

**What is Lacto fermentation?**

Most people think about beer or wine when they hear the term fermentation. While certain yeasts are used to convert the sugars in grape juice or grains into alcohol, it is bacteria that are responsible for lacto-fermentation. The “lacto” portion of the term refers to a specific species of bacteria, namely Lactobacillus. Various strains of these bacteria are present on the surface of all plants, especially those growing close to the ground, and are also common to the gastrointestinal tracts, mouths, and vaginas of humans and other animal species.

*Lactobacillus* bacteria have the ability to convert sugars into lactic acid. The *Lactobacillus* strain is so named because it was first studied in milk ferments. These bacteria readily use lactose or other sugars and convert them quickly and easily to lactic acid. **However, lacto-fermentation does not necessarily need to involve dairy products.** Lactic acid is a natural preservative that inhibits the growth of harmful bacteria .Beyond preservation advantages, lacto-fermentation also increases or preserves the vitamin and enzyme levels, as well as digestibility, of the fermented food. In addition, lactobacillus organisms are heavily researched for substances that may contribute to good health.

Did you know that over 75% of your immune system is housed in your digestive system?  Essentially, trillions upon trillions of “good” bacteria and fungus kill the “bad” microorganisms, which keeps you alive and well.

So what happens when you take antibiotics or regularly use antibacterial lotions and soaps?

Antibiotics kill the “good” and the “bad” bacteria. They have no respect for what they kill. The balance of good verses bad bacteria is at risk. Many diseases can be traced back to that imbalance. Autoimmune disease, allergies, autism, some forms of anemia, and poor mental health have all been traced back to be a contributing cause of gut “dysbiosis” (an imbalance of bacteria where the “bad” overtake the “good” bacteria).

According to a study titled “autoimmunity and the gut” “The gut microbiota can be influenced by several factors: the motility of the gastrointestinal tract (GIT); the intake of pharmaceutical medications, including antacids, antibiotics, and nonsteroidal anti-inflammatory drugs; smoking; the use of alcohol; the GIT transit time; mucosal blood flow; and renal clearance”

For every human cell in your body, there are roughly 10 single-celled microbes, most of which live your GI tract. In one study, published in the journal Cell Reports, shows that the gut bacteria produce an enzyme that modifies signaling in cells lining the gut. The enzyme also has another role in breaking down food components in our digestive tract.

**It is estimated that 500 to 1,000** [**species**](https://en.wikipedia.org/wiki/Species_(biology)) **of bacteria live in the human gut**

**Benefits of probiotic rich foods and supplements**

* [Improves immune health](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#immune)
* [Improves mood and mental health](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#mental)
* [Boosts energy levels](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#energy)
* [Improves cholesterol levels](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#cholesterol)
* [Regulates hormone levels](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#hormone)
* [Reduces yeast infection occurrences](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#yeast)
* [Supports a healthy weight](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#weight)
* [Improves oral health](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#oral)
* [Contributes to longer life](http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/#longer)

**Gut Health and mental health**

Scientists are increasingly convinced that the vast assemblage of micro fauna in our intestines may have a major impact on our state of mind. The gut-brain axis seems to be bidirectional—the brain acts on gastrointestinal and immune functions that help to shape the gut's microbial makeup, and gut microbes make neuroactive compounds, including neurotransmitters and metabolites that also act on the brain. These interactions could occur in various ways: microbial compounds communicate via the vagus nerve, which connects the brain and the digestive tract, and microbial derived metabolites interact with the immune system, which maintains its own communication with the brain.



**What are prebiotics?**

Essentially prebiotics are “food” for the probiotics.

Prebiotics are naturally present in vegetables and fruit such as garlic, onions, leeks, asparagus, artichokes, tomatoes, bananas, plums and apples; in grains and cereals like bran, and in nuts like almonds. For this reason, vegetables, fruits and cereals should be part of a balanced and healthy diet. The active ingredient in “prebiotics” is called inulin.

