



Using Dehydration to Preserve Fruits, Vegetables, and Meats

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Introduction

Why dry?

Drying (dehydrating) food is one of the oldest and easiest methods of food preservation. Dehydration is the process of removing water or moisture from a food product. Removing moisture from foods makes them smaller and lighter. Dehydrated foods are ideal for backpacking, hiking, and camping because they weigh much less than their non-dried counterparts and do not require refrigeration. Drying food is also a way of preserving seasonal foods for later use.

How dehydration preserves foods

Foods can be spoiled by food microorganisms or through enzymatic reactions within the food. Bacteria, yeast, and molds must have a sufficient amount of moisture around them to grow and cause spoilage. Reducing the moisture content of food prevents the growth of these spoilage-causing microorganisms and slows down enzymatic reactions that take place within food. The combination of these events helps to prevent spoilage in dried food.

The basics of food dehydration

Three things are needed to successfully dry food at home:

- **Heat** — hot enough to force out moisture (140°F), but not hot enough to cook the food;
- **Dry air** — to absorb the released moisture;

- **Air movement** — to carry the moisture away.

Foods can be dried using three methods:

- **In the sun**— requires warm days of 85°F or higher, low humidity, and insect control; recommended for dehydrating fruits only;
- **In the oven**;
- **Using a food dehydrator** — electric dehydrators take less time to dry foods and are more cost efficient than an oven.

Preparing Fruits and Vegetables for Drying

Many fruits and vegetables can be dried (Table 1). Use ripe foods only.

Rinse fruits and vegetables under cold running water and cut away bruised and fibrous portions. Remove seeds, stems, and/or pits.

Most vegetables and some fruits (Tables 2 and 3) should undergo a pretreatment, such as **blanching** or **dipping**.

Blanching is briefly precooking food in boiling water or steam, and it is used to stop enzymatic reactions within the foods. Blanching also shortens drying time and kills many spoilage organisms.

Table 1. Fruits and Vegetables Suitable for Drying

Fruits	Vegetables
Apples	Beets
Apricots	Carrots
Bananas	Sweet corn
Cherries	Garlic
Coconuts	Horseradish
Dates	Mushrooms
Figs	Okra
Grapes	Onions
Nectarines	Parsnips
Peaches	Parsley
Pears	Peas
Pineapples	Peppers (red, green, and chili)
Plums	Potatoes
	Pumpkin

Steps for steam blanching (fruit and vegetables):

- Use a steamer or a deep pot with a tight-fitting lid that contains a wire basket or could fit a colander or sieve so steam can circulate around the vegetables.
- Add several inches of water to the steamer or pot and bring to a rolling boil.
- Loosely place fruits/vegetables into the basket, no more than 2 inches deep.
- Place basket into pot (fruits/vegetables should not make contact with water).
- Cover and steam until fruits/vegetables are heated for the recommended time (Table 2 and 3).
- Remove basket or colander and place in cold water to stop cooking.
- Drain and place fruits/vegetables on drying tray.

Steps for water blanching (vegetables only):

- Use a blancher or a deep pot with a tight-fitting lid.
- Fill the pot two-thirds full with water, cover, and bring to a rolling boil.
- Place vegetables into a wire basket and submerge them into the boiling water for the recommended time (Table 2).
- Remove vegetables and place in cold water to stop cooking.
- Drain and place vegetables on drying tray.

Steps for syrup blanching (fruits only):

- Combine 1 cup sugar, 1 cup light corn syrup, and 2 cups water in a pot.
- Add 1 pound of fruit.
- Simmer 10 minutes (Table 3).
- Remove from heat and keep fruit in syrup for 30 minutes.
- Remove fruit from syrup, rinse, drain, and continue with dehydration step.

Dipping is a pretreatment used to prevent fruits such as apples, bananas, peaches, and pears from turning brown. Ascorbic acid, fruit juices high in vitamin C (lemon, orange, pineapple, grape, etc.), or commercial products containing ascorbic or citric acid may be used for dipping. For example, dipping sliced fruit pieces in a mixture of ascorbic acid crystals and water (1 teaspoon ascorbic acid crystals per 1 cup of water), or dipping directly in fruit juice for 3 to 5 minutes will prevent browning. Fruits may also be blanched as a means of treatment.

