

Drying Food at Home

Drying food at home has several advantages. It can help you save money, gain control over what's in your food, and preserve the bounty of summer gardens and orchards for your family's year-round enjoyment.

People have been preserving food by drying for thousands of years. In ancient times, drying was carried out naturally by the sun and wind. Today, the use of electric food dehydrators has made home food drying quicker, simpler, and much less dependent on the weather.

Drying preserves food by removing the moisture that bacteria, yeasts, and molds need to grow. It slows the action of enzymes so that color, texture, and quality do not degrade as quickly as in fresh foods. Drying is aided by warm temperatures, low humidity, and increased air flow to carry the moisture away from the food. With much of their moisture removed, dried foods are lighter, smaller, and do not need refrigeration, making them favorites for hikers and campers. They are also gaining popularity as healthier snack alternatives to candy and chips. Because much of the moisture is removed, flavors are concentrated. Some dried foods (such as fruits and jerky) can be eaten dry; others (most vegetables) require rehydrating before use. Dried herbs are often used in cooking.

To ensure the safety of dried food and prevent the growth of molds and other spoilage microorganisms, each type of food must be dried to the proper moisture level, as indicated under each food category on the following pages.

The nutritional value of foods is affected by the drying process, with some loss of vitamins A, B, and C. Less vitamin C is lost if fruits and vegetables are dried quickly, away from sunlight, using lower temperatures as drying nears completion. Blanching vegetables before drying causes the loss of the water-soluble vitamins B and C, as well as some minerals, but helps to preserve vitamins A, B, and C during drying and storage. Ounce-for-ounce, dried fruits and vegetables contain more calories and fiber than their fresh counterparts, since nutrients are concentrated as water is removed from the drying food. Nutritional value, as well as quality, is best preserved by proper storage of dried foods, away from heat, light, and moisture.

Outdoor Drying Methods

Sun drying relies on hot, dry, breezy weather to remove the moisture from foods. A minimum temperature of 86°F with humidity below 60 percent is best. In Kentucky, our typically humid summer weather makes sun drying difficult. Even under ideal conditions, sun drying takes several days and should only be used for fruits, whose high sugar and acid content help fight spoilage and ensure safety. Vegetables and meats are best dried indoors, where temperature and humidity can be controlled.

Racks used for drying fruits outdoors must be made of food safe materials such as stainless steel, Teflon-coated fiberglass, or plastic. Avoid screens made from "hardware cloth" or other galvanized metal, which may leave harmful residues on the

food. Aluminum screens may discolor and corrode. Placing the racks on raised blocks on a concrete, aluminum or tin surface will allow for better air circulation, aid in reflection of the sun, and help keep the drying food away from ground moisture. Covering the fruit with a second screen or cheesecloth during drying will help protect it from birds and insects. The drying racks need to be covered or brought indoors at night to keep moisture from the cool night air from settling back onto the food and slowing the drying process.

Solar dryers use the sun as a heat source but are designed to concentrate the sun's rays to increase temperature and air flow and speed up the drying process. They are covered to prevent rain or condensation from reaching the food and have screen-covered vents to keep insects and birds out. They may require turning or tilting during the day to capture the full heat of the sun. Plans or kits for building solar dryers are available online. Check with your local county Extension office for more information.

Vine drying can be used for mature beans and peas, including lima, kidney, and pinto beans, lentils, and black-eyed peas. The bean pods are simply left on the vines in the garden until the vines and pods are shriveled and the beans inside rattle when shaken. No pretreatment is necessary. To test for dryness, pick and shell a few beans. Properly dried beans should shatter when hit with a hammer. If the test beans are not dry enough, leave the rest on the vine for further drying. If necessary, drying can be completed in the sun or indoors in an oven or dehydrator. If not thoroughly dried, the beans will mold.

Pasteurization

All foods that are dried outdoors in the sun or on the vine must be pasteurized to kill any insects or eggs that may be present. Foods can be pasteurized in the freezer or in the oven. To pasteurize by freezing, seal the dried food in

plastic freezer bags and place in a freezer set at 0°F or lower for at least 48 hours. To pasteurize in the oven, place the dried food in single layers in shallow pans or cookie sheets and place in a preheated 160°F oven for 30 minutes. At the end of that time, spread the food out on a clean and sanitized surface to cool; package as soon as the food is cool.

Indoor Drying Methods

Electric food dehydrators offer the simplest, quickest way to dry most foods indoors. Electric elements provide heat; fans and vents provide air circulation. They are designed to efficiently dry foods at temperatures of 100 to 145°F, depending on the food. They can be used for fruits, vegetables, meats, herbs, and leathers. Both horizontal air flow and vertical air flow designs are available. For some models, additional drying trays can be added later, increasing drying space. Twelve square feet of drying space will dry about a half-bushel of produce.

When shopping for a dehydrator, look for the following features:

- the UL (Underwriters Laboratories) seal of approval
- double wall construction of metal or high-grade plastic
- enclosed heating elements
- fan or blower for air circulation
- thermostat and dial for regulating drying temperature
- four to ten open mesh trays
- warranty and service information or technical assistance

When using a dehydrator, preheat the appliance to 10°F higher than the recommended drying temperature and spray the trays with a nonstick cooking spray to prevent sticking. Mesh screens placed on the drying trays will prevent small

pieces of dried foods such as berries, herbs, peas, or corn from falling through the trays. Once the food is placed in the preheated dehydrator, decrease the temperature to the recommended drying temperature for the food being dried. This is usually in the range of 130 to 145°F and should be specified in the manufacturer's instructions for each model of dehydrator.

