

Food Safety News

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Fermenting Veggies at Home: Follow Food Safety ABCs

By Cookson Beecher | March 11, 2014

Fermentation has become what USDA microbiologist Fred Breidt, Jr., describes as a “movement that’s picking up speed.”

And for good reason, said Breidt, who specializes in the safety of fermented and acidic foods. Referring to home preparers, small producers and restaurant owners, he said that “they like being able to pick up these nice flavors (from fermentation) and making new ones.”

Sandor Katz, author of “Wild Fermentation” and “The Art of Fermentation,” refers to this “food movement” as a “fermentation revival.”



Considered to be “live foods, fermented foods have a natural tart flavor because the sugars and carbohydrates have been broken down and used up during fermentation.” Katz said that, in the case of vegetables, they’re more digestible than raw ones. And, because they contain “living bacteria,” they help digest other foods in the digestive tract.

Fermentation has long been part of human history. In fact, food scientists say that it played a vital role in human

survival in the days before stoves and refrigerators simply because it allowed people to preserve food in a nutritional and safe way. Think foods such as cheese, yogurt, sauerkraut, kimchee, olives, salami, jerky and even bread. And think beverages such as wine and beer, not to mention coffee and hot chocolate. All of these — and many more — are examples of fermented foods.

Although we eat one form of fermented food every day, the idea of fermenting our own food conjures up images of strange, iffy, and perhaps dangerous dishes. Surely it would be best to leave it to the experts.

Not so, say food scientists, microbiologists and fermentation advocates — especially in the case of fermented raw vegetables. They point out that just about any raw vegetable can be safely fermented at home, if done properly.

Breidt has often been quoted as saying that the scientific literature has never recorded a case of food poisoning involving raw vegetables that have been fermented properly. But he emphasized that the key word here is “properly,” which some people who quote him fail to include in that sentence.

How does it work?

Simply put, fermentation of vegetables happens when the natural bacteria in the vegetables break down the components of the vegetables into forms easier to digest and often more nutritious than the raw vegetable itself.

For those who have apprehensions about food safety, Breidt said that fermented vegetables can be safer than raw vegetables, thanks to the ability of lactic acid, which forms during fermentation, to hunt down and kill any harmful bacteria that might be present.

“It’s almost bulletproof,” he said, referring to fermentation of vegetables, which almost always includes adding salt to shredded, chopped or grated raw vegetables.

Breidt refers to lactic acid bacteria as the “world champions for consuming sugars and converting them to lactic acid.” From there, the lactic acid gets to work overpowering any pathogens on hand.

Fermentation was probably one of the first technologies adopted by humans, Breidt said, noting that it likely developed about the same time as pots in which to hold food. “Vegetables and salt got together,” he said, conjecturing about how this happy “food marriage” began.

Humans probably adopted fermentation about 12,000 years ago — at the dawn of civilization — and Breidt said the technology rapidly spread from region to region.

“We still do it the same way today,” he said. “Why? Because it works. It’s hard to mess it up. Things can go wrong, but it’s rare.”

Author Sandor Katz echoed this, telling **Food Safety News** that home fermentation of raw vegetables is intrinsically safe. He listed cabbage, daikon radishes, turnips, parsnips, cucumbers, okra, string beans and green tomatoes as good candidates for fermentation.

“There’s no vegetable you can’t ferment,” he said, but added that leafy greens such as kale — because of their chlorophyll content — aren’t to most people’s liking.

During an NPR interview, Katz explained that pickling and fermentation are not the same, although they are “overlapping” categories. A cucumber, for example, can be pickled with vinegar or fermented without vinegar, using a salty brine instead. During fermentation, however, vinegar and other acids are produced, which is why fermented sauerkraut and pickles taste “vinegary.”

When looking at fermented foods collectively, Katz said they’re a big part of the food industry, which means that a lot of research has been done, and is being done, on fermentation. Even now, he said, the traditional methods of fermentation continue to work well.

He pointed out that, until a few generations ago, fermentation was a common way to process foods.

“Historically, it was a way for people to preserve the harvest for the winter,” he said.

But now that it isn’t commonly done at home or in the community, people tend not to ferment foods at home because of their fear of bacteria, viewing fermentation as some sort of “mystique.”

Breidt said that, in Germany, sauerkraut was an important way to stay healthy during the winter, thanks to its nutritional value, which includes healthy amounts of Vitamin C. He also said that sailors, including those on Captain Cook’s crew, ate sauerkraut as a way to get enough Vitamin C.

“A large chunk of human history relied on fermentation as a way to preserve vegetables and help keep people healthy,” he said.

Today, fermentation continues to be widespread and practiced in all parts of the world, with regions and nations having their own special favorite fermented foods — kimchee in Korea, for example, and sauerkraut in Germany.

What about food safety?

