



Food Freezing Basics: Packaging, Loading the Freezer and Refreezing

Julie Garden-Robinson
Food and Nutrition Specialist

■ Introduction

Freezing is one of the easiest, quickest, most versatile and most convenient methods of preserving foods. Properly frozen foods maintain more of their original color, flavor and texture and generally more of their nutrients than foods preserved by other methods.

Good freezer management is important. The following tips will help you get the most of your freezer dollar.

- Place your freezer in a cool, dry area where the temperature is constant.
- Keep your freezer at least $\frac{3}{4}$ full for efficient operation.
- Continue to use and replace foods. Do not simply store them.
- Open the freezer door as rarely as possible.
- Make proper use of energy saving features on your freezer.
- Keep door seals clean and check for proper sealing. Replace when necessary.
- Defrost manual freezers regularly.
- Keep the condenser coils clean.

■ Factors Affecting Quality

The condition of the food at the time of freezing will determine the final quality of the frozen food. Frozen food can be no better than the food was before it was frozen. Freezing does not sterilize foods as canning does. It simply retards the growth of microorganisms and slows down chemical changes that affect quality or cause food spoilage.

Enzymes

Freezing, heating and chemical compounds can control enzyme actions. Freezing slows enzyme activity so that many frozen foods, such as meats and many fruits, will keep satisfactorily with little or no further treatment.

Enzymes in vegetables are inactivated by heat during the recommended blanching process.

Air

Oxygen in the air may cause flavor and color changes if the food is improperly packaged.

Microorganisms

Microorganisms do not grow at freezer temperature, but most are not destroyed and will multiply as quickly as ever when the frozen food is thawed and allowed to stand at room temperature.

Ice Crystals

The formation of small ice crystals during freezing is desirable. Fast freezing is the most practical way to form small ice crystals. Large ice crystals associated with slow freezing tend to rupture the cells, causing an undesirable texture change.

Freezer Temperature

Maintain temperature of 0 degrees Fahrenheit or less to keep frozen foods at top quality. The storage life of foods is shortened as the temperature rises. For example, the same loss of quality in frozen beans stored at 0 F for one year will occur in three months at 10 F, in three weeks at 20 F, and in five days at 30 F.

NDSU
Extension Service

North Dakota State University, Fargo, North Dakota 58105

AUGUST 2005

Fluctuating temperatures result in growth in the size of ice crystals, further damaging cells and creating a mushier product. Changes in temperature can also cause water to migrate from the product.

Evaporation of Moisture

Improperly protected food will lose moisture, color, flavor and texture. Ice crystal evaporation from an area at the surface results in freezer burn, which is a dry, grainy, brownish area that becomes tough. Freezer burn does not render a food unsafe, only less desirable.

■ Packaging Materials

The prime purpose of packaging is to keep food from drying out and to preserve nutritive value, flavor, texture and color. Labels on packages will say if the product is suitable for freezer storage. A good packaging material should have the following characteristics:

- Moisture/vapor-proof or at least moisture resistant.
- Made of food grade material, i.e. designed to be used for food products.
- Durable and leakproof.
- Doesn't become brittle and crack at low temperatures.
- Resistant to oil, grease or water.
- Protect foods from off flavors and odors.
- Easy to fill and seal.
- Easy to mark and store.



The packaging you select will depend on the type of food to be frozen, personal preference and availability. For satisfactory results, do not freeze fruits and vegetables in containers larger than one-half gallon.

Packaging not sufficiently moisture/vapor-resistant for long-time freezer storage includes ordinary waxed paper and paper cartons from ice cream and milk.

Rigid Containers

Rigid containers are made of plastic, glass, aluminum and heavily waxed cardboard and are suitable for all packs. These are often reusable. Straight or tapered sides on rigid containers make it much easier to remove frozen foods.

Glass jars used for freezing should be made for the purpose. Regular glass jars may not withstand the extremes in temperature. Do not use regular, narrow-mouth canning jars for freezing foods packed in liquid. Expansion of the liquid could cause the jar to break at the neck.

Cans, such as shortening and coffee cans, are good for packaging delicate foods. Line the can with a food-storage bag and seal the lid with freezer tape because they are not airtight.



Baking dishes can be used for freezing, heating and serving. Dishes may be covered with a heavy aluminum foil taped with freezer tape. To reuse the baking dish after the food is frozen, wrap the food in casserole-wrap fashion. (See "Food Freezing Basics: Methods of Wrapping.")

Ice cube trays are good for freezing foods in small amounts. Freeze food until firm and then transfer to freezer bags.

Flexible Bags or Wrapping

Bags and sheets of moisture/vapor-resistant materials and heavy-duty foil are suitable for dry packed vegetables and fruits, meat, fish or poultry. Bags can also be used for liquid packs. Protective cardboard cartons may be used to protect bags and sheets from tearing and to make stacking easier.

