



## Preserve Food, Preserve Nutrients!

With the end of summer approaching, it is a great time to preserve fresh and local fruits and vegetables for months ahead. If you grow a garden or have a fruit tree, you may already know how fun and practical it can be to preserve excess produce for enjoyment all year long. Processing of any sort, including methods of preservation, can affect the nutrition and health benefits of foods, sometimes negatively and sometimes positively. Have you ever wondered whether canned, frozen, dehydrated, or fresh produce is better for your health, and whether you should choose one over the other?

It is often touted that fresh produce is best, but that may not always be the case. Fresh, whole fruits and vegetables lose nutrients over time. For example, a freshly picked head of broccoli consumed shortly after harvest will contain more nutrients than a head of broccoli sitting in the fridge and consumed a week or two later. When it comes to preservation, while some nutrients can be lost or destroyed from the use of certain preservation techniques, many nutrients are also preserved. In some cases, preservation allows for a longer nutrient shelf life. Additionally, some nutrients can become more bioavailable when preserved. For example, have you ever heard that canned tomatoes have more lycopene than fresh ones? Lycopene is a healthy phytonutrient that is released during cooking and canning.

Keep in mind that preservation done commercially versus preservation done in the home can vary in the ingredients added, such as salt or sugar, and the containers used, such as glass jars or metal cans. This, too, may impact the nutrition and health benefits of the preserved food. Below is a brief summary of how three different common preservation methods can impact nutrients in foods.

### Canning

Some nutrients, such as vitamin C and the B vitamins, decrease during the canning process. However, this loss also occurs when using heat to cook fresh vegetables over the stove or in the oven, for example. According to the USDA, canning, on average, decreases some nutrients by about 1/3 to 1/2, but once they are canned, further loss is only 5 to 10% per year. Once the food is canned, it should be stored in a cool, dark place for best nutrient preservation.

Even though some nutrients are lost during canning, some nutrients are quite stable, such as fiber, vitamin A, carotenoids, minerals, and vitamin E. As mentioned above, some nutrients may actually

become easier for the body to digest. For example, some berry phytonutrients are more easily absorbed by the body after being heated. Any salt or sugar as an ingredient in canned foods is for flavor, not preserving.

### **Freezing**

Most nutrients are fairly stable to the freezing process but begin to break down during storage. Some vitamin loss in frozen foods occurs during the preparation, which depends on the food to be frozen. For example, vegetables are blanched before freezing to destroy enzymes that cause deterioration over time.

Once in storage, frozen foods lose nutrients more quickly than canned, largely due to oxidation. For example, folate is almost completely lost from some vegetables within 3 months. Thus, eat frozen foods within 3-6 months for maximum nutrition. For best nutrient retention, freeze quickly, keep frozen at 0° F or less, and store in airtight containers to keep out as much oxygen as possible.

### **Dehydrating**

Nutrients are stable in dried foods because the rates of enzyme and chemical reactions slow down without water. Vitamin A, beta-carotene, and vitamin C losses occur because of oxidation due to air exposure. Dipping foods in ascorbic acid, metabisulfite, citric acid, or lemon juice solution before drying also reduces nutrient loss. In addition, less is lost during rapid drying at higher temperatures, rather than slower drying at lower temperatures. Dried foods should be stored in airtight containers, out of direct light, and used within 6-12 months.

### **Tips**

- Just as preservation method can impact nutrients, so can variety, cultivar, growing condition, and cooking method as well. So, to get a full range of nutrients, eat a variety of foods prepared in a variety of ways!
- Preserve food as soon as possible after harvest, because this is when nutrients will be at their highest.
- Once preserved, store the food properly: in a cool, dark place, and in airtight containers.
- Eat canned foods within a year, frozen foods within 3-6 months, and dehydrated foods within 6-12 months for the best quality and nutrition.
- Refer to the tables below for information on how nutrients are impacted by preservation.
- Many canned recipes and products contain lots of added sugar and salt. Look for foods that have less. Check out the CSU Extension website for a [guide to canning with less sugar and salt](#).
- Also visit the [CSU Extension website](#) for complete guides to canning, freezing, and dehydrating.

Have fun trying your hand at a new preservation method this summer and reap the benefits all year long!