Table 2. Blanching and Drying Times for Selected Vegetables

Vegetable	Blanching		Drying time (hrs)*
	Method	Time (mins)	
Beets	cook before drying		3½–5
Carrots	steam	3–3½	3½–5
	water	3½	
Corn	not necessary		6–8
Garlic	not necessary		6–8
Horseradish	not necessary		4–10
Mushrooms	not necessary		8–10
Okra	not necessary		8–10
Onions	not necessary		3–6
Parsley	not necessary		1–2
Peas	steam	3	8–10
	water	2	
Peppers	not necessary		2½–5
Potatoes	steam	6–8	8–12
	water	5–6	
Pumpkin	steam	2½–3	10–16
	water	1	

* Dried vegetables should be brittle or crisp.

Table 3. Blanching and Drying Times for Selected Fruits

Fruit	Blanching*		Drying time (hrs)**
	Method	Time (mins)	
Apple	steam	3–5	6–12
	syrup	10	
Apricots	steam	3–4	24–36+
	syrup	10	
Bananas	steam	3–4	8–10
	syrup	10	
Cherries	syrup	10	24–36
Figs	not necessary		6–12
Grapes: seedless	not necessary		12–20
Nectarines	steam	8	36–48
	syrup	10	
Peaches	steam	8	36–48
	syrup	10	
Pears	steam	6	24–36+
	syrup	10	
Pineapples	not necessary		24–36
Plums	not necessary		24–36

* Fruits may be dipped in ascorbic acid or citric acid in place of blanching.

** Test for dryness by cutting the fruit. There should be no moist areas in the center. Times are estimated for use of the dehydrator or oven methods.

+ Drying times for whole fruits. Cutting fruit into slices may shorten drying time.

Drying Fruits and Vegetables

Natural sun drying

Sun drying is recommended for drying fruit only. Sun drying is not recommended in cloudy or humid weather. The temperature should reach 85°F by noon, and the humidity should be less than 60 percent. Outdoor dehydration can be difficult in Virginia and other southern states due to high humidity. **All food that is dried outdoors must be pasteurized.**

- Dry in the sun by placing slices of food on clean racks or screens and covering with cheesecloth, fine netting, or another screen. Food will dry faster if racks are placed on blocks and the rack is not sitting on the ground.
- If possible, place a small fan near the drying tray to promote air circulation.

- Drying times will vary (Tables 2 and 3).
- Turn food once a day. Dry until the food has lost most of its moisture (fruits will be chewy).
- Fruits should be covered or brought in at night to prevent moisture being added back into the food.

Drying with a food dehydrator

- Place food dehydrator in a dry, well-ventilated, indoor room.
- Arrange fruits or vegetables in a single layer on each tray so that no pieces are touching or overlapping.
- Dehydrate at 140°F. Check food often and turn pieces every few hours to dry more evenly.
- See Tables 2 and 3 for drying times.

Oven drying

- Dry food in an oven that can be maintained at 140°F. Leave door 2 inches to 3 inches ajar. Place a fan in front of the oven to blow air across the open door.
- Spread the food in a single layer on racks or cookie sheets. Check food often and turn pieces every few hours to dry more evenly.
- Drying time will vary (Tables 2 and 3). Do not leave oven on when no one is in the house.
- Oven drying is not recommended in households where children are present.

When food is dehydrated, 80 percent of the moisture is removed from fruits and up to 90 percent of the moisture is removed from vegetables, making the dried weight of foods much less than the fresh weight (Table 4).

Table 4. Pounds of Dehydrated Food from Fresh Fruits and Vegetables

Fresh fruits (20 lbs)	Dehydrated weight (lbs)
Apples	2
Peaches	1½–2½
Pears	2¼
Prunes/plums	2¼
Fresh vegetables (20 lbs)	Dehydrated weight (lbs)
Snap beans	1¾
Beets	2
Carrots	1¾
Onions	2½
Squash (summer)	1½–2
Tomatoes	¾

Pasteurizing Sun-Dried Fruits

All sun-dried fruits must be pasteurized to destroy any insects and their eggs. This can be done with heat or cold. To pasteurize with heat, place dried food evenly in shallow trays no more than 1 inch in depth. Fruits should be heated at 160°F for 30 minutes. To pasteurize with cold, fruits can be placed in the freezer at 0°F for 48 hours.

