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MICROGREENS: A GENERAL REVIEW

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Abstract - *Microgreens are a unique variety of palatable vegetables, from business sectors and top of the line cafés, that have picked up fame as another culinary practice in the course of recent years. Microgreens are delicate youthful greens created from the seeds of vegetables and spices, having two fully developed cotyledon leaves with or without the development of a simple pair of first obvious leaves. They are popular amongst health-conscious consumers and chefs that use microgreens as colorful and flavorful garnishes. An increasing number of recent studies attest to the health benefits of microgreens due to their high density of vitamins and nutrients. A broad range of aspects such as materials/methods used to grow these greens, nutritional comparison of greens with sprouts as well as their matured parts, and their future challenges are mentioned in this article.*

Key Words: Nutritional Comparison, Health- benefits, future challenges.

1. INTRODUCTION

The major difference between sprouts, baby greens, and microgreens is harvest time. Baby greens are generally harvested at 2–4 in. for 15–40 days, while microgreens are harvested right after their youngest leaves appear. In the case of sprouts, the harvest time is earlier than microgreens[1] (Choe et al., 2018). Due to its good content in micronutrients and bioactive compounds, microgreens have been identified as "superfoods", and are recommended by highly demanding consumers, such as raw foodists, vegetarians, and vegans. They are also indicated for growing in urban and peri-urban settings and have been proposed even as a component of space life support systems[2](Paradiso et al., 2018).

Some plants of microgreens germinate easily and grow rapidly. These include cabbage, beetroot, kale, kohlrabi, mizuna, mustard, seedling, swiss chard and amaranth. Soaking the seeds before sowing, like beets, helps to facilitate germination. As many as 80–100 crops and crop varieties have reportedly been used as microgreens. Others that have been used include carrot, cress, arugula, basil, onion, chive, broccoli, fennel, lemongrass, popcorn, buckwheat, spinach, sweet pea, and celery[3](UF/IFAS et al., 2016). Although small in size, microgreens can offer a wide range of vibrant flavors, bright colors, and tender textures. Therefore, microgreens can be served as a new ingredient in a salad, soups, and sandwiches, enhancing their color, texture, and/or flavor, and also can be used as an edible garnish to brighten up a wide variety of main dishes[4]. (Xiao et al., 2012).

2. MATERIALS/METHODS

Seeds - Seeds are demanded in large quantity and represent a major cost for the production of quality microgreens. Seeds should receive precautionary sanitary treatments for eliminating pathogenic bacteria[5].(Di Gioia & Santamaria, 2015)
Farmers usually determine which variety to grow based on the texture, colour, flavour of the microgreen. Single microgreen varieties or mixtures of multiple varieties. Commonly cultivated microgreens include radish, spinach, beets, broccoli, peas, and red cabbage[6].(Grooms, 2020)

Trays - Microgreens are usually planted in shallow plastic seed trays, either with or without suction holes depending on whether or not the microgreens are grown in or out of the soil. A commonly used tray is a 10x10" or 10x20" plastic nursery tray with a depth of 1-2.5 inches[6].(Grooms, 2020)

Growing Media- Microgreens can be grown in a standard, sterile, loose, soilless germinating media[3].(UF/IFAS et al., 2016). Growing media should have a pH of 5.5-6.5, low electrical conductivity (<500 µS/cm)and optimal water holding capacity(55-70% v/v) and aeration (20-30% v/v)[7](Kyriacou et al., 2016)

Other External Factors – Light, Temperature, Water.

Light emitting diodes (LEDs) are, to date, one of the most promising energy – efficient and rapidly developing plant lighting technologies. Combinations of red, blue and far red LED light wavelengths are reported to be efficient for microgreens[8].(Samuoliene et al., 2013). Optimal management of light intensity may enhance photosynthetic activity and

phytochemical content in vegetables, whereas excessive irradiance can provoke photodamage with detrimental effects on plant growth and product quality[9](Bian et al., 2015).

The commercial production of microgreens is usually done under a controlled environment, within seedlings or high-rise corridors provided with simple or advanced technology, depending on the size of the farm and mild or favourable weather conditions, using groundless growing systems that can be caused by three types: -Growing microgreens in "containers," constituted by plastic trays having different sizes, with height variable from 3 to 5 cm.

