

# ***MAKING JERKY AT HOME SAFELY***



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# Making Jerky at Home Safely

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# Introduction

Jerky is a nutrient-dense, portable, and lightweight source of protein from meat that has been dried. Sixteen ounces of raw meat or poultry make about 4 ounces of jerky.

Proper drying of jerky removes most of its moisture, making the product shelf-stable. This means it can be stored without refrigeration. Jerky is a favorite of hunters and hikers and a convenient snack food for people on the run who value texture, flavor, and safe preservation.

**An age-old practice.** Drying is the oldest method of food preservation. Canning dates back to the early 1800s. Freezing is more recent—only after electricity became readily available to most consumers.

The scientific principle behind preserving food by drying is that moisture removal prevents microorganisms from growing, thus diminishing spoilage.

Jerky has been known as a food source since ancient Egypt. Early civilizations made jerky from the meat of animals that were too big to eat all at once, such as buffalo, bear, and whales. North American Indians mixed ground, dried meat with dried fruit or suet to make pemmican. They also dried strips of meat in the sun or over a fire and with smoke to make Ch'arki. American pioneer settlers called the dried meat *jerky*, which was derived from the Spanish word *charque*, or South American dried salted beef.

## Jerky Safety

Several foodborne illness outbreaks have been traced to homemade jerky. Research has shown that traditional jerky preparation methods, in which raw meat is dried at temperatures of about 140°F–155°F, do not destroy pathogens if present in the meat. Ground meats are particularly challenging from a safety perspective because grinding distributes any pathogens present on the meat surface throughout the meat product.

The pathogens of greatest concern are *Escherichia coli* [*E. coli*] O157:H7 and *Salmonella*. The *Trichinella* parasite is dangerous too. After eating contaminated Idaho cougar jerky, ten people contracted trichinosis in 1995.

For illness to occur, a certain chain of events must take place:

- The meat source becomes contaminated with a pathogenic microorganism.
- The pathogen survives the jerky-making process.
- The jerky is consumed.

## **Research on Making Jerky Safely at Home**

Concerns regarding the safety of traditional home-prepared meat jerky have led to several university research projects to identify safe procedures. Scientists at Colorado State University and the universities of Georgia, Minnesota, and Wisconsin have identified safe methods to prepare jerky at home, including considerations about home dehydrators and judging doneness.

Their research focuses on jerky prepared from beef and on the elimination of *Salmonella* and *E. coli* O157:H7, the pathogens of most concern. The step-by-step methods described in this bulletin derive from their findings.

Jerky can be considered “done” and safe to eat only when meat has been heated sufficiently to 160°F and poultry to 165°F before or immediately after the dehydration process. This destroys any pathogens present and creates jerky that is dry enough to be shelf-stable. Shelf-stable means the jerky can be stored at room temperature 1–2 months without supporting microbial growth.

### ***Methods for Destroying Pathogens***

Researchers have identified the methods for destroying pathogens that may be present on meat used in preparing jerky at home: post-drying heating and precooking the meat, such as using a hot pickle cure or oven.

**Post-drying heating.** Placing dried meat strips on a cookie sheet in an oven preheated to 275°F and then heating the strips for 10 minutes effectively eliminates pathogens. This method produces the most traditional jerky.

**Precooking the meat.** Heating slices or strips of raw beef by dipping them in hot brine long enough to heat the meat to 160°F (or 165°F for poultry) destroys pathogens that may be present. Baking raw meat strips to an internal temperature of 160°F (or 165°F for poultry) is also effective.

## ***Judging Dryness***

Dryness corresponds to a measure known as *water activity*—a ratio that denotes the moisture content in a food product. A high value indicates an environment favorable for microbial growth. Shelf-stable meat jerky has a water activity of 0.85 or less. To prevent mold growth, a low water activity of 0.70 is recommended. People who make jerky at home, however, frequently judge homemade jerky to be done when its water activity scores above 0.85. Because measurement of water activity requires special equipment not available to consumers, use other tests to determine doneness. Carefully following the test for doneness as later described in this publication will result in properly dried jerky.

## **Equipment Selection**

An electric dehydrator produces the best-quality jerky, but you can also use a regular oven with the door propped open. Solar drying is not recommended for jerky due to the lack of a steady heat source and the potential for contamination from animals, insects, dust, and bacteria.

### ***Dehydrators***

**Electric dehydrators.** Home dehydrators vary in heating capacity (wattage), fan speed, and air movement direction (horizontal or vertical). Research shows that home dehydrators vary considerably in how quickly they come up to the desired temperature when

loaded with meat strips (30 minutes–4 hours), how well dehydrators maintain temperature during drying (some fluctuate 30°F–40°F), and how closely the air temperature inside the drier matches the dial setting (can vary by as much as 40°F). These findings suggest you should take care when selecting a food dehydrator to make jerky.

