

# Pickling

## Objectives

After completing this unit you should be able to:

1. Identify the four classes of pickled products.
2. Learn proper procedures for making pickled products.
3. Discuss the problems associated with different types of containers and utensils when making pickles.

### In this lesson:

Topic	Page
Introduction	2
Classes of pickles	2
Ingredients	3
Equipment	7
Procedures	8
Supplement Study Questions	14
Supplement <i>Preserving Food: Pickled Products</i> , U of Georgia <a href="http://www.uga.edu/nchfp/publications/uga/uga_pickled_products.pdf">http://www.uga.edu/nchfp/publications/uga/uga_pickled_products.pdf</a>	
Supplement <i>Peppers: Safe Methods to Store, Preserve and Enjoy</i> , U of CA <a href="http://anrcatalog.ucdavis.edu/pdf/8004.pdf">http://anrcatalog.ucdavis.edu/pdf/8004.pdf</a>	

## Introduction

Pickles, relishes, and chutneys add tangy interest to meals. Prize pickles are not the result of good luck. They require good ingredients and reliable methods.

Some pickle products, such as fresh-pack dills, bread and butter pickles and pickled fruits and relishes, may be easily and quickly prepared at home by inexperienced pickle makers. Other types of pickles, such as brined or fermented dills, sweet gherkins and sauerkraut require greater skill and more time. This unit contains information on both fresh-pack and fermented pickles.

Pickle products are classified on the basis of ingredients used and the method of preparation.

## Classes of pickles

### 1. Fresh pack or quick process pickles

These pickles are covered with boiling hot vinegar, spices and seasonings. Sometimes, the product is brined (soaked in a salt and water solution) for several hours and then drained before being covered with the pickling liquid. These are easy to prepare and have a tart flavor. Fresh pack or quick pickles have a better flavor if allowed to stand for several weeks after they are canned.

### 2. Fermented pickles or brined pickles

These pickles go through a curing process in a brine (salt and water) solution for one or more weeks. Curing changes the color, flavor and texture of the product. If the product is a fermented one, the lactic acid produced during the fermentation helps preserve the product. In brined products that are cured, but not completely fermented, acid in the form of vinegar is added later to preserve the food.

### 3. Fruit pickles

These pickles are prepared from whole or sliced fruits and simmered in spicy, sweet-sour syrup. The acidity of the fruit is increased by the addition of vinegar or lemon juice.

### 4. Relishes and chutneys

These are made from chopped vegetables or fruits cooked to desired consistency in a spicy vinegar solution.

## Ingredients

### 1. Vegetables or fruits

Select tender vegetables and firm fruits that are free from blemishes.

#### **Cucumbers**

If large cucumbers are used, slice or cut into chunks or chips. Good quality pickles are not made from immature “slicing” cucumbers. Waxed or “salad” cucumbers are not recommended for pickling whole, as the pickling solution can’t penetrate unless the cucumbers are sliced. Additionally, the skin will be tough and the flesh soft. The blossoms of cucumbers should be completely removed and the end cleaned well to reduce the microbial load and softening enzymes produced by molds growing in/on them. However, the National Center for Food Preservation recommends discarding 1/16<sup>th</sup> inch off the blossom end of cucumbers to be sure that the heavy concentration of mold and/or softening enzymes are removed.

#### **Cabbage**

Use fresh, firm, mature heads for sauerkraut.

#### **Fruit**

Use slightly under-ripe fruit to retain shape.

#### **Important**

##### **24 Hours from Vine to Brine**

For best results, start pickling within 24 hours of harvesting. If this isn’t possible, refrigerate or store the produce where well ventilated and cool. This is especially important for cucumbers, which deteriorate rapidly at room temperature.

### 2. Spices

Spices (or herbs) are the only ingredient that may be adjusted in a pickle recipe. One spice may be substituted for another, and the total amount may be decreased. Do not increase the total amount of spice in a recipe.

Use whole spices. Powdered spices may cause the product to darken and become cloudy. Use fresh spices. Last year’s supply will have lost much flavor. Pick dill as soon as the flowers begin to open. Dill seed can be substituted for fresh dill (3 dill heads = 1 tablespoon seeds).

#### **Note**

If spices are to be removed before pickles are put in canning jars, tie them loosely in a thin, clean square of cloth or layers of cheesecloth. A tea ball is a handy gadget for holding spices that are to be removed.

