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Author: Dr. Flavia Fayet-Moore
The University of Newcastle Australia, Australia

Ms. Annie Shelton
FOODiQ Global, United States
Dr. Meghann Thai
The University of Sydney, Australia
Dr. Celeste Ferraris
Australia
Dr. Kylie Abbott
Australia
Ms. Saamia Khan
Australia
Mr. Ralph Fritsche
United States

MISSION MUSHVROOM: PUSHING THE BOUNDARIES OF SPACE NUTRITION WITH THE FIRST MUSHROOMS TO FRUIT IN SPACE

Abstract

Sustainable and nutritious food production is one of the biggest challenges for long-duration space missions. NASA has recently recognized food and nutrition as a critical (the 11th) priority within the Civil Space Shortfall framework. Mushrooms are an ideal space crop as they grow fast—doubling in size daily—require minimal resources and can use 100% of inedible plant waste to grow. They're a nutrient powerhouse, packed with vitamins, minerals, and bioactives, including B vitamins, selenium, ergothioneine and beta-glucan, which support astronaut health. After UV exposure, mushrooms can provide 100% of the daily vitamin D needs, the only vitamin supplement given in low earth orbit. Their umami-rich flavour helps make space food more enjoyable, helping enhance crew morale and dietary adherence. Mission MushVroom, an Australian-led experiment in collaboration with the Fram2 Mission, attempted to fruit mushrooms in space for the first time. The experiment tested whether *Pleurotus ostreatus* (oyster) mushrooms could successfully grow and fruit in microgravity. Colonized substrate blocks and inoculated Falcon tubes were prepared on Earth and flown on Fram2 in microgravity for three and a half days. The substrate blocks were contained in plastic bags to maintain humidity, a key factor for successful growth. Falcon tubes with colonized substrates were included to explore potential differences in how mycelium grows in space compared to Earth. The experiment examined physical, biochemical, and genetic changes that could impact mushroom growth and future scalability. Outcome measures included mycelium growth, biochemistry, genetics and transcriptomics, pin growth and morphology, fruiting body formation and yield, nutritional composition, contamination and post-microgravity growth. This presentation will dive into the experiment's setup, what we discovered, and what it all means for the future of space nutrition, and bioregenerative life support systems. Mission MushVroom is a foundational step forward in developing self-sustaining food systems that reduce reliance on Earth's supply chains, helping future space missions become more independent and resource-efficient. Future experiments need to address challenges of growing mushrooms in space, including substrate, spores and oxygen consumption. Beyond space,

Mission MushVroom outcomes have implications for food security on Earth. With the global population expected to hit 10 billion by 2050, finding efficient, sustainable ways to produce nutrient-dense food is more important than ever.