Oven drying is slower and less efficient than using a dehydrator because most ovens do not have a built-in fan for air circulation. Drying foods in an oven takes more energy and two to three times longer than drying in a dehydrator. To increase air circulation, the oven door should be propped open a few inches and a fan placed outside the oven near the door so that the air flows through the oven and out the other side.

For an oven to be used in drying food, it must maintain a temperature of 140°F. (At higher temperatures, the food will cook instead of dry.) To determine whether your oven can maintain a low enough temperature, place an oven thermometer in the rear of the oven and arrange the door and fan as described above. Set the oven to its lowest heat setting and monitor the temperature on the oven thermometer. If the temperature inside the oven is higher than 160°F, the oven cannot be used for drying. If your oven is suitable for drying, the trays used should have at least 1½ inches of clearance on all sides and oven racks should be placed 2 to 3 inches apart to allow proper air circulation. Rotate the drying foods occasionally to increase moisture loss and prevent sticking.

Caution: Oven drying is not a safe practice for a home with small children.

Room drying takes place indoors in a warm, well-ventilated room, attic, or screened-in porch. It is most commonly used for herbs, hot peppers, and nuts in-the-shell. Herbs and peppers can be strung on a string or tied in small bunches and

hung from the ceiling or racks until dry. Enclosing them in paper bags with holes punched for air circulation protects them from dust and catches any leaves and seeds that fall off. Nuts are spread on parchment paper a single layer thick.

Microwave oven drying is not suitable for fruits, vegetables, or meats because there is no way to create enough air flow in the microwave oven. However, if allowed by the manufacturer, it can be a quick method for drying herbs when only small quantities are needed. Be sure to follow the microwave oven manufacturer's instructions to avoid damaging your microwave oven.

Drying Fruit

To dry or not to dry? Not all fruits are suitable for drying. Refer to Table 1 to see which fruits are recommended for drying or using in leathers. Some fruits are better enjoyed fresh, canned, or frozen.

When drying, start with good quality fruit. To minimize the loss of nutrients, dry as soon as possible after picking. Wash well and drain; core, if needed. Some fruits are best cut in half or sliced before drying. Thin, peeled uniform slices dry the fastest. Smaller fruits such as blueberries, grapes, and cherries can be left whole, but the skins need to be "checked" or cracked to speed drying. For more information on cutting fruits and vegetables see Kentucky Cooperative Extension publications *How to Hold a Knife* (FN-SSB.902A) and *How to Slice and Dice* (FN-SSB.902C).

Checking Skins

To check the skins of berries, grapes, or cherries that are dried whole, dip the fruit in briskly boiling water for 15 to 30 seconds or until skins crack and then immediately immerse in ice cold water for a few seconds to stop the cooking action. Drain on paper towels. No additional pretreatment is needed.

Pretreating Fruit

Pretreating fruit before drying is not required, but is advisable for most fruits to prevent darkening and to help maintain quality during storage. Following are several options for pretreating fruit.

Sulfuring is an old method in which sulfur is burned in an enclosed box with the fruit. Because of the health hazards presented, this method is no longer recommended.

- ♦ **Sulfite dips** can provide the same anti-darkening effect as sulfuring, but are safer, quicker, and easier to use. Only food grade (USP) or pure (reagent grade) sulfites should be used. These are available from some drugstores or stores that sell wine-making supplies. Dissolve sulfites in water at the following measurements per quart.
 - » sodium bisulfite: $\frac{3}{4}$ to $1\frac{1}{2}$ teaspoons
 - » sodium sulfite: $1\frac{1}{2}$ to 3 teaspoons
 - » sodium meta-bisulfite: 1 to 2 tablespoons per quart
- » Soak prepared fruit slices for 5 minutes; halves for 15 minutes. Rinse treated fruit lightly under cold water and place on drying trays. The sulfite solution can be used only once. The next batch of fruit requires a new sulfite solution. For long-term storage of dried fruit, sulfite pretreatment is more effective than the other options listed below. However, since sulfites have been found to cause reactions in people with asthma, you may wish to avoid their use. If dried foods are eaten within a short time, the shorter-term pretreatments listed below may be just as effective.
- ♦ **Ascorbic acid** (vitamin C) mixed with water is a safe way to prevent browning, but the effects are not as long-lasting as those of sulfite dips. Ascorbic acid is available in powdered or tablet form. One teaspoon of the powder is equal to 3,000 mg in tablet form. Mix 1 teaspoon ascorbic acid powder (or 3,000 mg in tablet form, crushed) in 2 cups water. Soak prepared fruit for 3 to 5 minutes. Remove, drain well, and place on drying trays. After this solution has been used twice, add more ascorbic acid.
- ♦ **Ascorbic acid mixtures** are used to prevent browning in fresh fruits, canning, and freezing. An example is Ball® Fruit-Fresh®. These mixtures contain ascorbic acid and sugar and are generally not as effective as pure ascorbic acid in preventing darkening in dried fruits. To use, follow the directions on the product label.
- ♦ **Fruit juice dips** can help prevent darkening, although they may not be as effective as pure ascorbic acid. Choose a pure fruit juice high in vitamin C, such as orange, lemon, pineapple, grape, or cranberry. Apple juice fortified with vitamin C can also be used. Each fruit juice will add its own color and flavor to the dried fruit. Cover prepared fruit with juice and soak for 3 to 5 minutes, drain well, and place on drying trays. Fruit juice can be used twice for soaking. The used juice is suitable for drinking.
- ♦ **Honey dip** adds flavor and calories to dried fruit. To make the dip, mix $\frac{1}{2}$ cup sugar with $1\frac{1}{2}$ cups boiling water. Cool to lukewarm and add $\frac{1}{2}$ cup honey. Soak prepared fruit for 3 to 5 minutes, drain well, and place on drying trays.
- ♦ **Syrup blanching** helps fruit keep its color fairly well during drying and storage and yields a product similar to candied fruit. It also adds calories. Fruits that can be syrup blanched include apples, apricots, bananas, nectarines, peaches, pears, persimmons, and sour cherries. To blanch fruit in syrup, combine 1 cup sugar, 1 cup light corn syrup, and 2 cups water in a saucepan. Bring to a boil. Add 1 pound of prepared fruit and simmer 10 minutes. Remove from heat and let stand for 30 minutes. Lift fruit out of syrup, rinse lightly in cold water, drain on paper towels, and place on drying trays.

