

Consumer and Family Sciences



Department of Foods and
Nutrition



Drying Foods at Home

Food dehydration is a method of preserving food that fits today's lifestyles. Drying food offers one of the most economical and energy-efficient ways of preserving a variety of foods. It is estimated that drying costs less than canning and one-quarter as much as freezing.

Drying not only preserves foods but also offers new and different nutritious snacks such as dried fruits, fruit rolls, and meat jerkies.

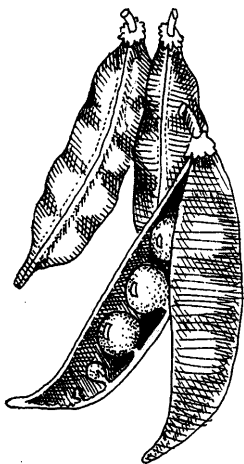
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How drying works as a preservative

The purpose of drying is to preserve food by lowering the amount of water or moisture in the food material to a point where microbial growth (bacteria, yeast, and mold) and chemical reactions (enzymatic deterioration) cannot destroy the food during storage. Though drying itself does not destroy enzymes, the dried food (especially pretreated dried food) is considered to be low enough in moisture to prevent enzymatic deterioration.

Because drying removes moisture, the food shrinks and becomes lighter in weight and thus is easier to store. When food is ready to use, the water is added back and the food returns to its original shape and form.

The **heat** used in drying is generally at a low temperature (120° to 150°F). If higher temperatures are used, the food cooks rather than dries. When the temperature is too high, the food cooks on the outside and the moisture cannot escape, causing “case hardening” and molding of the food. The drying process should never be hurried by raising the temperature during drying.



Low humidity aids the drying process, especially if the food naturally contains a lot of water. To dry food, the water must move from the food to the surrounding air. If the surrounding air is humid, drying of the food will be slowed down.

Air currents speed up drying by moving the surrounding moist air away from the food surface and drawing fresh dry air into contact with the food.

Foods can be dried by two general procedures: **indoor** or **outdoor drying**. Foods dried by **indoor drying** can be dried in an oven, a food dehydrator, or by the air. In **outdoor drying**, the food is dried directly in the sun, by a solar drier, or on the vine. Outdoor drying is not recommended in Indiana and other Midwestern states, because complete drying cannot be assured and the end quality of the food is questionable. All drying methods require the same essential guidelines of **warm temperatures, low humidity**, and an available **air current**.

General drying procedures

When selecting foods for dehydration, choose only foods that are in prime condition and



perfectly fresh, just as you would for any other method of preservation.

Although drying foods prevents microbial growth, certain chemical reactions caused by enzymes can still occur unless the product is pretreated before drying. Fresh produce, for example, contains many different enzymes that cause loss of color and loss of nutrients and flavor changes in dried vegetables and fruits. These particular enzymes must be inactivated by pretreating the food to prevent such reactions from taking place during the drying of the food.

Enzymes in vegetables are inactivated by the blanching process, which exposes vegetables to boiling water or steam for a brief period of time. Blanched vegetables, when dried, will have better color and flavor than unblanched.

The major problem associated with enzymes in fruits is the development of brown colors and the loss of vitamins A and C. Fruits are not blanched like vegetables because the blanching process gives them a cooked flavor. Instead, the enzymes in fruits are inactivated by using chemical compounds that interfere with deteriorative chemical reactions. The most common control chemical used is ascorbic acid (vitamin C). Ascorbic acid may be used in its pure form or in mixtures of ascorbic acid with citric acid and/or sugar. Sodium bisulfite is no longer recommended as a pretreatment chemical due to the increased number of people reporting sensitivities to sulfiting agents.

Dehydration processes

Indoor Drying Methods

Food Dehydrators. A food dehydrator is a small electrical appliance for drying foods indoors. Most food dehydrators have an electric element for heat and a fan and vents for air circulation. Efficient dehydrators are designed to dry foods rapidly and uniformly. They vary in cost from \$50 to \$300, depending on features. Some models are expandable so that additional trays can later be purchased. In general, 12 square feet dries a half-bushel of produce.

There are two basic designs for dehydrators: One has horizontal airflow and the other vertical airflow. The major advantages of horizontal flow are that it reduces flavor mixture, several different

foods can be dried at one time, all trays receive equal heat penetration, and juices or liquids do not drip down into the heating element. The heating element and fan are on the side.

Vertical airflow has the heating element and fan located at the base. If different foods are dried, flavors can mix, and liquids can drip into the base.

Dehydration of various fruits and vegetables at the University of Wisconsin-Madison, using the two types of dehydrators, has shown a difference in the final product depending on the type of dryer used. The vertical dryer usually dried food faster but readily over-dried the food if dried according to standard recipe specifications.

Helpful hints for using a food dehydrator:

- Spray trays with a nonstick pan coating spray to avoid sticking.
- Place food in a single layer. Avoid overlapping.
- Cut food in uniform sizes, shapes, and thickness.
- If the heat source and fan are at the bottom, the aromas will mix, so dry similar flavored foods. Horizontal fans and heat do not mix aromas.
- It is best not to dry strong-smelling foods such as onions and garlic in the home. The odors may linger in drapes, clothes, and furniture. Place the dehydrator in a carport or covered porch or patio. Protect the dehydrator from the rain.
- Near the end of the drying period, observe the food closely to avoid scorching.

