Fresh Microgreens

Dr. Uri Mayer-Chissick
Scientific Editor: Yael Leader

What are microgreens?

Microgreens are the first sprouts of seeds, grown from a large variety of edible plants. They are harvested 7-20 days after seedling emergence and before the full growth of the first pair of leaves. Their length can reach 10 cm.

Why is it important to eat them?

Most of us know that various nutrition institutes around the world recommend eating fruits and vegetables and that they should make up about 50% of our daily intake. The World Health Organization (WHO) emphasizes that increasing consumption of fruits and vegetables has been associated with reduced risk of heart disease, diabetes and some types of cancer. In addition, several vitamin deficiencies, such as vitamin A and vitamin B9 (folic acid), and some mineral deficiencies (iron, zinc, iodine), as well as the lack of several complex micronutrients, are currently defined as a global epidemiological disease[1].

About 60% of the world's population suffers from iron deficiency, 30% from zinc deficiency and 15% from selenium deficiency. Lack of calcium, magnesium and copper has also become common in some developed [as well as] developing countries[2].

On the other hand, high-sugar, fat and salt-laden diets that are at the same time low in dietary fiber, antioxidants, vitamins and minerals, prevail in Western cultures. Under this influence, many of us cannot meet the WHO's dietary recommendations.

Microgreens are not just a beautiful garnish for a dish in a chef's gourmet restaurant. They are important for all of us because of their concentration in essential nutrients that are vital for a healthy body.

How does this happen?

Plant germination is a very intense process. It begins when a seed meets water and oxygen at a favorable temperature. The seed absorbs the water, swells and begins breaking up growth-inhibiting substances that protected the seed when it was dormant. The seed also reserves materials that are later turned into energy. In a fast process lasting about two days, the seed turns into an embryonic root and then an embryonic sprout. The roots absorb water and

---

[1] Bailey, R. L., West Jr, K. P., & Black, R. E. (2015). The epidemiology of global micronutrient deficiencies. **Annals of Nutrition and Metabolism**, 66 (Suppl. 2), 22-33

[2] Pinto, E., Almeida, A. A., Aguiar, A. A., & Ferreira, I. M. (2015). Comparison between the mineral profile and nitrate content of microgreens and mature lettuces. **Journal of Food Composition and Analysis**, 37, 38-43

nutrients from the soil, and when the sprout rises up, the first leaves (microgreens) emerge and the process of photosynthesis begins.

The benefits of eating microgreens

Studies have found that at about 7-20 days after germination, microgreens have the highest content of vitamins and minerals to weight. In later development stages of the plant this ratio decreases, which means that every gram of the adult plant has fewer vitamins and minerals compared to the same plant's early developmental stage (microgreens).

A comparative study of lettuce microgreens and mature lettuce found that microgreens are significantly richer (sometimes up to 9 times) in basic minerals such as iron, manganese, zinc, selenium and molybdenum.[3]

Another study compared three types of broccoli microgreens to mature broccoli. The study found that both in compost and hydroponic growing systems, the amount of minerals in microgreens is higher. Grown in compost, when microgreens appear, they contain more phosphorus, potassium, magnesium, manganese, iron, zinc, sodium and copper.[4] This method of cultivation yielded microgreens with the highest nutritional values per unit weight.

Another study showed similar results in spinach microgreens compared to adult spinach.[5]

The variety of phenolic compounds (polyphenols), which are antioxidants (oxidation process creates free radicals and anti-oxidants neutralize free radicals), was tested in five types of cruciferae microgreens comparing to mature plant counterparts. The test revealed that the microgreens had a wider range of polyphenols divided into several families compared to a smaller diversity in mature plant counterparts.[6]

The stronger the taste of the leaf is, the more spicy, astringent and bitter the leaf is and the higher the content of phenolic components.[7] Phenolic compounds act as antioxidants in the body. So, the more strong-tasting microgreens we consume, the more antioxidants our bodies receive.

Sulforaphane is an antioxidant that is considered to play an anticancer role. Sulforaphane in cruciferous plants is formed during chewing. Tests revealed that its concentration in broccoli microgreens was 10 times higher than in the adult plant.[8]

---

[3] Ibid
[4] Weber, C. F. (2017). Broccoli microgreens: A mineral-rich crop that can diversify food systems. **Frontiers in Nutrition**, 4
[5] Mir, S. A., Shah, M. A., & Mir, M. M. (2017). Microgreens: Production, shelf life, and bioactive components. **Critical reviews in food science and nutrition** , 57 (12), 2730-2736
[6] Ibid
[7] Xiao, Z., Lester, G. E., Park, E., Saftner, R. A., Luo, Y., & Wang, Q. (2015). Evaluation and correlation of sensory attributes and chemical compositions of emerging fresh produce: **Microgreens. Postharvest Biology and Technology** , 110 , 140-148
[8] Nakagawa, K., Umeda, T., Higuchi, O., Tsuzuki, T., Suzuki, T., & Miyazawa, T. (2006). Evaporative light-scattering analysis of sulforaphane in broccoli samples: Quality of broccoli products regarding sulforaphane contents. **Journal of agricultural and food chemistry**, 54 (7), 2479-2483

A study of 25 different types of microgreens found that they can be a good source of vitamin K1, vitamin C and various types of carotenoids, and vitamin E,[9] which are also powerful antioxidants.

