Thermostabilized Shelf Life Study
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ABSTRACT
The objective of this project is to determine the shelf life of various food items by means of actual measurement or mathematical projection.

The primary goal of the Advanced Food Technology Project is to develop long-term, exploratory missions to provide the crew with a palatable, nutritious, and safe food system while minimizing volume, mass, and waste generation. The Mars mission could be as long as 2.5 years with the potential for the food being positioned prior to the crew arrival. Therefore, it is anticipated that foods that are used during the Mars missions will require a 5-year shelf life.

RESULTS AND DISCUSSION

ABSTRACT

**Fruits (Apricot Cobbler)**
Bulk Ingredients - Cocoa
Shelf Life will be determined by measurement or mathematical projection.

**Shelf life to be determined by**

- Identify the quality attribute, such as color, flavor, or texture, that will determine the shelf life.
- Determine the Q10 for the product based on quality changes.
- The Q10 is a measure of how the rate of a reaction changes for every 10°C change in temperature.
- The Q10 provides a prediction of shelf life at different temperatures.

**Shelf life at temperature 1°C**
Shelf life at temperature = T°C

**Preservation Method**
<table>
<thead>
<tr>
<th>Typical Q10 Values</th>
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<tbody>
<tr>
<td>Thermally Processed</td>
</tr>
<tr>
<td>Dehydrated</td>
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<tr>
<td>Frozen</td>
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Testing is still in progress for three vegetable products, one fruit, and one starch item. Testing will be completed in November 2005.

**RESULTS AND DISCUSSION**

**Materials and Methods**
Products stored at three temperatures – 40°F, 72°F, and 95°F for an accelerated shelf life test.

**Entrainés (Pork Chops, Tuna Noodle Casserole)**

<table>
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<th>Foods in general</th>
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| Textures are the altered quality attributes due to degeneration of the muscle proteins and the migration of free water. Cross-linking of proteins and end products of muscle breakdown contribute to the toughness of meat.
| Fatty tissues and pork, with higher unhydrolyzed lipid content, are more susceptible to oxidation.

**Grilled Pork Chops**

- L value 30
- Tuna-Noodle Casserole
- Product failure was attributed to decoloring for the holding of noodles and darkening of color during the 36 month study.
- Vitamin B1, nicotinic acid, and pantothenic acid showed linear declines as the holding temperature increased.
- Shelf life projected to be 87 months at 72°F

**Tuna Noodle Casserole**
Product failure was attributed to decoloring for the holding of noodles and darkening of color during the 36 month study.

**Eggs (Broccoli Soufflé, Vegetable Omelet)**

- It is difficult to produce a thermostabilized egg product due to sugar-amino production causes dark pigments, decreasing the nutritive value of the products and resulting in a hardening of the texture.
- Both products were unacceptable shortly after production indicating a shelf life of 6 months.
- Testing was conducted to a decline in nutritive value.

**Vegetables (Carrot Coins)**

- L value increases in all related color values at all temperatures over the storage period, yellow in particular.
- Overall acceptance score for canned coins declined gradually over the storage period with the comments as “too mushy”.
- Shelf life projected to be 48 months at 72°F

**Egg**

- Sensory panel did not find the 0-month (baseline) product to be acceptable, due to rubbery texture and brown color.
- Color continued to darken over time but the texture did not change.
- Vitamin E, B1, B6, pantothenic acid and folate acid demonstrate a linear decline with time and temperature.

**Conclusions**

- Shelf life is determined by safety, acceptability, and nutritional content.
- Safety is not an issue due to the processing.
- Acceptability is dependent on formulation and processing conditions.
- Nutrition is lost over time.
- Sugar can protect the food from degradation.
- Formulations that contain whole eggs at a significant level do not provide acceptable products using the current thermostabilization process.
- Fruit products tend to brown over time. The Maillard Browning reactions. The three most prevalent ingredients: salt, milk, sugar, and eggs, would provide sufficient amounts of free amino acids to group together to allow for condensation reactions to occur.
- Overall the foam stability increased over time regardless of storage temperatures.

**References**

