



Health Benefits of Spinach

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1. Overwhelming health benefits of spinach

Spinach is one of the most nutritious vegetables consumed worldwide (Morelock and Correll 2008). Scientific studies provide increasingly more evidence for the health benefits of eating spinach (Gutierrez, Velazquez et al. 2019).

Spinach is known to boost immune levels in humans (Aslam, Majeed et al. 2017) and to be an excellent source of crucial minerals, vitamins, plant proteins, fibres, omega 3's and chlorophyll (Nutritionix 2020). Spinach has the highest Nutrient Adequacy Score (NAS) and Nutrient Density Score (NDS) among vegetables ((Suchánková, Kapounová et al. 2015).

Spinach is known to ...

- Boost and maintain your **immune system**
- Repel **bacteria and viruses**
- Reboot **energy**
- Aid in **skin care**
- Regulate **blood pressure**
- Strengthen **muscles and bones**
- Reduce **oxidative stress**
- Aid in **digestion**
- Improve **eyesight**
- Prevent age-related **muscular degeneration**
- Contain **anti-cancerous** benefits
- Suppress **appetite**



Spinach makes it easy to eat healthy

Spinach is a very popular vegetable in the USA, Europe, China, Japan and the Pacific (Siemonsma and Piluek 1994). The interest in healthier diets and availability of pre-cleaned package spinach has caused a dramatic increase in per capita consumption in the USA in the past three decades (Lucier et al. 2004).

Eating healthy doesn't have to be complex. Spinach can be used in a variety of ways, both fresh and cooked. Aim for 1 cup fresh spinach or 1/2 cup cooked per day.

Spinach

- simply steam or add to salads and soups:

- Zingy courgette & spinach salad
- Spinach soup with bacon
- Warm cauliflower salad

Quick & easy super spinach suppers:

- Salmon & spinach with tartare cream
- Stir-fry prawns with peppers & spinach
- Chickpea, tomato & spinach curry
- Haddock & spinach cheese melt

Spinach is best friends with garlic:

- Aubergines filled with spinach & mushrooms
- Speedy soy spinach

Spinach is the most versatile with dairy, fish and meat

- Spinach & feta-stuffed chicken
- Parmesan spring chicken
- Smoked mackerel risotto

Spinach adores being paired with nutmeg...

- Creamed spinach
- Buttered spinach with feta

And not forgetting lots of pasta dishes:

- Bacon, spinach & gorgonzola pasta
- Pasta with chilli tomatoes & spinach
- Gnocchi with roasted squash & goat's cheese

See all recipes on [www.bbcgoodfood.com/recipes/col-lection/spinach](http://www.bbcgoodfood.com/recipes/collection/spinach)

Handling of spinach



Storing and washing

Fresh spinach should be medium to dark green and fresh-looking.

It should be stored loosely packed in a sealed plastic bag in the fridge where it will keep for about four days.

Do not wash spinach before storing as moisture spoils it. But do ensure it is washed properly before consumption as the leaves and stems may collect soil.

Cooking spinach for optimal benefit

Raw spinach has a milder taste that some describe as metallic once cooked. If cooking, opt for steaming, sautéing or microwaving spinach rather than boiling to preserve the nutrients.

When it comes to certain minerals and vitamins, you're better off eating your spinach cooked.

Oxalate and why you should avoid it

Oxalate-rich foods may increase the risk of kidney stones and is naturally found in leafy greens, nuts, seeds, most berries, certain fruits, soy and soy products. Spinach does have a high content of oxalate (Holmes and Kennedy 2000), and individuals with a history of oxalate containing kidney stones should avoid over consumption.

Most healthy people, however, consume oxalate-rich foods without problems, and the benefits of eating spinach outweigh the risks.

In any case, oxalate can easily be neutralised by adding "Nonoxal", a salt of calcium.



Kale vs. spinach: Which is healthiest?

