

Microgreens: Exciting new food for 21st Century

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(Received 23 April, 2020; Accepted 26 May, 2020)

ABSTRACT

Micro greens are emerging group of eatables vegetables grown when initial leaves have completely grown and just prior to true leaves begin to emerge. This concept is attaining people's interest as a new cooking and edible properties. These are added to increase flavors and nutritional value of raw veggies or as eatable toppings to decorate a large number of other food items. Main class of micro greens are raised generally from cabbage, mustard, buckwheat, radish, spinach, lettuce, etc. Day by day demand of micro greens has been increasing, due to presence of enormous number of biologically active compounds like essential vitamins, minerals and antioxidants as compare to fully grown greens(necessary for healthiness). This paper is aimed to give an overview on the nutritional facts, their comparison with sprouts, potential bioactive compounds and cultivation, harvesting and marketing of microgreens along with their future perspective.

Key words: *Microgreens, Biologically active compounds.*

What are micro greens?

In the course of 20 years, growing awareness of mass people in healthy meal has encouraged attention in fresh, functional and nutraceutical foods of high end. It is in the favor of micro green crop cultivators, extension experts and scientists to meet coming opportunities for relevant products.

Micro greens, commonly termed as 'Vegetable Confetti', are another form of distinction crop, portrayed as soft juvenile greens raised from the seeds of grains, vegetables, or herbs as well as its wild types. Since, in developed countries attraction towards healthy eating, gourmet cooking and indoor gardening has been increased and thereby microgreens have now attained recognition there. This new form of food has a comparatively small life span even in refrigerator and are utilised in very little amounts as garnishes, toppings, or seasonings (Riggio *et al.*, 2019).

Micro greens are identified by various number of colors, tastes, textures and are fresh and tenderly soft vegetables, found from the seeds of abundant varieties (aromatic herbs vegetables, wild edible plants, and herbaceous plants), harvested a few days or weeks after germination during the formation of cotyledons and appearance of the first true leaves (Paradiso *et al.*, 2018).

Micro greens have larger concentrations of phenolics, antioxidants, minerals, and vitamins than present in fully developed green or seeds and hence recognized as functional foods consisting of health improving or ailment prevention characteristics apart from their nutritional benefits. These are well recognize as good carrier of biologically active components (Mir *et al.*, 2017).

Unfortunately, commercialization of micro greens is less due to their speedy degradation and a very small storage life, generally 3 to 5 days at en-

compassing temperature, so these are supposed to be highly decomposable products. As the demand for micro greens rises, consequently their appearance in farmer's markets and specialty on grocery stores also begins, so the improvement of their bundling and post collect stockpiling circumstances is in this way getting significant for upgraded timeframe of realistic usability (Mir *et al.*, 2017).

Varieties of micro greens

Since the stock and consumption of micro greens is greatly affected by occurring of culinary trends and selectivity of species depends on maker's discussion with chefs and on customer adaptation with their specific sensory characteristics. Microgreens might be dispersed as new cut items yet in addition while developing on media, to be gathered by end clients. Species related to the families Brassicaceae, Asteraceae, Chenopodiaceae, Lamiaceae, Apiaceae, Amarillydaceae, Amaranthaceae and Cucurbitaceae are mostly exploited. Bioactive substance is conspicuous in types of rather harsh taste (for example Brassicaceae), the variable adequacy of which war-rants distinguishing proof of genotypes that may take into account requests for both taste and wellbeing (Xiao, Lester *et al.*, 2012).

Microgreens can be obtained from different sorts of seeds. The well known species are harvested using seeds from the following plant families (View & Club, 2019) :

Brassicaceae family: Broccoli, cauliflower, watercress, cabbage, arugula and radish

Asteraceae family: Endive, lettuce, radicchio, and chicory

Apiaceae family: Carrot, dill, celery, and fennel

Amaryllidaceae family: Onion, leek, and garlic

Amaranthaceae family: Quinoa swiss chard, amaranth, spinach, and beet

Cucurbitaceae family:, cucumber, squash and melon

Cereals such as rice, oats, wheat, corn and barley, as well as legumes like chickpeas, beans and lentils, are also sometimes grown into micro greens. Micro greens may differ in flavor that can vary from plain to spiced, tangy or even bitter, considering type of green. Basically, their flavor is supposed to be strong and concentrated. (View and Club, 2019).

(a) Bioactive components

Bio active amount is usually described in less edible micro greens varieties like sorrel (*Rumex acetosa* L.),

peppercress (*Lepidium bonariense* L.), red cabbage (*Brassica oleracea* L. var. capitata) and also in few varieties of more acceptable flavor like amaranth (*Amaranthus hypochondriacus* L.) and cilantro (*Coriandrum sativum* L.) (Xiao *et al.*, 2012).

The list of verified human bio active compounds consists of carotenoids (violaxanthin, β -carotene and lutein/zeaxanthin), ascorbic acid (free, total and dehydro), tocopherols(α - and γ -tocopherol), and phylloquinone.

b) Nutritional Details

Microgreens are full of nutritional sources. While their concentration may vary in less amounts, many types are rich K, Fe, Zn, Mg and Cu (Xiao *et al.*, 2016). Micro greens are good resource of significant plant compounds like antioxidants (Xiao *et al.*, 2012). In addition to this, their nutritional value is concentrated, indicating higher vitamins, mineral and antioxidants amount than the same quantity of mature greens (Xiao *et al.*, 2012). Researchers have shown that level of nutrients in micro greens are up to nine times greater than those found in mature greens (Pinto *et al.*, 2015).