### 3. **Garlic**

Use fresh or mature garlic. Immature or old garlic turns pink or purple as anthocyanins (coloring pigment) react to acid. This is not a safety issue.

### 4. **Water**

Use soft water, if possible. Extremely hard water can cause discoloration of pickles, particularly if the water contains iron. In fermented pickles, hard water will interfere with the formation of lactic acid.

Some types of hard water may be somewhat softened by the following method: Boil water for 15 minutes, skim off the scum, and allow the water to rest 24 hours. When the sediment has settled to the bottom, pour off the water from the top and use.

### 5. **Sugar**

White or brown sugar may be used for pickles. The sucrose sugar may be from beet or cane sources. Brown sugar may darken the liquid slightly.

If a non-nutritive sweetener is used, use a recipe developed by the manufacturer. *Saccharin* and *Nutrasweet (Aspartame)* are not recommended since heat alters their flavor. Artificial sweeteners do not plump the pickles as sugar does.

Honey may be substituted as a sweetener. It is sweeter than sugar, so use  $\frac{1}{4}$  less. If a recipe calls for 1 cup sugar, use  $\frac{3}{4}$  cup honey.

### 6. **Firming agents**

These ingredients are not needed to make pickles crisp and firm if good quality ingredients and up-to-date procedures are used. If firming agents are used, use them sparingly.

#### **Lime**

Lime, manufactured as a soil amendment, is not a food safe product. Unslaked or quick lime (calcium oxide) is food safe.. When unslaked lime is dissolved in water, it becomes calcium hydroxide (hydrated lime, lime hydrate, or slaked lime). Both slaked and unslaked lime can be used. It is added to brine in which cucumbers are soaked before being made into pickles. Use 2 tablespoons of lime per quart of brine and rinse thoroughly before packing.

Ball Pickling Lime is hydrated lime. Directions for its use include dissolving 1 cup lime product into 1 gallon of water. After soaking the pickles for 12 to 24 hours, they are to be rinsed four times.

### **Alum**

Alum (ammonium aluminum sulfate) is sold in the spice section of grocery stores. Use 1/8 teaspoon of alum per quart of pickling solution. Too much alum will give a bitter flavor and may cause digestive upset. Some commercial pickling spice mixtures contain alum.

### **Grape leaves**

Some older pickle recipes call for adding a grape leaf to each jar of pickles to make them crisper. Grape leaves contain a substance (scupernin), which inhibits pectic enzymes of mold that soften pickles. But as long as all the blossoms, which may be the source of the undesirable mold enzymes, are removed, grape leaves won't be needed.

## **7. Salt**

There are a variety of salts available on the market; however, not all of them are appropriate for pickling.

### **Note**

Never alter the amount of salt in quick pickle recipes. Do not alter salt concentrations in fermented pickles or sauerkraut. Proper fermentation depends on correct proportions of salt and other ingredients.

### **Pickling and canning salt**

Pickling salt is pure, granulated salt containing no anti-caking agents and no iodine. If available, pickling salt is the best choice.

### **Regular and iodized table salt**

Regular table salt or any food grade salt may be used. Iodized salt can be used, though it will darken pickles. Table salt contains an anti-caking agent, (probably sodium silicoaluminate or magnesium carbonate) that makes the brine of the pickles cloudy. The uniodized table salt does not contain the iodine, but still contains an anti-caking agent that will give the same cloudy brine.

### **Kosher salt**

Kosher salt is a flaked salt that is relatively expensive. It contains no iodine or anti-caking agents, and is therefore good for use in pickling. However, being flaked, the salt will not measure the same as either canning or regular table salt. The best method to determine how much flaked salt to use is to weigh it. One cup of pure, granulated salt weighs approximately 10.2 ounces (288 grams), so this is the weight of flaked salt equivalent to one cup of salt in a recipe.

**Sea salt**

Sea salt contains minute amounts of minerals including iodine. It is not suitable for pickling purposes for the same reason iodized table salt is not – the pickles turn dark.

**Ice cream salt or rock salt**

These salts are not considered food safe for they might contain impurities. They are not recommended.