- **Steam blanching** helps dried fruit keep its color, but changes the flavor and texture. To steam blanch, place several inches of water in a large saucepan with a tight-fitting lid. Heat to boiling. Place fruit, no more than 2 inches deep, in a steamer basket over the boiling water. Cover tightly with the lid, begin timing immediately and steam for the length of time specified in Table 2 for each fruit. Check for even blanching halfway through; stir if needed. Remove excess moisture with paper towels and place fruit on drying trays.

Drying the Prepared Fruit

When you are ready to dry the prepared fruit, spray the drying trays lightly with nonstick cooking spray to prevent sticking. Place the fruit pieces in a single layer on each tray, without touching or overlapping. Follow the directions for the drying method you are using. Most fruits should be dried at 135 to 140°F. After the fruit dries for 1 to 2 hours, lift and turn each piece gently with a spatula. Approximate drying times are given in Table 2. Food dries much more quickly near the end of its drying time, so be sure to watch it closely to prevent excessive drying or sticking.

Most fruits should have about 20 percent (20%) moisture content when dried. To test for dryness, cut several cooled pieces of fruit in half. There should be no visible moisture and you should not be able to squeeze out any wetness. The fruit may be pliable, but should not be sticky. If folded in half, it should not stick to itself. Berries should rattle when shaken.

After drying, cool the fruit for 30 to 60 minutes before packaging. Packaging warm fruit can cause sweating and moisture buildup, but letting the cooled fruit sit for too long before packaging can allow it to reabsorb moisture from the air.

Conditioning Dried Fruit

The moisture content of most fruits should be about 20 percent (20%) when dried. When the fruit is taken from the dryer, some pieces may be under-dried and some may be over-dried because of their size, shape, or position on the drying tray. Conditioning the dried fruit evens out the moisture level and reduces the risk of mold growth.

To condition the dried fruit, pack the cooled fruit loosely into plastic or glass jars. Close the jars and let them sit for 7 to 10 days; shake daily to mix and separate the pieces and check for condensation. The excess moisture in some pieces will be absorbed by the drier pieces. If condensation develops in the jar, return the fruit to the dehydrator for more drying. After conditioning, package and store the dried fruit as directed in this publication.

Fruit Leathers

Fruit leathers are made by puréeing fruit and spreading it onto a flat surface for drying. When dried, the fruit is shiny, chewy, and has the texture of leather. It can be rolled or cut into bite-size pieces for eating. Homemade fruit leather is a healthy choice for snacking or desserts, especially when made without added sugar.

Most fruits can be made into leathers, either on their own or in combination with other fruits or vegetables. Table 3 lists some common fruits and their suitability for use in leathers. Leathers can be made from fresh, frozen, or drained canned fruit. Applesauce or pear purée can be dried alone or added to any fresh fruit purée to extend the fruit, decrease tartness, and make the leather more smooth and pliable.

For fresh fruit, select ripe or slightly over-ripe fruit. Wash in cool water. Remove peel, seeds, and stems. Cut fruit into chunks. Thaw frozen fruit before use. Drain canned fruit and reserve the liquid.

Use 2 cups of fruit for each fruit leather (13-inch by 15-inch rectangle or 14-inch round). Purée fruit until smooth, using a blender, food processor, or food mill. For canned fruit, some of the reserved liquid can be added if the purée is too thick. For light-colored fruit, add 2 teaspoons lemon juice or ⅛ teaspoon ascorbic acid to prevent darkening. If desired, ¼ to ½ cup of corn syrup, honey, or sugar may be added for additional sweetness. Corn syrup or honey is best for longer storage of the fruit leather because it prevents the formation of crystals. Sugar is fine for leathers that will be eaten immediately or stored for shorter periods of time.

If desired, small amounts of spices or flavorings can be added to the purée before drying. Spices to consider include allspice, cinnamon, cloves, ginger, mint, nutmeg, or pumpkin pie spice. For flavorings, try almond, orange, or vanilla extract; lemon, lime, or orange juice; or lemon, lime, or orange peel. Use spices or flavorings sparingly; start with ⅛ teaspoon for each 2 cups of purée. Other possible additions are shredded coconut, chopped dried fruits, granola, chopped nuts, or poppy, sesame, or sunflower seeds. Be aware that some leathers intensify in flavor with longer storage times, so adjustments may be needed for amounts of sugar or spices and flavorings to meet your taste expectations.

To dry fruit leather in an electric dehydrator, use specially designed solid trays that fit into the dehydrator racks or line the racks with plastic wrap or parchment paper; be careful not to allow leakage. For oven drying, 13-inch by 15-inch cookie sheets are ideal. These can be lined with silicone non-stick baking mats. Lightly spray trays, plastic wrap, or cookie sheets with cooking spray before use to prevent sticking.

