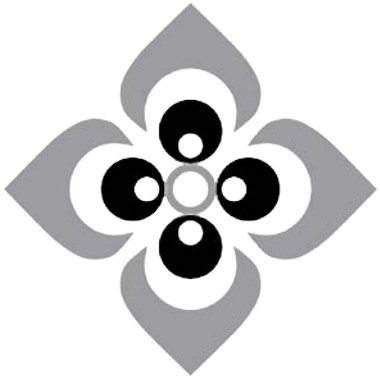

Consortium for Educational Communication

Module
on
Benefits Of Food Fermentation

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TEXT

Fermentation Food

Fermentation in food processing is the process of converting carbohydrates to alcohol or organic acids using microorganisms —yeasts or bacteria—under anaerobic conditions. Fermentation usually implies that the action of microorganisms is desired. The science of fermentation is known as zymology or zymurgy.

The term fermentation sometimes refers specifically to the chemical conversion of sugars into ethanol, producing alcoholic drinks such as wine, beer, and cider. However, similar processes take place in the leavening of bread (CO_2 produced by yeast activity), and in the preservation of sour foods with the production of lactic acid, such as in sauerkraut and yogurt. Apart from alcohol, widely consumed fermented foods include vinegar, olives, yogurt, bread, and cheese. In various parts of the world, more localised foods prepared by fermentation may also be based on beans, dough, grain, vegetables, fruit, honey, dairy products, fish, meat, or tea.

Fermented food has made a comeback in recent years, partially thanks to the popularization of Weston A. Price teachings. Fermented foods like sauerkraut and kimchi aren't considered to be the most appealing types of food; however, research exploring these and other fermented products on gut, brain, and body health has revitalized public interest. The fermentation process encourages essential bacteria such as *Lactobacilli and Bifidobacteria* to flourish. This makes fermentation a good source of probiotics for vegans, since many fermented foods are plant based. Vegetables are submerged in a salty brine during preparation to kill off dangerous, pathogenic bacteria. The good bacteria break down lactose and other sugars and starches in the food, making digestion easier. And once they reach your gut, they continue to help break down food and keep out bad guys like *E. coli* and *C. difficile.*

The Best Fermented Foods When it comes to fermented foods, your options aren't limited to sauerkraut or fermented soy. There are other fantastic options that are considered "fermented," including tea, yogurt, and various vegetables. Here are the nine best fermented foods you should be eating for your gut.

1. **Yogurt**

Yogurt has many benefits, mostly due to its rich probiotic content. Brands of yogurt that contain billions of live active cultures may support digestion, and some research indicates it could even

benefit the skin. Raw, unpasteurized yogurt is ideal if you can handle dairy. Personally, I tend to skip dairy altogether, but you can find dairy free yogurt options at many stores these days, some of which are made from coconut and almond milk. Be sure you're choosing yogurt that contains live active cultures, and try to choose plain, full fat versions in order to avoid sugar. Yogurt that contains sugar can be counterproductive, as sugars feed pathogenic bacteria and contribute to sugar overload.

2. **Natto**

Natto is prepared with soybeans and is fermented so it forms the beneficial bacteria Bacillus. It's an excellent source of calcium, iron, dietary fiber, and vitamin K2. You may not have heard a lot about it, but K2 is essential for heart health as it keeps calcium out of your arteries and gets it to your bones where it's needed. Natto also contains nattokinase, a powerful anti-clotting agent that protects your heart and brain and lowers your blood pressure.

3**. Kefir**

Kefir is a bit like yogurt, except that it's more of a drinkable consistency. Researchers report kefir may reduce irritation in the intestines, preventing toxins and other pathogens from getting into the blood. If you're choosing to drink dairy kefir, make sure it's organic and isn't loaded with refined sugar. There are options for making your own dairy free water kefir, and many health food companies online sell kefir grains specifically for this purpose. You can also check out our recipe for making coconut milk kefir.