The suggested temperatures for dehydrators with temperature control are:

Herbs	95°F
Vegetables	125°F
Fruits, fruit leathers	135°F
Jerkies	145°F

Portable dehydrators can be used on a 110/120-volt general-purpose circuit (15 AMP). When drying a particular food, follow the recipe accompanying the commercial dehydrator closely for a successfully dehydrated product.

Oven Drying. Everyone who owns an oven owns a food dehydrator. By combining the three factors discussed earlier — heat, low humidity, and air current — an oven can be used as a dehydrator.

An oven is ideal for occasional drying of meat jerkies, fruit leathers, and banana chips or for preserving leftovers like celery or mushrooms. Because the oven is needed for cooking, it may not be satisfactory for preserving abundant garden produce.

Drying in an oven is slower than in a dehydrator because ovens do not have built-in fans for the air movement (however, some convection ovens have a fan). It takes two to three times longer to dry food in an oven than in a dehydrator. Thus, the oven is not as efficient as a dehydrator and uses a great deal more energy.

To use your oven, check the oven dial to see if it has a reading as low as 140°F. If the thermostat does not go this low, your food will cook instead of dry.

For air circulation, leave the oven door propped open 2 to 4 inches. Place a fan near the outside of the oven door to improve circulation.

Because the door is left open, the drying temperature will vary. An oven thermometer placed near the food gives an accurate reading of the drying temperature. Adjust the temperature dial to give proper heat. Ovens can be heated 20 degrees higher than the recommended drying temperature and lowered to the suggested temperature after 2 hours.

Place food on wire racks 2 to 3 inches apart for proper air circulation.

Air Drying. This drying method differs from sun drying, since it takes place indoors in a well-ventilated attic, room, or screened-in porch. Herbs, hot peppers, and mushrooms are the most common air-dried items.

Herbs and peppers are not pretreated, but are simply strung on a string or tied in bundles and suspended from overhead racks until dry. Enclose them in paper bags to protect them from dust, loose insulation, or other pollutants.

Microwave Drying. Drying food successfully in a microwave oven is not possible, except for herbs and some leaf vegetables. Food that has been microwave dried tastes overcooked rather than dried. To dry herbs and leaf vegetables in a microwave, follow instructions in a microwave cookbook, or on page 10 of this publication.

Dehydrofreezing. Dehydrofreezing is a method of food preservation that combines the techniques of drying and freezing. Fruits or vegetables dried at home have had 85 to 90 percent of their moisture removed to prevent mold growth. However, by removing only 70 percent of the moisture and storing the fruit or vegetable in the freezer, a tastier product results. The freezer's low temperature inhibits microbial growth.

Fruits and vegetables processed this way have good flavor and color and reconstitute in about half the time it takes for dried foods.

This process is not freeze drying, which is a costly commercial technique that forms a vacuum while the food is freezing and is not available for home use.

Outdoor Drying Methods

Sun Drying. The high sugar and acid content of fruits make them relatively safe to dry outdoors. Sun-dried raisins are the best known of all dried foods. The San Joaquin Valley in California produces the world's largest supply of raisins. The warm temperature, low humidity, and constant breeze in the valley are ideal conditions for drying grapes.

High humidity or low drying temperatures are conditions that could halt the drying process, thus allowing favorable surroundings for the food to mold or rot before it is dried. For these reasons, outdoor drying of foods is not recommended in Indiana and other Midwestern states.

All foods dried outdoors also need a **pasteurization** treatment following drying to kill insects and their eggs. Unless destroyed, the insects will eat the dried food.

There are two recommended pasteurization methods:

Freezer Method. Seal the food in a plastic freezer bag, place in a freezer set at 0°F or below and hold for at least two days (48 hours).

Oven Method. Place the food on a tray or in a shallow pan and put in an oven preheated to 140° to 160°F for 30 minutes. Spread the food in a single layer when pasteurizing and package it as soon as possible following the brief heat treatment.



Solar Drying. Efforts to improve on sun drying have, in recent years, led to what is known as solar drying. Solar drying still uses the sun as the heat source, but a specially designed container increases the temperature and air current to speed up drying. The shorter drying time reduces the risk of food spoilage or molding.

Solar driers use a reflectant such as aluminum foil or glass to increase the sun's temperature from 85-100°F to 105-130°F. Air movement is increased by using air vents at each end. Cooler air enters the dryer, crosses the food, removes moisture, and escapes. Plastic covers the frame and prevents rain or condensation from dampening the food. Screens over the vents keep insects and birds off the food.

Solar dryers may need turning or tilting throughout the day to capture the direct, full sunlight. Food on the shelves needs to be stirred several times a day. Again, the food must be pasteurized prior to storage.