The utmost concentrations of ascorbic acid, carotenoids, phylloquinone, and tocopherols are found in red cabbage, cilantro, garnet amaranth, and green daikon radish micro greens respectively along with various bioactive components and significantly higher in micro greens while comparing with data base values for fully grown vegetable counterparts (Xiao *et al.*, 2012). However, this early small scale green research was carried out with restriction because the developing conditions, post cultivation conditions, and extraction techniques for the fully grown vegetables were unclear. As compare to database values, experimental data introduces uncertainties if we consider significant impacts of light wavelength and intensity on phytonutrients content. For instance, looking at information from head-framing fully grown vegetables for which just the peripheral leaves are accessible to light is questionable according to the micro green type of the vegetable (Xiao *et al.*, 2012).

Researches also reported that micro greens possess antioxidants and a number of polyphenols as contrast to their fully grown vegetable counterparts (Bull, 2008). According to one report, in 25 microgreen varieties which are commercially available, vitamins and antioxidant concentrations were found. While comparing these values with the

USDA National Nutrient Database for fully grown vegetable leaves, vitamin and antioxidant values varied and it was approximated that values measured in microgreens were up to 40 times more than those reported for fully grown vegetable leaves (Xiao *et al.*, 2012).

Microgreens Vs Sprouts

Microgreens might be generally misconcepted for grown seeds (sprouts), which have been regularly concerned in food-borne disease although, microgreens possess some characteristic similarities with freshly herbs (e.g. basil, thyme, and cilantro), petite greens (e.g. baby spinach and spring mix) and sprouts. Many research studies discussed about nutrition and physiological properties of microgreens but since 2009 a very few have reports particularly examined the food safety hazards of microgreens whereas worldwide studies have been carried out in order to explore leafy green and sprout safety (Riggio *et al.*, 2019).

Microgreens and sprouts are consumed in immature condition however they are distinct with each other (Treadwell *et al.*, 2013). Sprouts are mainly grown-up in dark environment of moisture where ready to microbial proliferation and their use different from of micro- and baby-greens has been applied in outbreaks of food borne epidemics. Also, micro greens are having wide range of leaf color, shape and varieties and greater taste increasing properties than sprouts. Many recent reports suggested that the nitrate content in microgreens is lower than that in fully grown vegetable leaves, further they also have higher amounts of minerals (Ca, Mg, Fe, Mn, Zn, Se and Mo) and phytonutrients (ascorbic acid, b-carotene, a-tocopherol and phylloquinone) (Xiao *et al.*, 2012).

Health Benefits of Micro greens

Since the amount of vitamins, minerals and beneficial plant compounds are high in microgreens so eating green vegetables is associated to decrease danger of many diseases (Bazzano *et al.*, 2002; Carter *et al.*, 2010). Microgreens are also blessed with such vital nutrients to protect us from diseases. **Heart disease:** Microgreens have great content of antioxidants e.g. polyphenols which can reduce the risk heart disease. As per different animal studies it is clear that microgreens may lower down the level of triglyceride and "bad" LDL cholesterol (Huang *et al.*, 2016; Tangney and Rasmussen, 2013).

Alzheimer's disease: Antioxidant-rich foods, including polyphenols, can decrease probability of memory related disease such as Alzheimer (Guest and Grant, 2016).

Diabetes: Presence of antioxidants can facilitate to lower risk of type 2 diabetes. In laboratory experiments, fenugreek microgreens are supposed to increase cellular sugar uptake by 25–44% (M.H., 1996; Wadhawan *et al.*, 2018).

Certain type of cancers: Antioxidant-rich fruits and vegetables particularly containing polyphenols, may decrease danger of different kinds of cancer (Zhou *et al.*, 2016).

Future Perspective of these microgreens

Most of the microgreen analysis and studies are carried out at comparatively small level and is limited to only few number of researchers with limited targeted areas. There is scope of broad range of area yet to be explored. Moreover some of the varieties of microgreens have been studied and analyzed, but many of them have not been put for commercialization. The influence of sun light on microgreens development and nutrition has been precisely taken care off whereas the effect of low night temperatures on plant development, nutritional level, and food risks of microgreens has not been analysed. Prevention and treatment methods should be identified for microgreens because they are beneficial but maintaining quality and safety of microgreens is still in its earliest stages. It has been established that post harvest light treatments can increase the formation bioactive elements, but this was not properly analyzed to apply on broad range of microgreens. It is an issue of discussion that phytonutrient substance could give innate protection from quality and wellbeing issues. Identification of many post cultivation treatments have been carried out time to time to keep quality and to extend life span of microgreens. For the production of ready-to-eat microgreen products, washing and drying methods should be more focused. It is especially significant that to put more and more research into ensuring the safety and quality of this new addition to healthy diets so that the food industry could resolve some of the problems that have created challenges for the fully grown vegetables.

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