

MICROGREENS: A MIRACLE FOOD WITH A TREASURE OF NUTRIENTS AND A NEW BEGINNING TOWARDS NUTRITION

Abstract

Microgreens are an emerging group of edible vegetables grown when the initial leaves are fully developed and just before the actual leaves appear. The concept is gaining popularity as a new culinary and food asset. They are used to enhance the flavor and nutritional content of raw vegetables or as edible garnishes for a variety of 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 micronutrients and antioxidants compared to fully grown vegetation (essential for health). This chapter aims to provide an overview of the nutritional information of microgreens and their benefits.

Keywords: Microgreens, biologically active compounds.

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I. INTRODUCTION

Food security and health have become serious problems in all countries, especially emerging countries, of the modern world. Due to continued changes in our ecosystem services and rapid climate change, there is considerable pressure on reliable food production to provide a healthy environment for human populations. World number is increasing. In the current situation, one in eight people is undernourished or chronically undernourished, and many are predisposed to diabetes, cardiovascular diseases, cancer, obesity, hypertension, stroke and other metabolic diseases, which have also reached epidemic proportions worldwide. Unbalanced food consumption patterns.

Food has played an important role in the development of human culture. Food provides calories and essential nutrients important for human growth, development, and survival. In addition to providing nutrition, food helps people in many cultures avoid and treat many health problems. The modern field of food science and nutrition reflects the evolution of humanity and the progress that has been made through the influx of knowledge from fields such as medicine, biology, and biochemistry.

In developing countries such as India, 13.5% of the population is chronically malnourished, with West Asia and sub-Saharan Africa being the most severely affected regions (Anonymous, 2015). Vegetables are often referred to as "protective foods" due to their nutritional and medicinal benefits and they are an important component of Indian agriculture when it comes to the nutritional security of the people. The lack of clean vegetables and no pesticides is gradually becoming a major concern for the vegetarian population of our country. From this perspective, it is necessary to consider a number of culinary traditions as well as the social value of culinary practices that have been lost over time. Functional foods have nutritional value compared to conventional diets and provide additional health benefits beyond basic nutritional functions.

Microgreens are a food that is gaining popularity these days. Microgreens offer an agricultural alternative for nutritional security as a new edible crop with great promise to fill various gaps (Pinto et al., 2015). More than 25 types of micro-vegetables are grown commercially around the world. They are about 4 to 6 times richer in nutrients than their adult equivalents (Xiao et al., 2012). Accordingly, microgreens can be classified as "functional foods," meaning they contain health-promoting or disease-preventing abilities.

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

II. WHAT ARE MICROGREENS?

Over the past 20 years, the growing consumer interest in nutritional foods has spurred interest in fresh foods, functional foods, and premium nutrition. Microgreens growers, extension professionals, and scientists can take advantage of upcoming opportunities for related products. Another special crop is microgreens, sometimes referred to as "paper flowers". Microgreens are described as delicate young greens grown from grains, vegetables, herbs, or wild plant forms. As gourmet cooking, healthy eating, and indoor gardening are increasingly popular in developed countries, microgreens are now well known there. Even

when refrigerated, this new food has a rather short shelf life and is only rarely used as a seasoning, toppings, or garnish.

A few days or weeks after germination, the microscopic shoots are harvested when the cotyledons form and the first true leaves appear. They are characterized by a wide range of colours, flavors and textures and are fresh and sweet vegetables grown from seeds of various varieties (herbal, edible and herbaceous) (Paradiso et al. events, 2018).

Microgreens are considered functional foods because, in addition to their nutritional benefits, they have higher concentrations of phenolics, antioxidants, minerals, and vitamins than those found in fully formed greens or seeds. It is widely recognized as an effective carrier of bioactive ingredients (Mir et al., 2017).

Microgreens are said to be highly biodegradable, but unfortunately, their commercialization is limited due to their rapid deterioration and relatively short shelf life, usually 3-5 days at room temperature. Therefore, improving post-harvest storage and packaging conditions becomes increasingly important during the extended practical shelf life as the demand for microgreens increases and, consequently, their appearance in farmers' markets. And specialty grocery stores also started (Mir et al., 2017).

Microgreens are considered seedlings or young green vegetables that are about 1-3 inches / 2.5-7.5cm tall, have an aromatic flavor and concentrated nutrient content, come in a variety of colours and textures, and are used as a nutritional supplement, visual enhancers, and flavor and texture enhancers. Micro plants should be harvested 7-21 days after germination, as soon as the cotyledons have developed, and possibly with a set of true leaves.