Vine Drying. Another method of drying outdoors is drying on the vines. To dry beans (navy, kidney, butter, great northern, lima, lentils, and soybeans), leave bean pods on the vine in the garden until the beans inside rattle. When the vines and pods are dry and shriveled, pick the beans and shell them. No further treatment is necessary. If beans are still moist, the drying process is not complete and the beans will mold if not more thoroughly dried. If needed, drying can be completed in an oven or a dehydrator. Pasteurization is needed for those beans dried entirely in the sun.

Determining dryness of food

Drying food is a slow process. Solar drying takes one to two days. It will take six or more hours to dry foods in a dehydrator and eight or more hours in your oven. Drying time depends on type of food, thickness, and type of dryer. Don't be tempted to speed up the drying time by increasing the temperature. You will end up cooking the food on the outside before it dries on the inside. This is called "case hardening." While the food may appear dry on the outside, it can be moist on the inside. Moisture left in the food will cause the food to mold.

To determine the dryness of the food, look, feel, and taste it. Remove several pieces of food from

the dehydrator. When the food has cooled, cut through the center of the thickest part. There should be no visible signs of moisture. A darker, wet interior indicates the need for extended dehydration.

To test for doneness, remove a piece of food during the end of the drying period. Cool to room temperature and check for the following signs:

- Fruit is pliable, springy, and will not stick together if folded (figs and cherries may be sticky).
- Vegetables are brittle and would shatter if hit with a hammer
- Meats are very dry. Jerky is dark, fibrous, and forms sharp points when bent.
- Herbs are brittle.
- Fruit leathers are dry to the touch. Fruit peels away from plastic wrap.

Packaging and storing

Dried foods must be properly stored to maintain a low moisture content and to prevent microbial deterioration. Before packing the foods, allow the dried pieces to cool. After the product has cooled, the food should be allowed to equilibrate for 5 to 10 days before storing. Place food in a covered container and recheck each day to see if the product is sufficiently dry; if not, dehydrate longer.

To store dried foods, pack them in clean, dry, insect-proof containers as tightly as possible without crushing. A recommended dry storage method is to place the dried food in plastic bags, press out air, seal or close and place in tightly sealed glass jars. Old peanut butter, mayonnaise, or other one-trip jars are recommended for storage of dried food.

To be sure that the food remains dry, add desiccant or silica gel, which are available in the notions or housewares section of department stores or at hobby shops. Place the substance in the glass jar to cover the bottom of the container to a depth of 1/4 inch. The desiccant absorbs any moisture from the surroundings and prevents the food from absorbing moisture. Place the dried food wrapped in a closed plastic bag over the desiccant and tightly seal the jar.

Packaged dried food should be stored in a dry, cool place at about 60°F. Because food quality is affected by heat, the storage temperature helps

determine the length of storage; the higher the temperature, the shorter the storage time. An acceptable storage area in winter may be too warm in the summer. Keep dried food out of the sun to prevent discoloration and nutrient loss. Some dried foods can also be stored successfully in the refrigerator or freezer.

Foods that are packaged seemingly “bone dry” can spoil if moisture is reabsorbed during storage. Check dried foods frequently during storage to see if they are still dry. Foods affected by moisture but not spoiled should be used immediately or redried and repackaged. Moldy foods should be discarded.

Rehydration of dried foods

Water removed during drying must be replaced either by soaking, cooking, or a combination of both.

Dried vegetables need about two hours soaking time before cooking. When you soak or rehydrate the vegetables, they should plump to nearly the same size they were when fresh. Start with 1½ to 2 cups water for each cup of dried vegetables. If necessary, add more water during the soaking process.

Soak root, stem, and seed vegetables for ½ to 2 hours in sufficient cold water to keep them covered (soaking in too much water may cause over-softening of vegetables). After soaking, simmer until tender, allowing excess water to evaporate. Greens, cabbages, and tomatoes do not need to be soaked. Simply add sufficient water to keep them covered and simmer until tender. Many vegetables lose their fresh flavor during drying. For this reason, flavorings such as basil, garlic, onions, and chili sauce may be added during cooking to improve flavor. Cook the vegetables in the same water in which they have soaked to save nutrients. Dehydrated vegetables are usually not used as cooked side dishes. They are best when used as ingredients for soups, casseroles, sauces, stuffings, and stews.

Dried fruits can be eaten or used in recipes as they are. If you wish to plump or soften the fruit slightly to make it more chewable, you can use one of these methods:

- Cover the dried fruit with boiling water, let it stand for five minutes and drain.

- Place the dried fruit in the top of a steamer over boiling water and steam three to five minutes until the fruit is plump.

Foods you should not dry at home

Milk, eggs, fish, and poultry are not recommended for home drying. Salmonella and Staphylococcus bacteria, which thrive on these foods, can survive and grow at low temperatures used to dry meat and dairy products. These bacteria grow very rapidly in such products because all the nutrient needs of these pathogenic or disease-producing bacteria are supplied by poultry, eggs, and dairy products.

Salmonella and Staphylococcus in home-dried foods have caused food poisoning outbreaks.

