

LETTUCE GROWN IN SPACE AS NUTRITIOUS AS ONES ON EARTH: NASA

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Researchers have found that the salad crop, red romaine lettuce, grown on board the International Space Station (ISS), is as nutritious as counterparts grown on the Earth, an advance that may help astronauts grow safe, fresh food during space missions.

According to the study, published in the journal *Frontiers in Plant Science*, the space-grown lettuce is free of disease-causing microbes and safe to eat, and is at least as nutritious as the Earth-grown plants.

The researchers, including Christina Khodadad from NASA's Kennedy Space Center in the U.S., said that the lettuce is nutritious despite being grown under lower gravity and more intense radiation than on the Earth.

Traditionally, astronauts in space live on processed, pre-packaged space rations such as fruits, nuts, chocolate, shrimp cocktails, peanut butter, chicken, and beef to name a few, they said.

Apart from a welcome diet change, the researchers said, the fresh produce may provide astronauts with additional potassium as well as vitamins K, B1, and C – nutrients that are less abundant in pre-packaged rations, and degrade during long-term storage.

Ms. Khodadad and her team believe that growing crops on board may be especially useful on long-distance space missions such as the upcoming Artemis-III missions, scheduled to land humans on the lunar South pole by 2024, and NASA's first crewed mission to Mars, planned for the late 2020s.

"The ability to grow food in a sustainable system that is safe for crew consumption will become critical as NASA moves toward longer missions. Salad-type, leafy greens can be grown and consumed fresh with few resources," Ms. Khodadad said.

The study noted that between 2014 and 2016, lettuce was grown on board the ISS from surface-sterilised seeds within Vegetable Production Systems, nicknamed "Veggie" – growth chambers equipped with LED lighting and a watering system, specifically designed to grow crops in space.

It said the crops grew undisturbed inside the Veggie units for 33 to 56 days, until crew members ate part of the mature leaves without any negative health effects.

The scientists said the remainder of the crops was deep-frozen until transport back to the Earth for chemical and biological analysis.

As a control, the researchers also grew plants on the Earth under the same conditions – possible because temperature, carbon dioxide, and humidity data were logged on board the ISS, and replicated in labs with a 24 to 48 hour delay.

They said the space-grown lettuce was similar in composition to the Earth-based controls.

The study noted that in some trials, the space-grown plants tended to be richer in elements like potassium, sodium, phosphorus, sulphur, and zinc, as well as in some molecules with proven antiviral, anticancer, and anti-inflammatory activity.

It said both varieties of lettuce also had similar levels of anthocyanin, and other antioxidants – molecules in food which can protect cells from damage by highly reactive natural chemicals present in the body.

When the scientists assessed the microbes growing on the lettuce varieties, they found that the typical Earth-grown plants harboured a diverse set of microbes with specialised, beneficial bacteria, and those that neither harm nor benefit their host.

They said these microbes can affect the health of plants and their suitability as food.

Using DNA sequencing technology, the researchers then characterised the communities of fungi and bacteria growing on the lettuce, and identified the 15 most abundant microbial genera on the leaves and 20 in the roots.

The findings revealed that the diversity and identity of these microbes were similar for space- and Earth-grown lettuce.

None of the detected bacteria genera are known to cause disease in humans, the scientists said.

They said the leaves never carried any dangerous bacteria known to occasionally contaminate crops, such as *E. coli*, *Salmonella*, and *S. aureus*, adding that the fungal and mould spores on them were also in the range fit for human consumption.

According to the study, the lettuce grown in the Veggie units is safe to eat, opening the door for experiments with other nutritious and tasty crops onboard the space station that may help astronauts journey further into space.

“The International Space Station is serving as a test bed for future long-duration missions, and these types of crop growth tests are helping to expand the suite of candidates that can be effectively grown in microgravity,” said study co-author Gioia Massa, a project scientist at the Kennedy Space Center.

“Future tests will study other types of leafy crops as well as small fruits like pepper and tomatoes, to help provide supplemental fresh produce for the astronaut diet,” Ms. Massa added.

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