- **Vitamin K1** is necessary for blood clotting in the human body and is abundant in green vegetables such as spinach and broccoli. The study found that microgreens of amaranth, sorrel, opal (purple) basil and peas are richer in vitamin K1 than spinach. Microgreens of coriander, celery, radish, pepper cress, kohlrabi, and purple cabbage are richer in vitamin K1 than broccoli.[10] It was also found that the concentration of vitamin K1 in broccoli microgreens is at least 3 times higher than its concentration in the mature plant and that the concentration of this vitamin in basil microgreens is 7 times higher than its concentration in mature leaves.
- **Vitamin C** (ascorbic acid) is a powerful antioxidant that plays an essential role in the production of collagen protein responsible for the stability of bones, tendons, ligaments and cartilage. Recommended daily intake of vitamin C is 90 mg / day and 75 mg / day for men and woman, respectively.
    - 100 g of purple cabbage microgreens contains almost 150 mg of vitamin C.
    - 100 g of amaranth microgreens contains 130 mg of vitamin C — 3 times higher than in mature leaves.
    - 100 g of radish microgreens or purple basil microgreens contain about 90 mg of vitamin C.
    - Mustard, green basil, daikon, kohlrabi and sorrel microgreens also provide a significant amount of vitamin C.[11]
- **Carotenoids** are a group of antioxidants that protect cell membranes (beta-carotene, which is also provitamin A) and promote eye health (lutein, zeaxanthin and yolaxanthin). Their consumption is necessary to protect the body against oxidants. The recommended daily intake of beta-carotene is about 6 mg /day. Tests found that, apart from microgreens grown in the dark, all examined microgreens contained 90-200% of the recommended daily dose of beta-carotene per 100 g of the product. Particularly prominent were microgreens of coriander, purple cabbage and garden berries.[12]

All 2BFresh microgreens [fresh microgreens] are grown in light. Wasabi, opal (purple) basil, tendrils of peas and amaranth microgreens have the same concentrations of beta-carotene as mature carrots and sweet potatoes. The concentration of lutein / zeaxanthin in coriander microgreens is 11 times higher than their concentration in mature leaves, and the concentration of violaxanthin is 5 times higher in microgreens.

[9] Xiao, Z., Lester, G. E., Luo, Y., & Wang, Q. (2012). Assessment of vitamin and carotenoid concentrations of emerging food products: edible microgreens. **Journal of agricultural and food chemistry** , 60 (31), 7644-7651
[10] Ibid
[11] Ibid
[12] Ibid

- **Vitamin E** is also a powerful antioxidant, which plays an important role in preventing the oxidation of cell membranes and low-density lipoproteins in the blood. The most active form of vitamin E in the body is alpha-tocopherol The recommended daily intake of vitamin E for adults is 15 mg.
    - The record-holders for the concentration of vitamin E are daikon microgreens, which contain more than 5 times the recommended daily dose per 100 g.
    - Coriander, beets, peas and radish microgreens are also an excellent source of vitamin E.
    - Rocket, celery, amaranth, basil, mizuna, mustard, purple cabbage, sorrel and wasabi microgreens provide 100% or more of the recommended daily allowance per 100 g.
    - Research data reveal that purple cabbage microgreens contain 40 times more vitamin E than mature purple cabbage.

Environmental impact of growing microgreens?

The world's population is growing, while Earth's resources are diminishing. Growing microgreens as a source of essential vitamins and minerals is good for the environment. For example, growing broccoli microgreens is about 90% faster than growing broccoli to maturity and in the process, much less water is required. [In addition, growing] microgreens does not require the use of fertilizers and pesticides, and the area of their cultivation is limited. [13]

How to choose microgreens?

When choosing microgreens, we recommend diversifying. A wide variety of leaves will allow us to enjoy the various benefits that each microgreen has to offer and make it easier to include them frequently in our diet. In any case, microgreens should be fresh-looking and have a strong and attractive color.

With root or without root?

A plant’s root system, which is responsible for water, oxygen and mineral uptake, is crucial during the growing period when the plant is exposed to light in which photosynthesis is an on-going process (sun-light or artificial photosynthetic light). However, in dark conditions where photosynthesis is halted, the root system becomes a burden, negatively influencing the quality of microgreens by depleting their carbohydrates and nutrient reserves. Thus, harvesting microgreens and storing them in low temperatures, supplemented with optimized packaging will assist in maintaining freshness and shelf life for extended periods.

[13] Weber, C. F. (2017). Broccoli microgreens: A mineral-rich crop that can diversify food systems. Frontiers in Nutrition, 4; Loedolff, B. (2017). Towards improving nutritional food security through phytochemical enhancement in micro-greens. **South African Journal of Botany** , 109 , 345

How should I consume my microgreens?

Microgreens can be added to a large variety of foods. Try adding to salads, replacing the lettuce in a sandwich, making a pesto-like paste, seasoning for a vegetable omelet and more. Many of us start our day with delicious fruit smoothies. Adding a handful of microgreens to the shake will increase its nutritional value.

Note that long cooking may damage some antioxidants in microgreens. Therefore, microgreens are better consumed fresh. It is important to remember that most of the vitamins and phenols listed in this report are oil-soluble and better absorbed in the digestive system in the presence of fats. Combine high quality olive oil or nuts and almonds with your meal to get the most out of your microgreens.