Nutritive value of dried foods

The nutritive value of dried foods, like that of foods preserved by canning and freezing, depends largely on the care exercised in preparation, processing, and storage. Some of the sugars, salts and water-soluble vitamins are lost during preparation. Some of the volatile oils and esters and readily oxidizable substances such as ascorbic acid (vitamin C) are lost during the drying process. The vitamin A content of vegetables decreases during storage. The loss of this vitamin is greatest in unblanched vegetables. Carbohydrates, minerals, and proteins are concentrated but are otherwise unaffected by drying. Further loss of nutrients can occur during storage unless the foods are properly packaged and sorted.

To keep the nutritional losses to a minimum, package dried foods in airtight containers, store them at the lowest temperature possible, and consume them within several months to a year after processing.

For those who follow the diabetes eating plan or other reduced-fat and reduced-calorie eating plans, dried fruits may satisfy a craving for sweets. However, be careful to consume only the amount equal to the fresh fruit exchange or serving. Drying removes water, not calories or sugar.

Drying fruits

Dried fruits are unique, tasty, and nutritious. It might be argued that they are even tastier than fresh fruits, and some people call them nature's candy. They taste sweeter because the water has been removed, thus concentrating the fruit's flavor. Dried fruit can be eaten as a snack or added to cereals, muffins, or ice cream.

Preparing the Fruit

There are many ways to slice fruit for drying. Thin, even, peeled pieces dry the fastest. The peel can be left on the fruit, but it will take longer to dry. Use a food processor for uniform, even slices.

Because fruits contain sugar and are sticky, spray the trays with nonstick pan coating spray before placing fruit on them. After the fruit dries for one to two hours, lift each piece gently with a metal spatula and turn.

Fruits dried whole take the longest to dry. Skins need to be cracked to speed up drying.

Pretreating the Fruit

Many fruits will darken rapidly after peeling due to oxidation, but there are several ways to prevent this color change:

Antioxidants

Ascorbic acid (vitamin C) is effective in preventing oxidation of most fruits. Ascorbic acid, in crystalline or tablet form, is available at drugstores. One teaspoon weighs about three grams (3,000 milligrams). Use $\frac{1}{2}$ teaspoon per quart of water as a dip to hold sliced peaches, apples, pears, or similar fruits while you get them ready for drying. Ascorbic acid may be added directly to fruit purees.

Ascorbic-citric acid mixture (A-C-M Everfresh*). Available in many supermarkets; can be used to prevent darkening. Use according to manufacturer's directions.

Ascorbic acid-sucrose mixture (Fruit-Fresh*). This product, available in supermarkets, is another anti-darkening product that should be used

* References to products in this publication are for your convenience and are not an endorsement of one product over similar products. You are responsible for using products according to the manufacturer's current label directions.

according to manufacturer's directions. Because the ascorbic acid is diluted by the presence of sugar in the mixture, larger amounts than pure ascorbic acid are needed.

Lemon juice or citric acid can help prevent darkening of some fruits, but they are not as effective as ascorbic acid. One tablespoon of lemon juice per quart of water can be used as a dip. There may be a slight but usually unobjectionable flavor change.

Simply dipping the fruits into a fruit juice containing vitamin C (ascorbic acid) will help keep the natural color and prevent further darkening. Suggested fruit juices include orange, lemon, pineapple (may be diluted half strength with water), grape, or cranberry with added vitamin C.

Pour two cups fruit juice into a one- to two-quart bowl. Slice fruit and place immediately in the bowl of juice. Soak fruit for three to five minutes, drain and place on sprayed trays. Fruit juice can be reused; cover and store in refrigerator and use within one to two days.

Honey

Honey is a sweetened dip that coats fruit to prevent darkening. Many of the commercially produced dried fruits are honey-dipped. This method can be used at home. Honey-dipped fruits are higher in calories.

Prepare the dip by dissolving $\frac{1}{2}$ cup sugar in $1\frac{1}{2}$ cups boiling water. Cool to lukewarm and add $\frac{1}{2}$ cup honey. Makes $2\frac{1}{2}$ cups. Dip fruit in small batches. Allow to soak three to five minutes. Remove with slotted spoon and drain.

Hot Syrup

This is another type of sweetened dip. Combine 1 cup each of corn syrup, sugar, and water. Bring to boil, add fruit, simmer 15 to 20 minutes and drain well. Place on sprayed trays and lift fruit gently. Syrup dip increases drying time. This product is like a candied fruit. For further recommendations on specific fruit pretreatment, see Table 1.

Drying Temperature

Fruits are generally dried at 140°F for varying lengths of time. Preheat the oven or dehydrator to 160°F. Load trays. After two hours, decrease the temperature to 140°F. Drying times vary. Fruits are soft and pliable and not tacky when dry. Banana

and apple chips can be dried until they are crisp. For recommended drying times, see Table 1 (remember to follow drying times specified for your commercial dehydrator, if available).

Drying vegetables

Vegetables contain less carbohydrates and dry faster than fruits. Drying is an excellent way to preserve potatoes, onions, and green or red peppers. Unused celery or mushrooms can be preserved for later use by drying.

For vegetables, drying time is crucial to tenderness. The longer the drying time, the less flavorful and the poorer the product. Drying time can be hastened by drying small uniformly cut pieces. To achieve this, use a food slicer or food processor.