4. **Kombucha**

Made from tea, clean water, sugar, yeast, and bacteria, kombucha has become popular recently for its probiotic qualities. Its fizzy bite is also popular among those used to drinking soda. Research finds this fermented tea fights of E. coli and

Staph bacteria in the digestive tract, possibly protecting against illness and aiding digestion.

5. **Sauerkraut**

Traditional sauerkraut preparation uses water, salt, and cabbage, and very little heat is applied to the final product in order to prevent killing off beneficial microbes. The sour taste comes from lacto-fermentation or the breakdown of lactose by the probiotic bacteria native to the cabbage. A serving gives you a powerful dose of healthy probiotics that aid digestion, and

research has found raw sauerkraut prevents cancer cells from forming. Be sure to purchase raw sauerkraut, or better yet, make it yourself with organic cabbage and Himalayan salt.

6**. Kimchi**

This spicy Asian fermented cabbage, similar to sauerkraut, provides you with loads of probiotics. Extensive research indicates it contributes to colon health, lower cholesterol, better thinking, a stronger immune system, healthy skin, and weight loss. Additional research also shows it has antioxidative, antiaging, and immune supporting properties.

7. **Tempeh**

This Indonesian 'cake' has a nutty flavor and chewy texture, and because of this it is often used as a replacement for meat in many vegan recipes. Traditionally made from soybeans and a yeast starter, it undergoes controlled fermentation that makes it a great source of probiotic bacteria. Tempeh is also a great source of calcium, iron, and magnesium.

8. Pickles

Raw pickles, much like sauerkraut, makes for a great introduction to fermented foods. Pickles made by lacto fermentation makes this a delicious snack and a great food for aiding digestion and supporting a strong immune system.

9**. Lassi**

Yogurt and fermented dairy play an important role in Indian cuisine. Lassi is made by combining yogurt and milk (or water) and sometimes fruit and spices to create a great probioticrich drink. It digests quickly, helps restore friendly gut bacteria, and soothes irritation in the colon. Again, I don't recommend consuming conventional dairy, especially from cows. If you are going to drink lassi, it's best to find a product using grassfed, freerange goat milk. Goat milk tends to digest more easily. If you're vegan, try finding or making lassi with organic coconut or almond milk yogurt.

Fermented foods by region

Worldwide: alcohol (beer, wine), vinegar, olives, yogurt, bread, cheese

Asia

East and Southeast Asia: amazake, atchara, baiming, belacan, burong mangga, com ruou,

dalok, doenjang, douchi, jeruk, lambanog, kimchi, kombucha, leppetso, narezushi, miang, miso, nata de coco, nata de pina, natto, nawmaidong, oncom, paksiamdong, pawtsaynob, prahok, ruou nep, sake, seokbakji, soju, soy sauce, stinky tofu, szechwan cabbage, taitan tsoi, chiraki, tape, tempeh, totkal kimchi,

yen tsai, zha cai

Central Asia: kumis (mare milk), kefir, shubat (camel milk)

South Asia: achar, appam, dosa, dhokla, dahi (yogurt), idli, kaanji, mixed pickle, ngari, hawaichaar, jaand (rice beer), sinki, tongba, paneer .

Africa: fermented millet porridge, garri, hibiscus seed, hot pepper sauce, injera, lamoun makbouss, laxoox, mageu, mauoloh, msir, mslalla, oilseed, ogi, ogili, ogiri, iru.

Americas: sourdough bread, cultured milk, chicha, elderberry wine, kombucha, pickling (pickled vegetables), sauerkraut, lupin seed, oilseed, chocolate, vanilla, tabasco, tibicos, pulque, mikyuk (fermented bowhead whale).

Middle East: kushuk, lamoun makbouss, mekhalel, torshi, boza Europe: rakfisk, sauerkraut, pickled cucumber, surströmming, mead, elderberry wine, salami, sucuk, prosciutto, cultured milk products such as quark, kefir, filmjölk, crème fraîche, smetana, skyr, rakı, tupí.

Fermented foods by type

Bean based

Cheonggukjang, doenjang, miso, natto, soy sauce, stinky tofu, tempeh, oncom, soybean paste, Beijing mung bean milk, kinama, iru.