**What are probiotics?**

The World Health Organization defines probiotics **as live microorganisms which, when administered in adequate amounts, confer a health beneﬁt on the host.**

They provide a range of benefits for the body, including the maintenance of digestive comfort and the regulation of the immune system. Probiotics can also help balance the gut microbiota when it has been affected by poor diet, infections, some antibiotics treatments or other external factors such as stress or heavy metal exposure.  
Many probiotics come from bacteria traditionally used for fermenting food. At the present time, a large number of relevant (well-designed) clinical trials with probiotics have been performed and the most common probiotics studied belong to two genera, Lactobacillus and Bifidobacterium, but other microorganisms including Enterococcus and Streptococcus, among others, have been also studied.

**Why fermented foods and not just take a probiotic supplement?**

A good quality probiotic supplement is no match for the many benefits of probiotic rich fermented foods. While a good quality probiotic supplement is beneficial in a pinch or to treat a certain condition even the very best supplement has under 50 different strains of beneficial bacteria. Since our bodies carry so many more different types, eating different types of fermented foods is wonderful way to repopulate the gut. Kombucha, kefir, sauerkraut, beet kvass, apple cider vinegar and many others contribute many different gut flora to maintain health.

**Fermented Foods**

The diets of every traditional society have included some kind of lacto-fermented food. Europeans consume lacto-fermented dairy, sauerkraut, grape leaves, herbs, and root vegetables. The Alaskan Inuit ferment fish and sea mammals. The Orient is known for pickled vegetables, sauces, and kimchi in particular. Farming societies in central Africa are known for porridges made from soured grains.

Pickles and relishes are a part of the American food tradition. Since the advent of industrialization, most pickling is done with vinegar, which offers more predictable results, but no lactic acid. With just a little patience, instruction, and minimal supplies, it is possible to [learn the time-honored art of lacto-fermentation](http://www.culturesforhealth.com/how-to-ferment-vegetables).

The important thing is not to be intimidated by lacto-fermentation. Unless it smells unmistakably putrid (in which case common sense says throw it away), fermented foods are some of the safest foods. They are easy for even a beginner to prepare, and it doesn’t take long to gain enough confidence to venture beyond basic [yogurt](http://www.culturesforhealth.com/yogurt) or [sauerkraut](http://www.culturesforhealth.com/sauerkraut) to an endless variety of fruits and vegetables. A list of the more common probiotics that we regularly see in fermented foods include:

* Bifidobacteria species
* Lactobacillus acidophilus
* Lactobacillus caucasus
* Lactobacillus bulgaricus
* Lactobacillus rhamnosus
* Acetobacter species
* Leuconostoc

There are some common misconceptions about lacto-fermented vegetables, most of them evolving from fear of the unknown. Once you are brave enough to prepare that first jar of sauerkraut or dilly beans, you are over the biggest hurdle. After that, you might struggle with some of the common misconceptions about lacto-fermented vegetables that may have been pushing you away from exploring more recipes.

Here are the facts to bust some of those myths and dissolve the fear of fermentation.

Myth 1: Fermented vegetables must be canned to be safe.

Fact: Canning is a relatively new form of preserving foods. Fermentation has been around for centuries. Fermented vegetables contain a natural preservative called lactic acid. This acid, much like the vinegar in canned pickles, preserves the vegetables. In this very acidic environment, harmful bacteria cannot exist, so fermented vegetables preserve themselves. The best way to see how a batch is progressing is to test aroma and flavor. If a batch smells unpleasant, toss it. If it smells sour but pleasant, it is fine to taste. If it smells ok and tastes ok, it is safe to consume.

Myth 2: Fermented vegetables must be stored in the refrigerator.

Fact: Fermented vegetables were actually born as a method of food preservation in the *absence* of refrigeration. A cool place is all that is required. This could be a basement, a root cellar, or cold pantry. Fermentation continues even under refrigeration, though very slowly. Slow fermentation often allows better flavor to develop. Read more on [moving fermented vegetables to cold storage](http://www.culturesforhealth.com/how-to-know-fermented-vegetables-ready-cold-storage).

Myth 3: Whey or a starter culture is required for fermenting vegetables.

Fact: Salt added to vegetable ferments keeps the batch free of harmful bacteria until the natural bacteria multiply enough to do the job.

Myth 4. Vegetables should culture at a warm temperature for a few days.

