



31 March 2005

Dear food storage study contributors:

Thank you to all who have shown interest in our research! Many of you have donated samples of your food storage to us over the past few years and wonder what we have found. I am writing this letter to explain some of our results.

For our research, we collected samples of dry food stored in No. 10 cans for up to 30 years at non-abusive temperatures. Since 2001, we have done extensive testing (including taste tests with 50 people and vitamin analyses) on the following food products: powdered milk, rice, baking powder, instant potatoes, dried apples, all-purpose flour, pasta, pinto beans, wheat and powdered eggs. From this testing, we can generally conclude that if properly packaged and stored, all of these foods store fairly well, except for the powdered eggs. Below is a summary of what we found:

<b>Product</b>	<b>Eating Quality</b>	<b>Nutritional Value</b>
Powdered Milk	Samples stored in lower oxygen levels had better flavor. A 23-year old sample was not significantly different from the fresh powdered milk sample in flavor. The worst sample (stored 29 years in high oxygen) was rated at 63% acceptance to drink in an emergency and 75% acceptance to use in a recipe in an emergency.	Thiamin and riboflavin levels varied between samples, but did not show a decrease with storage time.
Rice	Rice stored very well over 30 years. All samples were found to be acceptable for emergency use by the majority of tasters. A few samples not included in our study were packaged at too high of moisture level and contained mold.	Thiamin varied between samples, but did not show a decrease with storage time. Some of the samples that contained lower levels of thiamin may not have been enriched
Baking Powder	Baking powder stored very well over 30 years if kept dry. All samples leavened well when used to make biscuits.	Not applicable
Oats	Oats stored well over the 29 year span studied, with around 75% of the tasters indicating they would eat the worst sample in an emergency situation.	Vitamin E was retained over time, except for a couple of samples that were stored in hot conditions.
Instant Potatoes	Potato flakes stored better than potato granules. Potato flakes had above 70% acceptance for emergency use over a span of 30 years.	Vitamin C was well retained.
Dried Apples	Dried apples stored well and had around 80% or better acceptance for emergency use over the span of 30 years.	Although dried apples are not a significant source of vitamin C, vitamin C was well retained.
All-Purpose Flour	Flour stored in cans up to 11 years was evaluated and made acceptable loaves of bread.	No vitamins measured
Pasta	All samples were rated at over 90% acceptance for emergency use with up to 30 years of storage.	In process of testing thiamin
Pinto Beans	Beans stored well, with samples spanning 30 years rated above 80% acceptance for emergency use. Beans were soaked in baking soda water prior to cooking to improve rehydration.	In process of testing thiamin
Wheat	Wheat stored very well and all samples made acceptable bread. Wheat stored at warmer temperatures was lower in quality.	Thiamin varied between samples, but showed no loss with time.
Powdered Eggs	None of the stored powdered eggs were considered acceptable for eating. They might store better if kept in a freezer.	Riboflavin was stable during storage.



We have also done informal evaluations (with just a few people) on a variety of other food products stored in No. 10 cans. They have been categorized as okay, marginal, or unacceptable, based on their eating quality. Many of these foods did not store as well as those mentioned above. These results are summarized below:

