EXTENSION OF SPACE FOOD SHELF LIFE THROUGH HURDLE APPROACH

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ABSTRACT

The processed and prepackaged space food system is the main source of crew nutrition, and hence central to astronaut health and performance. Unfortunately, space food quality and nutrition degrade to unacceptable levels in two to three years with current food stabilization technologies. Future exploration missions will require a food system that remains safe, acceptable and nutritious through five years of storage within vehicle resource constraints. The potential of stabilization technologies (alternative storage temperatures, processing, formulation, ingredient source, packaging, and preparation procedures), when combined in hurdle approach, to mitigate quality and nutritional degradation is being assessed. Sixteen representative foods from the International Space Station food system were chosen for production and analysis and will be evaluated initially and at one, three, and five years with potential for analysis at seven years if necessary. Analysis includes changes in color, texture, nutrition, sensory quality, and rehydration ratio when applicable. The food samples will be stored at -20°C, 4°C, and 21°C. Select food samples will also be evaluated at -80°C to determine the impacts of ultra-cold storage after one and five years. Packaging film barrier properties and mechanical integrity will be assessed before and after processing and storage. At the study conclusion, if tested hurdles are adequate, formulation, processing, and storage combinations will be uniquely identified for processed food matrices to achieve a five-year shelf life. This study will provide one of the most comprehensive investigations of long duration food stability ever completed, and the achievement of extended food system stability will have profound impacts to health and performance for spaceflight crews and for relief efforts and military applications on Earth.