When selecting a new or used dehydrator, check to see that it has the following features:

- Instruction manual
- Thermostatically controlled temperature dial and the ability to maintain a temperature of 145°F–155°F. (Use a thermometer to determine that the empty, operating dryer can maintain a temperature of at least 145°F. Do not use dehydrators with factory preset temperatures that cannot be controlled.)
- Fan that distributes warm air evenly throughout all trays
- Shelves made of stainless steel or food-grade plastic
- Easy loading and unloading features
- Outside surface made of hard plastic, aluminum, or steel (double-wall construction with insulating materials sandwiched between the walls is desirable to reduce heat loss during use)
- Enclosed heating element
- Appropriate number of trays for your use
- A replacement-parts listing

**Ovens.** Oven drying is a good way to see if you like dried foods without investing in a dehydrator. However, foods dried in an oven are generally lower in quality because no fan generates air movement over the food. Oven drying thus takes two to three times longer than drying in a dehydrator, making it less energy efficient.

Before drying jerky meat in an oven, test the oven temperature with an accurate thermometer for about 1 hour. Prop open the oven door as you would when dehydrating jerky. The oven should maintain a temperature of 145°F–155°F. If it can't, do not use it for dehydrating meat. If the oven is too hot, the jerky may form a crust that does not

allow interior moisture to evaporate. If the oven is too cool, the meat may not dry fast enough and spoil instead.

## Thermometers

Thermometers are useful tools in preparing safe jerky. Two types of instant-read thermometers, dial and digital, are commonly available in grocery and variety stores (Figure 1). Use either type to measure air temperature in the dehydrator.

For measuring the temperature of thin meat, you will need a thin-tipped digital thermometer (Figure 1, bottom). Look for these in specialty cooking stores or online.

## Meat Selection

Choose lean cuts of meat that are in excellent condition. Highly marbled or fatty cuts of meat do not work well. Fat turns rancid very quickly and develops off-flavors during drying and storage.

**Beef.** Use lean cuts of beef. United States Department of Agriculture Select grade is leaner and less marbled than Choice or Prime grades. Chuck, flank, round, rump, and sirloin cuts work well.

**Game meats.** Most game meats can be used. Venison, elk, and antelope make excellent jerky. Because game meats tend to be quite lean, any cut can be used, but the best cuts tend to be the loin, round, and flank.

Unfortunately, some game meats are infected by *Trichinella* parasites, including bear, cougar, and feral hogs. Freezing and traditional drying techniques do not kill all *Trichinella* species found



**Figure 1.** A dial instant-read thermometer (right) displays the temperature sensed in the bottom 2 inches of its stem. Digital instant-read thermometers (left and bottom) display the temperature sensed in the bottom ½ inch of its stem. A thin-tipped thermometer (bottom) senses the temperature in thin meat.

in them. However, adequate heating of the game meat using precooking meat treatments described later in this publication will kill *Trichinella* parasites as well as bacterial pathogens.

**Poultry and rabbit.** The best cuts of poultry include the breast, thigh, and leg. For rabbit, use the loin. Remove the skin and fat before drying.

**Fish.** Choose non-oily fish for making jerky. Consumers have reported that trout, tuna, salmon, and other species produce acceptable jerky. Fish oil that has turned rancid reduces fish jerky shelf life, making it best to store fish jerky in a refrigerator or freezer.

**Ground meat.** Use ground meat that is at least 93% lean.

## Food and Equipment Handling

Washing your hands with soap and warm water often and thoroughly when handling raw meat, poultry, and fish is essential. Scrub your hands for at least 20 seconds, rinse, and dry with a clean paper towel.

Keep raw meat, cutting surfaces, and equipment that has touched raw meat separate from dried meat, other ready-to-eat foods, and other work surfaces and equipment. After washing cutting surfaces and equipment such as tongs, knives, and drying racks, sanitize them by dipping them in a solution of 1 tablespoon of chlorine bleach in 1 gallon of water at room temperature. Let them air dry.

## Meat and Poultry Preparation

**Whole meat and poultry jerky.** Keep meat and poultry at 40°F or slightly below. To make the meat easier to slice, freeze it in moisture-proof paper or plastic wrap until it is firm but not solid. Partially defrost frozen meat in the refrigerator, not on the kitchen counter. While the meat is slightly frozen, slice it into long, thin strips approximately  $\frac{1}{8}$ – $\frac{1}{4}$  inch thick, 1–1½ inches wide, and 4–10 inches long. For chewy jerky, slice with the grain of the meat.

Slice across the grain for tender jerky. Trim off the visible fat and

remove any thick connective tissue and gristle. Lay the meat strips in a single layer. Flatten them with a rolling pin so that they are uniform in thickness.