Okay	Marginal	Unacceptable	
23 yr-old Apple Dices (Farnsworth) 25+ yr-old Apple Flavored Dessert Mix (Pentelute) 28 yr-old Apple Granules (Dahl)	Apple Nuggets (Brown) 10 yr-old Apple Slices (Shaw) 20 yr-old Applesauce (Jefferies)	44 yr-old Apple Slices (Penrod) 30+ yr-old Bacon TVP (Sanders) 25+ yr-old Bacon TVP (Pentelute)	Corn (Farnsworth) 32 yr-old Corn (Penrod) 25+ yr-old Corn, Sweet (Pentelute)
23 yr-old Apple Nuggets (Farnsworth) 36+ yr-old Apple Nuggets (Bullock) Apple Nuggets (McVea) Apple Nuggets (McVea) 23 yr-old Blueberry Apple Nuggets (Farnsworth)	21 yr-old Applesauce (Moody) Applesauce (Nelson) 28 yr-old Apricot Slices (Dahl) Apricot Slices (Nelson) 25+ yr-old Banana Slices (Pentelute)	23 yr-old Bacon TVP (Farnsworth) Bacon TVP (Foutz) Bacon TVP (Foutz) 28 yr-old Bacon TVP (Dahl) 22 yr-old Bacon TVP (Moody)	Corn, Sweet (Anderson) 23 yr-old Corn, Sweet (Farnsworth) 28 yr-old Corn, Sweet (Dahl) 28 yr-old Corn, Sweet (Dahl) Corn, Sweet (McVea)
22 yr-old Blueberry Apple Nuggets (Jefferies) 23 yr-old Raspberry Apple Nuggets (Farnsworth) 20 yr-old Raspberry Apple Nuggets (Jefferies) 5 yr-old Apple Slices (Reimann)	21 yr-old Banana Slices (Moody) 21 yr-old Beef Bouillon Powder (Moody) 23 yr-old Beef Flavored Gravy Mix (Farnsworth) Carrots, Freeze Dried (Farnsworth)	21 yr-old Bacon TVP (Moody) 30+ yr-old Beef TVP (Sanders) Beef TVP (Farnsworth) 23 yr-old Beef TVP (Farnsworth)	Corn, Sweet (Patten) 30+ yr-old Green Beans (Sanders) 28 yr-old Green Beans (Musser) 28 yr-old Green Beans (Musser)
22 yr-old Apple Slices (Chatelaine) 28 yr-old Apple Slices (Dahl) Apple Slices (Pike) 28 yr-old Apple Slices (Williams)	29 yr-old Celery (Farnsworth) 21 yr-old Chicken Bouillon Powder (Moody) 23 yr-old Chicken Flavored Gravy Mix (Farnsworth) Chopped Onions (Farnsworth)	22 yr-old Beef TVP (Moody) 25+ yr-old Beet Slices (Pentelute) 25+ yr-old Cabbage Dices (Pentelute) 23 yr-old Cabbage Dices (Farnsworth)	23 yr-old Green Beans (Jespersion) 20 yr-old Green Beans (Farnsworth) 23 yr-old Green Beans (Farnsworth) 21 yr-old Green Beans (Moody)
28 yr-old Apple Slices (Williams) Apple Slices (Whipperman) 25+ yr-old Cheddar Cheese Powder (Pentelute) Cheddar Cheese Powder (Chatelaine) 21 yr-old Cheddar Cheese Powder (Moody)	30 yr-old Cottage Cheese (Farnsworth) Custard Mix (McVea) 21 yr-old Date Nuggets (Moody) Date Nuggets (Nelson)	28 yr-old Cabbage Dices (Dahl) 21 yr-old Cabbage Dices (Moody) 26 yr-old Carrot Slices (Anderson) 25+ yr-old Carrot Slices (Pentelute)	Green Bell Peppers (Farnsworth) 23 yr-old Green Peas (Farnsworth) 21 yr-old Green Peas (Moody) 25+ yr-old Green Peppers (Pentelute)
21 yr-old Cheddar Cheese Powder (Moody) 21 yr-old Cheddar Cheese Powder (Moody) Cheddar Cheese Powder (Nelson) Corn, Freeze Dried (Farnsworth)	28 yr-old Fruit Blend (Dahl) 26 yr-old Fruit Cocktail (Nelson) 25+ yr-old Fruit Galaxy (Pentelute)	23 yr-old Carrot Slices (Farnsworth) Carrot Slices (Hawkes) 11 yr-old Carrot Slices (Anderson)	Green Peppers (Patten) Ham TVP (Farnsworth) 23 yr-old Ham TVP (Farnsworth)
12 yr-old Dry Soup Mix (Sanders) 26 yr-old Freeze Dried Strawberries (Williams) 10 yr-old Fruit Drink Mix (Sanders)	23 yr-old Fruit Galaxy (Farnsworth) 20 yr-old Fruit Galaxy (Jefferies) 21 yr-old Fruit Galaxy (Moody)	28 yr-old Carrot Slices (Dahl) 28 yr-old Carrot Slices (Dahl) 21 yr-old Carrot Slices (Moody)	28 yr-old Ham TVP (Dahl) 22 yr-old Ham TVP (Moody) Ham TVP (Nelson)



