

Article Id
AL04402

MICROGREENS- FOOD FOR HEALTHY LIVING

Email

¹Subham Chakraborty* and ¹Ashim Kumar Dolai

subhame2994@gmail.com

¹Department of Agronomy, Institute of Agricultural Science,
University of Calcutta, 51/2, Hazra Road, Kol-700019, India

Microgreens are house of phytonutrients for which it is gaining popularity worldwide and its richness in flavour makes it a favourite choice for various culinary item preparations. The short duration of microgreens is attracting people of urban and peri-urban areas to grow microgreens as they are suitable both in indoor and outdoor condition with no use of chemical nutrients and pesticide. The main constraint is its short shelf-life which require to be solved and certain post-harvest options are also researched with excellent result which just needs to reach among the microgreen cultivators for better production and quality control.

By the end of 20th century and beginning of 21st century is marked with rapid urbanization, industrialization and globalization, the social lifestyle of humans has changed a lot which led to introduction of different health issues that needs to be look after. Now-a-days humans require easy source of nutrients which is readily available for consumption. But availability of chemical free agricultural produce is very rare and limited to some corners of the world where organic farming/natural farming has established fully. During 2023, about 735 million people were recorded to be malnourished and 29% children below age five were found to be stunting or wasting (Cohen, 2023). Such situation is due to lack of knowledge about food and nutrition, poverty, limited access or low availability of healthy food and improper diet planning. Food rich in different minerals, antioxidants like microgreens can be good option to overcome the problem of various non-communicable and communicable diseases by improving immunity of human body. Microgreens are immature edible green plant parts which are harvested when cotyledonary leaves are fully expanded and first pair of true leaves are emerging or partially expanded with a height of 1-3 inches and harvest 7 to 14 days after germination. It can be called as super food as they are packed with nutrients five times more than those mature form. They are highly suited for preparation of salads,

sandwiches, soups and other attractive culinary items for their availability in short time, unique flavours, appealing hues and fine textures and act as good alternative than sprouts as they are rich in more nutritional content (Pratap *et al.*, 2023 a). Commonly grown microgreen includes lettuce, cauliflower, cabbage, broccoli, kale, brussel sprouts, fenugreek, buckwheat, carrot, celery, mint, basil etc. The term microgreen is coined by 'Craig Hartman' in the year 1992 and was not known before 1980s. There is a distinctive difference between microgreens, baby greens, sprouts and veggies. Babygreen are harvested from 20-40 days after sowing while sprouts are picked before microgreen and are eaten with embryonic seeds and roots. Microgreens are smaller than babygreen and their status can be considered between sprouts and babygreens (Yadav, 2021 a). The popularity of microgreen is increasing day by day due to its potentiality to tackle malnutrition and its richness in flavour and aroma to be used in food items preparation also they are termed as vegetable confetti.

Nutritional Value

Microgreens are rich in vitamins and minerals than most mature vegetables and herbs. Vitamins like A, C, E and K, various enzymes and carotenoids are in high concentration than matured ones. The content of α carotenoids, β carotenoids, violaxanthin, lutein, and neoxanthin in comparison to sprouts. They are also rich in Fe, K, Zn, Mg and Cu. Plants of *Brassica* genus as microgreens are good source of phenols. The vegetables of brassica family are rich in selenium, copper, cobalt and zinc. Lettuce microgreens have the highest antioxidant and total phenolic concentration compared with mature plants when harvested 7 days after sowing. Spinach leaves as microgreens have good amount of phytonutrients and carotenoids (Koley *et al.*, 2016 a). The concentrations of carotenoids, phyloquinone, ascorbic acids and tocopherols in red cabbage, cilantro, Amaranthus and daikon radish microgreens respectively are significantly higher than their mature form (Xiao *et al.*, 2012). Xiao *et al.*, 2015 found that china rose, opal basil, red amaranth Studies have also shown that the nutrient concentration in microgreens depends on their types, cultivation medium, quantity of sunlight, temperature and harvesting period.

Growing Criteria for Microgreens

- They can be grown on pots, containers, baskets, plug-trays with soil or other media like cocopeat, wood fiber, vermicompost, perlite, vermiculite etc. which are to be sterilized properly to avoid fungal diseases. Plastic trays used are of 30 x 24 x 7 cm size in which 4-5 cm thick layer is made with 500 gm required mixture. Cocopeat

offers best suited option for microgreen cultivation due to its good moisture retention. Cocopeat, perlite and vermiculite in the ratio of 5:2:1 recommended for microgreen farming because this media release nutrients for micro-plant growth slowly and so the same media is re-usable several times (Koley *et al.*, 2016 b).