While kale offers more than twice the amount of vitamin C as spinach, spinach provides more folate and vitamins A and K. Both are linked to improved heart health, increased weight loss, and protection against disease

2. Specific physiological effects of spinach

Iron: Oxygen transport and vitality

Iron is involved in many essential metabolic processes in the human body, such as oxygen transport by iron-containing haemoglobin, DNA synthesis and electron transport. Iron deficiency can lead to anaemia and possibly neurodegenerative diseases (Abbaspour, Hurrell et al. 2014).

Spinach has remarkable abilities to restore energy, increase vitality and improve the quality of the blood (Szalay 2015) due to its high iron content.

Calcium: Strong bones

Calcium is essential for maintaining strong bones. Older people have a lower efficiency in retaining Calcium, therefore they need to consume larger amounts of calcium to maintain strong bone structure (Heaney 2002).

Spinach is a good source of calcium (Doane, Liebman et al. 1989).

Potassium & Magnesium: Prevent heart disease & high blood pressure

Current diets of people living in industrialised societies result in a low potassium uptake due to lack of leafy greens consumption. An increasing amount of studies suggest that a low potassium diet leads to higher occurrence of cardiovascular and hypertension diseases (Sica, Struthers et al. 2002, Castro and Raij 2013).

Magnesium is involved in several processes in the human body: Energy production, maintaining electrolyte balance, normal neuromuscular function and potassium transport. Evidence suggests that a lack of magnesium results in low levels of potassium leading to heart disease and high blood pressure (Rude 1989).

Therefore, regular consumption of leafy greens and especially spinach, which is high in both potassium and magnesium, is essential to reduce the risk of any cardiovascular diseases.

Zinc: Immune system

Zinc is essential for the functioning of more than 300 enzymes and for controlling gene expression. Zinc is known to be very important for our immune-defence system. Zinc deficiency causes poor functioning of our immune system, delayed wound healing, retarded growth, neural development disorders and other degenerative diseases (Yasuda and Tsutsui 2016).

Infants and elderly people have a lower uptake of zinc and have been shown to suffer from zinc deficiency (Yasuda and Tsutsui 2016).

Zinc is more readily available for uptake in the human body from spinach than from zinc tablets due to the natural presence of oxalic acid in spinach (Welch, House et al. 1977).

Manganese: Brain functioning and fertility

Manganese is essential for the functioning of the glutamine synthetase enzyme which plays an important role in the functioning of the brain.

Deficiency of manganese can cause infertility and impaired skeletal growth.

Vitamin A & beta-carotene: Night vision & healthy eyes, immune system

Beta-carotene is converted during digestion in the human body to Vitamin A. Spinach is high in both Vitamin A and beta-carotene.

Vitamin A is important for night vision, the immune system and inflammatory systems, cell growth and development, and antioxidant activity (Maqbool, Aslam et al. 2017).

Beta-carotene is thought to guard against heart disease and lung cancer.

Retinoic acid, which is a derivative of Vitamin A, inhibits the Hepatitis C virus, the causal virus for liver deterioration (Aslam, Majeed et al. 2017).

Dark green vegetables high in vitamins A and C were shown to be protective for glaucoma (one of the leading causes of blindness for people over the age of 60) (Ramdas, Schouten et al. 2018).

Studies have found that eating cooked spinach and carrots (vs. raw) results in much higher blood levels of beta-carotene.

Vitamin B6: Memory & mental ability

Spinach and other leafy greens are the main source of vitamin B6, which plays an important role in mental ability. A study with more than 200 women demonstrated that a higher intake of vitamin B6 through spinach and other leafy greens enhanced short-term memory and mental ability (Aisen, Schneider et al. 2008).

Vitamin B9: Fetal development and reduced risk of cleft lip or palate

Vitamin B9 (folate) is essential during the development of a baby during pregnancy. Deficiency of vitamin B9 can lead to birth defects such as neural tube defects and cleft lip/cleft palate (von Fraunhofer 2019).

In later life low vitamin B9 levels could lead to an increased cancer risk.

Spinach and lettuce have relatively high vitamin B9 amounts.

