



FERMENTATION The Oldest Culture on Earth

Before the advent of modern refrigeration and freezing, fermentation, drying or smoking were the primary methods of food storage and preservation. Wild yeasts in our environment, in the air and in the earth, can be harvested to preserve vegetables, fruits, milk, fish, meat and turn otherwise inedible parts of plants and animals into nutritious food. A good example is the *Aspergillus oryzae* mold, also called the *Koji fungus*, which has been domesticated at least two thousand years ago by the Japanese to make miso, soy sauce, rice vinegars and sake. Today it is regarded as a "national fungus" ("*kokkin*") because of its importance for making a range of traditional Japanese foods. *Sushi* also comes from a Japanese tradition of fermenting fish and rice together. A fermented fish sauce called *liquanmen* was the predominant condiment of ancient Rome, very similar to the Vietnamese *nuoc mam*, Thai *nam pla*, and other Southeast Asian fish sauces. In fact, fish sauce is the original base of our modern beloved national condiment, ketchup. The word 'ketchup' derives from the Chinese word ke-tsiap, meaning pickled fish-brine, the universal condiment of the ancient world. The English added mushrooms, walnuts and oysters to the fermented brew. Americans added tomatoes from Mexico.

Sally Fallon suggests that the science and art of fermentation is in fact the basis of human culture and that without this culturing of our food, there is no culture! Thus, she notes that ***culture begins on the farm, not in the opera house.*** And nations that consume cultured foods, such as France with its wine and cheese, are also recognized as nations that have culture. Similarly, sauerkraut and pickles are a cornerstone of Eastern and Central European cuisine. Asian, Indian and South Pacific cultures all utilize lactic-acid fermentation to preserve fruits and vegetables, as in Korean *kimchee*. Unfortunately, in this country, vinegar has replaced lactic acid in most vegetable pickling processes. Sally Fallon suggests that the United States is often viewed as a nation lacking culture because "we eat only food that has been canned, pasteurized and embalmed." She envisions the possibility for every town in America to produce its own distinctive lacto-fermented foods, made from the local products of gardens, woods, and fields." This simple act of fermenting our food could usher in a "new age of good health and well being, as well as a new era of economic vitality based on small-scale, local production rather than on large-scale monopolistic control of the food-processing industry."

Sandor Katz presents fermentation as a "small antidote" to the homogenization of culture and the mass marketing of industrially denatured foods. He encourages us to draw on the "extremely localized populations of microbial cultures" that live in our homes to produce unique fermented foods. What we ferment with the organisms around us is a manifestation of our specific environment and it will be unique and it will always be a little different. He reminds us:

Not everyone can be a farmer. But that's not the only way to cultivate a connection to the Earth and buck the trend toward global market uniformity and standardization. One small but tangible

way to resist the homogenization of culture is to involve yourself in the harnessing and gentle manipulation of wild microbial cultures. Rediscover and reinterpret the vast array of fermentation techniques used by our ancestors. Build your body's cultural ecology as you engage and honor the life forces all around you. (Wild Fermentation, p. 27).

Katz also encourages people not to be afraid and to experiment. The distinction between rotten and fermented food is highly subjective, and usually culturally determined. Katz has never experienced or heard of any reports of food poisoning from fermented food enthusiasts:

In general, the acidic or alcoholic environments created by fermentation are inhospitable to bacteria associated with severe types of food poisoning such as salmonella. However, I cannot state in any absolute or authoritative way that food poisoning could not result from something going wrong in a fermentation process.

If it looks disgusting, feed it to the compost. Trust your nose and your taste buds. Mix it with saliva and swish it around in your mouth like a wine tasting. If it doesn't taste or smell good to you, don't eat it. Even if it's not dangerous, you won't enjoy it. Katz notes that many cultures have favorite fermented dishes with such strong flavors, aromas, and textures that they become symbols of a cultural identity that people outside the group will find repulsive. An example is the Chinese "hundred-year egg" which ferments in horse urine for a couple months until the egg solidifies, the yolk turns green, and the white turns smoky black. In The Indigenous Fermented Food of the Sudan, Hamid Dirar identifies eighty distinct fermentation processes for every bit of animal flesh and bone. *Miriss* is made by fermenting fat; *Dodery* by fermenting chopped up bones in water, etc.

