids:** Spinacia oleracea is abundant in flavonoids.Various flavonoids reported to be present are querecetin; myricetin; kampefero; apigenin; luteolin; patuletin; spinacetin; jaceidin; 4'-glu-curonide; 5,3',4'-trihydroxy-3-methoxy-6:7-methylenedioxyflavone-4'-glucuronide; 5,4'-dihydroxy-3.3'-dimethoxy-6:7-methylene dioxyflavone-4'-glu-curonide; 5,4'-dihydroxi-3,3'-dimithoxi-6,7-methylene-dioxi- flavone (C18H14O8.); 3,5,7,3',4'pentahydroxi-6-methoxiflavone.

**2. Phenolic Compounds:** The polyphenols isolated from the plant are para-coumaric acid, ferulic acid, ortho- coumaric acid

Spinach shows presence of different carotinoids like lutein, β-carotene, violaxanthin and 9'-(Z)-neoxanhin.

**4. Vitamins:** Spinacia oleracea is rich in vitamins A, E, C, and K.and also folic acid, oxalic acid.

**5. Minerals:** Along with these chemicals various minerals present in the spinach. These are magnesium, manganese, calcium, phosphorus, iron, zinc, copper and potash.[14]

**Fig.Spinacea Oleracea Linn**

**Antioxidant activity :-**

Chemical substances that give free radical species electrons and transform them into innocuous molecules are referred to as "antioxidants" (1). One of the most valued green crops is spinach, which has strong antioxidant qualities. The ability to prevent oxidation is known as antioxidant activity, and the ability of a chemical to react with free radicals is known as antiradical activity. The importance of vegetable antioxidant components in maintaining health and preventing disease is well supported by data (10). The main health benefit of carotenoids is their potent antioxidant capability (11).

Antioxidants are frequently added to food in the food business as additives to prolong shelf life and stop food deterioration. The majority of antioxidants are chemical substances that may be harmful to human health (12).Grossman reported on the chemical proportion of natural antioxidant components in Spinacia oleracea. The study verified that antioxidant components, such as flavonoids and derivatives of p-coumaric acid, are present in the aqueous extract of spinach leaves. (13). The polarity of the solvents used during extraction typically water, methanol, ethanol, or ethyl acetate as has a significant impact on the total antioxidant activity of spinach extract. There are two primary components to spinach extract made with water as the solvent: the water-soluble fraction and the insoluble water fraction (1). When spinach is eaten, flavonoids, carotenoids, vitamins C and E, and phenolic chemicals all work together to counteract the negative effects of free radicals (17).

Green leafy vegetables like spinach contain phytochemicals that protect cells from oxidative damage and control the expression and activity of particular genes linked to redox balance, metabolism, and immunological response. (18) When spinach is eaten, flavonoids, carotenoids, vitamins C and E, and phenolic chemicals all work together to counteract the negative effects of free radicals (17).Green leafy vegetables like spinach contain phytochemicals that protect cells from oxidative damage and control the expression and activity of particular genes linked to redox balance, metabolism, and immunological (18).

Antioxidant like beta-carotene and lutein, which are rich in spinach, are essential for maintaining good health and preventing illness. While lutein helps minimise the incidence of cataracts and improves vision in elderly persons, beta-carotene aids improve recovery after lung surgery and lowers the risk of diabetes. (19)

Using petroleum ether, ethyl acetate, and methanol extracts, the DPPH free radical scavenging assay was used to assess the antioxidant capacity of Spinacia oleracea extracts. After adding the samples to the reaction mixture, they were left in the dark for half an hour.A discernible colour shift from violet to pale yellow was noted following the incubation period.

Because of its high phenolic component concentration, spinach ranks among the vegetables with the highest antioxidant activity. (20) Four hydrophobic fractions were determined to be glucuronic acid derivatives of flavonoids using $^{1}H$ and $^{13}C$ NMR spectroscopy. Furthermore, three other fractions were identified as p-coumaric acid's trans and cis isomers, and some of them were identified as p-coumaric acid meso-tartarate derivatives. This work is the first to show that the antioxidant qualities of the spinach leaf aqueous extract are influenced by both flavonoids and derivatives of p-coumaric acid (7).

By scavenging free radicals, avoiding damage to cell membranes, and limiting lipid peroxidation, antioxidants may provide some resistance to oxidative stress and delay the onset of chronic disease. The antioxidant properties of the phytochemicals found in our diet and in health food supplements are gaining attention (21).

**Conclusion:**

They show the studied that spinach plant is most valuable for health.and also usefully for treating many more diseases. The study verified that antioxidant components, such as flavonoids and derivatives of p-coumaric acid, are present in the aqueous extract of spinach leaves.They previous studied that show spinach seed effect can be used to treat liver inflammation, respiratory problems, and as a laxative.

They studied that leafy vegetables like spinach contain phytochemicals that protect cells from oxidative damage and control the expression and activity of particular genes linked to redox balance, metabolism, and immunological response. They studied that various components Present such as , minerals, and antioxidants such as polyphenols, flavonoids, and carotinoids, which have been demonstrated to have anti-inflammatory, antimutagenic, anti-tumor, and chemopreventive properties, are abundant in spinach.