Vitamin E: Reducing risk of heart attack, stroke, Parkinson's/Alzheimer's disease

Vitamin E is an important antioxidant. Deficiency of vitamin E could lead to hardening of the blood vessels (atherosclerosis), heart attack, cancer, stroke, fibrocystic breast disease, epilepsy, PMS, diabetes, Parkinson's disease, cataract, Alzheimer's disease, and an impaired immune system (Maqbool, Aslam et al. 2017).

Spinach is one of the sources of vitamin E, besides various other leafy greens and seeds, such as sunflower seeds.

Vitamin K: Blood clotting and bone health

Vitamin K is important for blood clotting, which is essential when wounded, and bone health.

Vitamin K deficiency occurs rarely in infants but could be fatal if blood clots are not formed on a wound, resulting in major blood loss (Maqbool, Aslam et al. 2017).

It is difficult to find vegetables richer in vitamin K than spinach (Gunnars 2019).

Lutein & zeaxanthine: Visual health

Lutein and zeaxanthin are stereoisomers that contribute to human visual health by providing photoprotective and antioxidant activity.

Lutein and zeaxanthin are mainly available in green leafy vegetables (Nwachukwu, Udenigwe et al. 2016). Especially, spinach has a very high content of lutein and zeaxanthin.

Flavonoids: Appetite suppression

Spinach is known to have appetite-suppressing properties, hence reducing the risk of obesity.

In a recent study it was found that several flavonoid compounds were responsible for the appetite-suppression (Panda and Shinde 2017).

Omega-3 fatty acids: Reduce the risk of heart disease and stroke

Various studies have shown that the consumption of foods containing omega-3 fatty acids, such as spinach, can significantly reduce the risk of heart failure and strokes (Kenney, 2011)

Chlorophyll: Anti-inflammatory and anti-cancerous

The dark green colour of spinach leaves indicates they contain high levels of chlorophyll which have anti-inflammatory and anti-cancerous properties (Roberts and Moreau 2016).

3. Spinach's superior nutritional value

Table 1: Nutrient Adequacy Score and Nutrient Density Score

Spinach has the highest Nutrient Adequacy Score and Nutrient Density Score compared to other vegetables and fruits ((Suchánková, Kapounová et al. 2015):

Table 1. Twenty fruits and vegetables with the highest nutrient adequacy score (NAS) and nutrient density score (NDS)

Foods	NAS	Foods	NDS
Spinach*	19.39	spinach*	24.55
Savoy cabbage*	18.33	savoy cabbage*	18.34
Broccoli*	16.86	pepper	15.29
Pepper	16.12	radishes	14.52
Kiwifruit	13.36	lettuce	13.02
Currant	13.05	broccoli*	11.55
Carrot*	12.47	head cabbage	11.20
Leek	12.39	carrot*	10.66
Kohlrabi	11.12	cauliflower*	10.21
Blueberries	10.93	kohlrabi	9.75
Parsley*	10.32	leek	9.12
Strawberries	9.93	cucumber	8.81
Cauliflower*	9.80	tomatoes	8.25
Green peas*	9.78	currant	8.16
Oranges	9.62	white radish	7.33
Mango	9.33	pumpkin*	7.18
Garlic	8.92	courgette*	7.16
Lemon	8.88	head cabbage*	6.69
Lettuce	8.46	pattypan*	6.32
Raspberries	8.29	blueberries	6.32

*cooked

$$\text{NAS} = [\sum (\text{Nutrient}_{1-10} / \text{DRV}_{1-10}) \times 100] / 10$$

DRV = dietary reference values

$$\text{NDS} = (\text{NAS} / \text{energy density}) \times 100$$

Table 2: Macronutrients

Macronutrients	Spinach (cooked)	Spinach (raw)	Romaine Lettuce	Carrots (cooked)	Cabbage (cooked)	Onions (cooked)	Boiled Potatoes	White Rice	Wheat Bread
Calories	23	23	17	35	23	44	87	130	274
Fat (g)	0.3	0.4	0.3	0.2	0.1	0.2	0.1	0.3	4.5
Carbohydrate (g)	3.8	3.6	3.3	8.2	5.5	10.2	20.1	28.2	47.5
Protein (g)	3	2.9	1.2	0.8	1.3	1.4	1.9	2.7	10.7
Cholesterol (mg)	0	0	0	0	0	0	0	0	0
Fibre (g)	2.4	2.2	2.1	3	1.9	1.4	1.8	0.4	4
Sugar (g)	0.4	0.4	1.2	3.5	2.8	4.7	0.9	0.1	5.7

Table 2. Amounts of macronutrients between different food sources (per 100 g) (USDA 2018). Spinach is relatively high in protein content compared to other vegetable. Fibre content is also high as in most vegetables.

