Intro to Fungal Ferments with Erica Gunnison

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Fermentation: The digestive action of bacterial and fungal cells and their enzymes

Nutrition and Medicine

Fermentation changes the nutrient profiles of the foods.
Many compounds, such as proteins and dietary fibers, are broken into simpler, more bioavailable forms. Many harmful compounds and antinutrients can be reduced or eliminated entirely. Phytates are broken down and mineral availability increases dramatically. Some fermented foods have been shown to help the body detox by eliminating harmful compounds stored in tissue. For the most part, it must be stressed that despite many grandiose claims, fermented foods promote overall health and vitality rather than treating specific diseases, although the effects can be profound.

Increase: Protein, Dietary fiber**,** Prebiotics**,** Probiotics**,** Isoflavones**,** Antioxidants**,** Saponins, Minerals
Reduce: Phytates, Oligosaccharides, Oxalates, Pesticide and herbicide residues
Produce: B complex vitamins, vitamin C, beneficial metabolites

Fermentation has been crucial to human and cultural development. Through fermentation, humans have been able to obtain more complete nutrition from their food, reduce the need for things like cooking and refrigeration, and to preserve foods for later use during seasons of scarcity.

・Always use non-chlorinated water!・Always wait for things to cool before adding cultures!・
・If you want wild yeasts, use organic produce・

SCOBY beverages – nature loves polycultures

Stands for “symbiotic community of bacteria and yeast” many (up to 30) species in collaboration, often defy reproduction in labs. Domesticated and require human help. Boosting immunity, healing digestive tracts, fighting allergies and degenerative diseases. Don't tend to get very alcoholic, as the alcohols produced by the yeasts are quickly converted by the lactic acid forming bacteria. Basic starting ratio around 2 cups of sugar to one gallon of water. Host in a wide-mouth glass or ceramic container, cover tightly with a clean cloth to keep critters out and allow for airflow.. Avoid reactive metals and plastics.

Kombucha and jun – leathery blob floats on top. Made with black tea and sugar for kombucha or, green tea and honey for jun. Can get very slightly alcoholic. If you add extra yeast, you can select for alcohol. Interesting things have been done with the leftover SCOBYs.

Milk Kefir – Very fast ferment, slightly alcoholic, bubbly yogurty drink. Not a blob but “grains” Just add to (critter) milk at a rate of 5% or 1 Tbsp/quart. Stir occasionally, usually done in a day. Store bought products very different, due to practical hurdles involving consistency and alcohol content.

Water Kefir/Tibicos – Fast ferment, can consume a variety of sweet liquids. Traditionally sugar but can eat fruit juices, honey, maple syrup, barley, agave, rice, coconut water, nut milks. Try using

sweetened herbal teas. Needs frequent feeding, can over acidify, I suspect it doesn't like the cold.

Ginger Beer – DIY starter culture! Grate a little (organic) ginger with skin, with a small amount of sugar and water – feed every day for a few days to build up. Ginger has natural yeasts and lactic acid bacteria on skin.

Vinegars – alcohol plus acetic acid bacteria makes vinegar. Can make vinegar from alcohol, or from letting your kombucha go too long, or from simple fruit scraps and sugar. Needs lots of oxygen until it "peaks" then needs sealed because bacteria will continue to convert the acetic acid into water and co2. Can pasteurize to stop the process.

・Bottling can make these ferments fizzy, but be careful to keep an eye or they can explode!・

Yeasts

It's thought that humans have been collaborating with yeasts since before the advent of agriculture. Yeasts eat sugars and excrete alcohols and CO2. CO2 is what makes breads rise, as well as promoting more rapid alcohol absorption in the stomach. In the presence of oxygen (aerobic) such as breads, yeasts work more rapidly and do not produce alcohol. Breads and alcohol are intertwined. In several traditions, the yeasts from alcohols were used to start breads. There are many, many wild yeasts but as they tend to be a bit unpredictable, humans have used various methods to select for desired ones, typically Saccharomyces. Medicinally, yeasts have many traditional and modern uses. They make available many vitamins, minerals and proteins, most notably proteins and b-complex vitamins. They also promote glucose utilization in the body and can reduce insulin needs. They can reduce serum cholesterol and triglyceride levels. Stimulant, tonic, nutritive, antiseptic, laxative. Used for ulcers, festering wounds, boils and carbuncles, diabetes. Each yeast is different in its metabolism and medicine.