Vegetables also have a lower moisture content than fruits; therefore, a lower dryer temperature of 125°F is needed (tomatoes and onions with more water can be dried at 140°F).

Vegetables dry much faster than fruits. Also, as the drying period ends, they give up moisture rapidly. Vegetables will scorch if too high a temperature is used and if dried too long. They will be brittle when dried.

Preparing Vegetables

Wash vegetables in cool water to remove soil. Trim and peel, then cut, slice, or shred. Remove any fibrous or woody portions and core when necessary, removing all decayed and bruised areas. Keep pieces uniform in size so they will dry at the same rate, and prepare only as many as can be dried at one time. Holding vegetables, even in the refrigerator, after washing and preparation for drying will result in loss of quality and nutrients. Dry vegetables immediately after harvesting.

Pretreating Vegetables

Blanching is a necessary step in preparing vegetables for drying. It stops the enzyme action that causes loss of color and flavor during drying and storage. It also sets the color and shortens the drying and rehydration time by relaxing the tissue walls so moisture can escape or enter more rapidly. By definition, blanching is the process of heating vegetables to a temperature high enough to destroy enzymes present in the tissue. In water blanching, vegetables are submerged in boiling water. In steam blanching, they are suspended above the boiling

water and heated only by steam. Water blanching usually results in a greater loss of nutrients but takes less time than steam blanching. Recommended blanching and drying times are shown in Table 2.

Water Blanching. Fill a large kettle two-thirds full of water, cover and bring to a rolling boil. Place vegetables in a wire basket or colander and submerge them in the water. Cover and blanch according to directions for each vegetable (Table 2). If it takes longer than one minute for the water to come back to a boil, too many vegetables were added. Reduce the amount in the next batch.

To stop blanching, see “Cooling Process” below.

Steam Blanching. Use a deep kettle with a close-fitting lid and wire basket, colander or sieve placed so steam will circulate freely around the vegetables. Place vegetables loosely in the basket no more than 2½ inches deep. Add several inches of water to the kettle and bring to a rolling boil. Place the basket of vegetables in the kettle. Make sure the water does not come in contact with the vegetables. Cover and steam according to directions for each vegetable (Table 2).

Cooling Process. After blanching, dip the vegetables briefly in cold water, only long enough to stop the cooking action; do not cool them to room temperature. When they feel only slightly hot to the touch, they will be cooled to about 120°F. Drain the vegetables by pouring them directly onto the drying tray and arrange them in a single layer. Then immediately place the tray in the preheated dehydrator. The heat left in the vegetables from blanching will cause the drying process to begin more quickly.

Dried food specialties: Fruit leathers

Fruit leather is made by drying thin layers of pureed fruit or leftover fruit pulp in the oven, sun, or dehydrator. While most fruits or fruit combinations can be used for making fruit leathers, grapefruit and lemons are not recommended because they turn bitter when dried.

Some references for preparation of fruit leather suggest heating the fruit before drying to stop enzymatic action, help preserve the fruit’s natural color, and speed the drying process. Other refer-

ences simply recommend blending the fresh fruit with an antioxidant and drying the puree as is. Both methods are given below.

Preparation

Uncooked Method. Select ripe or slightly over-ripe fruit. Sort and wash, removing blemishes or defective parts of acceptable fruit. Peel apples, oranges, peaches, pears, and tomatoes, if desired. Pit and core fruit as needed. Remove seeds from grapes, if desired. Hull strawberries. Cut fruit into chunks and place in food chopper or blender.

Add $\frac{1}{2}$ to 1 tablespoon lemon juice or $\frac{1}{4}$ teaspoon pure ascorbic acid (ascorbic acid mixtures also may be used according to label instructions) to each 2 cups of light-colored fruit to help preserve natural color and slow enzymatic action.

Chop, grind, or blend fruit until a thick puree is formed. One to 2 tablespoons water may be added to help blend some fruits. You may also wish to add 1 tablespoon of sugar, corn syrup, or honey to each 2 cups of tart fruit such as pineapples or oranges. Additional sugar is not needed for nontart fruit. A small amount of spice ($\frac{1}{4}$ teaspoon or dash of nutmeg) or $\frac{1}{4}$ cup sesame, pumpkin, or sunflower seeds may also be added per 2 cups puree, if desired.

Cooked Method. Select, wash, peel, pit, and core fruit as described for uncooked method above. Cut into slices or chunks and place in double boiler. Add water to bottom of double boiler. Cover and cook for 15 minutes or until soft. Crush fruit in a blender or food grinder. Addition of sugar and spices are optional, as described above.

Shortcut Canned Method. Substitute canned fruit or baby food fruit (without tapioca) for the cooked fruit above. Canned applesauce and strained baby food will not need to be pureed. Other canned fruits will need to be drained and pureed. Since canned fruits have been heat processed to stop enzymatic action, the addition of ascorbic acid is unnecessary.