Dough based

Proofing (baking technique)

Grain based

Amazake, beer, bread, choujiu, gamju, injera, kvass, makgeolli, murri, ogi, rejuvelac, sake, sikhye, sourdough, sowans, rice wine, malt whisky, grain whisky, idli, dosa, vodka, boza.

Vegetable based

Kimchi, mixed pickle, sauerkraut, Indian pickle, gundruk, tursu

Fruit based

Wine, vinegar, cider, perry, brandy, atchara, nata de coco, burong mangga, asinan, pickling, vişinată, chocolate, rakı

Honey based

Mead, metheglin

Dairy based

Some kinds of cheese also, kefir, kumis (mare milk), shubat (camel milk), cultured

milk products such as quark, filmjölk, crème fraîche, smetana, skyr, and yogurt

Fish based

Bagoong, faseekh, fish sauce, Garum, Hákarl, jeotgal, rakfisk, shrimp paste, surströmming, shidal

Meat based

Chorizo, salami, sucuk, pepperoni, nem chua, sommoo, saucisson

Teabased

Pu-erh -tea, Kombucha

Uses food fermentation: is the conversion of sugars and other carbohydrates into alcohol or preservative organic acids and carbon dioxide. All three products have found human uses. The production of alcohol is made use of when fruit juices are converted to wine, when grains are made into beer, and when foods rich in starch, such as potatoes, are fermented and then distilled to make spirits such as gin and vodka. The production of carbon dioxide is used to leaven bread. The production of organic acids is exploited to preserve and flavor vegetables and dairy products.

Food fermentation serves five main purposes: to enrich the diet through development of a diversity of flavors, aromas, and textures in food substrates; to

preserve substantial amounts of food through lactic acid, alcohol, acetic acid, and

alkaline fermentations; to enrich food substrates with protein, essential amino acids, and vitamins; to eliminate anti nutrients; and to reduce cooking time and the

associated use of fuel.

There are many benefits of fermented foods to your diet

Health effects of fermented foods

Probiotic effect:

One of the reasons for the increasing interest in fermented foods is its ability to promote the functions of the human digestive system in a number of positive ways. This particular contribution is called probiotic effect. Already early in 1900, Metchnikoff pointed out the use of fermented milks in the diet for prevention of certain diseases of the gastrointestinal tract and promotion of healthy day to day life. Since then a number of studies have now shown that the fermented food products do have a positive effect on health status in many ways. The human intestinal microbial flora is estimated to weigh about 1000 grams and may contain $10^{16} – 10^{17}$ colony forming units representing more than 500 strains. For physiological purposes, it can be considered to be a specialised organ of the body with a wide variety of functions in nutrition, immunology and metabolism. Studies on mice have shown that the indigenous microorganisms in the stomach are Lactobacillus, Streptococcus and Torulopsis, while in the small intestine, ceacum and colon several different species (*Bacteroides, Fusobacterium, Eubacterium, Clostridium,* etc.) coexist. The gastrointestinal microflora in humans are also known to contain hundreds of species. Even though there is a wide variation among individuals, the number of species and size of the population are usually kept stable in normal healthy subjects. There is a constant struggle in maintaining the desirable balance and a dynamic equilibrium between microbial populations within the intestinal flora . The anaerobic organisms, which outnumber the gram negative enteric bacteria by about 10 000: 1, are associated with the intestinal epithelium limiting adherence of potential pathogens by effective colonosation . The stability of the intestinal microflora is affected by many factors including dietary habits. Decrease in the number of anerobic bacteria is associated with increase in the numberof gram negative pathogens in the intestinal tract and their translocation to extraintestinal tissues. Under normal conditions the intestinal wall prevents translocation of organisms both dead and living as well as microbial products like toxins from the gut to the blood. However, in patients with systemic

insult like starvation, shock, injury and infection or specific insult of the gastrointestinal canal through inflammation, chemotherapy or radiation, the gut mucosal permeability will be increased leading to translocation of microbes (Carrico). A fermented food product or live microbial food supplement which has beneficial effects on the host by improving intestinal microbial balance is generally understood to have probiotic effect .