Conditioning Dried Fruits

Dried fruits must be conditioned prior to storage. Conditioning is the process of evenly distributing moisture present in the dried fruit to prevent mold growth. Condition dried fruit by placing it in a plastic or glass container, sealing, and storing for 7 days to 10 days. Shake containers daily to distribute moisture. If condensation occurs, place fruit in the oven or dehydrator for more drying and repeat the conditioning process.

Storing Dried Fruits and Vegetables

Cool-dried food should be placed in a closed container that has been washed and dried before storing. Home-canning jars are good containers for storing dried foods. Store in a cool, dry, and dark place.

Dried foods can maintain quality for up to a year depending on the storage temperature. The cooler the storage temperature, the longer dehydrated foods will last.

Reconstituting Dried Fruits and Vegetables

Dried fruits and vegetables may be reconstituted (restoring moisture) by soaking the food in water. Time for reconstituting will depend on the size and shape of the food and the food itself. Most dried fruits can be reconstituted within 8 hours, whereas most dried vegetables take only 2 hours.

To prevent growth of microorganisms, dried fruits and vegetables should be reconstituted in the refrigerator. One cup of dried fruit will yield approximately 1½ cups of reconstituted fruit. One cup of dried vegetable will yield approximately 2 cups of reconstituted vegetable. Reconstituted fruits and vegetables should be cooked in the water in which they were soaking.

Making Safe Jerky

Jerky can be made from almost any lean meat, including pork, venison, and smoked turkey. Jerky made from meat is of particular concern because dehydrators rarely reach temperatures beyond 140°F. This temperature is not high enough to kill harmful microorganisms that may be present on meat. Before dehydration, precook meat to 160°F, and precook poultry to 165°F. For best results, precook meat by roasting in marinade.

Meat preparation

To prepare meat for jerky, make sure that safe meat handling procedures are followed.

- **Clean:** Wash hands with soap and running water for at least 20 seconds before and after handling raw meat. Use clean utensils.
- **Chill:** Store meat or poultry refrigerated at 40°F or below prior to use. It is important to thaw frozen meat in the refrigerator. Never thaw meat on counter tops.

Slice partially frozen meat into strips no thicker than ¼ inch. Trim and discard any fat. Meat can be marinated for flavor and tenderness. Many marinade recipes can be used, including this recipe taken from Andress and Harrison, 2006.

Simple Meat Marinade Recipe

- 1½ – 2 lbs lean meat
- ¼ cup soy sauce
- 1 tbsp Worcestershire sauce
- ¼ tsp black pepper
- ¼ tsp garlic powder
- 1 tsp hickory-smoke flavored salt

Combine all ingredients. Place strips of meat in a shallow pan and cover with marinade. Cover and refrigerate 1 hour to 2 hours or overnight. **Heating meat to reduce chances of food-borne illness should be done at the end of marinating.** Bringing strips and marinade to a boil for about 5 minutes will accomplish this. Drain.

Drying meats

Drain strips on a clean, absorbent towel. Place strips in a single layer, making sure they don't touch or overlap. Dehydrate at 140°F until a test piece will crack, but not snap, when bent. Remove dried strips from rack and cool.

If the meat strips were not heated to 160°F in marinade prior to drying, you may want to do this in an oven after drying. Place the dried strips on a baking sheet and cook at for 275°F, or until meat reaches 160°F. This process adds an additional safety step to the process.

Storing meat jerky

Meat strips should be packaged in glass jars or heavy plastic storage bags. Jerky can be stored at room temperature for 2 weeks in a sealed container. For the longest shelf life, flavor, and quality jerky, store in the refrigerator or freezer.

References

Andress, E.C. and Harrison, J.A., Eds. 2006. So Easy to Preserve, (Bulletin 989, 5th ed.). Cooperative Extension Service, University of Georgia, Athens.

Kendall, P. and Sofos, J. 2003. Leathers and Jerkies, (No. 9.311). Cooperative Extension Service, Colorado State University.

For additional information on drying fruits and vegetables, contact the local Virginia Cooperative Extension office in your area.

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