Drying

Spray a cookie sheet or similar flat tray with vegetable spray or line with plastic wrap. Do not

use waxed paper or aluminum foil, as you may end up eating them with your fruit leather. Spread the fruit concentrate evenly over the surface of the pan to a depth of no more than $\frac{1}{4}$ inch. Two cups puree is enough to cover a 12 x 17-inch cookie sheet.

Oven Drying. Set oven at lowest possible setting (140°-150°F). Place the trays of puree on the racks in the oven and leave door cracked open about two to six inches, depending on oven door. Check temperature of oven periodically with thermometer. If necessary, turn oven off for short time if temperature is too high. The fruit concentrate should dry in four to 10 hours. Test frequently for dryness (See “Test for Dryness” section below).

Dehydrator Drying. Place sheets or trays of fruit concentrate in dehydrator. Set temperature control at 140° to 150°F or follow manufacturer’s directions. Test frequently for dryness. Drying time will be four to 10 hours.

Test for Dryness. Properly dried fruit leather will be translucent and slightly tacky to the touch, but easily peeled from the pan or plastic wrap. After loosening the edge of the leather from the plastic wrap or pan, loosely roll the leather in plastic wrap or waxed paper in one piece.

Storage. Store fruit leather in a cool, dry, dark place. It will keep up to a year or more in the freezer, several months in the refrigerator, or a few weeks at room temperature (70°F). Storage time usually reflects surrounding conditions (temperature fluctuation in refrigerator or freezer) and may influence shelf life one way or another.

Dried food specialties: Yogurt leathers

Yogurt leather is made by drying layers of plain or fruit-flavored yogurt in a dehydrator. Follow general drying directions for fruit leathers. Preheat dryer to 120°F, put tray of yogurt in dehydrator, and raise temperature to 125°F to compensate for initial temperature drop. Lower temperature to 120°F approximately one hour after placing tray in dryer. Check for doneness after four to five hours. Doneness test is similar to fruit leathers.



Drying meats

Meats need to be dried indoors at 145°F using a dehydrator or oven. Jerky can be stored at room temperature for one to two months, but placing it in the refrigerator or freezer extends its shelf life.

Meat Jerky

Jerky is a marinated meat, sliced thinly and dried. Marinades contain salt, oil, and an acetic liquid such as wine, vinegar, or lemon juice. These ingredients are important because they slow down microbial growth during the long drying process. Do not omit any ingredient from the recipe.

A number of lean meats can be used to make jerky, including round steak, flank steak, sirloin tip, rump roast, or lean venison. Never use pork or bear as is, but first cook to 170°F internal temperature to destroy parasites that cause trichinosis. The use of raw turkey and chicken is discouraged because drying does not destroy Salmonella (a disease-causing bacteria).

Preparation

Remove connective tissue and gristle from fresh meat. Trim off visible fat to prevent rancidity or off-flavors during storage. Freeze meat until firm, but not solid.

Slice the meat into long, thin strips, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, 1 to $1\frac{1}{2}$ inches wide and 4 to 12 inches long. Most references recommend cutting with the meat grain. Lay the strips out in a single layer on a smooth, clean surface. Flatten strips with heel of hand or a rolling pin so they are fairly uniform in thickness.

Season the meat strips by rubbing in no more than 1 teaspoon salt per pound of fresh meat. Add pepper, garlic and onion powder, favorite herbs, or other seasonings to taste. Curing salts are also available and often contain premixed spice mixtures.

Jerky may also be seasoned by marinating for several hours. A recipe for seasoning with Liquid Smoke and two recipes for seasoning with marinades are given on this page.

Drying

Remove meat strips from marinade, if used, and pat dry with paper towels. Dry strips in the oven or dehydrator.

Smoke Seasoning

(seasons 2 pounds lean meat)

2 tablespoons water

$\frac{1}{2}$ teaspoon Liquid or Powdered Smoke

Salt and pepper

Combine water and smoke flavoring. Brush mixture on both sides of meat strips. Place the meat strips, layer on layer, in a large bowl. Cover with a plate and put a weight on top. Refrigerate for at least two hours or overnight.

Spicy Marinade

(seasons 2 pounds lean meat)

$1\frac{1}{2}$ teaspoons seasoned salt

$1\frac{1}{2}$ teaspoons onion powder

$\frac{1}{4}$ teaspoon black pepper

$\frac{1}{2}$ teaspoon garlic powder

$\frac{1}{4}$ cup soy sauce

$\frac{1}{3}$ cup Worcestershire sauce

Combine seasonings, pour over meat strips, and mix gently. Cover and refrigerate for at least two hours or overnight. Stir occasionally while refrigerating.

Teriyaki Marinade

(seasons 2 pounds meat)

$\frac{1}{4}$ cup soy sauce

2 cloves garlic, crushed

1 teaspoon freshly grated ginger root or $\frac{1}{2}$ teaspoon ground ginger

2 teaspoons sugar

1 teaspoon salt

Combine seasonings, pour over meat strips in a large bowl, and mix gently. Cover and refrigerate for at least two hours or overnight. Stir occasionally while refrigerating.

