**Microgreens: A Miracle Food with the treasure of nutrients and A New Beginning Towards Nutrition**

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**Abstract**

Microgreens are an emerging group of eatable vegetables cultivated while the first leaves have fully developed and just before real leaves emerge. This notion is gaining popularity as a novel culinary and eating property. These are used to enhance the flavor and nutritional content of raw vegetables or as eatable toppings for a variety of different foods. The majority of microgreens are grown from cabbage, mustard, buckwheat, radish, spinach, lettuce, and other vegetables. Microgreens are becoming increasingly popular due to their high concentration of physiologically active substances such as important vitamins, minerals, and antioxidants when compared to fully developed greens (necessary for healthiness). This chapter aims to provide an overview of the nutritional information of microgreens and, their benefits.

***Keywords:*** *Microgreens, biologically active compounds.*

**Introduction**

Food security and health have become serious challenges in all countries, particularly emerging countries, in the modern world. Due to ongoing changes in our ecosystem services and fast climatic change, significant stress is placed on dependable food production in order to provide a healthy environment for the world's ever-increasing population. In the current situation, one in every eight people suffers from chronic malnutrition or undernourishment, and many are predisposed to diabetes, cardiovascular disease, cancer, obesity, hypertension, stroke, and other metabolic disorders, which have also reached global epidemic proportions as a result of unbalanced food consumption patterns.

Foods have been crucial to the development of human culture. Foods provide calories and vital nutrients that are important for human growth, development, and survival. In addition to providing nourishment, food has also helped people in many cultures avoid and treat numerous health issues. The modern area of food science and nutrition reflects the growth of humanity, and advancements have been made thanks to the knowledge influx from fields like medicine, biology, and biochemistry.

In developing nations such as India, 13.5% of the population is chronically malnourished, with Western Asia and Sub-Saharan Africa being the most badly affected regions (Anonymous, 2015). Vegetables are frequently referred to as "protective foods" due to their nutritive and therapeutic benefits, and they are a significant component of Indian agriculture in terms of people's nutritional security. The lack of fresh, pesticide-free veggies for eating is gradually becoming a big worry for our country's vegetarian population. In this perspective, it is critical to consider a few alimentary traditions as well as the social value of culinary practices that have been lost through time. Functional foods are nutritionally equivalent to regular diets and provide additional health advantages beyond basic nutritional functions.

Microgreens are amazing. Microgreens are a type of food that is gaining popularity these days. Microgreens, as a novel class of edible crops with a lot of promise to heal different deficiencies (Pinto et al., 2015), provide a homestead alternative for nutritional security. More than 25 micro greens are commercially cultivated across the world. These are around 4-6 times more nutrient-rich than mature equivalents (Xiao et al., 2012). As a result, microgreens can be classified as "functional foods," meaning they contain health-promoting or disease-preventing capabilities.

***“Microgreens: novel fresh and functional food to explore all the value of biodiversity”***

**What are Microgreens?**

Over the past 20 years, the general public's increased interest in nutritious food has sparked an interest in high-end fresh, functional, and nutraceutical foods. Microgreen crop growers, extension specialists, and scientists could take advantage of upcoming chances for pertinent goods.

Another sort of distinctive crop is microgreens, sometimes known as "Vegetable Confetti." Microgreens are described as delicate juvenile greens grown from cereals, vegetables, herbs, or wild forms of plants. Because of the rising popularity of gourmet cuisine, healthy eating, and indoor gardening in developed nations, microgreens are now well known there. Even in the refrigerator, this novel food type has a rather short shelf life and is only seldom used as spices, toppings, or garnishes.

A few days or weeks after germination, during the formation of cotyledons and the appearance of the first true leaves, microgreens are harvested. They are characterized by a variety of colors, tastes, and textures and are fresh and tenderly soft vegetables, found from the seeds of abundant varieties (aromatic herbs vegetables, wild edible plants, and herbaceous plants) (Paradiso et al., 2018).

