EFFECT OF PROCESSING AND SUBSEQUENT STORAGE ON NUTRITION

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OBJECTIVE
- To determine the effects of thermal processing, freeze-drying, irradiation, and storage time on the nutritional content of food
- To evaluate the nutritional content of the food items currently used on the International Space Station and Shuttle
- To establish the need to institute countermeasures

This study does not seek to address the effect of mining on nutrients in detail, but rather aims to place it in context, the overall nutritional status at the time of consumption.

BACKGROUND
- Food products for space feeding systems are processed to commercial quality.
- While heat sterilization is the most effective food preservation process, it affects vitamin and protein quality.
- The dehydration process has the smallest impact on nutrients.
- Micronutrient stability is dependent upon the composite macronutrient matrix.
- A kinetic model only provides an estimate of the remaining nutritional value.
- It is difficult to extrapolate between systems.
- Food composition databases do not take into account the effects of processing.

Justification
- Food with a 3-5 year shelf-life will be required for a mission to Mars.
- Nutrient losses during processing and subsequent storage can be significant.
- Nutrition requirements are delivered via the food system.
- The quantity of nutrients, e.g. vitamins, at consumption is currently unknown.
- Nutrients play a vital role in facilitating the capability of astronauts to tolerate physiological changes.
- The quantity, duration increases, physiology changes gain importance.

DELIVERABLES
- Conduct a literature review to better understand the potential effects of retorting, freeze-drying and irradiation on nutrient loss.
- Determine the effect of processing on representative flight food products by comparing the calculated nutrient to the actual nutrition one month after processing.
- Determine the effect of subsequent storage on nutrition by comparing the one month nutrition analysis results with those at 1 year and 3 years.
- Determine the capability of the current food system to provide adequate nutrition for long duration missions.

Exploring COUNTERMEASURES
- Optimization of process, packaging, and storage conditions for nutrient retention.
- Exploration of alternative sterilization methods.
- Mitigation of available nutrients by reformulation using ingredients with dense intrinsic nutrients.
- Treatments with food additives to provide nutrients, e.g. antioxidants.
- Fortification with stable nutrient forms, e.g. encapsulation, chelating, analogs, etc.
- Cultivation of quick growing fruits, vegetables, yeasts to deliver essential nutrients.

REFERENCES
- Methods of Analysis of AOAC International, 17th Ed., AOAC International, Gaithersburg, MD, USA.
- http://www.esha.com