



Microgreens: A Sustainable Path to Nutritional Security

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Global concerns over food insecurity, malnutrition and accelerating urbanization have highlighted the need for innovative, nutrient-rich food sources. Microgreens are young, tender greens harvested at the cotyledon or first true leaf stage-have emerged as a promising next-generation superfood. They are exceptionally rich in essential nutrients, including vitamins C, E and K, beta-carotene, minerals and polyphenols-often in significantly higher concentrations than those found in mature plants. Their short growth cycle (7–21 days), minimal space and input requirements and adaptability to soilless and vertical farming systems make them ideal for sustainable urban agriculture and home cultivation. In addition, their potential to improve dietary diversity and address micronutrient deficiencies positions them as a valuable tool for strengthening nutrition security across both developed and developing regions.

Introduction

Nutrition security, which ensures consistent access to adequate nutrition for optimal health, remains a major global challenge. The growing demand for nutrient-dense food, particularly in urban and resource-constrained settings, has intensified the search for sustainable and innovative solutions. In this context, microgreens- the young, edible seedlings of vegetables and herbs harvested within 7 to 21 days after germination have gained attention as next-generation superfoods. Despite their small size, microgreens are rich in vitamins, minerals, antioxidants and bioactive compounds, often surpassing the nutrient content of their mature counterparts (Xiao et al., 2012). Their ease of cultivation, short growth cycle, minimal resource requirements and adaptability to urban and indoor farming systems make them ideal for promoting food and nutrition security. As climate change and urbanization continue to threaten traditional agriculture, microgreens provide a promising pathway toward more resilient, sustainable, and health-oriented food systems.

Broader Perspectives of Microgreens

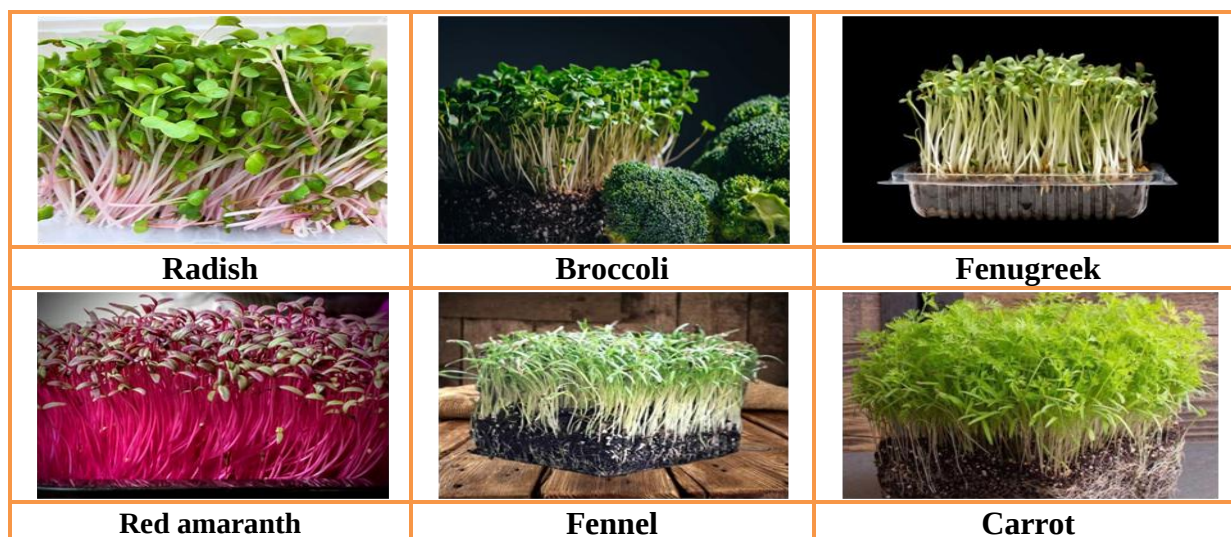
- 1. Nutritional Profile and Health Benefits:** Microgreens have been reported to contain significantly higher levels of ascorbic acid, tocopherols, phyloquinone and carotenoids compared to mature leaves (Xiao et al., 2012; Choe et al., 2020). Their rich phytochemical content contributes to antioxidant, anti-inflammatory and potential anticancer properties (Kyriacou et al., 2016).
- 2. Varieties of Microgreens:** Popular microgreens include broccoli, radish, kale, red cabbage, amaranth, mustard and basil. Each species offers a distinct nutritional and phytochemical profile. For instance, red cabbage microgreens contain high concentrations of vitamin C and carotenoids (Xiao et al., 2012).
- 3. Cultivation Methods and Sustainability:** Microgreens are typically grown hydroponically or in soil-based systems using minimal water and space. Their cultivation

does not rely on pesticides and can be accomplished in urban settings, rooftops, or even small indoor spaces (Pinto et al., 2015). This makes them a highly sustainable crop suitable for urban agriculture and vertical farming systems.

