

THE STABILITY OF BIOACTIVE COMPOUNDS IN SPACEFLIGHT FOODS

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ABSTRACT

The status and stability of bioactive compounds in the processed and shelf-stable spaceflight food system have not previously been investigated though the presence of such compounds in aged space foods could have health significance for crews on long duration exploration missions. Over forty foods – either existing International Space Station (ISS) food provisioning items, newly developed foods for spaceflight, or commercially-available ready-to-eat foods – that were predicted to have a relatively high concentrations of one or more bioactive compounds (lycopene, lutein, omega-3 fatty acids, phenolics, sterols, and/or flavonoids) were selected for the study. Food samples were sent overnight to the Food Composition Laboratory of the Linus Pauling Institute at Oregon State University (Corvallis, OR) for bioactive compound analysis. Three packages of each product were blended together for the analysis to reduce package-to-package variability. All ISS food items and commercial foods were analyzed initially and after 12 and 24 months of 21°C storage. Food development occurred in a staggered fashion, so data collection for the newly developed foods continues. Lastly, sensory evaluation and additional temperature storage data (4°C, 35°C) for select foods were collected to establish additional stability parameters. Efficacious concentrations of lycopene, lutein, and omega-3 fatty acids were measured in limited spaceflight foods; two grams of sterols a day may be difficult to achieve with the current space diet. Total polyphenol delivery appears stable and adequate, but individual phenolic compounds vary in stability and were not specifically evaluated in this study. The data suggests that some bioactive compounds, like lycopene and lutein, degrade and then plateau at some equilibrium concentration. The anthocyanin stability appears to be related to storage temperature and food matrix, and lutein stability in leafy vegetables may be impacted by storage temperature. Because of the limited number of foods with high concentrations of the bioactive compounds, additional menu variety, formulation optimization, and reduced temperature storage will be required to ensure delivery of several bioactive compounds in the space food system. Validation of stability to five years will enable provisioning of these functional foods within the space food system for a mission to Mars.