FERMENTING FOODS

I ILLINOIS EXTENSION

Fermentation is simply the process in which a substance breaks down into simpler components. Microorganisms like yeast, bacteria and mold play a role in the fermentation process, creating foods and drinks such as beer, wine, sourdough bread, sauerkraut, kimchi, yogurt, chocolate, pickles, tempeh, koji and miso. Fermentation has been used for thousands of years to preserve food and is seeing a revival as people learn to ferment their own foods and beverages. This is a safe, easy and economical way to preserve food. Whether you want to keep alive old traditions, create probiotic-rich foods or simply experiment with new flavors, food fermentation will prove to be a rewarding endeavor.

Lacto-Fermentation

To dispel a common myth about lacto-fermentation, it doesn't necessarily have anything to do with dairy as some relate "lacto" to the lactose (sugar) found in milk. Instead, the "lacto" refers to lactic acid that's produced during the fermentation process by lactic-acid producing bacteria which are present on the surface of all fruits and vegetables. In an anaerobic (oxygen-free) environment, these bacteria convert sugars into lactic acid, which inhibits harmful bacteria and acts as a preservative. It's also what gives fermented foods their characteristic sour flavor

The natural acids and other antimicrobial compounds produced by the fermenting bacteria inhibit the growth of other harmful bacteria, molds and yeasts that contribute to spoilage. Additionally, the carbon dioxide produced during the fermentation process helps maintain the low-oxygen conditions necessary for the fermenting bacteria to flourish. Carbon dioxide also aids in the stabilization of flavor and color.

Of the many groups of fermenting bacteria, those from the lactic acid bacteria family are the most important in vegetable fermentation – specifically Leuconostoc, Lactobacillus and Pediococcus species.

Benefits

- 1. Enhanced digestibility due to enzyme action
- 2. Increased vitamin levels, specifically B vitamins and preservation of vitamins A and C
- 3. Improved gut health due to presence of probiotics

Keep in mind that not all fermented foods you buy in the store will contain live probiotics. Check the label for "Live Active Cultures".



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Use Quality Water



Filtered water or spring water are preferred. Tap water usually contains chlorine, chloramines and fluoride that must be removed before culturing.

If using bottled water, check the source to be sure it is free of chemicals. Do not use distilled water.

Well water can be used but have it tested for contaminants prior to use.

Use Quality Salt



the vegetables

The salt used in fermentation should contain no additives. Canning or pickling salt is recommended since it contains no impurities and has a consistent granular size and weight.

Generally 5% salt concentrations are used for large vegetables (cucumbers and carrots) and a 3% concentration is used for shredded vegetables (cabbage).

Brine Calculation

Added to 1 quart of water:

3% = 2 tablespoons of salt (1 ounce or 27 grams)

5% = 3 tablespoons of salt (1.6 ounce or 45 grams)

• Aids in the growth of fermenting bacteria over spoilage bacteria, yeasts and molds

Allows needed water and sugars to be pulled from

Functions of salt in the fermentation process:

*It is best to weigh salt for accuracy.

- Allows for crisper vegetables by hardening the plant pectin and decreases the activity of pectinase, an enzyme that makes vegetables mushy
- Allows for longer fermentation by slowing the fermentation process and decreasing the chance of undesirable mold growth
- Gives flavor to the final product

Salting Methods

Dry Salting

Salt is added directly to the vegetables. After mixing in the salt, you may want to leave the mixture for 20-30 minutes to allow for natural juice extraction. Massaging the vegetables helps to speed up the process and is a fantastic workout for your hand muscles! This step in the process usually takes 10-15 minutes to get enough liquid pulled out to cover the vegetables in the fermentation vessel.

Brining

Mixing salt and water to form brine before adding to the vegetables. This technique can allow for better coverage of the vegetables which lessens the risk of fermentation failure and is best for whole or quartered pieces.

If there isn't enough brine to cover the vegetables from dry salting, make your own.

Brine = 1 quart water + 1.5 tbsp of salt

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Tools and Equipment

Your container, equipment and food contact surfaces should be washed with hot soapy water before you begin.

Sanitizing is another crucial step. If chlorine bleach is used, the equipment should be rinsed thoroughly to remove any residues which may inhibit the growth of fermenting bacteria. See box for more sanitizing options.