Microgreens are regarded as functional foods because, in addition to their nutritional advantages, they have higher concentrations of phenolics, antioxidants, minerals, and vitamins than are present in fully formed greens or seeds. These are widely acknowledged as effective carriers of biologically active ingredients (Mir et al., 2017).

Microgreens are claimed to be highly decomposable items, but unfortunately, commercialization of them is limited due to their rapid deterioration and relatively short storage life, usually 3 to 5 days at room temperature. The improvement of their packaging and post-collection stockpiling conditions is therefore becoming increasingly important for extended periods of realistic usability as the demand for microgreens increases and, as a result, their appearance in farmer's markets and specialty grocery stores also begins (Mir et al., 2017).

Microgreens are considered to be baby plants or young vegetable greens that are roughly 1-3 inches/2.5-7.5 cm tall, have an aromatic flavor and concentrated nutrient content, come in a variety of colors and textures, and are used as a nutrition supplement, visual enhancer, and flavor and texture amplifier. Microgreens should be harvested 7–21 days after germination, just as the cotyledon leaves have developed, and possibly with one set of true leaves.

They are not to be mistaken for sprouts, which do not have leaves, since they are in between a sprout and a baby green. Since their stems and leaves are considered edible, microgreens are considerably more comparable to baby greens; yet, as their stems and leaves are viewed as edible components, microgreens are considerably more similar to baby greens than they are to regular greens. However, unlike baby greens, they are much smaller and can be sold before being harvested. Microgreens may be grown in a number of places, including outdoors, in greenhouses, and even on our windowsill, making them incredibly handy to cultivate.

Microgreens may give dishes a sweet or spicy flavor. They are currently considered by premium supermarkets as a particular type of green that is suitable for garnishing salads, soups, sandwiches, and plates. They may also be used as the primary vegetable in some dishes for powerful flavor and nutrients.

**Varieties of microgreens**

Since the availability and consumption of microgreens are significantly influenced by the emergence of culinary trends, the species' selection relies on manufacturer discussions with chefs and on consumer acculturation to their unique sensory qualities. Microgreens can be distributed as freshly cut foods as well as while growing on a medium for end users to harvest.

The most often exploited species are those belonging to the groups Brassicaceae, Asteraceae, Chenopodiaceae, Lamiaceae, Apiaceae, Amarillydaceae, Amaranthceae, and Cucurbitaceae. The varying sufficiency of the bioactive substance necessitates the differentiation of genotypes that may take into consideration desires for both flavor and wellness. The bioactive substance is noticeable in types of food with a pretty harsh taste (for example, Brassicaceae) (Xiao, Lester et al., 2012).

**Different Types of Microgreens**

A variety of seeds can be used to develop microgreens. The following plant families give rise to the most common varieties:

* **Brassicaceae:**cauliflower, broccoli, cabbage, watercress, radish, and arugula
* **Asteraceae:**Lettuce, endive, chicory, and radicchio
* **Apiaceae:**Dill, carrot, fennel, and celery.
* **Amaryllidaceae:**garlic, onion, leek
* **Amaranthaceae:**amaranth, quinoa, swiss chard, beet, and spinach
* **Cucurbitaceae:**melon, cucumber, and squash.

Sometimes, legumes like chickpeas, beans, and lentils as well as grains like rice, oats, wheat, corn, and barley are produced as microgreens. Depending on the type of green, microgreens can have flavors that range from mild to spicy, acidic to even bitter. In essence, their flavor is meant to be intense and concentrated (View & Club, 2019).

**Microgreens Are Nutritious and its health benefits**

Eating green vegetables is linked to a decreased risk of many illnesses because microgreens contain significant amounts of vitamins, minerals, and beneficial plant chemicals. Microgreens are likewise endowed with the essential elements that keep us healthy. The presence of bioactive compounds makes them more nutritious.

1.Microgreens provide a variety of healthy nutrients; the majority of the kinds are typically high in potassium, iron, zinc, magnesium, copper, etc.