**Ground meat jerky.** Ground meat is generally flavored by mixing in spices, including salt, before being shaped into strips. Salt helps bind the ground meat together so that it holds its shape. Jerky guns or shooters work well for shaping ground meat (Figures 2 and 3). You can also press meat into a jellyroll pan to a thickness of  $\frac{1}{4}$  inch thick and slice it into strips. Precook by baking to 160°F prior to drying or utilize the post-drying method.



**Figure 2.** A jerky gun helps shape ground meat.



**Figure 3.** Jerky made from ground beef formed into logs (left) and strips (right).

# Meat Treatments to Ensure Safe Jerky

For a variety of reasons, traditional dehydration processes use relatively low temperatures. This creates an ideal environment for microbial growth. Thus other steps must be taken to kill any harmful microorganisms that may be present in the meat, poultry, or fish you are drying. Research has shown that two different methods will produce safe jerky. Carefully follow one of them:

- Heating the jerky in an oven after drying (post-drying heating)
- Precooking the meat, poultry, or fish

## *Post-Drying Heating*

This method is the easiest way to produce safe jerky (Figure 4). After you've seasoned the whole muscle or ground meat according to your taste and then dehydrated it, use tongs to immediately place the dried meat strips on a baking sheet so that they are close together but not touching or overlapping one another. Heat them in a preheated 275°F oven for 10 minutes. Next, remove them from the oven, cool them to room temperature, and condition them before packaging them.



**Figure 4.** Traditionally produced jerky is heated in an oven (275°F for 10 minutes) to make sure it is safe to eat.

## RECIPES

### Traditional Jerky Recipe

- ¾ teaspoon salt
- ¼ teaspoon cracked pepper
- 1 tablespoon brown sugar
- 1 garlic clove, crushed
- 2 tablespoons soy sauce
- 1 tablespoon Worcestershire sauce
- 1 pound lean meat, thinly sliced

In a small bowl, combine all the ingredients except the meat strips. Stir to mix well. Place the seasoning mixture and meat strips in a 1 gallon, food-grade, resealable plastic bag. Marinate 6–12 hours in the refrigerator, turning and massaging the meat occasionally to evenly distribute the seasoning. Remove the meat strips from the bag. Either immediately bake meat to 160°F and poultry to 165°F before starting the dehydration process or start the drying process and follow with the post-drying heating.

### *Precooking the Meat*

#### **Precooking option 1: Dipping the meat in a boiling marinade.**

This method shortens the drying time, makes a tender jerky, and adds flavor. The color and texture of precooked jerky does not fully resemble traditional jerky (Figure 5), and ground meat jerky may break apart during boiling.



**Figure 5.** Jerky produced using the hot pickle cure recipe.

Soaking meat strips in marinade before precooking is not recommended because the marinade will become a source of bacteria.

Putting unmarinated strips directly into the boiling marinade minimizes a cooked flavor and maintains the safety of the marinade.

Prepare 1–2 cups of a marinade of your choice in a saucepan. Bring the marinade to a boil over medium heat. Add a few meat strips.

Reheat to a simmer, stirring to thoroughly immerse each strip in the marinade. Simmer strips for 1½–2 minutes (strips need to reach 160°F). Remove the pan from the heat. Working quickly and in small batches to prevent overcooking, use tongs to remove the strips from the hot marinade. Repeat the process until all the meat strips have been precooked, adding more marinade if needed. Immediately start the drying process.

**Precooking option 2: Baking the meat strips.** Preheat the oven to 325°F. Place seasoned raw meat strips close together on a baking sheet without them touching or overlapping.

For strips of beef, game meats, or rabbit, heat until they reach an internal temperature of 160°F as measured by a thermometer. For fish, heat until the strips reach and hold an internal temperature of 160°F for 1½ minutes. Poultry should be brought to an internal temperature of 165°F. Use a thin-tipped thermometer only when measuring the temperature of baked meat strips (Figure 6). Start the drying process immediately after baking.



**Figure 6.** A thin-tipped thermometer is essential for measuring the temperature of baked meat strips.



## RECIPES

### Hot Pickle Cure

This recipe was specifically developed for precooking meat before drying. It is a two-step process that takes more than 24 hours. Ingredients listed are for 2 pounds of lean meat strips.

#### **Step 1. Season and refrigerate the meat.**

1½ tablespoons salt

1 tablespoon sugar

1 teaspoon black pepper

Combine the pickling spices (see salt, sugar, and black pepper amounts above). Place the lean meat strips on a clean baking sheet. Evenly distribute half of the pickling spices over the meat and press the spices into the strips with a rubber mallet or meat tenderizer. Turn the strips and repeat on the opposite side. Cover and refrigerate the strips for 24 hours.