Fact: Many, many recipes advise letting a batch ferment for three days and then transferring it to cold storage. This method will allow the vegetables to culture and then halt the culturing process, but it doesn’t paint a full picture. The required fermentation time varies from batch to batch, depending on the vegetables, how they were prepared, and the ambient temperature. Lower fermentation temperature is often better, to allow the flavors to develop more fully.

Eating fermented foods can help prevent malnutrition in three ways. First, fermenting makes more food available overall. Second, the process of fermenting foods increases the amounts of certain vitamins and minerals in foods, including biotin, nicotinic acid (Vitamin B3), riboflavin (vitamin B2), thiamine (vitamin B1) and vitamin B12. Finally, fermenting some foods makes them easier to digest, breaking down fiber that you wouldn't normally be able to digest and turning it into sugars that you can digest. This increases the amount of calories you get from the food. Lactose is also partially broken down during fermentation, making yogurt easier to consume for those who are lactose intolerant.

* [Sauerkraut](http://www.drdavidwilliams.com/sauerkraut-recipe)
* Pickled cucumbers
* Pickled garlic
* Pickled beets
* Pickled radish
* Pickled corn relish
* Korean kimchi
* Natto
* Miso
* Tempeh
* Soy sauce
* Fermented tofu
* Naturally fermented and unpasteurized beers

**OK Lets get started:**

**Fermentation requires a few things:**

* **Clean work surfaces**- this means all knives, cutting boards, hands and anything that the food comes in contact with.
* **A source of non-chlorinated water**- Chlorine kills beneficial bacteria along with the bad. Either filter your water through a simple carbon filter, reverse osmosis, or use distilled water from the store.
* **Never use table salt**. Use Himalayan, Celtic or Redmond salt
* **Salt's Purpose**  
  Salt serves a useful function in fermenting vegetables, beyond the flavor it contributes. Salt helps to harden the pectins in vegetables. Fresh produce carries enzymes that decompose and soften them; salt helps to neutralize this enzyme. Salt also works by exclusion, preventing spoilage organisms from becoming dominant. With no salt very few organisms are excluded. As salt levels are increased more organisms are excluded. At very high levels of salt, no organisms can reproduce. Best results are achieved when one uses enough salt to disable enzymes and exclude spoilage organisms, but not so much that good lactic acid bacteria won't function.
* **Clean fermentation vessels**. I mean really clean. Run them through the dishwasher if available.
* **A place where the fermentation cannot be disturbed** (for some ferments, others like to be swirled around a bit!)
* **Weights of some sort to keep the liquid below the brine.**
* **Patience**: Lactic acid fermentation of vegetables is a process that proceeds through several stages of bacterial growth How much time it takes depends on how much food there is for the bacteria to eat (vegetables fermented in their own juices have more glucose than those in a salt-water brine) and how warm it is (warmer temperatures speed up the process). Generally speaking, it is a process that takes weeks, not days.

**To begin with what equipment will you need?**

Other than the knife, cutting board and right place to store the food fermentation requires very little in the way of tools!

**Fermentation Vessel**

**AIRLOCK CROCKS**

These crocks have a special ring around the top that the lid fits into. When water is added to this "moat" it forms a seal which allows fermentation gases to escape while preventing oxygen from entering. Harsch Gairtopf of Germany is the classic version of this crock. These are harder to find locally and are usually purchased online. Google "Harsch crock" to find retailers.Ohio Stoneware in 2013 began making their own airlock crock. Currently they are available in only the 3 gallons size, but at a price significantly below Harsch crocks.

**BOTTLES**

Mixed culture ferments like water kefir and kombucha can be very volatile during fermentation. Unlike a single strain yeast ferment, it is difficult to predict how they will behave in a bottle.

Extreme caution must be used when carbonating sweet beverages in glass. (they have a habit of exploding). Be sure to use only heavy-duty grolsch or EZ-cap bottles. Avoid the pretty swing-top bottles available in home goods stores, and also those sold with lemonade in them - this includes Bormioli Rocco brand bottles. Heavy glass bottles can be purchased from a local homebrew supply store or online brewing supply retailers. They are available in 16oz. or 32oz. sizes, in clear, brown, or blue. However, plastic bottles may be the safest option for carbonating fermented sodas. Soda Stream brand bottles are good quality and will last a long time.