Here are some of the main health benefits of fermented foods:

1. Lacto-fermentation preserves food – the fermentation produces alcohol, lactic acid and acetic acid, bio-preservatives that retain nutrients and prevent spoilage. You can preserve vegetables, fruits, milk, fish, meat. Captain Cook's 60 barrels of sauerkraut on his sea voyages lasted 27 months and conquered scurvy among his crew.
2. Fermentation breaks down nutrients into a more digestible form. It is a form of pre-digestion. Soybeans, for example, are a protein rich food that is otherwise indigestible, but when fermented become very nourishing in the form of miso, tempeh, and soy sauce. Milk lactose is more digestible when fermented into yogurt, kefir, and cheese. Wheat and grains are easier to digest when soaked and fermented into small beers, gruels and sourdough bread.
3. Lacto-fermentation creates new nutrients such as B vitamins: folic acid, riboflavin, niacin, thiamin, biotin.
4. Some fermented foods serve as an antioxidant and scavenge free radicals. Lactobacilli create omega-3 fatty acids for cell membranes and immune function.
5. Fermented foods removed toxins from food. Cassava has naturally high levels of cyanide which is eliminated when fermented. All grains have phytic acid which blocks mineral absorption which fermentation neutralizes. Toxic chemicals are eliminated by fermentation, such as nitrites, prussic acid, oxalic acid, nitrosamines, and glucosides.

For the full benefit of all the enzymes, vitamins, and beneficial flora, consume fermented foods live

and raw when possible. With bread this is not possible, but with sauerkraut, pickles and yogurt, read the labels carefully when buying or make them yourself as much as possible.

Lacto-Fermentation

Lacto-fermented foods are “pickled” foods using salt instead of vinegar. Pickles and sauerkraut are well known examples, but most fruits and vegetables can be preserved and enhanced by lacto-fermentation. Salt keeps the harmful bacteria at bay, so that beneficial bacteria and yeasts can take hold. These feed off the sugars in the fruits and vegetables, causing the carbohydrates to break down and form lactic acid which is a natural preservative. The food will keep stable for months and sometimes years. Whey can be added as a lactic acid inoculant to speed up the process.

Lacto-fermented beverages are the original electrolyte drinks with sugar, mineral ions and lactic acid. They replace lost mineral ions and are absorbed and retained for longer than plain water. Modern sports drinks are just mostly sugar. Traditional lacto-fermented beverages include root beer (United States), ginger ale (Caribbean), kvass (Russia and Eastern Europe), kombucha (throughout north eastern hemisphere), Tepae (South American rain forest), shamita (Ethiopia), Gamju (Korea), sweet potato flu (Guyana), Munkoyo (Zambia), birch beer (United States and Russia), UbuSulu (southern Africa), Tesguino (Mexico), Posol (Maya),

Lacto-fermentation does not destroy enzymes as happens when food is canned or frozen. In fact, lacto-fermentation increases enzymes and vitamins, especially vitamin C, in addition to a host of other beneficial, probiotics, lactobacilli, enzymes, and other long-chain fatty acids that are all good for our gut and essential for healthy digestion. Pickling with vinegar does not allow for any of these probiotic benefits to form.

Lactic-acid containing foods are valued for their medicinal qualities. They relieve intestinal problems and constipation, promote lactation, strengthen the sick, promote overall well-being and stamina, relieve thirst during hard labor. Taken with meals, lacto-fermented foods promote thorough and easy digestion, thus pickles and sauerkraut are served with stews in the winter. Pour your soup over some sauerkraut at the bottom of the bowl. It is not necessary to eat large quantities of it. A little bit, often, goes a long way.

Lacto-fermentation occurs in an anaerobic environment. This is achieved by keeping the food submerged underwater with salt, which inhibits the bad bacteria as the lactic acid forms. When the food is not fully submerged, contact with the “microbe rich air” will allow molds to grow on the surface of the water. These are harmless but should be removed or it will diminish the acidity and affect flavor and texture of the fermented vegetable. Underneath it the ferment is fine. There are various ways to keep the produce submerged:

1. Harsch crocks (expensive) use a moat system. See http://www.culturesforhealth.com/harsch-fermenting-crock.html?a_aid=4d420ac348d51
2. Pickle-It jars (less expensive) use a special air-lock device. See <http://www.pickl-it.com/>.
3. Simple glass disks (small expense) to fit in ball jars are available at http://www.ebay.com/itm/Lacto-ferment-glass-jar-weights-canning-preserves-new-keeps-food-down-2-sizes-/110750934578?pt=LH_DefaultDomain_0&var&hash=item5f78313d99.
4. A simple solution for ball jars is a plastic yogurt container lid (no expense). Bend it to get it inside the jar and when it unfolds inside the neck of the jar with hold it down.
5. Other simple solutions for larger, containers, like a 5 gallon bucket or an open crock, are to use

a plate weighed down with a boiled rock, or a plastic bag filled with water. If you use a plastic bucket, make sure it's food grade.