Table 3: Mineral content

	Spinach (cooked)	Spinach (raw)	Romaine Lettuce	Carrots (cooked)	Cabbage (cooked)	Onions (cooked)	Boiled Potatoes	White Rice	Wheat Bread
Iron (mg)	3.6	2.7	1	0.3	0.2	0.2	0.3	1.2	3.6
Calcium (mg)	136	99	33	30	48	22	5	10	125
Potassium (mg)	466	558	247	235	196	166	379	35	141
Magnesium (mg)	87	79	14	10	15	11	22	12	41
Phosphorus (mg)	56	49	30	30	33	35	44	43	129
Sodium (mg)	70	79	8	58	8	3	4	1	473
Zinc (mg)	0.8	0.5	0.2	0.2	0.2	0.2	0.3	0.5	1
Copper (mg)	0.2	0.1	0	0	0	0.1	0.2	0.1	0.1
Manganese (mg)	0.9	0.9	0.2	0.2	0.2	0.2	0.1	0.5	1
Selenium (µg)	1.5	1	0.4	0.7	0.6	0.6	0.3	7.5	28.8
Fluoride (µg)	37.8	-	-	47.5	1	-	49.4	41.1	-

Table 3. Amount of minerals between different food sources (per 100 g) (USDA 2018). Spinach is very rich in minerals with clear benefits for health. Iron, calcium, potassium, magnesium, sodium, zinc, and manganese are present in much higher quantities in spinach compared to other vegetables.

Table 4: Vitamins

Vitamins	Spinach (cooked)	Spinach (raw)	Romaine Lettuce	Carrots (cooked)	Cabbage (cooked)	Onions (cooked)	Boiled Potatoes	White Rice	Wheat Bread
Vitamin A (µg)	524	469	436	852	4	0	0	0	0
Vitamin C (mg)	9.8	28.1	4	3.6	37.5	5.2	13	0	0.2
Thiamin (B1) (mg)	0.1	0.1	0.1	0.1	0.1	0	0.1	0.2	0.4
Riboflavin (B2) (mg)	0.2	0.2	0.1	0	0	0	0	0	0.3
Niacin (B3) (mg)	0.5	0.7	0.3	0.6	0.2	0.2	1.4	1.5	5.6
Vitamin B5 (mg)	0.1	0.1	0.1	0.2	0.2	0.1	0.5	0.4	0.8
Vitamin B6 (mg)	0.2	0.2	0.1	0.2	0.1	0.1	0.3	0.1	0.1
Folate (B9) (µg)	146	194	136	14	30	15	10	58	85
Choline (mg)	19.7	19.3	9.9	8.8	20.3	6.8	13.5	2.1	18.7
Vitamin B12 (µg)	0	0	0	0	0	0	0	0	0
beta-Carotene (µg)	6288	5626	5226	8332	48	1	2	0	1
alpha-Carotene (µg)	0	0	0	3776	0	0	0	0	0
Lutein + Zeaxanthine (µg)	11308	12198	2312	687	27	4	10	0	44
Vitamine E (mg)	2.1	2	0.1	1	0.1	0	0	0	0.2
Vitamine D (µg)	0	0	0	0	0	0	0	0	0
Vitamine K (µg)	493.6	482.9	102.5	13.7	108.7	0.5	2.2	0	4.9

Table 4. Amount of vitamins between different food sources (per 100 g) (USDA 2018). Spinach has a record high content of vitamin A, E and K compared with other vegetables. Spinach also has high contents of Vitamin C, B2 and B6.

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