While fermented vegetables can be safer than raw vegetables, primarily because the fermentation process kills harmful bacteria, basic food-safety practices need to be followed.

Both Breidt and Katz said that it's important to start out with vegetables that have been grown using good food-safety practices. This includes making sure the vegetables didn't come into contact with manure or compost that still has some pathogens such as E. coli or Salmonella in it.

"You don't want to use vegetables that have been contaminated when they're raw," Katz said.

"Just normal fermentation will kill the organisms," said Breidt. "But you don't want to ignore good handling and good sanitary practices."

These include washing the produce, your hands, any cutting or preparation utensils, surfaces where the food will be cut or chopped, and any containers you use for the food.

As for quality, both agree that the fresher the veggies, the better.

University of Idaho food scientist Gulhan Unlu, who focuses on food microbiology and bacteriology, told **Food Safety News** that the biggest concern with fermented vegetables is contamination after the foods have been fermented. This includes handling them with unclean hands, or letting them come into contact with contaminated meat or fish or with surfaces that haven't been adequately cleaned. But overall, she agreed that, from a food-safety standpoint, fermented vegetables can be safer than raw vegetables.

A World Health Organization report, which focused on the value of fermentation for people in developing nations who don't have refrigeration — or enough fuel to thoroughly cook their food, or to store it at high enough temperatures, or to reheat it — shared some similar thoughts about food safety.

"From the food safety point of view, the benefits of fermentation include the inhibition of the growth of most pathogenic bacteria and the formation of bacterial toxins," states the report.

The report also made it clear that basic food-safety guidelines must be followed and states that "there is considerable evidence that lactic acid fermentation inhibits the survival and multiplication of a number of bacterial pathogens."

However, the report adds, the potential of lactic acid fermentation to control the harmful effects of food contamination depends on factors difficult to quantify, such as the initial level of contamination, which, in turn, depends on local conditions, levels of hygiene and sanitation, and the resulting degree of acidity.

“On its own, fermentation cannot eliminate all food-related health risks, and it should not be seen as a replacement for observing the principles of food hygiene,” reads the report.

Proper temperature is important. According to USDA, at temperatures between 70-75 degrees F, kraut will be fully fermented in about three to four weeks; at 60-65 degrees F, fermentation may take five to six weeks. At temperatures lower than 60 degrees F, kraut may not ferment, and, above 75 degrees F, kraut may become soft.

The take-home message: Proper fermentation temperature allows for problem pathogens to be “selected” and destroyed, while it also inhibits the growth of organisms that can spoil the food.

Salt is an essential ingredient, and since consumers don’t usually have a good way to measure salt concentration in the finished product, they need to be sure they measure the salt carefully and follow a tested recipe. Types of salt to use are canning and pickling salt, since table salt, kosher salt, or other types of salt cannot be interchanged with canning and pickling salt. Also, salt with iodine added shouldn’t be used since iodine can inhibit fermentation.

The correct level of salt to use varies with the food being fermented. It ranges from 2.25 percent (by volume) for sauerkraut to more than 13 percent for other food items. Again, tested recipes should be followed when it comes to the proper amount of salt to use.

Salt affects the type and extent of microbial activity and helps keep vegetables from becoming soft.

Storage time also affects the texture. The shorter the time, the firmer the vegetables. Storing food that has already been fermented in the refrigerator or a root cellar significantly slows down the rate of fermentation. That’s why fermented foods can be stored for up to three months, or longer, without losing their quality and good taste.

Fermented food needs to reach a pH level of 4.6 or lower (which indicates it is acidic enough to be safe). Fermentation, if done properly, will bring food to the “safe” acid level.

In a case of botulism poisoning in fermented tofu in 2012 in New York City, the city’s health department informed the manager of the grocery store where the tofu was purchased that the tofu needed to be stored below 41 degrees F. in closed containers. The people who fell ill bought from the store’s bulk tofu, which had been kept

unrefrigerated, uncovered, and in water-filled bins.

Botulism is an extremely dangerous and often deadly foodborne pathogen.

According to the U.S. Centers for Disease Control, only one similar botulism poisoning in the U.S. has been recorded. Yet home-fermented tofu and other fermented bean products are the leading cause of botulism poisoning in China. Again, the proper food-safety precautions, chief among them sanitation, but also temperature controls, need to be taken.

Sauerkraut it is

Breidt encourages people to find tested recipes at university Extension sites or in cookbooks written by reputable food experts.

Making sauerkraut is a good way to get started on the road to fermentation. It's simple to do but also involves a basic procedure that can be used with other vegetables, although the amount of salt and fermenting time can vary.

Breidt advises beginners to grate, chop or shred the vegetables they plan to ferment because vegetables such as carrots and beets are dense enough that it's difficult for the lactic acid to get inside of them if they're in big chunks. The more surface area, the better — and the safer.