**Sour salt**

Sour salt is a small tablet containing citric acid and salt that is used in the commercial canning of seafood. At retail level, it is marketed as a water softener. The salt in the tablet removes ions of calcium and magnesium, while the citric acid renders the iron in the water unavailable. This type of salt is not suitable for pickling purposes.

**Salt substitutes**

Salt substitutes, such as those made of potassium chloride, cannot be used to make a satisfactory fermented pickle product. The pickles will be crisp and crunchy, but will not have the characteristic salty pickled taste. Potassium has a bitter taste and the pickles generally taste terrible.

**8. Vinegar****Cider and white distilled vinegar**

All USDA tested and recommended pickle recipes are based on the use of 4% to 6% acetic acid vinegar. This is the range of acidity of most commercially bottled vinegars. Check the label to be sure the vinegar contains 4% to 6% acetic acid; 40 – 60 grain acetic acid means the same thing.

Cider or white distilled vinegar may be used in pickle recipes. Cider vinegar has a more mellow taste but may discolor certain vegetables. White distilled vinegar has a sharper taste; it is not imitation or synthetic vinegar. Use white vinegar where a light color is important.

Some old-time recipes are based on 3% acidity vinegar. This is the reason some of Grandma's pickle recipes do not give expected results when prepared today. This acidity percentage is too low. Pickles may spoil if the vinegar is below 4% acetic acid content. Always use a research tested recipe.

**Specialty vinegars**

Specialty vinegars such as Balsamic, wine vinegar and malt vinegar are usually 4 to 6% acidity, however always check the label. These vinegars have a strong flavor and may be unsuitable for pickle making.

### Important

Never use homemade vinegar of unknown acidity in pickle making. Do not dilute vinegar. If the pickling solution is too tart, add sugar rather than decreasing the vinegar.

### Lactic Acid

In some fermented pickle products such as sauerkraut, no vinegar or acetic acid is used. Lactic acid is produced naturally in these products during fermentation.

Edible lactic acid may be substituted in whole or in part for vinegar in recipes given for vegetable pickles. Edible lactic acid is available in concentrations of 50% and may be purchased from a chemical supply company. Because most vinegar is 5% acid, only 1/10 of the amount is needed when using lactic acid. Dilute the 50% lactic acid to 5% acid by adding 1 part lactic acid to 9 parts water (1 cup lactic acid to 9 cups water). Leftover diluted (5%) lactic acid can be stored in a glass bottle or jar. Be sure to label it.

## Equipment

### 1. Utensils

For heating pickling liquids, use utensils of unchipped enamelware, stainless steel, aluminum, or glass. Don't use copper, brass, galvanized, or iron utensils.

Copper utensils may turn pickles a peculiar shade of green. Iron may turn them black. The action of acid or salt on galvanized utensils may produce a toxic substance.

For fermenting pickles, use a wooden barrel, stoneware crock, stainless steel container, unchipped enamel-lined pan, large glass bowl or jar, or plastic container. Large food-grade plastic containers are available at wine making supply stores. Gallon jars, plastic or glass, used for mayonnaise, mustard, and similar products, can be used for fermentation.

### 2. Weights

Fermenting pickles and cabbage must be kept submerged. Use a clean, heavy plate to cover pickles and weigh them down with a plastic jar filled with water or the pickling brine. Do not use stones or bricks because they introduce impurities. **A heavy plastic bag filled with pickling liquid makes the best cover and weight.**

### 3. Jars for canning

Select only standard canning jars and lids. Discard jars with chips and cracks.

### 4. Canners

A boiling water bath canner or deep pot is needed to process jars of pickles. The pot should be deep enough to allow the tops of the jars to be covered with 1" to 2" of simmering water. You will need a rack in the bottom of the pot. The rack can be of wire or wood, but should keep the jars off the bottom of the pot and allow the water to circulate around the jars. If no rack is available, use a layer of jar rings covered with a dishcloth or tea towel.

### 5. Thermometers

Use a candy or meat thermometer to determine the simmering water bath temperature (170° F to 190° F). The best way to process pickles is in simmering 180° F water for 30 minutes. Some pickle recipes call for boiling water bath canning.

## Procedures

### 1. Quick process or fresh pack pickles

Fresh pack pickles, such as quick process dill pickles, crosscut pickle slices, bread and butter pickles, and mixed vegetable and cauliflower pickles, are quick and easy to prepare.