4. **Economic Potential and Urban Farming:** The rapid turnover rate of microgreens and their increasing market demand provide income opportunities for small-scale farmers, urban dwellers, and startups. Their low production costs and premium market value make them economically viable (Treadwell et al., 2010).
5. **Role in Combating Malnutrition:** Microgreens can be incorporated into local diets to enhance micronutrient intake, particularly in regions affected by “hidden hunger”—the lack of essential vitamins and minerals (FAO, 2021). They are especially valuable in addressing vitamin A, C and iron deficiencies.

Important Vegetables Grown as Microgreens

Family	Microgreens	Key Nutrients/Benefits
Brassicaceae (Mustard Family)	Broccoli (<i>Brassica oleracea</i>)	High in sulforaphane, vitamin C, and antioxidants.
	Red Cabbage (<i>Brassica oleracea</i> var. <i>capitata</i>)	Rich in anthocyanins and vitamin K.
	Radish (<i>Raphanus sativus</i>)	Spicy flavor, high in vitamin E and C.
	Kale (<i>Brassica oleracea</i> var. <i>sabellica</i>)	Rich in carotenoids, vitamin K, and calcium.
	Mustard Greens (<i>Brassica juncea</i>)	Pungent taste, rich in glucosinolates and iron.
Amaranthaceae (Amaranth Family)	Amaranth (<i>Amaranthus spp</i>)	Bright red/purple leaves, high in vitamin C and antioxidants.
	Beet (<i>Beta vulgaris</i>)	Earthy flavor, high in betalains and folate.
	Swiss Chard (<i>Beta vulgaris</i> subsp. <i>cicla</i>)	Nutritious and colorful, rich in vitamins A and K.
Fabaceae (Legume Family)	Pea Shoots (<i>Pisum sativum</i>)	Mild, sweet flavor; rich in folate and protein.
	Fenugreek (<i>Trigonella foenum-graecum</i>)	Spicy taste; used in Indian cuisine; rich in iron.
	Lentil (<i>Lens culinaris</i>)	High in protein, iron, and fiber.
Apiaceae (Carrot Family)	Cilantro/Coriander (<i>Coriandrum sativum</i>)	Citrusy flavor; high in vitamin C and potassium.
	Carrot (<i>Daucus carota</i>)	Mild, sweet flavor; contains beta-carotene.
	Fennel (<i>Foeniculum vulgare</i>)	Anise-flavored; rich in antioxidants and fiber.
Asteraceae (Daisy Family)	Lettuce (<i>Lactuca sativa</i>)	Delicate texture; rich in folate and vitamin A.
	Chicory (<i>Cichorium intybus</i>)	Bitter greens; known for liver support and antioxidants.
Lamiaceae (Mint Family)	Basil (<i>Ocimum basilicum</i>)	Aromatic; high in vitamin K and essential oils.
	Mint (<i>Mentha spp.</i>)	Refreshing flavor; antioxidant-rich.



Key Characteristics of Microgreen Vegetables

Characteristic	Description
Growth Time	7–21 days after germination
Harvest Stage	Cotyledon or first true leaves
Growing Mediums	Soil, hydroponic mats, coco coir
Nutritional Value	High in vitamins, minerals, antioxidants
Popular Use	Salads, smoothies, garnishes, sandwiches

Conclusion

Microgreens offer a compelling solution to the multifaceted challenge of nutrition security. Their exceptional nutrient density, ease of cultivation, and adaptability to diverse environments make them ideal for enhancing food systems, especially in urban and climate-vulnerable regions. As a sustainable, high-value crop, microgreens hold the potential to reduce micronutrient deficiencies, support urban agriculture, and empower communities through decentralized food production. Integrating microgreens into global nutrition and agricultural policies, alongside research and education, can significantly contribute to health and food sustainability goals. With their unique combination of health, environmental, and economic benefits, microgreens truly represent the next-generation superfood for a secure nutritional future.

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