Anticancerogenic effect:

Apart from this, there are interesting data on anticarcinogenic effect of fermented

foods showing potential role of lactobacilli in reducing or eliminating procarcinogens and carcinogens in the alimentary canal. The enzymes b-glucuronidase, azoreductase and nitroreductase, which are present in the intestinal canal, are known to convert procarcinogens to carcinogens . Oral administration of Lb rhamnosus GG was shown to lower the faecal concentration of b-glucuronidase in human implying a decrease in the conversion of procarcinogens to cancinogens. Fermented milk containing *Lactobacillus acidophilus* given together with fried meat patties significantly lowered the excretion of mutagenic substances compared to ordinary fermented milk with Lactococcus fed together with fried meat patties . The process of fermentation of foods are also reported to reduce the mutagenicity of foods by degrading the mutagenic substances during the process.

Lactic acid bacteria isolated from dadih, a traditional Indonesian fermented milk,

were found to be able to bind mutagens and inhibit mutagenic nitrosamines. Milk

fermented with Lactobacillus acidophilus LA-2 was demonstrated to suppress faecal mutagenicity in the human intestine. Studies on antimutagenic activity of milk fermented with mixed-cultures of various lactic acid bacteria and yeast, showed that the fermented milks produced with mixed cultures of lactic acid bacteria had a wider a wider range of activity against mutagens than those produced with a single strain of lactic acid bacteria. However, a review by McIntosh (1996) concludes that there is only limited data to support the hypothesis that probiotic bacteria are effective in cancer prevention. On the other hand, a study by Hosono & Hisamatsu (1995) on the ability of the probiotic bacteria to bind cancerogenic substances have reported that E feacalis was able to bind aflatoxin B1, B2, G1 and G2 as well as some pyrolytic products of tryptophan.

Immunoactive effects

Some lactic acid bacteria which are present in fermented milk products, are found to play an important role in the immune system of the host after colonisation in the gut. Oral administration of *Lactbacillus casei* caused an improvement of the function of the peritoneal macrophages and increased the production of IgA . The mechanism of this effect is not clearly known, but it is speculated that the lactobacilli, their enzymes or the metabolic products present in the fermented food product may act as antigens, activating production of antibodies.

Marin et al. (1997) have studied the influence of lactobacilli used in fermented dairy products on the production of cytokines by macrophages. The results indicated that for most strains, direct interaction with macrophages caused a concentration dependent increase in tumour necrosis factor and interleukin. A study by Perdigon et al (1995) showed that the Lactobacillus casei could prevent enteric infections and stimulate secretory IgA in malnourished animals but also translocate bacteria, while yoghurt could inhibit growth of intestinal carcinoma through increased activity of IgA, T cells and macrophages. In a review by Marteau & Rambaud (1993) the authors concluded that there is a potential of using lactic acid bacteria for therapy and immunomodulation in mucosal diseases, especially in the gastrointestinal tract.

Isolauri (1996) have presented a study suggesting that Lactobacillus sp. strain GG

could be used in the prevention of food allergy. It is suggested that dietary antigens

induce immunoinflamatory response that impairs the intestine's barrier function and that probiotic organisms could be a means of introducing a tool to reinforce the

barrier effect of the gut.

Important nutrients: Some fermented foods are outstanding sources of essential nutrients such as vitamin K2, which help prevent arterial plaque buildup and heart disease. For instance, cheese curd is an excellent source of both probiotics and

vitamin K2. Just half an ounce (15 grams) of natto daily can also provide all the K2 you'll need. Fermented food is also a potent producer of many B vitamins.

Optimizing your immune system: An estimated 80 percent of your immune system is actually located in your gut. Probiotics play a crucial role in the development and operation of the mucosal immune system in your digestive tract, and aid in the production of antibodies to

pathogens. This makes a healthy gut a major factor in maintaining optimal health, as a robust immune system is your top defense system against all disease.

Detoxification: Fermented foods are some of the best chelators available. The beneficial bacteria in these foods are highly potent detoxifiers, capable of drawing out a wide range of toxins and heavy metals.