There has been some debate recently whether submersion in and of itself provides the anaerobic environment required for a healthy ferment, particularly for those with a compromised digestive system. For an interesting discussion of the concerns, see

<http://www.deliciousobsessions.com/2012/05/52-weeks-of-bad-a-bacteria-week-18-fermenting-methods-weve-had-it-all-wrong/> and

<http://www.cookingtf.com/controversy-pickl-it-vs-mason-jars/>. Sandor Katz has responded to this debate and assures us that no particular vessel is critical:

People have been fermenting vegetables for millennia in crocks open and closed, in pits and trenches, in sealed and open vessels. It can be done many different ways. The only critical factor is that the vegetables be submerged under brine.

Whenever vegetables are submerged under brine, lactic acid bacteria (which are anaerobic) develop. Whether or not the vessel protects the surface of the ferment from atmospheric oxygen, the microbial development under the brine is anaerobic lactic acid bacteria. In the vocabulary of microbiology, lactic acid bacteria are “facultative” in that they do not require oxygen, but are not inhibited by its presence; in contrast, certain other bacteria (for example *Clostridium botulinum*) are “obligate anaerobes that require a perfectly anaerobic environment.

The ferment is a lactic acid ferment, even though the surface is aerobic.... As long as you can keep vegetables submerged, lactic acid bacteria will develop. The process is extremely versatile. (To read the full response see the facebook page

<http://www.facebook.com/groups/63032745368/permalink/10150822500915369/> _

Sauerkraut

Adapted from Nourishing Traditions, Sally Fallon
makes 1 quart

1 medium cabbage, cored and shredded

2 tablespoon caraway seeds

1 tablespoon sea salt

brine (optional): 1 quart unchlorinated water with 1 tablespoon salt

In a bowl, mix cabbage with caraway seeds, salt and whey. Pound with a wooden pounder for about 10 minutes to release the juices. Place in a quart-sized, wide-mouth mason jar and press down firmly with a pounder until juices come to the top of the cabbage. The top of the cabbage should be at least 1 inch below the top of the jar. If the cabbage does not produce enough liquid while pounding, add some brine till the cabbage is submerged: 1 quart unchlorinated water with 1 tablespoon salt.

Cover lightly and keep at room temperature for about 3 days before transferring to cold storage. The sauerkraut may be eaten immediately but improves with age. At 5 weeks it has fermented to its maximum in terms of beneficial bacteria, lactic-acid and other long-chain fatty acids. It will keep for several years.

Pickled Cucumbers

Adapted from Nourishing Traditions, Sally Fallon
makes 1 quart

4-5 pickling cucumbers or 15-20 gherkins
1 tablespoon mustard seed (brown and/or yellow)
2 tablespoons fresh dill, snipped
1 tablespoon sea salt
unchlorinated, clean water

Wash cucumbers and place in quart-sized wide-mouthed mason jar. I like to use cucumbers just long enough to fit into the jar and cut them into spears. Wedge them tightly together. Add remaining mustard seed, dill and salt and enough water to cover the cucumbers. The top of the cucumbers should be at below the surface of the water and the water at least 1 inch below the top of the jar. Cover tightly and keep at room temperature for about 3 days before transferring to cold storage.

Save the pickle juice! It is a refreshing drink, and can be recycled as inoculant in fermenting the next crop of vegetables and/or sauerkraut.

Beet Kvass

Adapted from Nourishing Traditions, Sally Fallon
makes 2 quarts (half gallon jar)

3 medium or 2 large organic beets, peeled and chopped up coarsely
¼ cup whey
1 tablespoon sea salt
unchlorinated, clean water

This drink is valued for its medicinal qualities and as a digestive aid. Beets are loaded with nutrients. One 4-ounce glass, morning and evening, is an excellent blood tonic, promotes regularity, aids digestion, alkalizes the blood, cleanses the liver and is a good treatment for kidney stones and other ailments. Beet kvass may also be used in place of vinegar in salad dressings and added to soups.

Place beets, whey and salt in a 2-quart glass container. Add filtered water to fill the container. Stir well and cover securely. Keep at room temperature for 2 days before transferring to refrigerator.