The second way is to grow microgreens in "channels" or on benches (made of plastic, aluminium, galvanized iron, wood) of various sizes, by placing growing media right inside the stations or on channels. A third growing system, quite simple but less common at commercial level, is the "floating system"[10].(Renna et al., 2017)

Table -1: COMPARISON BETWEEN THE NUTRITIONAL VALUE OF EDIBLE MICROGREENS WITH THEIR MATURED PARTS

1. MICROGREENS V/S SPROUTS

MICROGREEN	SPROUTS	
They can be grown hydroponically or in soil ,they are mostly grown in flat trays .They require good amount of moisture .Most of the greens also grow under artificial lighting system(LED),They can also be grown in natural light.	They don't need light or air ventilation and can be grown even as hydroponics.	
Harvesting Period: 7 to 14 days	Harvesting Period: 3 to 5 days	
Microgreens are distinguished with their unique colour, texture and flavour. They are harvested at their first true leaf stage.	Sprouts are generally consumed as whole and the risk of contamination is also high.	
Value is lower in greens.	Value is higher in sprouts.	Fe and Zn Content in Amaranth (Ebert et al., 2014)
More in greens.	Lesser in sprouts.	Caffeic Acid
More in greens (few exceptions are there)	Lesser in sprouts.	Antioxidant Activity

2. MICROGREENS V/S MATURED PARTS

MICROGREENS	MATURED PARTS	NUTRITIONAL VALUE
Value is higher in microgreens.	Lower in their corresponding matured parts.	Phylloquinone (Vitamin K1)
Microgreens have higher concentrations of ascorbic acid.	They have lower concentrations.	Ascorbic Acid Concentration
Almost the majority of greens possessed higher concentration values or some equal concentration.	The matured parts (matured leaf spinach) possessed lower concentration.	Violoxanthin

Higher concentration	Lesser concentration levels.	β-carotenoids
Lesser content was found in microgreens.	Higher in Vegetables.	Sugar Content
Red cabbage microgreens contained over 40 times the vitamin E content of its mature counterpart.(Xiao et al., 2012)	Vitamin E	

3. CHALLENGES

The growing demand for "superfoods" like microgreens can be a good opportunity for the Indian food industry. By creating special categories for greens, more people become aware of microgreens. Microgreens have a high price market and reliable customer segment (culinary and fancy restaurants) and, its high price market is a result of expensive production costs and challenges to keep them contamination-free during all stages, starting from media preparation to proper packaging. Contamination is no more a challenge because of modern technology, however that also amounts to its expense. On the other hand, microgreens low yield, rapid senescence, and very short shelf-life curbs the expansion of their commercial production[12,13].(Chandra et al., 2012)(Kou et al., 2013)

The COVID pandemic is actively impacting supply chains across industries. Restaurants have experienced closures or substantial drop-offs in demand, and lots of farms have adapted their business to undertake to remain afloat. Food safety, accessibility, and quality is usually the topic of public policy and political discussion due to the role it plays in public health.. Most microgreen production is currently domestic and the 2020 pandemic is expected to decelerate demand growth for organic crops due to a decline in discretionary spending[6].(Grooms, 2020)

4. CONCLUSIONS

Through this study, we conclude that the concentrations of vitamins and other minerals, carotenoids are higher in microgreens than their fully matured counterparts. We can also consider them as a new, promising food source and we can incorporate them in our daily diet as they are highly nutritious.

Microgreens ought to be gathered at the principal genuine leaf phase of plant development when seedlings are around 2 inches tall. Collecting is generally the most tedious segment of microgreen production. Microgreens are exceptionally transitory, so they ought to be taken care of with most extreme consideration following reaping. Collected microgreens are best put away in plastic compartments that shield greens from being harmed. Microgreens are entirely transient. Whenever refrigerated and avoided direct light, microgreens commonly last for 5-7 days after harvest. It is hence imperative to design production appropriately. Microgreens are an arising class of claim to fame crops that have increased expanding consideration in the most recent decade for both their dietary and organoleptic attributes. The sorts of yields that are chosen for production and deal as microgreens have an incentive regarding color (like red or purple), texture, or flavors. Indeed, microgreens are regularly promoted as strength blends, for example, "sweet," "mellow," "brilliant," or "hot."

Developing microgreens can give networks expanded food security and empower independence in homes. Microgreens are brilliant yields for urban farming in little spaces, as they can be filled in practically any climate with negligible supplies. Urban farming of microgreens gives monetary occasion to home producers that can create benefit from a little zone in their homes with negligible forthright expenses. Microgreens can be created rapidly and are right now encountering developing interest from customers that now like never before are looking for nearby, supportable hotspots for food.

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