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**Reference :-**

1. NUR HUDA-FAUJAN, SAIFUL IRWAN ZUBAIRI & AUNI AFIQAH AHMAD BAKER. Nutritional and Bioactive Constituents of Antioxidant and Antimicrobial Properties in Spinacia oleracea: A Review, pg no: 2571 – 2581.

2. Mohammed N. Abu Al-qumboz, Samy S. Abu-Naser. Spinach Expert System: Diseases and Symptoms, pg no: 16 – 22.
3. Amit Kumar Nayak, Dilipkumar Pal, Dipti Ranjan Pany, Biswaranjan Mohanty. Evaluation of Spinacia oleracea L. leaves mucilage as an innovative suspending agent, Pg no: 338 – 341.
4. Kaur, Nitu Trehan, Bhawanpreet Kaur. ANALYSIS OF SPINACH (SPINACIA OLERACEA) PIGMENTS USING CHROMATOGRAPHY AND UV-VISIBLE SPECTROSCOPY, pg.no: 96 – 101.
5. Dinesh Kr. Sharma, Manisha Sharma, Devendrea Kr. Singh and Prem Mohan Gupta. Comparative nutritional analysis of Spinacia oleracea in different cities of west uttar pradesh (INDIA) , pg no: 56 – 63.
6. Pratima Phulsagar, Sukhwinder Jeetendra Kulkarni,Lakshmi Velide. SCREENING OF ANTIBACTERIAL ACTIVITY AND PHYTOCHEMICAL ANALYSIS OF SPINACIA OLERACEA, Volume 6, Issue 5, pg no: 367 – 375.
7. Pramod C. Mane, Deepali D. Kadam, Ravindra D. Chaudhari, Kanchan A. Varpe, Sunita D. Sarogade, Vrushali T. Thorat, Siddhi S. Said and Shabnam A. R. Sayyed. Phytochemical Investigations of Spinacia oleracea: An important leafy vegetable used in Indian Diet. Pg.no:1-4.
8. Bahiram V. K., Virkar A. M. and Bhosale S.S. Economical importance and cultivation practices Spinach. Volume 1,pg.no:282-283
9. Abhinandan Patil, Vidyarani Khot, Nita Pawar. SPINACIA Olreacea LINN: A REVIEW BASED ON PHARMACOLOGICAL Activities
10. Ramesh Babu, J Divakar, U Lal Krishna, and C Vigneshwaran . Study of antimicrobial, antioxidant, Anti-inflammatory activities and phytochemical analysis of cooked and uncooked different spinach leaves.pg.no:1798-1803.
11. Ramesh Kumar, Roshni Patwa. Study of phytochemical constituents and Anti-oxidant Activity of Spinacia oleracea L.Bundelkhand Region.pg.no:1599-1604.
12. MRINALINI C DAMLE, SHIVANI K JADHAV. AN IN VITRO ANTIOXIDANT CAPACITY AND RADICAL SCAVENGING EFFECT OF SPINACIA OLERACEA LEAF EXTRACT. Vol 11, Issue 11,pg no:321-328.
13. Sumit kumar, Aaditya Singh. An Ethnobotanical, Phytochemical and Antioxidant activity of Spinacia oleracea,L. Vol. 11.Pg no:2521-2525.
14. Yeşim DAL, Önder TÜRKMEN. Determination of Some Morphological Features of Spinach Populations.pg no:12-24.
15. Bokov DO, Sidorova YuS, Mazo VK, Bessonov VV. Prospects

Use of Spinach (Spinacia oleracea L.) Containing Phytoecdysteroids and Polyphenols. Vol 12.pg.no:246-250.

16. Ohidul Islam, A.K. Azad, M. Mustafezur Rahman, A. Khorshed Alam, M. Khairuzzaman, Jannatun Ferdous, Marirul Islam, Sharif M. Shaheen. Phytochemical profiling and evaluation of antioxidant and antidiabetic activity of methanol extract of spinach (spinacia oleracea l.) Leaves. Volume 4 Issue 1,pg.no:24-27.

17. ADYASHA SWAIN, S.K. SINGH, K.K. MOHAPATRA AND ABHIK PATRA. Effect of sewage sludge application on yield, nutrients uptake and nutrient use efficiency of spinach (Spinacia oleracea L.).Pg.no:305-309.

18. Ravi Thorudomsak. Biological Activities of Spinacia oleracea L.Volume 4 Issue 5,pg.no:869-873.

19. Pramod C. Mane, Deepali D. Kadam, Ravindra D. Chaudhari, Kanchan A. Varpe, Sunita D. Sarogade, Vrushali T. Thorat, Siddhi S. Said and Shabnam A. R. Sayyed. Phytochemical Investigations of Spinacia oleracea: An important leafy vegetable used in Indian Diet. Pg.no:1-4.

20.Bahiram V. K., Virkar A. M. and Bhosale S.S. Economical importance and cultivation practices Spinach. Volume 1,pg.no:282-283