2. They are a great source of antioxidants and other healthy plant elements, like polyphenols.

3. Compared to the same number of mature greens, they frequently have more vitamin and mineral content.

4. According to the study, microgreens can have up to nine times the number of nutrients as mature greens.

**(a) Bioactive components**

Red cabbage (Brassica oleracea L. var. capitata), sorrel (Rumex acetosa L.), peppercress (Lepidium bonariense L.), and a few varieties of amaranth (Amaranthus hypochondriacus L.) and cilantro (Coriandrum sativum L.) are examples of microgreens that tend to be less edible but still contain high levels of bioactive compounds (Xiao et al., 2012).

Carotenoids (violaxanthin, carotene, and lutein/zeaxanthin), ascorbic acid (free, total, and dehydro), tocopherols, and phylloquinone are on the list of substances that have been scientifically proven to be biologically active in humans.

**b) Nutritional Details**

Microgreens are loaded with nutrients. Many varieties have high concentrations of K, Fe, Zn, Mg, and Cu despite the concentration variations that may occur (Xiao et al., 2016). A good supply of important plant chemicals, such as antioxidants, is microgreens (Xiao et al., 2012). Additionally, they have concentrated nutritional value, meaning they contain more vitamins, minerals, and antioxidants per serving than the same amount of mature greens (Xiao et al., 2012). According to studies, the nutrients in microgreens might be up to nine times more than those in mature greens (Pinto et al., 2015).

Red cabbage, cilantro, garnet amaranth, and green daikon radish microgreens have the highest concentrations of ascorbic acid, carotenoids, phylloquinone, and tocopherols, respectively. When compared to database values for fully grown vegetable counterparts, micro greens also contain significantly more bioactive substances (Xiao et al., 2012).

One study indicated that 25 commercially available microgreen cultivars included high levels of vitamins and antioxidants. Vitamin and antioxidant levels differed when compared to those recorded for fully grown vegetable leaves in the USDA National Nutrient Database, and it was estimated that the amounts found in microgreens might be up to 40 times higher (Xiao et al., 2012).

The risk of the ensuing illnesses may be lowered by eating microgreens:

1. Heart Diseases: Polyphenols, a family of antioxidants associated with a decreased risk of heart disease, are abundant in microgreens. They could also reduce levels of "bad" LDL cholesterol and triglycerides.

2. Alzheimer's disease: Eating foods strong in polyphenols and other antioxidants may reduce your chance of developing Alzheimer's disease.

3. Diabetes: Antioxidants may aid in lowering the kind of stress that might obstruct sugar from correctly entering cells.

4. Specific cancers: Microgreens high in polyphenols may be expected to benefit some cancer patients.

**Some Challenges of Microgreens**

 1. Weak and slender: Microgreens may grow weak and skinny if not given enough light, as opposed to their mature counterparts.

2. Crowding: Overly dense seeding can result in damping off, although it is readily remedied by treating the medium with Trichoderma.

