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Microgreens: The Ultimate Superfood for a Healthy Diet

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Microgreens are high value tiny edible greens with tender cotyledonary leaves obtained from vegetables and herbs. These are smart food products of novel generation which imparts innumerable health benefits. They can be grown in the urban society as they require less space to grow and has become a vital culinary component owing to its higher composition of vitamins and mineral content accompanied by innumerable bioactive and phytochemical compounds as compared with the mature plant. They are rich in vitamins, minerals like (copper, zinc etc) antioxidants, phytochemicals, carotenoids, phenolic compounds and other substances. They are not nutrient exhaustive and can be grown easily throughout the year.

What are microgreens?

Microgreens are tiny young seedlings of vegetables and herbs are harvested when the cotyledonary leaves (seed leaves) are completely expanded and the first pair of the true leaves are emerging and are partially expanded. The size of the microgreens ranges from 1 to 3 inches (2.5 to 7.6 cm) in height which occurs within 7 to 14 days after germination which varies from crop, variety and environmental conditions. The three basic parts of microgreens are: a central stem, two cotyledonary leaves and the first pair of very young leaves (Riggio *et al*., 2019). Microgreens are found in various textures, colours, taste buds, and morphology. They are harvested in the tender leaf stage after few days of germination during the formation of the cotyledonary leaves. As they are highly perishable in nature therefore the commercialization is very less. (Paradiso *et al*., 2018). It differs from sprouts. Sprouts are germinated seeds that are consumed with the embryonic root and seeds. Microgreens are smaller than baby greens and it lies between sprouting and baby greens. It is also called vegetable confetti.

Fig 1. Microgreens

Varieties of Microgreens

Microgreens can be grown from several seeds. The seeds are harvested from different plants which are associated with below mentioned families (View and Club, 2019).

- Asteraceae family: Lettuce, radicchio, endive and chicory.
- Apiaceae family: Carrot, dill, celery and fennel
- Amaryllidaceae family: Onion, leek and garlic
- Amaranthaceae family: Amaranthus, beet, spinach, quinoa and swiss chard

- Brassicaceae family: Broccoli, cauliflower, cabbage and radish
- Cucurbitaceous family: cucumber, squash and melon

Legumes like chickpea, lentils, beans and cereal grains like oats, rice, wheat, corn and barley are also being cultivated sometimes. Microgreens can differ by its taste like sourness, bitterness or may be sweetness considering the type of microgreen, so the flavour is highly concentrated. They are also juicy and crunchy and viability is more as well as they are economical.

Fig 2. Types of microgreens

Conditions required for growth of the microgreens

We should intake them in our daily diet which provide nourishment and having various sustenance. They can be easily cultivated commercially and in small margins basis so that's why they are being grown in the urban regions they can be easily cultivated due to their short period of growth with simple growing methods less soil requirement artificial light can be given. Below mentioned are few factors which ae required to grow them.

- **Seed treatment**: Seeds must be of good quality, high germination capacity and should be viable. (Lee *et al*., 2004) investigated that different seed treatment is required to grow beet and chard microgreen. There are different types of seeds and different kinds of treatments like seed priming & matric priming.
- **Seed priming**: In this process the seeds are soaked in sodium hypochlorite, water, hydrochloric acid and hydrogen peroxide can be used.
- **Matric priming**: The germination of seed taken place in vermiculite at 12^0C for 6 days.

From the above both methods it was found that matric priming can be used for more germination percentage.

- **Light**: The light requirements for different species and varieties differ in their wavelengthand intensities. The wavelength of red to blue light (445 nm) and far to red light (730 nm) has increased the photosynthetic pigment and thecarotenoids levelcarotenoid. An optimum photosynthetic phyton flux (PPF) is required and the fluctuations of PPF may affect the antioxidants in the microgreens and their biomass concentrations.