**MASON JARS (this is what I mostly use- easy to find and cheap)**

Mason jars (Ball & Kerr) are widely available throughout the U.S., and can often be purchased at grocery stores, K-Mart, Wal-Mart, etc. White plastic lids are great to use for storage but harder to find; they are easily purchased online. These lids are not airtight and will leak if the jar is stored on its side.

**RECYCLED JARS**

Old pickle or olive jars, especially in 1 gallon size, work well for fermenting. Restaurants and bars will often give these away for free. Slow-cooker inserts are also suitable and may be found at Goodwill or The Salvation Army.

**HERMETIC JARS**

European wire-bale jars are popular for fermenting. They have a glass lid with a rubber gasket that clamps shut. The opening is wider than a mason jar and they are available in sizes from 1/2L up to 5L. Recommended brands are: Bormioli Rocco Fido, Le Parfait, and Ermetico. The lids for these jars are not interchangeable. They are all made in Europe and have sturdy wire baling. Can be found at discount stores such as: TJ Maxx, Ross, Marshall's, Home Goods, Tuesday Morning, and Christmas Tree Shop. Also available in store or by mail at Sur la Table, Crate & Barrel, and The Container Store. (Often there are sales.) Replacement gaskets can be purchased at most stores that sell these jars and also through Amazon.

**CUSTOM CROCKS**

Renewed interest in fermenting has opened up the market for handmade crocks**. They are beautiful and functional. These can be found on etsy or your local pottery store may carry them**

**FERMENTATION WEIGHTS**

During fermentation, the food must be weighted to keep it submerged under the brine at all times. The liquid brine is where fermentation occurs, and food that rises above the surface will not fully ferment. Additionally, it is at risk of oxidation and mold. DIY fermentation weights include: small jars or glasses, baggies filled with brine, vegetable sticks jammed in sideways to hold food down, chopsticks or skewers used in the same manner. One may also purchase fermentation weights, made of either glass or ceramic.

**KRAUT PACKERS**

Wooden tools are traditionally used to pack shredded cabbage down into a crock, releasing its juices.

**How Much Salt Do I Use?**

**(Note- if you are trying to reduce the amount of salt in your diet you can juice celery and use that for the brine- celery contains naturally occurring sodium)**

Our rule of thumb for salt in vegetable ferments is 1-3 tablespoons per quart.

* Add 1-3 tablespoons of salt directly to a medium head of cabbage or equivalent amount of other shredded vegetables before pounding or kneading, to make about 1 quart of finished product.
* For making a brine to cover vegetables, dissolve 1-3 tablespoons salt in 1 quart water.

Depending on the coarseness of the salt, one tablespoon can equate to a different weight of salt, so a different level of saltiness in the finished batch. It may take some experimentation to achieve just the right flavor, and the amount of salt preferred may vary with different vegetables. A salty sauerkraut may be tasty, but the same amount of salt may not work in a batch of shredded carrots.

In any recipe for fermented vegetables, it is acceptable to reduce or increase the amount of salt to fit your taste. However, there are limits on both ends. Too little salt may allow mold and other unwanted bacteria in to the batch; it may not keep the vegetables crisp. Too much salt can slow the fermentation process down to the point of halting it altogether.  Please understand that this fermentation is an ART and to use the following as a guide only:

Here is an easy brine calculator:

To mix 4 cups of brine to various salinity percentages, dissolve the following amounts of salt into 4 cups of water:

2% brine – 1 TBS sea salt  
3% brine – 1.5 TBS sea salt  
4% brine – 2 TBS sea salt  
5% brine – 2.5 TBS sea salt

**Keeping Cucumbers Crunchy During Fermentation**

* Add a tannin-containing agent to your pickling jars. [Black tea leaves](http://www.culturesforhealth.com/supplies/tea.html), oak leaves, grape leaves, or horseradish leaves all work well. Add a few larger leaves or a good teaspoon or so of loose tea or a teabag to a half-gallon jar.
* Ferment at the coolest temperature you can achieve. A fast, hot fermentation can result in a less-than-stellar crunch to a pickle. Try small whole cucumbers first. They tend to retain their crunch better than a chopped-up larger cucumber.
* Remove the blossom end. The end of the cucumber contains enzymes that soften pickles. Use a knife to remove a thin slice from the end, to preserve the firm texture.
* Puncture the skin. If the cucumber is harvested a bit later in the year or has been on the vine a little longer, it will develop a thicker skin. Use a skewer or paring knife to prick a hole in each cucumber. The brine can penetrate faster and the cucumbers will culture more evenly.

