History

Sauerkraut is a traditional food of finely cut raw cabbage that has been fermented by various lactic acid bacteria, the bacteria ferment the sugars in the cabbage leaves, resulting in a distinct sour flavor and long shelf life. It is rich in probiotics, vitamins, and minerals, offering numerous health benefits.

Sauerkraut typically requires only cabbage, salt, and time.
The natural bacteria present on the cabbage leaves convert its sugars into lactic acid during fermentation, which acts as a preservative and provides the characteristic tanginess.

It is low in calories and a good source of dietary fiber, vitamins (especially C, K, and B vitamins), and minerals like iron, manganese, and calcium. The fermentation process makes these nutrients more bioavailable than in raw cabbage.

Consuming unpasteurized, raw sauerkraut can improve digestion by supporting a healthy gut microbiome, strengthen the immune system, support bone and heart health (due to Vitamin K2), and may even help with weight management.

Raw (unpasteurized) sauerkraut, usually found in the refrigerated section of stores, contains live probiotics and beneficial enzymes, offering the most health benefits. Canned or shelf-stable versions are typically pasteurized (heated), which kills the beneficial bacteria, although the fiber and other nutrients remain.

Sauerkraut is a versatile ingredient used in many cuisines worldwide.
Condiment: It is commonly used as a tangy condiment on hot dogs, burgers, and Reuben sandwiches in American cuisine.

Fermentation is one of humanity's oldest and most influential technologies—and it sits at the intersection of food, culture, science, and survival.

Prehistory: Discovery by accident (c. 10,000 BCE and earlier)
Fermentation almost certainly began unintentionally. Early humans gathering fruits, grains, or honey would have encountered naturally fermented foods when wild yeasts and bacteria transformed sugars into alcohol, acids, and gases. These foods:

- lasted longer,
- were often safer to eat or drink,
- and sometimes had pleasant flavors or intoxicating effects.

Archaeological evidence suggests:
Fermented beverages (from honey, rice, or fruit) existed in China as early as 7000 BCE.

- Beer-like drinks likely emerged soon after humans began cultivating grains.
- Fermented milk probably arose among pastoral societies when milk was stored in animal skins, encouraging bacterial fermentation.

Ancient civilizations: Fermentation becomes culture (c. 3000–500 BCE)

- As societies settled, fermentation became intentional and central to daily life.

Mesopotamia

- Beer was a staple food and payment for laborers.

Ancient Egypt

- Bread and beer were dietary foundations.
- Yeast fermentation was used without understanding microbes—bakers reused dough starters, brewers reused foam.

China

- Fermented soy products (early soy sauces, pastes) and rice wines developed.
- Fermentation was linked to medicine and longevity.

Mesoamerica

- Maize fermentation produced foods and drinks like chicha and pulque.
- Fermentation enhanced nutrition and digestibility of corn.
- Classical and medieval periods: Preservation and craft
- Without refrigeration, fermentation was essential for survival.

Across Europe, Africa, and Asia:

- Vegetables were preserved as sauerkraut, kimchi, pickles.
- Dairy became cheese, yogurt, kefir.
- Meat and fish were fermented into sausages, and fish sauces.
- Vinegar emerged as both food and medicine.

Fermentation knowledge was passed down through: monasteries (beer, wine, cheese), households, and guilds.

The scientific revolution: Understanding microbes (17th–19th centuries)

For millennia, no one knew why fermentation worked.

Key breakthroughs:

- Antonie van Leeuwenhoek (1600s) observed microorganisms through microscopes.
- Louis Pasteur (1850s–60s) proved fermentation was caused by living organisms, not spontaneous chemical reactions. Pasteur's work led to:
    - pasteurization,
    - controlled fermentation
    - modern microbiology

Fermentation shifted from mystery to science.

Industrial age: Scaling and standardization (late 1800s–1900s)

Industrialization transformed fermentation:

- Pure yeast strains enabled consistent beer and wine.
- Large-scale production of bread, alcohol, vinegar, and dairy expanded.