Laminated papers made of various combinations of paper, metal foil and/or cellophane are suitable for dry packed vegetables and fruits, meats, fish and poultry. Laminated papers are also used as protective overwrap.

■ Packaging, Sealing and Labeling

- Cool all foods and syrup before packing. This speeds up freezing and helps retain natural color, flavor and texture of food.
- Pack foods in quantities that will be used at one time.
- Most foods require head space between the packed food and the closure for expansion as the food freezes. Loose packing vegetables, such as asparagus and broccoli, bony pieces of meat, tray-packed foods and breads, do not need head space.
- Pack foods tightly to cut down on the amount of air in the package.
- Run a nonmetal utensil, such as a rubber scraper handle, around the inside of the container to eliminate air pockets.
- When wrapping food, press out as much air as possible and mold the wrapping as close to the food as possible.
- When packing food in bags, press the air from the bags. Beginning at the bottom of the bag, press firmly moving toward the top of the bag to prevent air from re-entering or force the air out by placing the filled bag in a bowl of cold water taking care that no water enters the bag. Seal either method by twisting and folding back the top of the bag and securing with string, good quality rubber band, strip of coated wire or other sealing device. Many bags may be heat sealed, and some have a tongue-in-groove seal built in.
- Keep sealing edges free from moisture or food so they'll make a good closure.

- When using tape, it should be freezer tape, designed for use in the freezer. The adhesive remains effective at low temperature.
- Label each package with name of product, date, amount and any added ingredients. Use freezer tape, freezer marking pens or crayons, or gummed labels made especially for freezer use.

■ Loading the Freezer

- Freeze foods at 0 F or lower. To facilitate more rapid freezing, set the freezer at minus 10 F about 24 hours in advance of adding unfrozen foods.
- Freeze foods as soon as they are packaged and sealed.
- Do not overload the freezer with unfrozen food. Add only the amount that will freeze within 24 hours. This is usually 2 or 3 pounds of food per cubic foot of storage space. Overloading slows down the freezing rate, and foods that freeze too slowly may lose their quality.
- Place packages against freezing plates or coils. Leave space between packages so air can circulate freely. After freezing, store packages close together.
- Arrange packages so you use those that have been in the freezer the longest first.



FREEZER INVENTORY					
FOOD	Date Packaged	Size	No. Frozen	No. Used	
MEAT			20	10	10
Hamburger	5/1/85	3 lbs	10	1	11
Chicken	3/5/85	whole	5	1	1
Pork chops	4/20/85	4 chops	5	1	1
Past-beef	4/20/85	4 lbs	5	1	1
FRUIT			25	12	13
peaches	7/5/85	pints	20	1	11
strawberries	10/10/85	pints	5	1	1
VEGETABLES			12	1	1
peas	8/10/85	pints	12	1	1
green beans	8/5/85	pints	12	1	1

■ Freezer Inventory

Keep a list of all the foods in the freezer. Update the list each time food you put food in or take it out of the freezer. Use of an inventory can prevent overstorage of foods and loss of quality.

■ Thawing Foods

Most of the changes that appear during thawing are a result of freezing and storage. When food is thawed the ice crystals melt, the liquid is either absorbed back into the food or leaks out from the food. Slow, well-controlled thawing usually results in better return of moisture to the food and results in a food more like the original food than rapid thawing.

Thawing in the refrigerator is the safest thawing method. Food standing at room temperature gives microorganisms the opportunity for growth and activity.

■ What If the Freezer Stops?

The basis for safety in refreezing foods is the temperature at which thawed foods have been held and the length of time they were held after thawing. You can safely refreeze foods that still contain ice crystals or if they are still cold, i.e. below 40 F, and have been held no longer than one or two days at this temperature after thawing. In general, if it is safe to eat it is safe to refreeze.

Unfortunately, you often don't know the time and temperature. In these cases, you need to consider the following points.

- Do not open the door to check items; make a plan first.
- Try to determine, if possible, when the freezer may have stopped working.
 - Food in a closed, fully loaded freezer will keep for two days.
 - Food in a closed less than half loaded freezer won't keep longer than one day.
 - Meat, because of density, will remain frozen longer than baked goods.
 - Foods in a larger, well-stocked freezer, will stay frozen longer.
- If the freezer will not be operational within a day or two:
 - Use dry ice if available. Twenty-five pounds of dry ice in a 10 cubic foot freezer should hold the temperature below freezing for two to three days with less than half a load and three to four days in a fully loaded cabinet if you obtain dry ice quickly following interruption of freezer operation.

Place dry ice on boards or heavy cardboard on top of packages. Open freezer only when necessary. Don't handle dry ice with bare hands as it will cause burns. When using dry ice be sure the room is ventilated.