Oven Drying. Stretch strips across clean oven racks or other drying trays. If any strips are too short, fasten several together with wooden toothpicks. Allow edges of the meat strips to touch but not overlap. Leave enough open space on the racks for air to circulate around strips. Arrange racks so that the top one is at least four inches below the top heat source and the bottom rack is at least four inches above the bottom heat source. Set oven temperature at 140° to 150°F and let strips dry for about 11 hours, or until they are chewy and leathery.

Dehydrator Drying. Follow manufacturer's or oven drying instructions.

Test for Dryness. Properly dried jerky is chewy and leathery. Be sure to test for dryness after cooling; warm jerky will be pliable, even though enough moisture is removed.

When jerky is sufficiently dry, remove from drying area and blot up any drops of oil that have accumulated from marbled fat with paper towels. Cool. Serve, or store in an airtight container. Too much air causes off-flavors and rancidity.

Store containers of jerky in a cool, dry, dark place or the refrigerator or freezer. Dried jerky may be stored up to a year.

Herbs

The best time to harvest most herbs for drying is just before the flowers open when they are in the bursting bud stage. Rinse herbs in cool water and shake to remove excess moisture. Discard all bruised, soiled, or imperfect leaves and stems.

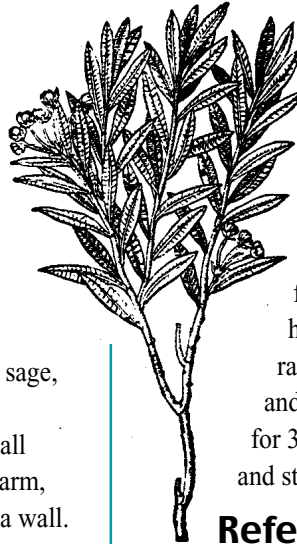
Herbs with long stems such as marjoram, sage, savory, mint, and rosemary can be dried in bunches. Tie the stem ends together into small bunches and hang them upside down in a warm, dry, shaded area. Do not hang them against a wall. Air should circulate freely around the drying herbs to remove the moisture without destroying the oils. If herbs are dried outside, bring them inside at night to prevent them from reabsorbing moisture. To protect the herbs from dust and other airborne contaminants, place each bunch inside a paper bag. Gather and tie the bag firmly around the stem ends so that the herb leaves hang freely inside the bag. Cut out the bottom of the bag or leave air holes in the sides to provide ventilation.

Tray drying is best for seeds and large-leaved herbs such as basil and those with short-tipped

stems. Spread seeds or herbs one layer deep on screens so air can circulate freely. If drying outside, cover trays with cheesecloth to protect herbs from birds, insects, and airborne contaminants. Stir or turn herbs daily to ensure uniform and thorough drying.

Drying should be complete in one to two weeks, depending upon temperature and humidity. When leaves are crispy dry and crumble easily in the fingers, they are ready to be packaged and stored. Place herbs in airtight containers and store in cool, dry, dark areas to protect color and fragrance.

Microwave ovens are a quick way to dry herbs when only small quantities are to be prepared. Place no more than four or five herb branches between two paper towels and put in the oven. Turn oven on for two to three minutes. Remove herbs from oven and place them on a rack for cooling. If herbs are not dry and brittle, repeat microwave drying for 30-second intervals until dry. Prepare and store as for air-dried herbs.



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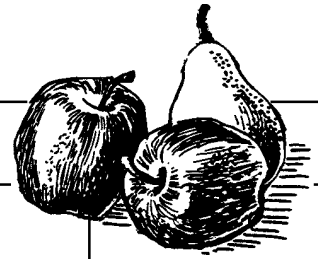


Table 1. Home Drying of Fruits

Fruit	Preparation	Treat before drying with one of these methods (minutes)			Drying times		Test for Dryness (cool first)
		Dipping	Steam Blanch	Water Blanch	Sun Drying (days)	Dehydrator (hours)	
Apple	Peel and core, cut into slices or rings about 1/8 inch thick.	3-5*	3-5, depending on texture	- -	3-4	6-12	Soft, pliable, no moist area in center when cut
Apricots	Pit and halve for steam blanch. Leave whole for water blanch. Pit and halve after water blanch.	3-5*	3-4	4-5	2-3	23-36*	Same as for apples
Bananas	In dry, warm, sunny climates, it is preferable to partly dry on the tree.	3-5*	N.R.	N.R.	4-5	5-24	Light to medium brown, pliable to brittle
Figs	Figs normally drop from the tree when 2/3 dry. In coastal areas, pick fruit when ripe.	No treatment necessary			4-5	12-20	Fresh, pliable, slightly sticky, but not wet
Grapes: Muscat, Tokay, or any-seedless grape	Grapes dry in less time if blanched 1/2 to 1 minute.		Opt.	Opt.	3-5	12-20	Raisin-like texture, no moist center
Nectarines and Peaches	For steam and water blanching, leave whole, then pit and halve.	3-5*	8	8	3-5	36-48*	Same as for apples
Pears	Cut in half and core. Peeling preferred.	3-5*	6 (peeled will be soft)	- -	5	24-36*	Same as for apples
Persimmons	Use firm fruit when using the longer, softer variety, and use riper fruit when using the round, drier variety. Peel and slice with stainless steel knife.	No treatment necessary			5-6	18-24	Light to medium brown, tender but not sticky
Prunes	For sun drying, blanch in boiling water or steam for 1 to 1 1/2 minutes to "check" skins. For oven drying, rinse in hot tap water. Leave whole.		Opt.	Opt.	4-5	24-36	Leathery: pit should not slip when squeezed if prune not cut

*Preferred method

**Drying times can be shortened by cutting fruit into slices.



Table 2. Home Drying of Vegetables

For portable dehydrators, set temperature at 140°F.
Sun drying requires temperatures of 98° to 100°F (Not recommended in humid climates.)