Fermentation was also harnessed beyond food:

- antibiotics (penicillin)
- Enzymes
- organic acids
- fuels

Late 20th century to today: Revival and innovation

In recent decades, fermentation has resurged for multiple reasons:
- interest in gut health and probiotics
- culinary exploration and craft food movements
- sustainability and food preservation
- reconnecting with traditional knowledge

Modern fermentation now spans:
- artisanal foods (kombucha, sourdough, miso)
- biotechnology and pharmaceuticals
- alternative proteins and cultured foods
- climate solutions (fermented fertilizers, biofuels)

Fermentation has:
- fed civilizations,
- shaped religions and rituals,
- enabled preservation before modern technology,
- and laid the groundwork for microbiology and biotechnology.

In many ways, it's not just a food process—it's a quiet partnership between humans and microbes that has been shaping culture for over 10,000 years.

Contemporary Fermentation Influencers & Artists in the Food World
1. Sandor Ellix Katz – Perhaps the most influential fermentation revivalist today, Katz's books and workshops have inspired home fermenters and professional chefs alike. He's known for celebrating spontaneous fermentation and community-based food practices.
2. René Redzepi & the Noma Fermentation Lab – While not artists in the traditional visual arts sense, Redzepi (chef/author) and his fermentation team push fermentation into gastronomic art, using microbes to create new flavors and techniques that blur culinary science and creative expression.

1. Lactic Acid Fermentation
Microbes: Lactic acid bacteria (e.g., Lactobacillus)
Main product: Lactic acid
What it does: Preserves food, creates tangy flavors, improves digestibility
Common examples:
- Sauerkraut
- Kimchi
- Yogurt

- Kefir
- Pickles (naturally fermented)
- Sourdough (partly lactic, partly yeast)

Why it matters
- Lowers pH, preventing spoilage
- Supports gut health
- One of the safest and most ancient forms of fermentation

2. Alcoholic Fermentation
Microbes: Yeasts (especially Saccharomyces cerevisiae)
Main products: Alcohol (ethanol) + carbon dioxide
What it does: Produces alcohol and/or leavening
Common examples:
- Beer
- Wine
- Cider
- Mead
- Sake
- Bread (CO_2 causes dough to rise)

Why it matters
- Central to ritual, celebration, and trade
- CO_2 production makes bread possible
- Often paired with other fermentations (like lactic)

3. Acetic Acid Fermentation
Microbes: Acetic acid bacteria (Acetobacter)
Main product: Acetic acid
What it does: Turns alcohol into vinegar
Common examples:
- Apple cider vinegar
- Wine vinegar
- Rice vinegar
- Kombucha (second stage)

Why it matters
- Requires oxygen (unlike most fermentations)
- Used for preservation, flavor, and medicine
- One of the few fermentations that “likes” air

4. Fungal / Mold Fermentation
Microbes: Molds (e.g., Aspergillus, Rhizopus, Penicillium)
Main products: Enzymes, amino acids, complex flavors

What it does: Breaks down proteins and starches into usable nutrients
Common examples:

- Miso
- Soy sauce
- Tempeh
- Koji- A mold used for fermentation
- Blue cheese
- Brie, Camembert

Why it matters

- Enables other fermentations (koji is a starter)
- Creates deep umami flavors
- Often misunderstood but foundational in many cuisines

5. Mixed or Wild Fermentation
Microbes: Multiple species of bacteria and yeast
Main products: Varies (acids, alcohol, CO_2, esters)
What it does: Creates complexity through microbial communities
Common examples:

- Sourdough starter
- Kombucha
- Ginger bug
- Water kefir
- Natural wines

Why it matters

- Less predictable, more expressive
- Reflects place, environment, and time
- Often associated with artisanal and traditional practices

6. Alkaline Fermentation
Microbes: Bacillus species
Main product: Alkaline compounds (not acids)
What it does: Raises pH, softens proteins
Common examples:

- Natto (Japan)
- Dawadawa (West Africa)
- Some fermented fish and seed pastes
- Why it matters
- Very different flavor profile (strong, funky)
- Important protein source in some cultures
- Less common globally but culturally vital

“Sauerkraut: Crunchy Cabbage Magic

“Sauerkraut: Crunchy Cabbage Magic!”