Meads/Wines/Ciders/Perrys - Some sugars are already available to yeasts. There are a huge number of ferments made from fruits, honey, cane sugar, and other plant and tree saps such as agave, birch and maple. When made from fruits, often the only thing used is the (pressed) fruit juice itself. Fruit skins are typically rich in natural yeasts, unless irradiated or pasteurized. With honey (mead) a general starting ratio is 1 part honey to 4 parts water. More sugars will result in a more alcoholic beverage, to a point. Depending on the yeast used, they max out at an average of 8-12% alcohol.

Beers and Ales/Grains/Starchy Tubers - Starches are unavailable to the yeasts, and must be broken down into sugars through enzymatic activity, called saccharification. These enzymes traditionally come through malting grains (Europe), adding certain molds (Asia), or through the addition of saliva (Mesoamerica and others). Commonly fermented starchy foods were: potatoes, corn, sorghum, rice, sweet potatoes, barley, yuca, millet.

Around the world, many traditional drinks were "opaque beers", fermenting the grains themselves and leaving them in, providing thick starchy food/drinks, often staples. High in starches, sugars, proteins, fats, vitamins and minerals.

Breads - Grains are said to be the foundation of civilization as we know it. Many of the compounds that make them so stable and easily stored also make them challenging to digest. Phytic acid, starches, complex proteins.

Until around 1867 when Louis Pasteur isolated yeasts, all breads were sourdoughs to some degree or another. Sourdoughs collaborate with lactic acid bacteria, increasing the lysine content and decreasing the gluten content in breads, among other things. Sourdoughs store better, are moister, and more digestible. Isolated yeasts (not sourdough) can produce a faster, more consistent product, but typically at the expense of nutrition.

If you use a higher proportion of fresh flour in your sourdoughs, it will favor the yeast. If you use a higher proportion of starter, it will favor (sour) bacteria.

Molds

Can have a bit of a learning curve or need special equipment, but can be very fun and rewarding, and if you're familiar with mushroom cultivation, many of the same principles translate. These food mold spores won't harm humans but keep them away from your mushroom lab as they can be highly competitive!

Tempeh – *Rhizopus ogliosporus*, traditionally made from soy, can be grown on a variety of legumes and even grains. Traditionally, beans are soaked overnight in order to start a lactic acid fermentation that lowers the pH. This is easier to accomplish in tempeh's native tropical climate, and most folks now use vinegar in the cooking water. Simmer beans until they're *undercooked* and then dry the surface well before adding spores. Too moist can result in bacterial competition. Too dry and the mold struggles to take hold. Pack into containers that allow for breathing but stay moist, I use ziplocks with holes poked, no thicker than an inch or less. Incubate between 83-90°F, turning down/off your heat source once the tempeh's metabolism starts to kick into gear. You're done when fully myceliated, some folks like the taste when it starts to produce black spores.

Koji – *Aspergillus oryzae, (interestingly not a producer of aflatoxin tho most aspergillus are)* but traditionally a mixed culture, with many different strains for different uses. Infrequently eaten on its own but rather used as a starting point for other ferments, such as miso, soy sauce, sake, and several others. Grown on rice for most uses and then transferred to their final home. In miso, the koji doesn't stay alive but its enzymes continue to work. In soy sauce/shoyu/tamari, koji is grown on the grains as well as the beans. To grow koji, rice is soaked, steamed, cooled, inoculated and incubated at 80-95° for 36-48 hours, until fully myceliated. For alcohol, koji is grown at slightly higher temps to favor amylolytic activity, converting starch to sugars. For other uses, growing koji at lower temps favors protease activity, converting proteins instead.

Moldy cheeses – not all cheeses have been cultured with mold, and those that have fall into two categories “white rind” and “blue” cheeses. Both are made with different species of *Penicillium*. For white rind cheeses such as brie, the mold is sprayed on externally, forming a white rind as the mycelium penetrates the mass. For blue cheeses, the spores are blended with the curds, and the mycelium binds the cheese together over the course of several weeks. Both types need to incubate at cooler temperatures of around 50°.