Instead of allowing the lactic acid bacteria to produce acid as in fermented pickles, the acid is poured over cucumbers in the form of vinegar.

Some recipes call for soaking the cucumbers in ice water for a specified amount of time.

Vegetables may also be soaked for a few hours or overnight in brine (salt water) prior to pickling. This soaking pulls water out of the pickles and helps them absorb the final pickling solution (vinegar, salt, and other flavorings). This results in a firmer pickle product.

After brining, the vegetables are drained, packed into clean jars, and covered with pickling solution. The jars are then closed with two-piece canning lids and processed.

The pickling solution must contain sufficient vinegar. A good rule of thumb for pickle recipes is a covering liquid of **1 part vinegar to 1 part water**. Cucumber pickles can be safely made with 1 part vinegar to 2 parts water. Beets, on the other hand, have a higher buffering capacity and require 2 parts vinegar to 1 part water.

**Salt** should **not** be removed from quick pickle recipes, as the salt is necessary for the safety of the product. Recipes using a salt substitute (potassium chloride) are also available; however, these leave a bitter aftertaste.

Low-salt pickle recipes are available in USDA resources. These recipes contain equal amounts of vinegar and water, or more vinegar than water or other liquid. These recipes should be carefully followed.

Since both microorganisms and enzymes can cause spoilage of pickled products, processing is recommended to prevent these problems.

To ensure crisp pickles, use a simmering water bath (180° F) in the boiling water bath canner. Use a thermometer to judge the correct temperature. Always process for times recommended in specific recipes.

## **2. Fermented or brined pickles**

Fermented pickles require more time to make than fresh-pack pickles. They are prepared by immersing cucumbers in spiced brine. During this time, lactic acid is formed from the sugars in the cucumbers by several types of lactic acid bacteria.

All fermented foods must have a source of sugar for fermentation. This sugar may come from the covering brine or from the food itself.

To establish conditions favoring growth of lactic acid producing bacteria, salt is added to the fermentation mixture. It is essential to correctly measure the amount of salt added to a fermentation mixture. The concentration given in tested and approved recipes should never be reduced. Salt inhibits the growth of many spoilage organisms. As bacteria produce lactic acid, the pH drops. The low pH inhibits the growth of harmful bacteria.

When added to the vegetables, the salt content of the brine should be about 8% salt, or about  $\frac{3}{4}$  pound salt per gallon of water. This salt content is high enough to inhibit growth of spoilage organisms, but allows lactic acid bacteria to grow well.

Fermented pickles can be made by substituting calcium chloride for sodium chloride and allowing the fermentation to progress at a low temperature - between 45° F to 55° F. These pickles, however, will not taste like traditional pickles.

When food is cooked, the native flora is destroyed, including the lactic acid producing bacteria. If a cooked food is fermented, harmful bacteria may be

able to multiply rapidly due to lack of competition from other microorganisms. Very hot covering brine will destroy many bacteria. Food should not be heated if it is to be fermented and the brine should be made with cold or room temperature water.

The temperature in the room where the food is being held will affect the fermentation process. At 70° F to 75° F, fermentation will take place between 3 to 4 weeks. This is ideal. Between 55° F and 65° F, it will take 5 to 6 weeks or longer to ferment, and fermentation may even stop altogether, causing spoilage. At 80° F. and above, fermentation is too rapid and pickles will be soft or they will spoil.

#### **Important**

Fermenting pickles must be kept submerged. Pickles not covered with the fermenting liquid will spoil.

There are some yeasts and molds that can grow on top of the fermented product, causing off-flavors and undesirable texture changes. A tight-fitting cover (such as a brine or water-filled plastic bag) can help to eliminate air from the surface, which will reduce the growth of yeasts and molds. Nevertheless, the container should be checked for mold growth frequently, and light mold or yeast growth should be skimmed off and **discarded daily**.

After 10 – 15 days, depending on the room temperature, fermentation should be complete. The pickles will have an olive-green color and a desirable flavor. The brine will be cloudy as a result of bacterial growth during the fermentation. The brine should be strained and then heated to boiling. The pickles should be packed into clean jars, covered with hot brine, sealed with lids and processed in a simmering water bath (180° F) for 15 minutes or for the time specified in the recipe used.