Cutting, chopping and pounding tools aid in the extraction of the vegetable juices necessary to cover the fermenting mixture. What you will need when it comes to chopping and cutting will depend upon what your desired final product will be. Kraut boards, food processors, sharp knives, and mandolins all work well.

Crushers, pestles and sauerkraut pounders break the vegetable tissue, allowing more juices to be released. Clean hands or gloved hands will also get the job done. You may need to massage the shredded vegetables for 10-15 minutes

until you have extracted enough liquid to cover the vegetables once transferred to your vessel.

Vessels/Containers

General Rule: 1-gallon container for 5 pounds of fresh vegetables

- Use food-grade containers such as glass or plastic (BPA free)
- Quart-size glass jars with airlock lids are great for small batches
- Do not use copper, iron, or galvanized metal containers or lead-glazed crocks
- High-grade, commercial stainless steel can be used

If you are unsure about the safety of a container, err on the side of caution to avoid harmful materials leaching into your food.

Use of plastic jar lids is advisable since metal lids will degrade under acidic and salty conditions.

Keeping Vegetables (and other foods) Submerged

This is a critical step to the safety and quality of the finished product. Your fermenting product should be kept 1-2 inches below the brine. There are several options to aid in this:

- Ceramic weights
- Tempered glass weights
- Food grade bag filled with brine
- Glass or pie plate in addition to the brine filled bag
- Whiskey stones are good for smaller vessels (do not confuse with rocks)
- A cabbage leaf can help prevent floaters, a brine-filled bag can serve as the weight

Sanitizing methods

- Boil for 10 minutes
- Oven for 2 hours, at 320°F
- Sanitizers made for food/ beverage production







Controlling for Mold

Submerge vegetables 1-2 inches below juice/brine mixture to prevent spoilage. Exposure to oxygen can encourage and allow for both mold and yeast to grow. It is critical for vegetables to remain submerged during the fermentation process to prevent spoilage. The box on the right as additional tips.

When in Doubt—Throw it Out

If fermented product is slimy, smells spoiled/rotten, discard it. Clean the container thoroughly and try again!

Moving to Cold Storage

1.Use a jar with an airlock lid

- 2.Keep food submerged below the brine level
- 3.Control room temperature- ideal=68-72°F
- 4.Use the freshest produce possible
- 5.Use the correct amount of salt
- 6.Clean and sanitize equipment; wash hands and surfaces often

Three helpful signs to look for to know when your product is ready for cold storage.

Bubbling- Fermented products should have bubbles in the brine mixture. This is because Lactic acid bacteria produce gases and this shows up in the form of bubbles.

Aroma- The fermented product should have a pleasant yet slightly sour aroma. If it smells spoiled or rotten, discard it.

Taste- Depending on the type of vegetables used, there will be varying ranges of fermented flavors. Generally, if you want a less sour product, use a shorter fermentation time; longer for more tang. Refer to your recipe for specifics. Expect subtle changes in flavor even during refrigeration (the process slowly continues).

References

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•Breidt, F., McFeeters R. F., Perez-Diaz I., and Lee C. 2013. Food Fermented Vegetables Microbiology: Fundamentals and Frontiers, 4th Ed. Edited by M. P. Doyle and R. L. Buchanan: ASM Press, Washington, D.C.

•USDA. 2009. USDA Complete Guide to Home Canning. U.S. Department of Agriculture National Institute of Food and Agriculture. Agriculture Information Bulletin No. 539.

Additional Food Preservation Resources

Additional Resources

- So Easy to Preserve, 6th Edition
- Complete Book of Home Preserving
- The Ball Blue Book
- National Center for Home Food Preservation
- YouTube: What's Cooking with Mary Liz Wright
- From Garden Gates to Dinner Plates: <u>https://</u> web.extension.illinois.edu/cottage/taskforce.cfm
- University of Illinois Extension Food Preservation Resources: <u>https://web.extension.illinois.edu/</u> <u>foodpreservation/</u>

Created by: Kristin Bogdonas, MPH University of Illinois Extension Educator, Nutrition & Wellness Serving Henry, Mercer, Rock Island and Stark Counties June 2020

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