- Proper seed selection ensuring quick and healthy germinating seeds with high nutritional value is must. Seed treatment is avoided.
- Seed density of 50g-60g m⁻² for basil, argula; 60g-70g m⁻² for red cabbage, broccoli, raddish and mustard; 100g-120g m⁻² for sunflower, peas and corn are recommended, small sized seeds are sown at a distance of 2.0-2.5 cm apart and large size seeds require in rows at 3 cm spacing (Partap *et al.*, 2023 b).
- Vegetable seeds require to be soaked in water for 4-24 hours based on crops and hardness of seed coat, thickness and texture. 6-8 to 10-12 seeds per square inch must be the seed density and those seeds are to be covered with thin film of well decomposed FYM or vermicompost. (Nayak *et al.*, 2023 a).
- The optimum temperature ideal for microgreen is 18-24° C., with 60% humidity and quality of light affects growth, flavor, antioxidant properties and other physiological and bio-chemical properties of microgreen especially LED light (blue and red LED light). (Partap *et al.*, 2023 c). Light intensity of 12000-16000 LUX is optimum.
- The container of microgreens must be in room temperature and in dry condition and it is necessary to ensure that the seedlings get 3-4 hours of sunlight and carefully watering twice to maintain proper moisture. No nutrients are required. Watering is done depending upon requirement which can be followed by misting.
- Microgreens are harvested within 2 to 3 weeks after germination which also depends on environmental factors. They are cut with stems and attached leaves through scissors or sharp knives maintaining proper hygiene and timely harvesting is essential to obtain best quality microgreens.

After the harvest of microgreens, those have a high respiration rate which shortens its shelf life from 3 to 5 days at ambient temperature (Chandra *et al.*, 2012; Mir, Shah and Mir 2017). They can be kept fresh upto 14 days which depends on cultivar and storage conditions. Due to its short shelf life, for transportation clamshell containers are used. Low temperature

packaging is best suited to increase shelf-life by slowing down respiration or metabolic rates. Microgreens also had a longer shelf life in polyethylene, polypropylene, and polyester bags. Hydro-cooling can be done to extend its shelf life and treatment with NAOCL which prevents microbial

contamination (Kalal et al., 2021) and (Nayak et al., 2023 b). Mustard greens stored polyethylene bags at 5o C preserves its antioxidant activity and sensory activity upto 14 days. (Dayarathna *et al.*, 2023). Previous studies suggested that 2 to 10° C is the best temperature for the storage of microgreens like spinach, buckwheat, table beet, cabbage, celery, radish, pea, basil, broccoli, and lettuce. According to Yadav 2021, biodegradable plastic containers are also available for storage. Proper washing and sanitization maintain the nutrient content, freshness and shelf life of microgreens.

Health Benefits

Due to high quality nutrients present in microgreens it is also termed as super-food. Heart disease, diabetes, several types of cancer etc. can be managed with microgreens.

- The antioxidant present in microgreens reduce blood cholesterol and improve heart health. Moringa greens can lower blood cholesterol and helps in weight management. Similarly, beet microgreens lower blood pressure. Studies on effect of red cabbage on managing weight, lowering bad cholesterol and triglyceride level also gave positive result (Huang *et al.*, 2016). Microgreens of *Vigna radiata* L. and *Cicer arietinum* L. in comparison with various sprouts and seeds have more antioxidant properties (Ebert, 2022). Alzheimer's disease may also be treated with microgreens due to presence of antioxidant substances like polyphenols (Guest and Grant, 2016).
- Broccoli sprouts contain vitamins A and C, fiber, isothiocyanates, and sulforaphane; these modulate cell proliferation and development, and trigger the production of anti-inflammation properties and antioxidants (Hyun-Jung Park, 2023).
- Fenugreek microgreens posses antidiabetic properties due to presence of polyphenols and other antioxidant substances at certain concentration as per report of Sharma, Dhingra and Koranne, 2020.
- Anti-cancerous aliphatic glucosinolates properties found in broccoli microgreens are four times than its mature form. Bio-active compound rich microgreens are most

effective for preventing cancer (De La Fuente *et al.*, 2020). More studies are necessary to obtain proven data on microgreen activity in preventing cancer.

- Weight management can be tackled through microgreen due to its fiber content by minimizing the calorie content (Tucker, L. A and Thomas, K. S. 2009). Microgreens of broccoli are rich in vitamin K and calcium which prevents osteoporosis (Weaver, C. M., 2015).
- Pea shoots are high in protein content as proteins are essential for tissue repair, immune function and overall growth of body (Xiao Z *et al.*, 2015).

Benefits of Microgreens Farming

They are very much necessary in this era due to several factors pointed below:

- Good source of nutrients- They are known as functional food due to their richness in different vitamins, minerals and different anti-oxidant properties.
- Low in anti-nutritional factors- Anti-nutritional compounds like nitrite and nitrates are present in low quantity in microgreens.
- Richness of flavor- They are packed with multiple flavors which makes them a great choice for chefs to use them in their culinary preparations.
- Ease of cultivation throughout the year- Farmers can grow microgreens throughout the year as there is no requirement of special cultivation time, seedlings are harvested within a few weeks and can earn extra profit in a short time. No extra inputs are required and can be produced in urban and peri-urban areas also they are chemical free.
- Harvested within a few days- Microgreens are able to be collected within a few days of germination i.e., 7-14 days approximately.
- Less startup cost- Farmers may start microgreen farming as business with very low investment as input requirement is very less and meeting the needs of restaurants and increasing the production based on local demand.