Pour the fruit purée into the prepared trays, spreading it ⅛ inch to ¼ inch thick. The edges of the leather should be slightly thicker than the center because they will dry more quickly. Dry

fruit leathers at 140°F. Approximate drying times are 6 to 8 hours in a dehydrator or up to 18 hours in an oven. To test for dryness, touch the center of the leather; no indentation should remain. The leather will be slightly sticky. While warm, peel the dried leather from the tray. It can be rolled for cooling or cut into pieces. Cookie cutters can be used to cut shapes that children will enjoy. When cool, wrap in plastic or store in air-tight containers. Fruit leathers will keep for up to one month at room temperature or up to one year in the freezer, tightly wrapped.

Drying Vegetables

When drying vegetables, start with fresh, crisp vegetables and dry as soon as possible after harvesting to minimize the loss of nutrients. Wash well in cool water, then trim, peel, cut, slice, or shred according to the instructions given in Table 4. Remove all decayed and bruised areas and woody portions. As much as possible, cut pieces the same size so they will dry at the same rate. To preserve quality and nutrients, prepare only as many vegetables as can be dried at one time.

As with fruits, some vegetables are more suitable for drying than others. Table 3 lists some common vegetables and their suitability for drying.

Pretreating Vegetables

Before drying, most vegetables should be pretreated by blanching. Blanching inactivates the enzymes that cause loss of color and flavor during drying and storage. It also helps destroy microorganisms, sets the color, and reduces drying time by relaxing tissues so that moisture can escape more quickly. Not all vegetables need to be blanched before drying. Refer to the instructions given in Table 4 for each vegetable.

- **Steam blanching** minimizes the loss of water-soluble nutrients, but takes longer than water blanching. Use a deep pot with a close-fitting lid and a wire basket, rack or colander to hold

the vegetables and allow the free circulation of steam around them. Add water to the pot and bring to a rolling boil. Place vegetables loosely in the basket, no more than two inches deep. Place the basket in the pot, making sure that the vegetables are above the water. Cover and steam for the time specified in Table 4.

- **Water blanching** is quicker than steam blanching, but usually results in a greater loss of nutrients. Fill a large saucepan two-thirds full of water, cover and bring to a rolling boil. Place the prepared vegetables in a colander or wire basket and submerge in the water. Cover and return to a boil. Start timing as soon as the water returns to a boil and blanch for the length of time recommended in Table 4. If it takes longer than one minute for the water to return to a boil, too many vegetables were added. Reduce the amount for the next batch.

Cooling and Drying the Prepared Vegetables

After blanching, dip the vegetables briefly in cold water, just long enough to stop the cooking action. Do not cool them to room temperature. When they feel just slightly hot to the touch, drain them by pouring them directly onto the drying tray held over a sink. Wipe excess water from the bottom of the tray, arrange the vegetables in a single layer and pat them dry. Place the tray with the warm vegetables immediately into the preheated dehydrator or oven. This will help the drying process to begin more quickly.

Most vegetables should be dried at 130 to 140°F. Approximate drying times are given in Table 4. Vegetables dry much more quickly at the end of the drying period, so watch them closely to avoid excessive drying or sticking. Strong smelling vegetables like onions, garlic, or horseradish may produce strong odors during drying. Avoid drying these vegetables with other foods because the flavors will blend. Provide adequate ventilation.

Most vegetables should be dried until they are brittle or crisp (e.g., asparagus, beans, beets, broccoli, celery, corn, greens, onions, peas, potatoes). Some will shatter when hit with a hammer. Others will be leathery (e.g., carrots, cauliflower, mushrooms, okra, peppers, pumpkin, tomatoes, zucchini). When dried, vegetables should contain about 10 percent moisture. Because they are so dry, most vegetables do not need to be conditioned. However, vegetables that are pliable when dried should be conditioned to even out the moisture level. See the instructions for conditioning dried fruit earlier in this publication.

After drying, cool the vegetables for 30 to 60 minutes before packaging. Packaging warm vegetables can cause sweating and moisture buildup, but letting the cooled vegetables sit for too long before packaging can allow them to reabsorb moisture from the air.

Vegetable Leathers

Vegetable leathers are made in the same way as fruit leathers. The vegetables are cooked, puréed, and strained if needed. Spices can be added for flavor. Dry vegetable leathers at 140°F.

For mixed vegetable leather, combine 2 cups cored, chopped tomatoes, 1 small chopped onion, ¼ cup chopped celery and salt to taste. Cook in a covered saucepan 15 to 20 minutes. Purée or force through a sieve or colander. Return to saucepan and cook until thickened. Pour into a prepared tray for drying.

For pumpkin leather, combine 2 cups canned pumpkin (or 2 cups fresh pumpkin, cooked and puréed) with ½ cup honey, ¼ teaspoon cinnamon, ⅛ teaspoon nutmeg, and ⅛ teaspoon ground cloves. Mix well. Pour into a prepared tray for drying. Sweet potatoes or any winter squash can be substituted for the pumpkin.

Drying Herbs

Harvest herbs for drying just before the flowers are ready to open. To minimize wilting, the best time to harvest is in the morning, just after the dew has evaporated. Avoid bruising the leaves. Rinse herbs in cool water and gently shake off excess water. Lay the herbs on paper towels to absorb excess moisture. Discard any dirty, bruised, or imperfect leaves and stems.