Okay	Marginal	Unacceptable	
Gelatin (McVea)	30+ yr-old Fruit Mix (Sanders)	21 yr-old Carrot Slices (Moody)	30+ yr-old Multipurpose Food (Sanders)
26 yr-old Green Beans (Anderson)	25+ yr-old Fruit Mix (Pentelute)	Carrot Slices (McVea)	Multipurpose Food (Nelson)
20 yr-old Green Beans, Freeze Dried (Farnsworth)	32 yr-old Fruit Mix (Penrod)	Carrot Slices (Nelson)	32 yr-old Peanut Butter Powder (Penrod)
30+ yr-old Lime Gelatin Dessert (Sanders)	Green Beans (Patten)	28 yr-old Celery (Musser)	Plain TVP Granules (Nelson)
21 yr-old Mushrooms (Moody)	26 yr-old Green Peas (Anderson)	25+ yr-old Celery (Pentelute)	Pork TVP (Farnsworth)
23 yr-old Onions (Nelson)	21 yr-old Mung Beans (Moody)	28 yr-old Celery (Dahl)	Sausage TVP (Nelson)
30+ yr-old Onions, Chopped (Sanders)	Orange Breakfast Drink (Farnsworth)	21 yr-old Celery (Moody)	Soup Base (Jefferies)
10 yr-old Onions, Chopped (Sanders)	Orange Breakfast Drink (Nelson)	Celery (Patten)	21 yr-old Spinach (Moody)
25+ yr-old Onions, Chopped (Pentelute)	25+ yr-old Peach Slices (Pentelute)	Chicken TVP (Farnsworth)	28 yr-old Tomato Crystals (Musser)
21 yr-old Onions, Chopped (Moody)	23 yr-old Peach Slices (Farnsworth)	Chicken TVP (Jefferies)	28 yr-old Tomato Crystals (Musser)
23 yr-old Onions, Minced (Farnsworth)	20 yr-old Peach Slices (Jefferies)	Chicken TVP (Nelson)	23 yr-old Tomato Crystals (Farnsworth)
28 yr-old Onions, Powdered (Musser)	28 yr-old Peach Slices (Dahl)	30+ yr-old Chicken TVP (Sanders)	25+ yr-old Tomato Crystals (Pentelute)
28 yr-old Onions, Powdered (Dahl)	Peach Slices (Brown)	23 yr-old Chicken TVP (Farnsworth)	Tomato Crystals (Farnsworth)
26 yr-old Parsley Flakes (Nelson)	21 yr-old Peanut Butter Powder (Moody)	22 yr-old Chicken TVP (Moody)	28 yr-old Tomato Crystals (Dahl)
30+ yr-old Peanut Butter Powder (Sanders)	Prunes (Farnsworth)	Chicken TVP (Nelson)	21 yr-old Tomato Crystals (Moody)
6 yr-old Popcorn (Clayson)	28 yr-old Prunes (Dahl)		
6 yr-old Popcorn (Clayson)	21 yr-old Prunes (Moody)		
20 yr-old Prunes (Williams)	Raspberry Apple Nuggets (Brown)		
Pudding Mix (McVea)	30 yr-old Raspberry Apple Nuggets (Penrod)		
10 yr-old Soup Mix (Jacobson)	32 yr-old Raspberry Apple Nuggets (Penrod)		
22 yr-old Stew Blend, Mountain (Morrill)	30+ yr-old Spinach Flakes (Sanders)		
Tang (Farnsworth)	28 yr-old Spinach Flakes (Musser)		
4.5 year old Vanilla Pudding (Lloyd)	Spinach Flakes (Farnsworth)		
	21 yr-old Stew Blend (Moody)		
	32 yr-old Strawberry Drink Mix (Penrod)		
	25+ yr-old Swiss Cheese Powder (Pentelute)		
	23 yr-old Vegetable Soup Blend (Farnsworth)		

Hopefully this list will give you an idea about the quality of your food. If you have samples listed in the unacceptable or marginal categories, I would consider replacing them. If you think your food storage is getting too old, the best test would be for you to open a can for yourself and decide if it is edible to you. Some people are more picky than others about the flavor of the food they eat.

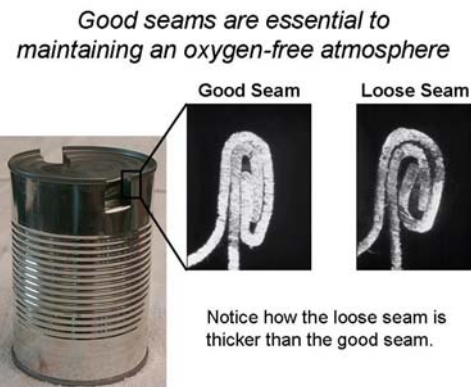


Keep in mind that there are many factors which influence the quality of food during storage. To optimize food quality during storage, minimize exposure to:

1. **H**umidity (moisture)
2. **A**ir (oxygen)...
3. **L**ight
4. **T**emperature (**This one is the most important**)

Also, if you pack your food or buy it in cans, make sure that the cans are sealed tightly to make an airtight seal. A good way to tell if your can is sealed tightly enough is to compare the can seam that you sealed to the seam of the other end of the can to make sure they look the same. If the can seam looks loose, it is.

For further information about our research, you can go to <http://ndfs.byu.edu/foodstorage/>. For practical ideas on storing and using food storage, please go to <http://www.providentliving.org/>



Thank you again for your interest in our research. If you have any further questions, I would be happy to try to answer them. I will be leaving BYU shortly to pursue a PhD in Food Science at North Carolina State University, but you can still reach me at michelle\_lloyd@byu.edu. You can also contact Dr. Oscar Pike (oscar\_pike@byu.edu, 801-422-6671) who is overseeing this research.

Sincerely,

*Michelle*

Michelle Lloyd