Cost-effectiveness: Adding a small amount of fermented food to each meal will give you the biggest bang for your buck. Why? Because they can contain 100 times more probiotics than a supplement!

Natural variety of microflora: As long as you vary the fermented and cultured foods you eat, you'll get a much wider variety of beneficial bacteria than you could ever get from a supplement.

Makes food more digestible: Because the bacteria predigest the food, the resulting product is easier to digest. If you have trouble digesting raw fruits and vegetables, fermentation may be helpful for you.

Fermented foods have more nutrients: The bacteria in fermented foods produce more vitamins and nutrients as they digest the starches and sugars. They particularly produce B vitamins and vitamin K2.

Chock full of good bacteria (probiotics) : Some experts say that each small 1/2 cup serving of fermented foods can contain up to 10 trillion probiotic organisms.

Helps curb sugar cravings: By adding fermented foods to your diet, you can limit, if not completely stop, your sugar cravings.

Lactic acid promotes growth of healthy bacteria in the gut: The lactic acid produced during fermentation helps healthy bacteria already present in your gut to proliferate. This leads to better gut health.

Increases flavor of foods: Fermentation adds a new depth of flavor to fermented foods. They are delicious.

What the State of Your Gut Tells About Your Overall Health

Probiotics, along with a host of other microorganisms, are so crucial to your health that researchers have compared them to "a newly recognized organ." Your microflora – a term used to describe the bacteria, fungi, viruses and other microbes that make up your microbial inner ecosystem – impact far more than your digestive tract.

Here are areas where your gut bacteria play key roles in:

1. **Behavior**: A study published in Neuro-gastroenterology & motility found that mice lacking in gut bacteria behave differently from normal mice, engaging in what would be referred to as "highrisk behavior." This altered behavior was accompanied by neuro-chemical changes in the mouse brain.

In fact, your gut serves as your second brain. It produces more of the neurotransmitter serotonin, which is known to have a positive influence on your mood, than your brain does.

2. **Gene expression:** A probioticrich beverage has been shown to influence the activity of hundreds of your genes to help them express in a positive, disease fighting way. This makes your gut health a very powerful variable of epigenetics, a

Cutting edge field of medicine showing that your lifestyle plays a significant role in your genetic expression.

3. **Diabetes:** According to a study from Denmark, bacterial population in the gut of diabetics differs from nondiabetics.

According to the authors, the results of their study indicate that type 2 diabetes in humans is linked to compositional changes in intestinal microbiota.

A healthy diet – low in sugar and grains; high in whole raw foods and fermented foods – allows your beneficial gut bacteria to flourish.

4. **Autism:** Establishment of normal gut flora in the first 20 days or so of life is critical in appropriate maturation of your baby's immune system. Hence, babies with abnormal gut flora have compromised immune systems and are particularly at risk for developing ADHD, learning disabilities, and autism, especially if they are vaccinated before restoring balance to their gut flora.

5. **Obesity:** Probiotics may help fight obesity. Restoring your gut flora is therefore a crucial consideration if you're struggling to lose weight.

The Phenomenal Health Benefits of Fermented Vegetables

But whether you're suffering from GAPS or not, cultured or fermented vegetables will do great wonders for your health, as shown in their presence in virtually all native and traditional diets.

Fermented vegetables are a mainstay in the GAPS diet.

Remember, though, that cultured foods are very efficiency detoxifiers – you may experience a "healing crisis" or detox symptoms if you introduce too many of these foods at once.

Begin with very small servings, then work your way up to the quarter to- half cup

Serving size. This gives your intestinal micro biota the chance of adjusting.

- It is ideal to include a variety of fermented foods and beverages in your diet, because each food with inoculate your gut with a mix of different microorganisms. There are many fermented foods you can easily make at home, including:
- Cultured vegetables, including pureed baby foods Chutneys
- Condiments, such as salsa and mayonnaise
- Cultured dairy, such as yogurt, kefir, and sour cream
- Fish, such as mackerel and Swedish gravlax