They should not be confused with sprouts without leaves because they are located between the sprouts and young greens. Since their stems and leaves are considered edible, microgreens are comparable to young shoots; However, because their stems and leaves are considered edible ingredients, microgreens look more like young shoots than regular green leaves. However, unlike young shoots, they are much smaller and can be sold before harvest. Microgreens can be grown in many locations, including outdoors, in greenhouses, and even on our windowsills, making them incredibly convenient to grow.

Microgreens can give dishes sweet or spicy flavors. They are currently being considered by high-end supermarkets as a green variety especially suitable for decorating salads, soups, sandwiches, and plates. They can also be used as the main vegetable in some dishes for strong flavours and nutrients.

III. VARIETIES OF MICROGREENS

Since the availability and consumption of microgreens are strongly influenced by emerging culinary trends, species selection depends on producer discussions with chefs and consumer cultural uptake. Consumers for their unique sensory qualities. Microgreens can be distributed as freshly chopped food as well as while growing on racks for end-user harvesting.

The most exploited species are those belonging to the cabbage family, the Asteraceae family, the Chenopodiaceae family, the lily family, the Canopyaceae family, the Amaryllidaceae family, the Amaranth family, and the Cucurbit family. Fully variable levels of bioactive require a variety of genotypes with regard to taste and health desires. Bioactive substances are noticed in foods with a rather harsh taste (eg, cruciferous vegetables) (Xiao, Lester, et al., 2012).

Different types of microgreens

Many types of seeds can be used to grow microgreens. The following plant families give rise to the most common varieties:

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

Sometimes legumes such as chickpeas, beans, and lentils as well as grains such as rice, oats, wheat, corn, and barley are produced as microgreens. Depending on the type of green plant, microgreens can have flavors ranging from sweet to spicy, sour, or even bitter. Basically, their flavors aim to be bold and concentrated (View & Club, 2019).

IV. MICROGREENS ARE NUTRITIOUS AND ITS HEALTH BENEFITS

Green vegetable consumption is associated with a reduced risk of many diseases because microgreens contain significant amounts of vitamins, minerals, and beneficial phytochemicals. Microgreens are also endowed with essential elements that keep us healthy. The presence of bioactive compounds makes them more nutritious.

1. Microgreens provide many healthy nutrients; most types often contain a lot of potassium, iron, zinc, magnesium, copper, etc.
2. They are an excellent source of antioxidants and other healthy plant elements, like polyphenols.
3. Compared to the same number of ripe green vegetables, they usually have more vitamins and minerals.
4. According to research, microgreens can have up to 9 times more nutrients than mature greens.

1. **Bioactive components:** Red cabbage (*Brassica oleracea* L. var. *Capitata*), sorrel (*Rumex acetosa* L.), watercress (*Lepidium binaries* L.), and some varieties of amaranth (*Amaranthus hypochondriacus* L.) and coriander (*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 phyloquinone are on the list of substances with scientifically proven biological activity in humans.

2. **Nutritional details:** Microgreens contain many nutrients. Many cultivars have high concentrations of K, Fe, Zn, Mg, and Cu, although differences in concentrations may occur (Xiao et al., 2016). Microgreens are a source of important phytochemicals, such as antioxidants (Xiao et al., 2012). Furthermore, they have concentrated nutritional value, which means they contain more vitamins, minerals, and antioxidants per serving than the same amount of ripe green vegetables (Xiao et al., 2012).

According to studies, the nutrients in microgreens can be up to 9 times higher than the nutrients in mature greens (Pinto et al., 2015). Red cabbage, cilantro, amaranth garnet, and daikon radish have the highest levels of ascorbic acid, carotenoids, phyloquinone, and tocopherols, respectively. Microgreens contain significantly more bioactive than database values for mature plant counterparts (Xiao et al., 2012).

One study found that 25 commercially available microbial greens contain high levels of vitamins and antioxidants. Vitamin and antioxidant levels differ from those recorded for mature leafy vegetables in the USDA National Nutrient Database, and it is estimated that amounts found in microgreens can be up to 40 times higher (Xiao et al., 2012).

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

1. **Heart disease:** Polyphenols, a family of antioxidants linked to a reduced risk of heart disease, are abundant in microgreens. They can also lower levels of "bad" LDL cholesterol and triglycerides.
2. **Alzheimer's disease:** Eating foods rich in polyphenols and other antioxidants may reduce the risk of developing Alzheimer's disease.
3. **Diabetes:** Antioxidants can help reduce the type of stress that can prevent sugar from entering cells properly.
4. **Specific cancers:** Polyphenol-rich microgreens may be beneficial for some cancer patients.