If dry ice is not available, other options are to:

- Cover the freezer with layers of newspaper and blankets. Pin the blankets away from the air vent. The air vent must be open because the freezer needs air when electricity comes on. A blanket cover will help even when using dry ice.
- Find other freezer storage at a locker plant or with friends and neighbors. Transfer foods in insulated boxes or well-wrapped in layers of newspapers.

■ Refreezing

Refreezing needs to be done quickly. Clean the freezer before refilling. If the freezer has an adjustable temperature control, turn it to the coldest position.

Check each package or container of food. You often can check nonrigid containers without opening by squeezing to feel for ice crystals. If they need to be opened they should be carefully rewrapped.

Place the warmer packages against the refrigerated surface when possible, but leave space between packages for air circulation.

The quality of refrozen foods is diminished.

Label and use refrozen foods as soon as possible.

■ What to Refreeze

Foods that have defrosted have no remaining ice crystals. If defrosted foods have warmed above refrigerator temperature (40 F) they should not be refrozen, except for very high acid foods, such as fruits.

Many thawed foods, i.e. those still containing many ice crystals or a firm-to-hard core of ice in the center, may be safely refrozen.

Any signs of spoilage, off-odors or color in any food indicate you should dispose of the food without tasting.

Remember, however, that you can't rely on appearance and odor. Some foods may look and smell fine, but if they've been at room temperature too long, food poisoning bacteria may have multiplied enough to cause illness.

Meats, such as beef, pork, veal, lamb and poultry can be refrozen when they are still firm with ice crystals. Meat still safe to eat can be cooked and refrozen. Discard meats if they have any signs of spoilage such as an off-color or off-odor.

Fruits usually ferment when they start to spoil, which will not make them dangerous to eat but will spoil the flavor. Defrosted fruits that smell and taste good can be refrozen.

Vegetables should be refrozen only if they contain plenty of ice crystals.

Shellfish, prepared foods or leftovers should not be refrozen if defrosted. If the condition of the food is poor or even questionable, get rid of it. It may be dangerous.

Never refreeze melted ice cream, cream pies, eclairs or similar foods.

Unfrosted cakes, uncooked fruit pies, breads and rolls can be refrozen.

The investment in the foods in the freezer may be significant, but so are the benefits of serving safe foods.

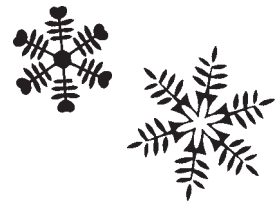
■ Foods That Do Not Freeze Well

FLAVOR CHANGE

- Pepper, cloves, imitation vanilla, garlic (especially uncooked), sage and celery seasonings may become strong and/or bitter.
- Curry may develop a musty off-flavor.
- Onion changes flavor during freezing.
- Salt loses flavor and has the tendency to increase rancidity of any item containing fat.
- Add artificial sweeteners and salt substitutes at serving time to be on the safe side.

TEXTURE CHANGE

- Cooked egg whites become tough and rubbery.
- Soft meringues toughen and shrink.
- Mayonnaise and cooked egg or cream-based salad dressings separate when frozen alone.
- Milk sauces or wheat-flour thickened gravies may separate or curdle.
- Half-and-half, sour cream and cottage cheese separate and may become grainy and watery when frozen alone. Buttermilk and yogurt react similarly, but can be used for baking.
- Custard or cream fillings tend to separate and become lumpy and watery.
- Boiled or fluffy frostings made with egg whites become sticky and weep.
- Cooked pasta products lose texture and tend to taste rewarmed when frozen alone.
- Most gelatin dishes tend to weep when thawed.
- Cheese or crumb toppings become soggy.
- Fried foods, except french-fried potatoes and onion rings, lose crispness and become soggy.
- Lettuce, tomatoes, celery, cucumbers, parsley, radishes and similar high-water-content vegetables become limp and watery.
- Potatoes might darken and have a texture change when included in frozen soups and stews. New potatoes freeze better than older ones.
- Canned hams can become tough and watery.
- Stuffed poultry cannot be safely frozen.



For more information about food preservation, contact your local office of the NDSU Extension Service or visit our food preservation Web site: www.ag.ndsu.nodak.edu/food.htm

NDSU Extension Service, North Dakota State University of Agriculture and Applied Science, and U.S. Department of Agriculture cooperating. Duane Hauck, director, Fargo, N.D. Distributed in furtherance of the acts of Congress of May 8 and June 30, 1914. We offer our programs and facilities to all people regardless of race, color, national origin, religion, sex, disability, age, Vietnam era veterans status or sexual orientation; and are an equal opportunity employer.

Web only-7-05

This publication will be made available in alternative format, upon request to people with disabilities, (701) 231-7881.