3. Incorrect planting period: Some seeds could not sprout at extremely high or extremely low temperatures.

4. Oversoaking: Oversoaking seeds might cause them to die.

**List of Microgreens**

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| --- | --- | --- | --- |
| **Commercial name**  | **Botanical Name**  | **Family**  | **Color**  |
| Arugula  | Eruca sativa Mill.  | Brassicaceae  | Green  |
| Bull's blood beet  | Beta vulgaris L.  | Chenopodiaceae  | Reddish green  |
| Celery  | Apium graveolens L.  | Apiaceae  | Green  |
| Cilantro  | Coriandrum sativum L.  | Apiaceae  | Green  |
| Garnet amaranth  | Amaranthus hypochondriacus L.  | Amaranthaceae  | Red  |
| Golden pea tendrils  | Pisum sativum L.  | Fabaceae  | Yellow  |
| Green basil  | Ocimum basilicum L.  | Lamiaceae  | Green  |
| Green daikon radish  | Raphanus sativus L.  | Brassicaceae  | Green  |
| Magenta spinach  | Spinacia oleracea L.  | Chenopodiaceae  | Red  |
| Mizuna  | Brassica rapa L.  | Brassicaceae  | Green  |
| Opal basil.  | Ocimum basilicum L  | Lamiaceae  | Greenish purple  |
| Opal radish  | Raphanus sativus L.  | Brassicaceae  | Greenish purple  |
| Pea tendrils  | Pisum sativum L.  | Fabaceae  | Green  |
| Pepper cress  | Lepidium bonariense L.  | Brassicaceae  | Green  |
| Popcorn shoots  | Zea mays L.  | Poaceae  | Yellow  |
| Purple kohlrabi  | Brassica oleracea L.  | Brassicaceae  | Purplish green  |
| Purple mustard  | Brassica juncea L.  | Brassicaceae  | Purplish green  |
| Red beet  | Beta vulgaris L.  | Chenopodiaceae  | Reddish green  |
| Red cabbage  | Brassica oleracea L.  | Brassicaceae  | Purplish green  |
| Red mustard  | Brassica juncea L.  | Brassicaceae  | Purplish green  |
| Red orach  | Atriplex hortensis L.  | Chenopodiaceae  | Red  |
| Red sorrel  | Rumex acetosa L.  | Polygonaceae  | Reddish green  |
| Tartary buckwheat  | Fagopyrum tataricum L.  | Poaceae  | Green  |

**Conclusion**

In recent years, consumer awareness of and enthusiasm for microgreens' sensitive texture, distinctive fresh flavors, vibrant colors, and concentrated bio-active compounds—such as vitamins, minerals, antioxidants, etc.—as opposed to mature leafy greens, has grown. In the USA, in 1998, the term "microgreens" first appeared in writing. To grow microgreens, dozens of different vegetable varieties with a variety of flavors can be planted. These include mellow, spicy, acidic, earthy, nutty, and crisp. Basil, parsley, cilantro, radish, salad burnet, fennel, chervil, mustard, kale, collards, cabbage, carrot, beet, and other popular variations are some of the most popular types that may be seeded and harvested as microgreens.

The importance of this crop has been emphasized both in the context of rich nations and emerging nations. It may significantly contribute to the expansion of economies, the creation of new export markets, and, in the far future, national sustenance. Nevertheless, the so-called "wonder food" known as microgreens might be viewed as a strategic crop to add to the diet plan in rural or remote places where the majority of the population in developing nations is at risk of protein and energy deficiency. Microgreens, on the other hand, may be promoted as a very nutritious food, a superfood of the future, and a staple of the twenty-first century.

**Future Perspective of these microgreens**

The majority of microgreen analyses and studies are conducted at a comparably small scale and are confined to a small number of researchers with limited targeted locations. There is still a wide range of territory to be explored. Furthermore, while some microgreen types have been investigated and analyzed, many have not been commercialized. The effect of sunlight on microgreens development and nutrition has been well studied, however, the effect of low night temperatures on plant development, nutritional level, and food safety has not been investigated. Although prevention and treatment strategies for microgreens should be found since they are useful, preserving the quality and safety of microgreens remains a challenge.

Prevention and treatment strategies for microgreens should be developed since they are useful, but preserving the quality and safety of microgreens is still in its early phases. Although it has been demonstrated that post-harvest light treatments can boost the synthesis of bioactive components, this has not been well investigated for application to a wide range of microgreens. It is being debated if phytonutrient substances can provide intrinsic protection from quality and wellness concerns. Many post-cultivation therapies have been identified from time to time in order to maintain the quality and extend the life of microgreens. Washing and drying processes should be prioritized in the creation of ready-to-eat microgreen products. It is extremely important to conduct more and more research. It is also important to conduct further studies to ensure the safety and quality of this new contribution to healthy diets so that the food industry can address some of the issues that have posed obstacles to fully grown veggies.

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