V. SOME CHALLENGES OF MICROGREENS

1. **Weak and thin:** Microgreens can become weak and thin if not given enough light, unlike mature foundations.
2. **Overcrowding:** Too much seeding can cause wetting, although this can be easily remedied by treating the medium with Trichoderma.
3. **Inappropriate planting time:** Some sprouts cannot germinate at extremely high or low temperatures.
4. **Overheating:** Overcooking seeds can cause seeds to die.

VI. LIST OF MICROGREENS

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

VII. CONCLUSION

In recent years, consumer awareness and enthusiasm for microgreens' sensitive textures, distinctive fresh flavors, vibrant colors, and concentrated bioactive compounds - such as vitamins, minerals, antioxidants, etc. - in contrast to ripe, raised green leaves. In the United States, in 1998, the term "microgreens" first appeared in the text. To grow microgreens, dozens of different types of vegetables with different flavors can be grown. These include mellow, spicy, sour, earthy, nutty, and crunchy. Basil, parsley, cilantro, radish, parsley, dill, chervil, mustard, kale, cabbage, carrots, beets, and other popular variations are among them. Common varieties can be sown and harvested as microgreens.

The importance of this culture has been emphasized both in the context of rich and emerging nations. It can significantly contribute to the expansion of the economy, the creation of new export markets, and, in the distant future, the national food supply. However, the so-called "miracle food" called microgreens can be considered as a strategic crop to add to the diet in rural or remote areas where the majority of the population. In developing countries, there is a risk of protein and energy deficiency. On the other hand, microgreens can be promoted as a nutrient-dense food, a superfood of the future, and a staple of the 21st century.

VIII. FUTURE PERSPECTIVE OF THESE MICROGREENS

The majority of microgreens analyses and studies were performed on a relatively small scale and limited to a small number of researchers with limited targeted sites. There are still a bunch of territories to explore. Additionally, while several types of microgreens have been studied and analyzed, many have yet to be commercialized. The effects of sunlight on the growth and nutrition of microgreens have been well studied, however, the effects of low night temperatures on plant growth, nutrient levels, and security food have not been studied yet. Although strategies to prevent and treat microgreens must be found as they are useful, preserving the quality and safety of microgreens remains a challenge.

Strategies for the prevention and treatment of microgreens need to be developed because they are so useful, but preserving the quality and safety of microgreens is a stub. Although postharvest light treatments have been shown to stimulate the synthesis of bioactive compounds, this has not been well studied to apply to many types of microgreens. There are questions about whether phytonutrients can provide intrinsic protection against health and quality problems. Many post-crop therapies have been identified over time to maintain the quality and prolong the shelf life of microgreens. Washing and drying processes should be prioritized in the creation of ready-to-eat microbial products. It is extremely important to conduct more and more research. It is 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 raised roadblocks. for mature vegetables.

REFERENCES

- [1] Anonymous. (2015). Indian Horticulture Database, National Horticulture Board, Ministry of Agriculture, GoI, Gurgaon, India.
- [2] Mir, S. A., Shah, M. A. and Mir, M. M. 2017. Microgreens: Production, shelf life, and bioactive components. *Critical Reviews in Food Science and Nutrition*. 57(12): 2730–2736.
- [3] Paradiso, V. M., Castellino, M., Renna, M., Gattullo, C. E., Calasso, M., Terzano, R., Allegretta, I., Leoni, B., Caponio, F. and Santamaria, P. 2018. Nutritional characterization and shelf-life of packaged microgreens. *Food and Function*. 9(11) : 5629–5640.
- [4] Pinto, E., Almeida, A. A., Aguiar, A. A. and Ferreira, I. M. P. L. V. O. 2015. Comparison between the mineral profile and nitrate content of microgreens and mature lettuces. *Journal of Food Composition and Analysis*. 37(3): 38–43.
- [5] View, M., and Club, G. 2019. *Microgreens What Will We Cover?*
- [6] Xiao, Z., Codling, E. E., Luo, Y., Nou, X., Lester, G. E. and Wang, Q. 2016. Microgreens of Brassicaceae: Mineral composition and content of 30 varieties. *Journal of Food Composition and Analysis*. 49: 87–93.
- [7] Xiao, Z., Lester, G. E., Luo, Y. and 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.