However, he said that's not the case with cucumbers, primarily because they're about 90 percent water, which makes it easier for the lactic acid to penetrate them.

Getting started

To get started making sauerkraut, select a nice-looking, firm head of cabbage that's as fresh as possible. Remove the outer leaves and cut out any spoiled or damaged spots. Rinse the cabbage head.

Quarter the cabbage and remove the core. After shredding, grating or chopping the cabbage, put it into a clean container large enough for a generous amount of headroom at the top. Add the amount of salt suggested in the recipe and spread it out evenly throughout the cabbage. (Some people layer the cabbage and the salt.) Mix it together well, and then let it set for 10 minutes so that the salt can start drawing the juice out of the cabbage.

Katz recommends three tablespoons of salt for five pounds of cabbage. But he also says that he uses more salt in the summer and less in the winter. (A medium-sized head of cabbage weighs about 2 to 2-1/2 pounds.)

Start squeezing handfuls of the cabbage as hard as you can. The goal is to get as much juice out of the cabbage as possible. Some people pound the cabbage mixture with a potato masher or a tool known as a “kraut pounder.” Overall, this part of the process takes about 10 minutes.

Some people like to add “a starter” such as lactobacillus or whey to speed things up. But Katz said that it’s not necessary to do that since fermentation is a natural process that doesn’t need any sort of a boost. A USDA recipe for sauerkraut calls for only salt and cabbage. However, if you do use a packaged starter, make sure you follow the instructions.

Once the brine has been “released,” tightly pack the cabbage into a clean fermenting jar, crock, or food-grade plastic container (don’t use anything metal), making sure there are no cracks or scratches in the containers that could harbor pathogens.

Other good choices for containers include a glass jar with a standard airlock system (available online or in some kitchen-goods stores), a round slow-cooker insert (make sure it doesn’t have any cracks), or a specialty ceramic fermenting crock (complete with lids, weights, a water-trough-airlock system and weights).

Cultures for Health has more information about equipment and tools for fermenting sauerkraut and other vegetables.

With the goal of keeping the cabbage submerged in its brine, put some sort of sterile lid on top of it once it’s in the new container. A large plate can work well, with a zip-lock plastic bag filled with water placed on top of the plate to weight it down. A sterilized heavy rock on top of the plate will also do the trick.

In the case of a smaller batch, an open-mouth canning jar with a smaller jar filled with water placed on top of the chopped cabbage to keep it submerged works well.

Whether making a large or small batch, place a clean towel over the container and secure it with a rubber band.

This will keep insects out while allowing some of the gases produced during fermentation to escape.

The goal at this point is to keep the minimum amount of oxygen from reaching the vegetables so that mold doesn't develop. But, if a light amount of mold does develop at the surface, just skim it off and remove any of the sauerkraut that has become discolored. It's essential not to let mold develop to the point that it can get down into the sauerkraut or other vegetables being fermented. If that happens, Breidt advises, for the sake of food safety, toss the batch.

Once all of that is done, put the sauerkraut in a place where you can keep an eye on it. After about three to 21 days, the brine will clear and the cabbage will start to taste tangy.

Start sampling to see when the sauerkraut tastes the way you want. Some people like a lightly fermented sauerkraut; others like it tangier. Once it reaches the stage you like it, put it into a container, such as a tightly covered jar, and put it into the refrigerator, making sure there's 1/2 inch of headroom. It's important that the brine covers the sauerkraut. If the kraut doesn't stay submerged, add some clean water.

It's also important to release the pressure from the gases that will build up. This can be done by opening the lid now and then to let the gases escape.

Other vegetables such as grated carrots, beets or turnips can be added to the sauerkraut mix at the beginning of the process. Adding red cabbage, which provides some color, is another option. Caraway seeds, garlic or even juniper berries are another nice touch.

"Why not?" Breidt commented, referring to using a mix of ingredients. "That's what adds flavor and variety to fermented vegetables."

As the sauerkraut cools down when you put it in the refrigerator or into a root cellar, the fermentation process slows rapidly, which means you'll be able to enjoy the finished product for several weeks or longer.

Many people find that putting their fermented vegetables in a root cellar or refrigerator for four to six weeks improves the flavor. In storage, the bacteria continue to ferment, but at a very slow rate.

Fermented vegetables with 1 percent to 2 percent salt by volume of the fermented product should keep well for at least four to nine months, respectively, in a refrigerator. A 2-percent salted version should keep well in a dark, cool area such as a root cellar for at least three months, if the vegetables are kept submerged under liquid.

Some people recommend covering the containers with a dark cloth to maintain Vitamin C levels.

Katz has a video of how to make sauerkraut on YouTube.

The National Center for Home Food Preservation has more information about fermentation and recipes including sauerkraut and pickles.

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