When most of the liquid has been drunk, you can fill up the container with filtered water and keep at room temperature for another 2 days. The resulting brew will be slightly less strong than the first. After the second brew, discard the beets and start again. You can, however, reserve some of the liquid and use this as your inoculant instead of the whey.

Do not use grated beets in the preparation of beet kvass. When grated, beets exude too much juice resulting in a too rapid fermentation that favors the production of alcohol rather than lactic-acid.

Ketchup

from Nourishing Traditions, Sally Fallon
makes 1 quart

3 cups canned tomato paste (preferably organic, in glass)
¼ cup whey
1 tablespoon sea salt
½ cup maple syrup
¼ teaspoon cayenne pepper (optional)
3 cloves garlic, peeled and mashed
½ cup fish sauce (homemade recipe is in Nourishing Traditions)

Mix all ingredients until well blended. Place in a quart sized, wide-mouthed mason jar. The top of the ketchup should be at least 1 inch below the top of the jar. Leave at room temperature for about 2 days before transferring to refrigerator.

Hannah's Lacto-Fermented Gingerale

from Hannah Springer, TraditionalFoodsKitchen.com

1/2 cup fresh ginger root (peeled and grated, lightly packed in measuring cup--make sure the root is moist and aromatic, not dried out)
3-6 tbsp. raw honey (very soft or liquefied but NOT hot; use only 3 tbsp for a less sweet ginger ale)
1/4 cup fresh lime juice (juice from about 2-4 limes, depending on relative juiciness)
2 tbsp. whey
two large pinches unrefined sea salt
enough unchlorinated, clean water to fill the jar

Combine all ingredients in a one-quart glass jar with a screw lid, shake it up to dissolve the honey, and leave at room temperature for 1-2 days. Strain into two 25.3 oz. Pellegrino bottles with screw-on lids (each bottle will be about half full). Top off both with Pellegrino and store.

Water Kefir

1/3 cup of water kefir grains.
1 black mission fig or apricot
½ lemon sliced
1/3 cup sugar or sucanat (honey won't work)
1 quart unchlorinated, clean water

Combine all of the above in a half gallon mason jar.

Cover and let sit 24-72 hours

Strain and put liquid in an airtight bottle (like a snap lid beer bottle) and do a “second fermentation with ginger, cucumber and honey dew cubes, raspberries, or the juice of one lemon. Experiment with different fruits and flavors. Add an egg shell for extra calcium.

Do not use aluminum or other reactive metals as the metal can be eroded by the acid. Culture grains in a glass jar with tight-fitting lid, using clean stainless steel or plastic utensils when handling the grains.

Water kefir grains, also known as *Tibicos* is a symbiotic cluster of bacteria and yeasts that forms spontaneously on the pads of the *Opuntia* cactus (from Mexico) as hard granules that can be reconstituted and propagated in a sugar-water solution. It is found around the world and varies as it attracts bacteria and yeast from the local environment. It is also known as *Japanese water crystals*, *California bees*, *bébées*, *African bees*, *ale nuts*, *Australian bees*, *balm of Gilead*, *beer seeds*, *beer plant*, *bees*, *ginger beer plant*, *ginger bees*, *Japanese beer seeds* and *vinegar bees*. It is cultured in different sugary liquids, feeding off the sugar to produce [lactic acid](#), alcohol ([ethanol](#)), and [carbon dioxide](#) gas, which carbonates the drink. Water Kefir provides the probiotic benefit of milk kefir, for people who cannot consume milk. The grains propagate and are passed from person to person. While it is possible to purchase kefir grains and have them sent to you through the mail, the results are unreliable. It is best to obtain grains in person from someone who has extra to share.

Kombucha

Boil 1 gallon of water

Add 3 teaspoons (3 teabags) black tea, green tea, white tea or yerbe mate (preferably organic)

Dissolve 1 cup sugar into the tea: white sugar, evaporated cane sugar, sucanat, brown sugar, molasses, (preferably organic). Do not use honey. Let steep.

Strain after ½ hour and let cool to room temperature.

Pour into glass gallon jar and add kombucha scobi.

Cover with dish towel to keep out flies, molds, bacteria and dust.

Let sit at room temperature for 7 to 14 days. In summer it ferments quickly, in the winter slowly.

Strain out the liquid, leaving about a cup with the mushrooms to start a new batch

A new scobi will have formed during the fermentation, on top of the old one. You can use this or give it away. You can do second fermentations at this point by bottling in swingtop bottles with fruits. Burp the bottle regularly to release pressure from carbonation.