Drying Herbs in Electric Dehydrator

Herbs are delicate and should be dried at 95°F to 115°F. Check your dehydrator's manual for specific instructions. Place the herbs in single layers on the dehydrator trays. Drying times may range from 1 to 4 hours. Check for dryness periodically. Herbs are dry when they crumble between your fingers and their stems break when bent.

Air Drying Herbs

Sturdy herbs such as rosemary, sage, thyme, summer savory, and parsley are the easiest to air dry. Tie them into small bundles and hang in a warm, dry, well-ventilated area. Avoid direct sunlight for best color and flavor retention.

Tender herbs (such as basil, oregano, tarragon, lemon balm, and mint) or those with seeds can be dried hanging in paper bags to catch any leaves or seeds that fall off. Use small bunches to allow fast drying and prevent molding. Tear or punch holes in the sides of the bag to allow air currents to circulate. Close the top of the bag with a rubber band and hang in a warm, dry, well-ventilated area.

Oven Drying Herbs

For some herbs (especially mint, sage, or bay leaves), the leaves can be dried separately using an oven. Remove the best leaves from the stems and lay the leaves on a paper towel, without allowing the leaves to touch. Cover with another paper towel and another layer of leaves. Five lay-

ers of leaves can be dried in this way at one time. Allow to dry overnight in a very cool oven. The oven light of an electric range or the pilot light of a gas range will provide enough heat. Leaves dried this way dry flat and retain good color.

Drying Herbs in a Microwave Oven

It may be possible to dry small amounts of herbs quickly in a microwave oven. Be sure to follow the microwave oven manufacturer's instructions, to avoid damaging your microwave oven.

Drying Meats

Jerky is dried meat or poultry. Making jerky at home requires proper safe food preparations. Guidelines for making jerky can be found in Kentucky Cooperative Extension publication *Jerky Safety* (FCS3-594).

Packaging and Storing Dried Foods

Allow dried foods to cool completely before packaging them, to prevent sweating and possible mold growth. However, once they have cooled package them promptly so that they do not reabsorb moisture from the air.

Use clean, dry containers that will seal out air, moisture, and insects. Glass jars, plastic freezer containers with tight-fitting lids, or plastic freezer bags work well. Vacuum packaging is another good option. Label each package with the contents and date.

Package dried foods in amounts that will be used in one sitting. Each time a package of dried food is opened, the food inside is exposed to air and moisture that will reduce its quality and may cause spoilage. To reduce the amount of air in the container when packaging, pack dried foods as tightly as possible without crushing. After several days of storage, check each package for moisture. If any moisture has built up, the food should be

returned to the dehydrator for a short time to complete drying.

Dried foods should be stored in a cool, dark, dry area. The shelf life will depend on the specific food and the storage conditions. Food quality is affected by heat. Most dried fruits can be stored for 1 year at 60°F, but only 6 months at 80°F. The shelf life for dried vegetables is about half that of dried fruits. Even under ideal conditions, there will be a gradual loss of color, flavor, and nutritive value of dried foods over time.

Using Dried Foods

Dried fruits make delicious snacks. They can be rehydrated by soaking in water for 30 to 90 minutes. See Table 5 for directions for rehydrating specific fruits. Oversoaking may cause a loss of flavor and mushy texture. To cook rehydrated fruit, simmer covered, in the soaking water. Rehydrated fruit may also be used in favorite recipes. Any liquid remaining after soaking can be used as part of the liquid in the recipe.

Some dried vegetables make tasty snacks too, especially when thinly sliced and dried into vegetable chips. These can be served with dips as a nutritious, lower-calorie alternative to commercial potato chips. Good vegetables to try are carrot, tomato, parsnip, turnip, beet, or zucchini chips.

Most dried vegetables, however, are rehydrated before use. The simplest way is to do this is to add them directly to soups or stews during cooking. Make sure there is enough liquid to keep them covered and simmer until tender. Dried vegetables can also be rehydrated by covering with boiling liquid and soaking for 30 to 90 minutes. The liquid can be water or, for additional flavor, bouillon or vegetable juice. See Table 5 for directions for rehydrating specific vegetables. If cold water is used, longer soaking times will be needed. If the vegetables are soaked for longer than 2 hours,

they should be refrigerated. Once rehydrated, the vegetables can be used in place of fresh vegetables in favorite recipes. The soaking liquid can be used in cooking.

Vegetable flakes can be made by crushing dried vegetables with a wooden mallet, rolling pin, or clean dry hands. Finer vegetable powders can be made by grinding dried vegetables in a food mill, food processor, or blender. Both can be used in cooking.

Dried herbs are used in cooking. Their flavor is about three to four times stronger than that of fresh herbs. If substituting dried herbs for fresh herbs in a recipe, use only $\frac{1}{4}$ to $\frac{1}{3}$ of the fresh herb amount.

Recipes

Vegetable Soup

4 cups water

$\frac{3}{4}$ to 1 cup dried vegetables (green beans, corn, peas, tomatoes, onions, etc.)

2 teaspoons bouillon granules or 2 cubes

Seasonings to taste (herbs, spices or soy sauce)

- Bring water to a boil. Add dried vegetables, bouillon and seasonings.
- Simmer about 20 minutes or until vegetables are tender.
- Remember to refrigerate leftovers.

Yield: 6 servings

Variations: Vegetable, chicken or beef broth may be used in place of the water and bouillon. Rice, noodles, lentils or barley ($\frac{1}{2}$ cup) may be added with the other ingredients.

Nutritional Analysis: Will depend on specific ingredients chosen.