Pickles may also be allowed to “cure” for 2 to 3 weeks after fermentation stops. This curing allows development of flavors. However, scum yeasts may grow on the surface during this time. So check for and remove scum daily. The scum consists of yeasts, which destroy lactic acid. Unless the scum is removed daily, the pickles will have unwanted flavors. If mold grows on the surface, remove it promptly. The mold produces enzymes that will soften the pickles.

Fermented pickles can be stored in the crock for a few months if certain care is taken. Store the crock in a cool place, preferably 60° F or below. Keep the pickles submerged. Check periodically for scum, yeast or mold and keep them removed.

The fermentation becomes anaerobic (oxygen free) when the oxygen, which is dissolved in the brine is used up by bacteria. The fermenting products should not be stirred or mixed because this adds air to the brine and also introduces yeasts and molds from the surface throughout the brine.

Fermented pickles can also be stored, without processing, in the refrigerator.

After the fermentation process has been completed, sauerkraut may be stored in the refrigerator for several months or it may be canned. When canning, kraut must be processed in simmering water in a boiling water bath canner.

### **3. Storage**

Pickle flavors blend after being stored for several weeks. Ideal storage conditions for pickles (or any canned product) include the following:

- Cool – Extreme fluctuation of temperatures can cause a breakdown of the pickle texture. Pickles stored at warm temperatures could start fermenting again and cause the jars to break.
- Dark – Light often causes products to fade and become less appetizing. This does not necessarily mean a spoiled product
- Dry – Continuous moisture may cause closures to rust and eventually produce spoilage.

As with all preserved food, properly discard any product you suspect of spoilage. This includes foods with bad odor or a mushy or cloudy appearance. A covering of mold on fruits and pickled foods may present some special hazards. The environment under the mat or mold may allow the growth of the botulism bacteria. Any canned product with a covering of mold must be properly discarded.

Occasionally, a jar of pickles will seal and then weeks later lose its seal. The liquid will be cloudy and some bubbling will occur. In quick process pickles, it is usually a result of an unintentional fermentation. These pickles are safe to eat. Observe the jar. When the bubbling stops and the cloudiness settles, the fermentation is complete.

### **4. Reprocessing**

Cucumber pickles, pickled peppers and pickled vegetables can be safely reprocessed if the seal was lost by fermentation (production of acid and gas). They should not be reprocessed if spoiled by surface yeast or mold. Allow the fermentation to come to completion, which can be determined as when the brine becomes less cloudy and the bacterial cells settle to the sides and bottom of the jar. After the fermentation is complete, remove the contents from the jar, and wash the jar in hot, sudsy water.

**To Reprocess:**

1. Strain the brine through a paper coffee filter.
2. Pour the brine into a saucepan.
3. Bring the brine to a boil and allow it to simmer 10 minutes.
4. Pack the cucumbers into clean, hot jars.
5. Cover with hot brine leaving  $\frac{1}{2}$  inch headspace.
6. Remove trapped air bubbles. Wipe jar rims.
7. Apply hot lids and rings and tighten just tight.
8. Process 10 minutes in a simmering hot water bath (180° F).

## Pickling Study Questions

1. What is another term for “fresh pack” pickles? How are they acidified?
2. What two ingredients are essential in a brine?
3. What are three changes that take place in cucumbers during the curing process? What is another term for “curing”?
4. What ingredients change the acidity of fruit in fruit pickles? Does this raise or lower the pH?
5. Why must the blossom end of a cucumber be extremely clean? What is one way of assuring this?
6. What is the substitution of dry dill seed for fresh dill heads in a pickle recipe?
7. Explain whether it is better to use whole or ground spices when pickling.
8. If a garlic clove in a jar of pickles changes color, is this a sign of spoilage? What makes this happen?
9. List three additives that may be used to “crisp” pickles. Are these additives necessary? Why?
10. Why is it better to use pickling salt instead of other salt products?

11. What acidity concentration is necessary for safe pickles?
12. What is the best processing temperature for jars of pickles?
13. When making quick or fresh pack pickles what is the standard vinegar to water ratio for most vegetables? For cucumbers?
14. What is the original source of acid in a fermented pickle? What acid does this produce?
15. In what temperature range will pickles ferment in about 3 to 4 weeks?
16. Why must molds and scum be removed from the surface of fermenting pickles? How often must this be done?