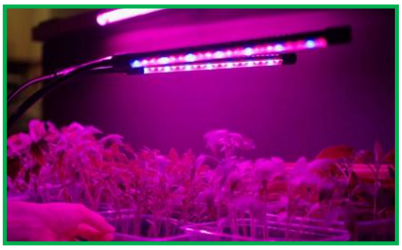

Fig.3. LED lights

- **Growing media**: As microgreens can be grown in less amount of soil or in soilless so we can use substrates like vermiculite, perlite, peat, hemp mats, coconut coir dust and many more has enhanced the growth of the microgreens. Occasionally water and few essential major nutrients are added.

Fig.4.Growing media

- **Pathogen treatment and harvesting :** There are many kinds of infections which can be caused by thepathogensdue to the artificial raising of the microgreens. Some control measures are using *Trichoderma* sp. to control the infection of the pathogen by using biocontrol agents. Microgreens are harvested at 7 to 14 days after germination (tropical)

Fig.5 Harvesting of microgreens

and 14 to 28 days (temperate) depending on crop. Microgreens along with the stem and attached seed leaves can be cut with the help of scissors.

- **Post harvest and packaging**: Microgreens are refrigerated at 3-^{50}C for 7 to 8 days. They can be kept in the polythene bags to avoid any type of contamination or else clam shell containers can also be used. They should be kept in sterile environment also to increase their storage as they are highly perishable (Danielle *et al*., 2010).
- **Business and entrepreneurship**: Due to low start-up costs, quick turn around time, year-round growing, higher nutrition and high valuation, microgreens can be grown as a good startup option and likely to have a good profit.

Fig.6 Packaging

Conclusion

There is abundant source of nutrition available in the microgreens like they contain various micro and macro nutrients like Fe, Mo, Zn, K, Ca, N, P etc. Some are essential nutrients are also present in them which our body do not usually synthesize by its own. Microgreens of same family of Brassicaceae have different molar ratios of broccoli, cauliflower, broccoli (Renna and Paradiso *et al.*, 2020) They also contain few bioactive compounds like phenolic antioxidants, ascorbic acids carotenoids etc are present in different amount in various microgreens. Some secondary metabolites like phenolic antioxidants are present in these tender leaves. Antioxidant property are related to colour, taste and flavours also 10.71-11.8 mg/g phenolic component is present in broccoli. Which 10 times more than mature sprouts (Gao *et al.*, 2021). Anthocyanins are the compounds which are present in the plant which produces different colours like blue, purple, and red pigments responsible for anti-inflammatory, anti-cancer and anti-viral properties. The microgreens would be administrated in the upcoming days microgreens to the people who face nutritional deficiency.

Table 1. Nutrient composition of 6 microgreens:

Microgreens	Total sugar (g/100g)	Water content (%)	Ascorbate mg/100g)	Phylloquinone (mcg/g)	Total phenol (mg /100g)	Tocopherol (mg/100g)
Beet	0.44 ± 0.03	95.1± 0.2	13.2±1.9	2.1±0.4	303.0±9.8	0.1±0.0
Radish	1.03±0.17	92.1±0.5	68.0±3.6	3.2±0.6	465.5±15.9	0.5±0.0
Mustard	0.77±0.06	94.3±0.0	58.9±0.8	3.2±0.7	149.5±3.9	0.5±0.0
Opal basil	0.20±0.02	94.3±0.2	10.6±0.5	4.0±0.7	700.4±9.7	0.2±0.0
peppercress	0.88±0.11	93.8±0.1	46.0±2.1	2.9±0.7	274.7±20.1	0.3±0.0
Red Amaranth	0.17±0.00	93.5±0.2	35.8±2.7	2.3±0.4	256.5±12.0	0.2±0.0

Source: Xioa *et al*., 2013

Table 2. Proximate composition of 6 different genotypes of microgreens:

Microgreens	Dry Matter (g/100g)	Lipids (g/100g)	Protein (g/100g)	Fibre (g/100g)	Glucose (g/100g)	Fructose (g/100g)	Sucrose (g/100g0	Ash (g/100g)
Chicory	6.4	0.3	1.9	0.62	0.11	0.14	0.19	0.9
Lettuce	5.2	0.3	2.6	0.43	0.03	0.05	0.12	1.0
Broccoli	6.8	0.4	3.0	0.36	0.17	0.03	0.38	1.2

Source: Xhang *et al*., 2014

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