72 – 80 degrees Fahrenheit is the optimum temperature for the yeasts. A heating strip can help in cold locations. Put it around the sides of the vessel, not on the bottom.

The Kombucha culture is a microbial cluster of symbiotic bacteria and yeast that feed off black tea and sugar to form a *scobi* (also referred to as a mushroom) that, in Chinese is called *koubo* which means literally “yeast mother”. It is generally believed that kombucha originated in China and spread through Russia to the rest of the world. *Jun* is a scobi that is prepared exactly like Kombucha, but feeds off honey instead of cane sugar.

Kombucha cultures almost always include *Gluconacetobacter xylinus* (formerly *Acetobacter xylinum*) which ferments the alcohols produced by the yeasts into acetic acid which is mildly antibacterial. In addition, the finished drink can contain butyric acid, B-vitamins, ethanol, gluconic acid, glucaric acid, lactic acid, malic acid, oxalic acid, and usnic acid. Normally, kombucha contains less than 0.5%

ethanol, depending on the proportion of sugar to yeast and how long it was left to “brew”. The kombucha scobi resists contamination by most airborne molds or bacterial spores and may also produce antimicrobial defense molecules.

While kombucha has some lactic acid and probiotic value, it is valued for its detoxifying effects. There is some evidence that the glucaric acid in kombucha helps the liver be more efficient in detoxifying the body (glucaric acid, commonly found in fruits and vegetables, is being explored independently as a cancer-preventive agent). There is some concern that acute conditions, such as lactic acidosis, can be caused by drinking too much kombucha in persons with pre-existing medical conditions.

The acidity of kombucha (approximately pH 3.0 when finished) prevents unwanted growth of contaminants, and alkalizes the body. But it can also leach unwanted and potentially toxic materials from containers that are not food grade. Do not use metal vessels like aluminum. Food-grade glass like a ball jar is very safe. Lead-free china or glazed earthenware, raw wooden bowls, and stainless steel are all acceptable. Keep cultures covered with a dish towel (not cheese cloth) and in a clean environment to reduce the risk of contamination and infestation by insects. If blue, green or black mold forms on the scobi, throw it out.

The kombucha yeast will grow dormant around 50 degrees. A fridge is not necessary to store it. Hannah of KombuchaKamp.com recommends that you create a “scobi hotel” instead. Fill a jar with sweet tea and numerous scobis. A new layer that will form on top and slow down the fermentation. This will also create a starter liquid. As long as the scobi does not dry out, you can leave it out at room temperature in some kombucha. It will simply become more vinegary. Add a bit of tea from time to time.

“Continuous brew” is the traditional way to prepare kombucha. You simply drink a portion of the kombucha and then top it off with sweet tea. Healthy acids are created at 15 days and another batch at 30 days. You get the benefits of all the stages of the fermentation process with continuous brew. Clean out the vessels a few times a year.

For more information on making Kombucha see an interview with Hannah of Kombucha Kamp at http://nourishedkitchen.com/kombucha-kamp-questions/?utm_source=Newsletter+List&utm_campaign=8e2c76f9f7-RSS_EMAIL_CAMPAIGN&utm_medium=email

In her discussion of the “wort moon” which comes in mid summer, Jessica Prentice is inspired by lacto-fermented drinks, medicinal herbs, and the memory of the alewife who brewed mildly fermented beverages from the herbs that she grew or gathered from the wild areas surrounding a village. Those drinks were the original sodas. Root beer and ginger ale were once traditionally fermented herbal ales. And something in our bodies still craves that bubbly, thirst quenching drink. Let's not forget that our ancestors drank (and ate) *the real thing!*

Recommended Reading

Sandor Ellix Katz, Wild Fermentation and The Art of Fermentation

Sally Fallon, Nourishing Traditions

Jessica Prentice, Full Moon Feast

Dr. Natasha Campbell-McBride, Gut and Psychology Syndrome

Stephen Harrod Bukner, Sacred and Herbal Healing Beers: the Secrets of Ancient Fermentation

<http://www.westonaprice.org/food-features/lacto-fermentation>

<http://www.westonaprice.org/food-features/lacto-fermentation-made-easy-with-the-pickl-it-system>

<http://www.westonaprice.org/food-features/lacto-fermented-soft-drinks>

<http://www.wildfermentation.com/>

<http://www.kombuchakamp.com/>

Compiled by Lucia Ruedenberg-Wright for the Upper Delaware chapter, Weston A. Price Foundation. 2012. See <http://upperdelaware-wapf.org> for more information.