**Caution and information on probiotics and fermented foods**

While probiotic supplements are beneficial in improving gastrointestinal health, not all patients should take them. (this would also go for fermented foods)According to Julie Lanford, MPH, RD, CSO, LDN, wellness director at Cancer Services in Winston-Salem, North Carolina, individuals at risk of infections, including those undergoing cancer treatment and with significantly suppressed immune systems, should avoid them. This caution likely is the result of the fungal infections individuals often experience when receiving chemotherapy through central lines, or catheters, and taking S boulardii supplements.10 However, if these patients want to use them to help manage treatment side effects, Landford recommends they use prescription probiotics under the close supervision of their medical team so they can be monitored for adverse side effects.

**What is Histamine?**

Histamine is a natural substance produced by the body and is also present in many foods Fermented foods are high in histamine. It is released by the body during times of stress and allergy.

In an allergic response, an allergen stimulates the release of antibodies, which attach themselves to mast cells. When histamine is released from the mast cells it may cause one or more of the following symptoms:

* Eyes to itch, burn, or become watery
* Nose to itch, sneeze, and produce more mucus
* Skin to itch, develop rashes or hives
* Sinuses to become congested and cause headaches
* Lungs to wheeze or have spasms
* Stomach to experience cramps and diarrhea

Histamine intolerance is the result of an imbalance between the breakdown of histamine and its buildup in the gut. This is generally caused by a deficiency in the DAO enzymes (found in intestinal mucosa) that helps metabolize and breakdown dietary sources of histamine. A food source of the DAO enzyme is pea sprouts.

**Candida**

The reality is that many fermented foods are rich in lactic acid bacteria.

Contrary to popular belief, fermented foods should not be avoided when fighting off Candida overgrowth. Fermented foods, rich in lactic acid bacteria, can help to control systemic Candida. Kefir is widely consumed and recommended to help combat Candida.

These bacteria produce lactic acid and are beneficial to the human body, helping to control Candida and bacterial overgrowth.

**Kombucha, however is one fermented food that should be avoided when a person is suffering from candida**

**References**

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3667473/

<http://www.microbiomeinstitute.org/http://www.sciencedirect.com/science/article/pii/S0740002013001846>

http://www.futurity.org/topic/microbiomes/

https://en.wikipedia.org/wiki/Gut\_flora

<http://nourishingplot.com/2014/06/21/sauerkraut-test-divulges-shocking-probiotic-count/>

http://draxe.com/treating-candida-with-fermented-vegetables/

http://microbialfoods.org/science-digested-microbial-diversity-kombucha/

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3904694/>

<http://www.michiganallergy.com/food_and_histamine.shtml>

http://www.biomedcentral.com/content/pdf/1757-4749-5-3.pdf

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4036413/>

[http:/ http://www.worldgastroenterology.org/guidelines/global-guidelines/probiotics-and-prebiotics/probiotics-and-prebiotics-english/www.naturalhealth365.com/digestive\_problems.html/](http://www.naturalhealth365.com/digestive_problems.html/)

<https://en.wikipedia.org/wiki/Human_microbiota>

<http://www.sciencedaily.com/releases/2014/02/140213122358.htm>

<https://en.wikipedia.org/wiki/Allicin>

<http://www.medwelljournals.com/fulltext/?doi=javaa.2010.1.4>

<http://www.hindawi.com/journals/ecam/2014/562804/>

<http://articles.mercola.com/sites/articles/archive/2014/06/30/ginger-health-benefits.aspx>

<http://www.thecandidadiet.com/kefir.htm>

<http://www.drdavidwilliams.com/9-ways-good-gut-bacteria-support-your-overall-health/>

http://thelowhistaminechef.com/dr-joneja-how-to-boost-your-histamine-lowering-dao-enzyme-naturally/