Vegetable	Preparation	Blanching		Drying	
		Method	Time (minutes)	Method	Time (hours)
Asparagus	Wash thoroughly. Halve large tips.	Steam Water	4-5 3½-4½	dehydrator sun	6-10 8-10
Beans, green	Wash thoroughly. Cut in short pieces or lengthwise.	Steam Water	2-2½ 2	dehydrator sun	8-14 8-10
Beets	Cook as usual. Cool. Peel. Cut into shoestring strips ⅛ inch thick.	Already cooked; no further blanching		dehydrator sun	10-12 8-10
Broccoli	Trim, cut as for serving. Wash thoroughly. Quarter stalks lengthwise.	Steam Water	3-3½ 2	dehydrator sun	12-15 8-11
Brussels sprouts	Cut in half lengthwise through stem.	Steam Water	2½-3 1½-2	dehydrator sun	12-18 9-11
Cabbage	Remove outer leaves; quarter and core. Cut into ⅛-inch strips.	Steam until wilted Water	2½-3 1½-2	dehydrator sun	10-12 6-7
Carrots	Use only crisp, tender carrots. Wash thoroughly. Cut off roots and tops; preferably peel, cut in slices or strips ⅛ inch thick.	Steam Water	3-3½ 3½	dehydrator sun	10-12 8
Cauliflower	Prepare as for serving.	Steam Water	4-5 3-4	dehydrator sun	12-15 8-11
Celery	Trim stalks. Wash stalks and leaves thoroughly. Slice stalks.	Steam Water	2 2	dehydrator sun	10-16 8
Corn on the cob	Husk, trim.	Steam until milk does not exude from kernel when cut. Water	2-2½ 1½	dehydrator sun	12-15 8
Corn, cut	Prepare in same manner as corn on the cob after blanching.			dehydrator sun	6-10 6
Eggplant	Wash, trim, cut into ¼-inch slices.	Steam	3½	dehydrator sun	12-14 6-8
Horseradish	Wash; remove small rootlets and stubs. Peel or scrape roots. Grate or cut into ⅛-inch slices.	None	- -	dehydrator sun	4-10 7-10

Table 2. Home Drying of Vegetables (continued)

Vegetable	Preparation	Blanching		Drying	
		Method	Time (minutes)	Method	Time (hours)
Mushroom (See warning below)***	Scrub thoroughly. Discard any tough, woody stalks. Cut tender stalks into short sections. Do not peel small mushrooms or “buttons.” Peel and slice large mushrooms.	None	--	dehydrator sun	8-10 6-8
Okra	Wash, trim, slice crosswise in 1/8 to 1/4-inch disks.	None	--	dehydrator sun	8-10 8-11
Onions	Wash, remove outer “paper shells.” Remove tops and root ends, slice 1/8 or 1/4 inch thick, or dice.	None	--	dehydrator sun	10-20 8-11
Parsley	Trim, cut as for serving. Wash thoroughly. Quarter stalks lengthwise.	None	--	dehydrator sun	1-2 6-8
Peas	Shell.	Steam Water	3 2	dehydrator sun	8-10 6-8
Peppers and Pimientos	Wash, stem, core. Remove “partitions.” Cut into 3/8-inch disks.	None	--	dehydrator sun	8-12 6-8
Potatoes	Wash; peel. Cut into shoestring strips 1/4 inch thick, or cut in slices 1/8 inch thick.	Steam Water	6-8 5-6	dehydrator sun: 1/4" strips 1/8" slices	8-12 8-11 4-6
Spinach and other greens (Kale, Chard, Mustard)	Trim, wash very thoroughly.	Steam until thoroughly wilted	2-2 1/2	dehydrator sun	8-10 6-8
Squash: Summer	Wash, trim, cut into 1/4-inch slices.	Steam Water	2 1/2-3 1 1/2	dehydrator sun	10-12 6-8
Squash: Winter	Cut or break into pieces. Remove seeds and cavity pulp. Cut into 1 inch-wide strips. Peel rind. Cut strips crosswise into pieces about 1/8 inch thick.	Steam Water	2 1/2 1	dehydrator sun	10-16 6-8
Tomatoes, for stewing	Dip in boiling water to loosen skins. Chill in cold water. Peel. Cut into sections about 3/4 inch wide, or slice. Cut small pear or plum tomatoes in half.			dehydrator sun	10-18 8-10

*** WARNING: The toxins of poisonous mushrooms are not destroyed by drying or cooking. Only an expert can differentiate between poisonous and edible varieties.

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