Recipe from Swanson, M.A. (1995). *Drying Fruits & Vegetables* (PNW 397). Pacific Northwest Extension Publications. Used with permission for educational purposes only.

Dried Apple Pies

4 cups dried apple slices

3½ cups water

1½ cups sugar

½ teaspoon cinnamon

½ teaspoon nutmeg

¼ cup low-fat margarine, melted

- Combine apples and water in a large saucepan. Bring to a boil, cover, reduce heat and simmer 30 minutes or until tender. Stir in sugar and spices.
- Roll any pie crust mixture into approximately 6-inch circles. Fill each circle with a large tablespoon of filling. Moisten one edge with water, fold crust to form a half-moon shape and press with a fork to seal. Brush very lightly with melted margarine and place on a cookie sheet.
- Bake at 350°F until golden brown.

Yield: 30 pies

Variation: Canned biscuit dough also makes a good crust.

Nutritional Analysis: (1 pie): 161 calories, 6 g fat, 27 g carbohydrate, 2 g protein, 315 mg sodium

Recipe from Bastin, S.S. (2010). *Kentucky Favorites: The Low-fat Way* (FN-SSB.142). Lexington: Cooperative Extension Service, University of Kentucky.

Terrific Trail Mix

1 cup dried fruit (choose ¼ cup of favorites such as apricots, peaches, apples, cherries, prunes)

½ cup raisins (and/or dried cranberries)

1½ cups unsalted sunflower kernels

1 cup unsalted dry roasted nuts (choose ¼ cup of favorites such as peanuts, honey roasted peanuts, almonds, chopped walnuts, pecan halves)

- Combine ingredients in a bowl and mix. Store in an airtight container or resealable plastic bag for up to 2 weeks.

Yield: 4 cups (8 servings)

Nutritional Analysis: 308 calories, 20g fat, 27g carbohydrate, 8g protein, 6g fiber, 31mg sodium

Recipe from Allrecipes.com (2004).

References

Allrecipes.com (2004). Terrific Trail Mix.

<http://allrecipes.com/recipe/78019/terrific-trail-mix/?internalSource=hub%20recipe&referringContentType=search%20results&clickId=cardslot%208>.

Andress, E.L., and J.A. Harrison. (2014). *So Easy to Preserve* (6th ed.). Athens, GA: Cooperative Extension, University of Georgia.

Bastin, S.S. (2010). *Kentucky Favorites: The Low-fat Way* (FN-SSB.142). Lexington, KY: Cooperative Extension Service, University of Kentucky.

DeLong, D. (2006). *How to Dry Foods*. New York, NY: Penguin Group (USA) Inc.

Mills-Gray, S. (2015). *Quality for Keeps: Drying Foods* (GH1562). University of Missouri Extension. <http://extension.missouri.edu/p/GH1562>.

National Center for Home Food Preservation, University of Georgia. (n.d.). *How Do I?...Dry*. <http://nchfp.uga.edu/how/dry.html>

Swanson, M.A. (1995). *Drying Fruits and Vegetables* (PNW 397). Pacific Northwest Extension Publications.

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Table 1. Fruits: Suitability for Drying

| Fruit | Suitability for Drying | Suitability for Fruit Leather |
|--|-------------------------------|--------------------------------------|
| Apples | Excellent | Excellent |
| Apricots | Excellent | Excellent |
| Bananas | Good | Fair to good |
| Berries with seeds (e.g. blackberries, raspberries) | Not recommended ¹ | Excellent |
| Blueberries | Fair | Poor unless in combination |
| Cherries | Excellent | Excellent |
| Citrus fruits | Not recommended ² | Only in combination |
| Citrus peel | Excellent | Only in combination |
| Crabapples | Not recommended ³ | Only in combination |
| Cranberries | Poor | Only in combination |
| Currants | Good | Not recommended |
| Figs | Excellent | Only in combination |
| Grapes | Excellent | Fair to good |
| Melons | Poor | Not recommended |
| Nectarines | Excellent | Excellent |
| Peaches | Excellent | Excellent |
| Pears | Excellent | Excellent |
| Persimmons | Fair | Not recommended |
| Pineapples | Excellent | Excellent |
| Plums | Good | Good |
| Prune plums | Excellent | Excellent |
| Quince | Not recommended ⁴ | Only in combination |
| Rhubarb ⁵ | Good | Fair |
| Strawberries | Fair to good | Excellent |

¹ High seed content and slow rate of drying.

² Too juicy; pulp lacks firm texture.

³ Too small and tart.

⁴ Hard flesh and strongly acidic flavor.

⁵ Never consume rhubarb leaves. They contain toxic salts of oxalic acid.

Table adapted from Andress and Harrison. Used with permission for educational purposes only.