1. Welcome from ABG & UC Master Food Preservers Mission

- Brief welcome and introduction
- **UC Master Food Preservers Mission**
    - To teach **safe, science-based food preservation**
    - To help people **reduce food waste**
    - To support **healthy, sustainable communities**
    - To share **practical skills people can use at home**

- Connect mission to today’s topic:
    - Sauerkraut is a way to **save food**, **stay healthy**, and **use science you can see**

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2. What Is Sauerkraut?

Purpose: Simple definition before history

- Sauerkraut = **cabbage + salt + time**
- No cooking, no vinegar
- Made by **friendly bacteria**
- Crunchy, sour, and full of flavor

Optional visual: fresh cabbage vs. finished sauerkraut

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3. Sauerkraut History & Fun Facts

Purpose: Spark curiosity and laughter

- Sauerkraut is **over 2,000 years old**
- It did **not** start in Germany!
    - Early versions came from **China**
- Sailors ate sauerkraut to **avoid getting sick**
    - It helped prevent **scurvy**
- Cabbage was popular because:
    - It grows easily

    - It lasts a long time
    - It turns into sauerkraut without fire or electricity

Fun facts

- There are **more bacteria in sauerkraut than people on Earth**
- The bacteria are so tiny you need a microscope to see them
- Sauerkraut is sometimes called a **"living food"**
- The bubbles you see are a sign that fermentation is working

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4. What Is Fermentation? (Very Simple Explanation)

Purpose: Prep for the "how"

- Fermentation = **microbes eating sugars and making acids**
- Good bacteria eat cabbage sugar
- They make **lactic acid**
- The acid:
    - Makes it sour
    - Keeps bad germs away
    - Helps preserve the food

("It's like the bacteria are having a snack and leaving behind sour juice.")

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5. Supplies Needed to Make Sauerkraut

Purpose: Clear, practical setup

Ingredients

- Fresh cabbage
- Salt (non-iodized preferred)

Tools

- Cutting board
- Knife
- Large bowl
- Clean hands (very important!)
- Fermentation vessel:
    - Jar, crock, or food-safe container
- Weight or something to keep cabbage submerged

- Lid (loose or airlock)

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7. What's Happening in the Jar?

Purpose: Reinforce science

- Bacteria eat sugar → make lactic acid
- Acid protects the food
- Bubbles = carbon dioxide
- Smell changes = normal
- Mold on top = remove (but not ideal)

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8. Why Sauerkraut Is Special

Purpose: Bring it back to mission

- Preserves food naturally
- Uses just **two ingredients**
- Supports digestion
- Reduces food waste
- Connects us to history and science

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9. Wrap-Up & Questions

Purpose: Close warmly

- Review key ideas:
    - Mission
    - Microbes
      Simple steps
- Invite questions
- Encourage to:
    - Observe fermentation
    - Smell, listen, and watch
    - Try it at home

Presentation Step

Ingredients:

- Cabbage
- Salt (pickling, canning ok; not anti caking)
- Water

Supplies needed:

- Cutting board
- Knife
- Scale
- Large bowl
- Large jar
- Measuring spoons
- Tamper (optional)
    - Weights
    - Baggies
    - Coffee filters
    - Rubber bands

Notes about containers:

- Use- nonreactive materials
    - Stoneware, glassware, wood, hard plastics, silicone, stainless steel
- Don't use- reactive materials
    - Aluminum, copper, cast iron, low grade stainless steel

UCMFP Video

- Funky Cabbage March 27, 2025 Recording

UCMFP

- UCMFP-Sauerkraut-1.pdf

Brine Recipe:

- Cabbage must be covered with 1-2" of brine
- 1 quart of water: 1 ½ T. of salt

Start this first! You need time for it to cool.

How Lacto-Fermented Sauerkraut Is Made!

