

Beyond the garnish: Will a new type of produce get the microgreen light?

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Sarah Johnson with a tray of microgreens. Credit: Colorado State University

Microgreens. They're leafy green vegetables that are relatively new to the dining room, but a study by a Colorado State University team indicates that they will be welcome company at the table.

"You've probably heard of sprouts and baby greens," said lead researcher

and registered dietitian nutritionist Sarah Ardanuy Johnson, an assistant professor and director of the Functional Foods & Human Health Laboratory in CSU's Department of Food Science and Human Nutrition. "These are somewhere in the middle."

Microgreens are young and tender leafy greens of most vegetables, grains, herbs and flowers that are harvested when their first leaves appear. Their rapid maturity of a few weeks and affinity for controlled-environment agriculture (also known as indoor farming) means they use very little water and can be harvested quickly. It makes them a model of sustainability: They can be grown indoors, year-round, in cities and rural communities, in greenhouses, warehouses, vertical farms and even homes.

"I came across microgreens and had never heard of them before," said Johnson, who initially studied environmental science and ecology as an undergraduate before realizing her true academic passion was in nutrition and [food science](#). "The need for our food to be more sustainable is greater than ever. I love the idea that they can be grown in an urban environment, indoors in big cities and smaller towns. We can't just grow everything in the soil outside anymore, and we need to conserve what natural resources we still have."

Nutritional benefits

Johnson described them as leafy greens that pack a punch. They carry fewer food safety concerns than sprouts because they are grown in an environment with less moisture and, unlike sprouts, the roots of microgreens are removed during harvest. Nutritionally, they have been shown to have higher concentrations of phytochemicals and nutrients like beta-carotene (which can be converted to Vitamin A) than mature plants.

"Vitamin A deficiency is the leading cause of blindness worldwide," Johnson said, explaining that microgreens may become a key food source for preventing nutrient deficiencies and promoting global health and environmental sustainability. "That potential is pretty cool."

But she and her fellow researchers wanted to find out if microgreens are acceptable to consumers, and possible factors in how much consumers like or dislike them. They sought to understand if microgreens' appearance, taste and other considerations make them an appealing addition to people's plates. The answer? Signs point to more and more people exhibiting a microgreen palate.

Results of the study were published in March in the *Journal of Food Science*. Johnson's team surveyed 99 people about their reactions to six different types of microgreens: arugula, broccoli, bull's blood beet, red cabbage, red garnet amaranth and tendrill pea. The microgreens were grown in the CSU Horticulture Center. The participants, who didn't know in advance what they would be trying, answered a variety of questions about things like flavor, aroma, texture and appearance.



Images of the microgreens species evaluated in the consumer acceptability and sensory perception test: arugula (A), broccoli (B), bull's blood beet (C), red cabbage (D), red garnet amaranth (E), and tendril pea (F). Credit: Colorado State University

"Funfetti"

"Some people call them 'vegetable confetti' or 'funfetti' because they're small, colorful and flavorful," Johnson said, adding that they have

historically been used as a garnish or topping in restaurants.

The red-colored ones—beet, cabbage and amaranth—received top marks for appearance, but broccoli, [red cabbage](#), and tendril pea got the highest grades overall. Arugula was ranked lowest, on average, likely due to its somewhat spicy and bitter flavor, although many people did like the taste. Overall, microgreens that rated highly for appearance, flavor and texture also scored lower on factors like astringency, bitterness, heat and sourness. Food neophobia, or the fear of trying new foods, was found to also be an important factor driving consumer acceptability.

"But they were all liked well enough that people said they would consume them and purchase them," Johnson said. "I feel like they should be used more as a vegetable and not just a garnish. That's part of the reason why I wanted to do this study."

Increasing demand

In fact, that was one of her key goals in launching the research: Can the appeal of microgreens lead to more popularity, more demand, more production and more grocery stores carrying them? Such products can be expensive due to markup and packaging.

"But people's mindsets are changing," Johnson said. "People don't want to buy something that's going to just end up in the landfill. They are looking for something that can benefit their health and the environment."

Participants said factors they would consider in buying microgreens included familiarity and knowledge, cost, access/availability and freshness/shelf-life.

For the research project, Johnson teamed up with Steven Newman, a professor and greenhouse crops specialist in CSU's Department of

Horticulture and Landscape Architecture. Johnson found him online in her quest to find a collaborator with expertise in greenhouse crops; Newman has provided leafy greens grown in the Horticulture Center to campus dining halls. Newman's team grew the microgreens used in the study with help from Johnson's team, in a classic example of the type of cross-disciplinary research that's on the rise at CSU.

"This has been a fun project with fruitful outcomes," Newman said.

"This is how transdisciplinary research is supposed to work."



Credit: Colorado State University

Other partners

Study co-author Marisa Bunning, a food science professor and Extension food safety specialist, has become a microgreens fan and now grows them at home. Laura Bellows, an associate professor with expertise in public health and health behaviors, helped assess factors contributing to consumer acceptability, such as food neophobia.

Other members of Johnson's team included Hanan Isweiri, Newman's former postdoctoral fellow; first author Kiri Michell, one of Johnson's graduate students; graduate student Michelle Dinges; undergraduate Lauren Grabos; Associate Professors Michelle Foster and Tiffany Weir of the Department of Food Science and Human Nutrition; Assistant Professors Adam Heuberger and Mark Uchanski, Associate Professor Jessica Prenni, and Professor Henry Thompson of the Department of Horticulture and Landscape Architecture; and Assistant Professor Sangeeta Rao of the Department of Clinical Sciences.

Experts say that by 2050, there will be more than 10 billion people in the world to feed, making it more important than ever to think about ways to produce and grow nutritious food, as well as diversify the food supply in a sustainable way.

'Small but mighty'

"This was a very exciting, [interdisciplinary study](#), and I am glad I was able to take part and help lead it," Michell said. "I look forward to more research regarding these small but mighty greens and their role in our food supply and on human health."

"I don't know that we could have done the advanced interdisciplinary research without Kiri's hard work and leadership," Johnson said. "But this was truly a team effort."

Michell noted that The Foundry dining hall on the CSU campus has started using microgreens in some of its dishes, and even has a viewing window where students can see them being grown.

The large collaboration aims to advance research on microgreens, and to increase knowledge of microgreens and their integration into the global [food](#) system. The group is conducting additional research, such as examining the feasibility, tolerability and potential health impacts of daily microgreen consumption at a higher dose (two cups per day, which is a typical serving size for [leafy green vegetables](#)), and comparing the nutritional value of microgreens to that of their more mature counterparts.

More information: Kiri A. Michell et al. Microgreens: Consumer sensory perception and acceptance of an emerging functional food crop, *Journal of Food Science* (2020). [DOI: 10.1111/1750-3841.15075](https://doi.org/10.1111/1750-3841.15075)

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