Table 2. Guide to Drying Fruits

| Fruit | Preparation¹ | Pretreatment (Choose One) | Estimated Drying Time in Dehydrator (Hours)² |
|--|---|--|--|
| Apples | Peel (if desired) and core. Cut into slices or rings 1/8 to 1/4 inch thick. | Sulfite dip Ascorbic acid solution Ascorbic acid mixture Fruit juice dip Steam blanch 3 to 5 minutes Syrup blanch 10 minutes | 6 to 12 |
| Apricots | Pit and halve. May slice if desired. | Sulfite dip Ascorbic acid solution Ascorbic acid mixture Fruit juice dip Steam blanch 3 to 4 minutes Syrup blanch 10 minutes | 24 to 36 ³ |
| Bananas | Use solid yellow or slightly brown-flecked fruit. Peel and slice 1/4 to 3/8 inch thick, crosswise or lengthwise. | Sulfite dip Ascorbic acid solution Ascorbic acid mixture Fruit juice dip Honey dip Steam blanch 3 to 4 minutes Syrup blanch 10 minutes | 8 to 10 ³ |
| Berries, firm with waxy coating (blueberries, cranberries, currants, gooseberries) | | "Check" skins | 24 to 36 |
| Berries, soft (strawberries, boysenberries) | May slice if desired. | No treatment necessary | 24 to 36 |
| Cherries | Use fully ripe fruit. Stem and pit. Cut in half, chop or leave whole. | Whole: "Check" skins Cut and pitted: No treatment necessary Sour: Syrup blanch 10 minutes | 24 to 36 ³ |
| Citrus peel | Remove outer 1/16 to 1/8 inch of peel. Avoid bitter white inner pith. | No treatment necessary | 8 to 12 |
| Grapes, seedless | Leave whole. | "Check" skins | 12 to 20 |
| Grapes, with seeds | Cut in half and remove seeds. | No treatment necessary | 12 to 20 |
| Nectarines and peaches | Pit and halve. Peel if desired. For steam and syrup blanching, leave whole, then pit and halve. May slice or quarter. | Sulfite dip Ascorbic acid solution Ascorbic acid mixture Fruit juice dip Steam blanch 8 minutes Syrup blanch 10 minutes | 36 to 48 ³ |
| Pears | Cut in half and core. Peeling preferred. May slice or quarter. | Sulfite dip Ascorbic acid solution Ascorbic acid mixture Fruit juice dip Steam blanch 6 minutes (halves) Syrup blanch 10 minutes | 24 to 36 ³ |

Table 2. Guide to Drying Fruits *(continued)*

| Fruit | Preparation¹ | Pretreatment (Choose One) | Estimated Drying Time in Dehydrator (Hours)² |
|--------------|--|--|--|
| Persimmons | Use firm fruit of long, soft varieties or fully ripe fruit of round drier varieties. Peel and slice using stainless steel knife. | No treatment necessary May syrup blanch | 12 to 15 ³ |
| Plums | Leave whole. | Rinse in hot tap water | 24 to 36 |

¹ Wash all fruits thoroughly before preparing.

² Drying times vary depending on the initial moisture content of the fruit and the particular dehydrator being used. Drying times in an oven could be up to twice as long, depending on air circulation. Drying times for sun drying could range from 2 to 6 days, depending on temperature and humidity.

³ Drying times are shorter for slices and other cuts of fruit.

Table adapted from Andress and Harrison. Used with permission for educational purposes only.

Table 3. Vegetables: Suitability for Drying

| Vegetable | Suitability for Drying | Vegetable | Suitability for Drying |
|---------------------|-------------------------------|-----------------------|-------------------------------|
| Artichokes | Fair | Okra | Fair to good |
| Asparagus | Poor to fair | Onions | Good to excellent |
| Beans, green | Fair to good | Parsley | Good |
| Beans, lima | Fair | Parsnips | Good |
| Beets | Fair to good | Peas | Fair to good |
| Broccoli | Not recommended | Peppers, green or red | Good |
| Brussels sprouts | Poor ¹ | Peppers, chili | Excellent |
| Cabbage | Fair ² | Popcorn | Good |
| Carrots | Good | Potatoes | Good |
| Cauliflower | Poor | Pumpkins | Fair to good |
| Celery | Poor | Radishes | Not recommended ⁶ |
| Corn, sweet | Good | Rutabagas | Fair to good |
| Cucumbers | Poor | Squash, summer | Poor to fair |
| Eggplant | Poor to fair | Squash, winter | Not recommended |
| Garlic | Good | Sweet potatoes | Fair |
| Greens ³ | Poor | Tomatoes | Fair to good ⁷ |
| Horseradish | Good ⁴ | Turnips | Fair to good |
| Kohlrabi | Fair | Yams | Fair |
| Lettuce | Not recommended ⁵ | Zucchini | Poor to fair |
| Mushrooms | Good | | |

¹ Difficult to dry because of small size and layered leaves; strong flavor.

² Readily absorbs moisture from the air. Keeps well only if stored at very cold temperature.

³ Collard, kale, mustard, spinach, Swiss chard, turnip greens.

⁴ Odor extremely strong during processing; use adequate ventilation.

⁵ High water content; product will be undesirable for use.

⁶ Product would be of low quality.

⁷ Re-absorb moisture readily causing undesirable color and flavor changes, shortened shelf life. Package tightly. Black color can develop because of oxidation.

Table adapted from Andress and Harrison. Used with permission for educational purposes only.