**Table: Nutrient impact of different preservation methods**

Nutrient	Impact of Canning	Impact of Freezing	Impact of Dehydrating	Tips	Common Food Source
<b>Vit C</b>	Reduced due to heat and oxidation. However, stable once in storage.	Well preserved, depending on food. Blanching losses are greater with greater surface area.	Not well preserved. Reduce loss if in ascorbic acid, citric acid, sodium metabisulfite, or lemon juice.	Fresh or frozen may be best sources. Brief blanching helps preserve by deactivating enzymes.	Fruits & vegetables.
<b>Thiamin</b>	Very sensitive to heat.	Stable.	Stable.	Water soluble, so save blanching/canning liquid.	Green peas, beans, nuts seeds, fish.
<b>Riboflavin</b>	Some loss due to heat.	Stable.	Stable.	Light sensitive-store away from light.	Mushrooms, spinach, almonds, meat, fish.
<b>Niacin</b>	Stable	Water soluble, so losses in blanching.	Stable.	Water soluble, so save blanching/canning liquid.	Mushrooms, green peas, meat, peanuts.
<b>B6</b>	Some loss.	Some loss, but fairly stable.	Some loss, fairly stable.	Water soluble, so save blanching/canning liquid.	Spinach, potatoes, banana, fish, meat.
<b>Folate</b>	Some loss due to heat.	Degrades relatively quickly during frozen storage. Eat within 3 months, or 6 months for green beans.	Scarce data.	Antioxidants such as ascorbic acid increase stability. Water soluble, so save blanching/canning liquid.	Leafy greens, green beans, asparagus, beets, liver, chickpeas.
<b>B12</b>	Stable to heat.	Stable. Water soluble, so some may be lost in blanching.	Stable.	Water soluble, so save blanching/canning liquid.	Meat, fish, dairy.

*\* Nutrient levels in foods vary due to many factors, and the research is not always consistent or complete. Thus, these are general guidelines, not conclusive statements.*

Nutrient	Impact of Canning	Impact of Freezing	Impact of Dehydrating	Tips	Common Food Source
<b>Vit A (beta-carotene)</b>	Can increase due to heat processing.	Varies depending on food, but degrades during storage.	May be somewhat retained under controlled heat methods.	Not susceptible to loss from blanching. Sensitive to oxidation, keep cool, in dark place, in airtight containers	Fruits & vegetables, especially red/orange and dark greens.
<b>Vit E</b>	Varies. High levels in canned tomatoes. Canning varieties of tomatoes are very high in vitamin E.	Stable.	Scarce data.	Stable to blanching, and may even increase availability. Can oxidize, so keep in airtight containers.	Tomatoes, asparagus, dark leafy greens, almonds.
<b>Vit D</b>	Stable	Stable.	Stable.		Salmon.
<b>Vit K</b>	Heat stable	Stable.	Stable.	Light sensitive- store in dark place or opaque containers.	Greens, brussels sprouts, cabbage.
<b>Minerals</b>	Stable.	Stable.	Some loss in water during rehydration or blanching.	Water soluble, so save blanching/canning liquid.	Varies.
<b>Poly-phenols + Phyto-nutrients</b>	Water soluble, so use the canning liquid when possible. May increase due to heating. Add ascorbic acid to slow loss from oxidation.	Relatively stable to freezing, but mixed results. Some loss due to blanching, but blanching also helps prevent further loss.	Scarce data. Blanching can cause some leaching loss, but also helps preserve.	Avoid peeling when possible. Store in airtight containers when frozen or dehydrated. Eat within 6 months	Fruits, vegetables, plant foods.
<b>Fiber</b>	Stable.	Stable.	Stable.	Much is in the peels, so avoid peeling when possible.	Fruits, vegetables, plant foods.

\* Pantothenic acid and biotin are not included; they are widely found in foods and have not been a focus of studies.

## Safe Food Preservation

Home food preservation practices have been passed from generation to generation for enjoyable, tasty ways to extend a bountiful harvest. Although the goals to save food through home preservation activities still remain, many methods are no longer considered acceptable or have not been updated for safety purposes. Anyone practicing methods of food preservation, whether it be freezing, canning, dehydrating, pickling, fermenting, or processing to value-added-products should become familiar and comfortable with updated recommendations and ensure safe practices to minimize risk of foodborne illness or spoilage issues.



Also, all Colorado residents live above 3000 feet of elevation, this has a direct impact on several areas of food preservation. Living at high altitude requires that home preservers must also be aware of additional challenges in food preparation techniques due to the drop in atmospheric pressure and dryer climate.

### Home Preservation Resources

CSU Extension is a leader in providing user-friendly, evidence-based information on food preservation processes.