- High value crop- Farmers can fetch high cost of their produce through selling in restaurants and super markets and can supply microgreens within a short time period and most of the microgreen are high value crops. (Yadav, 2021 b).

Future Scope: Microgreens though are high in nutritional qualities and can be harvested within a few weeks of germination but they have short shelf-life which poses difficulty in their storage for long time and transportation to far distance. Proper and efficient storage and packaging techniques are need to be researched. The effect on yield of microgreens due to certain fungal pathogens are required to be addressed and more proper ways of cultivation with minimum effort are highly essential. Awareness among people on microgreen cultivation both in urban and rural areas needs to be wide spread along with their necessity in human diet.

Conclusion

People now-a-days are suffering from variety of diseases which is a serious concern and need to be addressed. A huge number of populations are targets of malnutrition and hidden hunger. To meet those problems, microgreens are a good option which can be cultivated with low input by people in both indoor and outdoor condition which can generate income along with adding nutrients in their diet too. Small scale start-ups by a community will be of huge benefit to the nations revenue and the problem of unemployment can also be met to some extent. Few awareness programmes are essential which can boost the production and marketing of microgreens in major and minor cities also in core areas of the country and with the help of government latest packaging practices which if can be provided to people will be very helpful in lifting the production all over the country.

References

- Chandra, Dulal & Kim, Ji & Kim, Yong. (2012). Changes in microbial population and quality of microgreens treated with different sanitizers and packaging films. *Horticulture, Environment, and Biotechnology*. 53(1).
- Cohen, M. J. 2023. *Advances In Food Security And Sustainability*. Elsevier.
- Dayarathna, N. N., Gama-Arachchige, N. S., Damunupola, J. W., Xiao, Z., Gamage, A.,Merah, O., & Madhujith, T. 2023. Effect of storage temperature on storage life and sensory attributes of packaged mustard microgreens. *Life*, 13(2), 393.

- de la Fuente, B., López-García, G., M´añez, V., Alegría, A., Barber´a, R., & Cilla, A. 2020. Antiproliferative effect of bioaccessible fractions of four Brassicaceae microgreens on human colon cancer cells linked to their phytochemical composition. *Antioxidants*, 9 (5): 368.
- Ebert, A. W. (2022). Sprouts and microgreens-novel food sources for healthy diets. *Plants*, 11(4): 571.
- Guest, J. and Grant, R. 2016. The Benefits of Natural Products for Neurodegenerative Diseases. *Advances in Neurobiology*, 12: 199–228.
- Huang, H., Jiang, X., Xiao, Z., Yu, L., Pham, Q., Sun, J., Chen, P., Yokoyama, W., Yu, L.L., Luo, Y.S., and Wang, T.T.Y. 2016. Red Cabbage microgreens lower circulating low-density lipoprotein (LDL), liver cholesterol and inflammatory cytokines in mice fed a high-fat diet. *Journal of Agricultural and Food Chemistry*, 64 (48): 9161-9171.
- Hyung-Jung Park, 2023. Anti-inflammatory properties of broccoli sprouts extract in a lipopolysaccharide-induced testicular dysfunction. *Journal of Animal Reproduction and Biotechnology*, 38 (1): 17-25.
- Koley, T.K., Singh, S., Prasad, R.N. and Singh, B. 2016 a, b. Microgreens are new generation smart food. *Indian Horticulture*, 61(1): 3-4.
- Koley, T.K., Maurya, A. and Singh, B. 2016 a, b. Microgreens from vegetables: more nutrition for better health. *New Age Protected Cultivation*, 2(2): 25-27.
- Mir, Shabir & Shah, Manzoor & Mir, Mohammad. (2016). Microgreens: Production, shelf life and bioactive components. *Critical Reviews in Food Science and Nutrition*, 57(12).
- Nayak, P.S., Acharya, S. and Chatterjee, S. 2023 a, b. Microgreens - A Potential Game Changer for Achieving Nutritional Security. *Recent Advances in Agricultural Science and Technology*, 231-241.
- Partap, M., Sharma, D., HN, D., Thakur, M., Verma, V., Bhavya Bhargava, U. 2023 a, b, c. Microgreen: A tiny plant with superfood potential, *Journal of Functional Foods*, 107.
- Sharma, S., Dhingra, P., & Koranne, S. 2020. Microgreens: Exciting new food for 21st Century. *Ecology, Environment and Conservation*, 26: S248–S251.

Tucker, L. A., & Thomas, K. S. (2009). "Increasing Total Fiber Intake Reduces Risk of Weight and Fat Gains in Women." *The Journal of Nutrition*, 139(3), 576-581.

Weaver, C. M., (2015). "Dietary Calcium and Bone Health in the Elderly." *Nutrition*, 31(1): 120-135.

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.

Yadav, K. 2021 a, b. Microgreens: an ultimate superfood. *Indian Horticulture*, 66(3): 26-28.