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MUSHROOM MISSIONS: PIONEERING NUTRITIONAL, CULINARY AND AGRICULTURAL SOLUTIONS FOR DEEP SPACE EXPLORATION

Abstract

Food and nutritional security in deep space missions remain a challenge for space exploration as no food systems exist that meet the needs for the duration of a Mars-mission. There is also a need to develop an autonomous food supply for space travel and human settlement in distant celestial bodies as the ability to re-supply with fresh plant foods and shelf-stable pre-made foods will become impossible.

Fungi foods are unique and biologically distinct kingdoms and are more similar to animals than plants. Mushrooms are higher-order fungi with unique nutritional and culinary properties. They provide more than 20

Mushrooms contain important bioactive compounds (ergothioneine, chitin, beta-glucan) with gut and immune-modulating properties. In addition, mushrooms contain flavour-enhancing compounds (glutamates), including the fifth basic taste, umami. They could be used to enhance the flavour of space food, potentially improving nutritional intake and food enjoyment. Unlike the other basic tastes, umami taste is preserved in the space environment with altered pressure, humidity, and sound.

Mushrooms grow in microgravity and the dark, as they do not photosynthesize like plants and obtain their nutrients from their environment as parasites, saprophytes (dead or decaying organic matter) and symbiotes. As deep space exploration demands a closed-loop environment, mushrooms ability to grow on waste substrate (including human waste) is critical. The spent mushroom substrate can be utilized as an organic fertilizer creating a circular farming system, and utilised to create soil from regolith, in plant agriculture.

With more than 2,000 varieties of edible mushrooms in the world, and the mycelium's ability to adapt to many environments, this project will review the available evidence on utilizing UV-exposed mushrooms as a closed-loop sustainable and autonomous food system with the constraints of the space environment that meets the need of critical nutrients including vitamin D while enhancing flavor and enjoyment.