- *Local support:* Several Colorado counties provide hands-on or demonstration classes for specific preservation topics or offer extended coursework to become a trained Master Food Safety Advisor. Contact your county CSU Extension office for information on food preservation classes near you, or stop by the CSU Extension booth at a local county farmers' market and speak with a volunteer food safety expert.
- *Online support:* Home preservers can access [Food Preservation fact sheets](#) online at the [CSU Extension publications webpage](#). When using any recipe, follow adjustments to time and/or temperatures depending on your elevation.
- *High altitude specific:* Recipes developed for home preservers living above 3000 feet can be obtained from the links above or directly from the [Colorado Farm to Table](#) website on [High Altitude Food Preservation](#).
- *NEW preservation app:* CSU Extension Nutrition, Food Safety, and Health educators and researchers are developing an exciting new mobile app that will make food preservation content for home preservers living at or above 3000 feet in elevation easy to access and use on a smart phone, tablet, or computer. **Look for this app for your mobile device or online in fall 2017!**

**Sources:**

1. Retention of Folate, Carotenoids, and Other Quality Characteristics in Commercially Packaged Fresh Spinach. Journal of Food Science S. Pandrangi, L.F. LaBorde. December 2004. DOI: 10.1111/j.1365-2621.2004.tb09919.x Accessed from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2621.2004.tb09919.x/epdf>
2. Thermal Processing Enhances the Nutritional Value of Tomatoes by Increasing Total Antioxidant Activity. VERONICA DEWANTO, XIANZHONG WU, KAFUI K. ADOM, AND RUI HAI LIU. J. Agric. Food Chem. 2002, 50, 3010–3014
3. USDA Complete Guide to Home Canning, 2015 revision. Accessed from: [http://nchfp.uga.edu/publications/publications\\_usda.html](http://nchfp.uga.edu/publications/publications_usda.html)
4. George F. M. Ball. Vitamins In Foods. Analysis, Bioavailability, and Stability. CRC Press 2005. Print ISBN: 978-1-57444-804-7. eBook ISBN: 978-1-4200-2697-9. DOI: 10.1201/9781420026979
5. D'Archivio M, Filesi C, Vari R, Sczzocchio B, Masella R. Bioavailability of the Polyphenols: Status and Controversies. *International Journal of Molecular Sciences*. 2010;11(4):1321-1342. doi:10.3390/ijms11041321.
6. Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 1. Vitamins C and B and phenolic compounds. Joy C Rickman, Diane M Barrett and Christine M Bruhn. *J Sci Food Agric* 87:930–944 (2007)
7. Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 2. Vitamin A and carotenoids, vitamin E, minerals, and fiber. Joy C Rickman, Diane M Barrett and Christine M Bruhn. *J Sci Food Agric* 87:1185–1196 (2007)
8. Czarnowska M, Gujska E. *Plant Foods Hum Nutr*. 2012 Dec;67(4):401-6. doi: 10.1007/s11130-012-0312-2. Effect of freezing technology and storage conditions on folate content in selected vegetables. Accessed from: <https://www.ncbi.nlm.nih.gov/pubmed/22983767>
9. Bouzari A1, Holstege D, Barrett DM. Vitamin retention in eight fruits and vegetables: a comparison of refrigerated and frozen storage. *J Agric Food Chem*. 2015 Jan 28;63(3):957-62. doi: 10.1021/jf5058793. Accessed from: <https://www.ncbi.nlm.nih.gov/pubmed/25526594>
10. Colorado State University Extension. Drying Fruits. <http://extension.colostate.edu/topic-areas/nutrition-food-safety-health/drying-fruits-9-309/>
11. Colorado State University Extension. Drying Vegetables. <http://extension.colostate.edu/topic-areas/nutrition-food-safety-health/drying-vegetables-9-308/>
12. Colorado State University Extension. Food Preservation without Sugar or Salt. <http://extension.colostate.edu/topic-areas/nutrition-food-safety-health/food-preservation-without-sugar-or-salt-9-302/>

**References for Chart:**

1. George F. M. Ball. Vitamins In Foods. Analysis, Bioavailability, and Stability. CRC Press 2005. Print ISBN: 978-1-57444-804-7. eBook ISBN: 978-1-4200-2697-9. DOI: 10.1201/9781420026979
2. Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 1. Vitamins C and B and phenolic compounds. Joy C Rickman, Diane M Barrett and Christine M Bruhn. *J Sci Food Agric* 87:930–944 (2007)
3. Nutritional comparison of fresh, frozen and canned fruits and vegetables. Part 2. Vitamin A and carotenoids, vitamin E, minerals, and fiber. Joy C Rickman, Diane M Barrett and Christine M Bruhn. *J Sci Food Agric* 87:1185–1196 (2007)