Table 4. Guide to Drying Vegetables

| Vegetable | Preparation¹ | Pretreatment (Choose One) | Estimated Drying Time in Dehydrator (Hours)² |
|---------------------------------------|--|---|--|
| Asparagus | Cut large tips in half. | Steam blanch 4 to 5 minutes Water blanch 3½ to 4½ minutes | 4 to 6 |
| Beans, green | String, if necessary. Cut in short pieces or lengthwise. ³ | Steam blanch 2½ minutes Water blanch 2 minutes | 8 to 14 |
| Beets | Cook as usual. Cool; peel. Cut into shoestring strips ⅛ inch thick. | No further blanching required | 10 to 12 |
| Broccoli | Trim; cut as for serving. Quarter stalks lengthwise. | Steam blanch 3 to 3½ minutes Water blanch 2 minutes | 12 to 15 |
| Brussels sprouts | Cut in half lengthwise through stem. | Steam blanch 6 to 7 minutes Water blanch 4½ to 5½ minutes | 12 to 18 |
| Cabbage | Remove outer leaves; quarter and core. Cut into strips ⅛ inch thick. | Steam blanch 2½ to 3 minutes ⁴ Water blanch 1½ to 2 minutes | 10 to 12 |
| Carrots | Use only crisp, tender carrots. Cut off roots and tops; preferably peel. Cut in slices or strips ⅛ inch thick. | Steam blanch 3 to 3½ minutes Water blanch 3½ minutes | 10 to 12 |
| Cauliflower | Prepare as for serving. | Steam blanch 4 to 5 minutes Water blanch 3 to 4 minutes | 12 to 15 |
| Celery | Trim stalks; slice. | Steam blanch 2 minutes Water blanch 2 minutes | 10 to 16 |
| Corn, cut | Select tender, mature, sweet corn. Husk and trim. Blanch until milk is set. Cut kernels from cob after blanching. | Steam blanch 2 to 2½ minutes Water blanch 1½ minutes | 6 to 8 |
| Garlic | Peel and finely chop bulbs. Odor is pungent | None | 6 to 8 |
| Greens (chard, kale, spinach, turnip) | Use only young, tender leaves. Wash and trim very thoroughly. | Steam blanch 2 to 2½ minutes Water blanch 1½ minutes | 8 to 10 |
| Horseradish ⁵ | Remove small rootlets and stubs. Peel or scrape roots. Grate. | None | 4 to 10 |
| Mushrooms (SEE WARNING ⁶) | Scrub thoroughly. Discard any tough, woody stalks. Cut tender stalks into short sections. Peel large mushrooms. Slice. | None | 8 to 10 |
| Okra | Trim; slice crosswise in ⅛- to ¼-inch disks. | None | 8 to 10 |
| Onions | Remove outer "paper" skins, tops and root ends. Slice ⅛ to ¼ inch thick. | None | 3 to 9 |
| Parsley | Separate clusters. Discard long or tough stems. | None | 1 to 2 |
| Peas, green | Shell. | Steam blanch 3 minutes Water blanch 2 minutes | 8 to 10 |
| Peppers and pimientos | Stem, core and remove partitions. Cut into disks about ⅜ inch by ⅜ inch. | None | 8 to 12 |
| Potatoes, sweet and white | Peel. Cut into shoestring strips ¼ inch thick or slices ⅛ inch thick. | Steam blanch 6 to 8 minutes Water blanch 5 to 6 minutes | 8 to 12 |

Table 4. Guide to Drying Vegetables (continued)

| Vegetable | Preparation¹ | Pretreatment (Choose One) | Estimated Drying Time in Dehydrator (Hours)² |
|-----------------------------|---|---|--|
| Pumpkin and hubbard squash | Cut or break into pieces. Remove seeds and cavity pulp. Cut into 1-inch strips. Peel rind. Cut strips crosswise into pieces about 1/8 inch thick. | Steam blanch 2½ to 3 minutes Water blanch 1 minute | 10 to 16 |
| Squash, summer and zucchini | Trim. Cut into ¼-inch slices. | Steam blanch 2½ to 3 minutes Water blanch ½ minute | 10 to 12 |
| Tomatoes, for stewing | Blanch to loosen skins. Chill in cold water. Peel. Cut into sections about ¾ inch wide or slice. Cut small pear or plum tomatoes in half. | Steam blanch 3 minutes Water blanch 1 minute | 10 to 18 |
| Tomatoes, sliced | Remove cores. No peeling or blanching is necessary. Cut crosswise into ¼- to ¾-inch slices. ⁷ | None | 6 to 12 |

¹ Wash all vegetables thoroughly before preparing.

² Drying times vary depending on the initial moisture content of the vegetable and the particular dehydrator being used. Drying times in an oven could be up to twice as long, depending on air circulation.

³ For a texture more similar to canned green beans, after blanching freeze beans in a single layer for 30 to 40 minutes before drying.

⁴ Steam until wilted.

⁵ Odor extremely strong during processing; use adequate ventilation.

⁶ Slices may be lightly sprinkled with crumbled dry oregano or other dry herb of your choice prior to drying.

⁷ **WARNING:** The toxins of poisonous varieties of mushrooms are not destroyed by drying or cooking. Only an expert can differentiate between poisonous and edible varieties.

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Table 5. Rehydrating Dried Fruits and Vegetables

| Dried Food | Water to Add to 1 Cup of Dried Food (Cups) | Minimum Soaking Time (Hours) |
|-------------------------------|---|-------------------------------------|
| Fruits¹ | | |
| Apples | 1½ | ½ |
| Pears | 1¾ | 1¼ |
| Peaches | 2 | 1¼ |
| Vegetables² | | |
| Asparagus | 2¼ | 1½ |
| Beans, lima | 2½ | 1½ |
| Beans, green | 2½ | 1 |
| Beets | 2¾ | 1½ |
| Carrots | 2¼ | 1 |
| Cabbage | 3 | 1 |
| Corn | 2¼ | ½ |
| Greens (turnip, other) | 1 | ¾ |
| Okra | 3 | ½ |
| Onions | 2 | ¾ |
| Peas | 2½ | ½ |
| Pumpkin | 3 | 1 |
| Squash | 1¾ | 1 |
| Spinach | 1 | ½ |
| Sweet potatoes | 1½ | ½ |

¹ For fruits, water is at room temperature.

² For vegetables, boiling water is used. If cold water is used, longer soaking times will be needed.

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