#### **Step 2. Dip the meat in simmering brine.**

¾ cup salt

½ cup sugar

2 tablespoons black pepper

1 quart water

Combine the salt, sugar, black pepper, and water (the brine) in a large kettle. Stir to dissolve the salt and sugar and bring to a slow boil. Place a few meat strips at a time into a steamer basket and lower them into the brine. Simmer for 1½–2 minutes, stirring occasionally to make sure all the pieces are immersed. Using clean tongs, remove the meat strips and immediately start the drying process.

## Jerky Seasoning Options

Many commercial jerky mixes are available and acceptable for use. You can also use marinade or seasoning recipes from other sources or create your own. With any of these options, however, you must precook the meat or use post-heat drying to ensure that you are making safe jerky.

# Drying

Preheat the dehydrator or oven to 145°F–155°F for 15–30 minutes. Use a thermometer to monitor the circulating air temperature of the dehydrator or oven.

Using clean tongs, arrange the meat strips on dryer trays, baking racks, or oven racks. The strips should be close together but not touching or overlapping. Leave enough open space on the racks for air to circulate around the strips.

Place the filled trays in the preheated oven or dehydrator. Dry the jerky for a minimum of 4 hours and until the pieces are adequately dry. Drying times will vary. Precooked meat will require less time.

Properly dried jerky is chewy and leathery. It will bend like a small, green stick and won't snap like a dry twig. Also, it should not have damp spots.

To test for dryness, remove a strip of jerky from the oven or dehydrator. Let it cool slightly, then bend it (Figure 7). It should crack but not break. When the jerky is sufficiently dry, remove the strips from the drying racks and place them on a clean surface. If using the post-drying heating method for pathogen destruction, put them in the



**Figure 7.** Properly dried jerky should crack but not break when bent.

oven. After the jerky is done, pat off any beads of oil with absorbent paper towels and let the jerky cool before packaging the strips.

## Conditioning

Some pieces of jerky will be moister than others after drying, so condition each batch before storing for the long term. Conditioning distributes moisture evenly among the pieces of jerky.

To condition jerky, loosely pack the cooled, dried pieces in plastic or glass containers to about two-thirds full. Cover the containers tightly. Shake them daily for 2–4 days. The drier pieces will absorb the excess moisture of some pieces, but if you notice moisture forming on the container lid, place all the jerky back in the dehydrator or oven.

Before packaging the jerky for storage, check it again for doneness. If necessary, dry it further and repeat the conditioning steps. Once you've determined the jerky is dry, it's ready for packaging.

## Packaging

**Containers.** The ideal container for dried food must be

- Clean and sanitary
- Food grade
- Lightweight
- Easily disposable or recyclable
- Moisture resistant
- Airtight
- Protective against light
- Easily opened and closed
- Impermeable to gases and odors
- Durable
- Low cost

Unfortunately, no single food container has all these characteristics. Make your choice based on the intended storage conditions and storage time. Airtight plastic food bags or jars with tight-fitting lids work well for long-term storage.

Jerky should be packaged with the least amount of trapped air possible. Too much air causes off-flavors and rancidity. Vacuum packaging is a good option for long-term storage because it reduces oxidation and eliminates the possibility of mold growth.

**Labeling.** After you have packaged the jerky, label each container by type of meat, pretreatment steps, and date. Tape the label on the outside of a package, tie it on with string, or insert it into a clear glass or plastic package (Figure 8).



**Figure 8.** Dehydrated jerky stored in a vacuum bag. Courtesy of Amy Robertson.

Proper labels help you to avoid opening multiple packages to find a specific jerky.

## **Storage**

An ideal storage area is cool, dark, and dry. The cooler the storage area, the longer the shelf life of the jerky. The storage area need not be fancy—a dark, unheated closet or drawer works fine.

Metal containers have the advantage of keeping their contents in darkness. If using glass or plastic containers, cover them with a cardboard box, a barrel, or black plastic to keep light out.

Many people store dried foods in a refrigerator or freezer. Homemade jerky maintains its best quality for 1–2 months in a sealed container at room temperature, 3–6 months in the refrigerator, and up to 1 year in the freezer.

Occasionally check jerky you've stored at room temperature or in the refrigerator to make sure no mold is forming. Discard it if you find mold.



## Your Guide for Making Jerky at Home

Jerky is a nutritious, nonperishable, and lightweight protein snack, but making it requires a lot of care. This booklet provides all the basics and more. Learn the preparation techniques needed when dehydrating different types of protein, including fish; the proper use of ovens or dehydrators; how to accurately judge doneness; and how to condition, package, and store your batches after they're done. The helpful photographs and recipes will get you started. You'll be safely enjoying this nutritious treat in no time!



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