Preparing cabbage:

- Step 1: remove outer leave and set aside. These leaves help to hold down the shredded cabbage in the brine once packed in the jar.
- Step 2: rinse head under cold water
- Step 3: cut cabbage into quarters

- Step 4: cut out the core
- Step 5: shred or slice cabbage to the thickness of a quarter
- Step 6: tare your scale with a bowl on it
- Step 7: weigh out your cabbage
- Step 8: add the correct ratio of salt to the cabbage and mix thoroughly

Yield	Cabbage	Canning Salt
About 9 quarts	25 lbs	¾ cup
About 5 pints	5 lbs	3 Tablespoons
About 1 quart	2 lbs	4 teaspoons

- Step 9: continue to massage salt into the cabbage until juices are released (cabbage will darken and soften in this step)
- Step 10: begin packing into fermentation container (jars), leaving 4”-5” of headspace. This is where your tamper can come in handy to pack the cabbage down. You will begin to see the juices coming to the surface as you pack.
- Step 11: if the juice does not cover the cabbage, add extra brine.
- Step 12: use a cleaned outer cabbage leaf to keep the cabbage submerged.
- Step 13: use a weight or baggie with brine in it to keep cabbage leaf submerged.
- Step 14: label your container with the product and the date.
- Step 15: cover the container with a towel or coffee filter
- Store at 70° to 75°. It will take 3-4 weeks to fully ferment.
    - 60° to 65° may take 5-6 weeks.

What to expect as the cabbage ferments:

- Bubbles will form in the fermentation process
- An odor is natural as well
- If a scum forms, simply remove it and continue the fermentation process

Mold?

- Small amounts of mold may be skimmed off, but large amounts will affect the flavor and may affect safety, so kraut should then be discarded.

Scum (kahm yeast/wild yeast) is usually a harmless, thin white film or foamy layer from normal fermentation that can be skimmed off, while mold appears fuzzy, powdery, or has distinct colors like green, blue, or black, signaling potential spoilage and usually requiring discarding the batch. Key differences: scum is thin/powdery, often white/pink, and safe; mold is fuzzy/discolored (g Cause: Exposure to air, insufficient salt, or temperature issues.
“Submerge in brine, all will be fine!”

Fully fermented kraut (when bubbling ceases) may be kept tightly covered in the fridge for several months (2-3 months).

Failures can be caused by:

- Air pockets in jar
- Lack of salt
- Uneven distribution of salt
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The Sauerkraut Quiz

The Sauerkraut Quiz!

1. What is sauerkraut mostly made from?
A. Lettuce
B. Cabbage
C. Pickles
D. Broccoli

2. What two main ingredients are needed to make sauerkraut?
A. Cabbage and vinegar
B. Cabbage and sugar
C. Cabbage and salt
D. Cabbage and water

3. Sauerkraut is sour because…
A. Someone added lemon juice
B. The cabbage spoiled
C. Friendly bacteria made acid
D. It was cooked too long

4. Where did sauerkraut (or something like it) first come from?
A. Germany
B. Mexico
C. China
D. United States

5. Why did sailors eat sauerkraut long ago?
A. It tasted sweet
B. It prevented scurvy
C. It made them stronger
D. It was crunchy

6. Sauerkraut is cooked to make it ferment.
True / **False**

7. The bubbles you see in sauerkraut are a sign it is fermenting.
True / False

8. Sauerkraut helps food last longer without a refrigerator.

True / False

9. Sauerkraut is made by a process called **FERMENTATION**

10. The “good” bacteria in sauerkraut make **LACTIC** acid.

11. There are more bacteria in a spoonful of sauerkraut than:
A. People in your house
B. People in your city
C. People on Earth
D. Ants in an anthill

Bigger Supply List

- cabbage
- bowls x10
- salt (more than enough)
- jars x36 (they come in 12s)
- baggies
- scales x6
- mandoline x1
- knives x4
- cutting boards x3
- funnels x3
- glass weights x5 (examples)
- silicone air releases x4 (examples)
- old school fermentation crock (example)
- disposable gloves
- paper towels
- dish towels
- hand sanitizer
- clorox wipes for the tables we will be working on
- handouts for recipe
- a bunch of books to share
- double burner hot plate
- 2 pots to make brine
- Wooden spoon
- Potato masher
- Sauerkraut
- Small containers
- Tongs