

THE FERMENT WARS

Keeping Your Gut Healthy!

Did you know that your digestive system contains billions and billions of bacteria?

Although “bad” bacteria that can make you sick do exist, the bacteria inside you are mostly “good guys”. These harmless bacteria are, in fact, essential to your well-being: they help you to digest food, protect you from illness, and produce vitamins. In exchange, you provide the bacteria with a habitat and nutrients.

Are you familiar with yogurt and kefir? These foods are probiotics, which means they are full of live bacteria. Just like the ones that live in your intestinal tract, the bacteria you take in by eating probiotics stay in your large intestine for a period of time and help you digest food.

Try this fun experiment, to see how milk can be turned into a nutritious probiotic. Then make yourself a yummy breakfast smoothie that’s chock full of “good” bacteria.



MAKING YOGURT

Lactic Fermentation Experiment



The beneficial bacteria *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are responsible for changing milk into yogurt. When these bacteria feed on lactose (milk sugar), they release lactic acid as a waste product. This process is called lactic fermentation. Lactic acid causes milk proteins to combine and form chains. This makes the milk thicker and firmer. Lactic acid also gives yogurt its slightly acid taste.

Experiment

In this experiment, you'll make your own yogurt by turning milk into a probiotic through lactic fermentation.

Objective

You will gain an understanding of how the lactic bacteria found in fermented milk products can help us digest food and keep our gut healthy.

Materials

- saucepan
- measuring spoon
- mixing spoon
- candy thermometer
- measuring cup
- insulated container or glass jar, 500 ml or larger



Ingredients

- 500 ml (2 cups) milk (note that the percentage of milk fat affects the texture of the yogurt: for a creamier yogurt, use milk with 3.25% milk fat)
- 30 ml (2 tablespoons) plain yogurt containing live bacteria (look for the words **active or live bacterial cultures** in the ingredients list or on the packaging).

Instructions

1. Wash the insulated container or glass jar thoroughly.
2. Pour the milk into the saucepan.
3. With the help of an adult, heat the milk on the stove over medium heat. Stir gently, until the thermometer reads between 79°C and 82°C (175°F and 180°F). Heating the milk destroys harmful microorganisms that could be present. This process is called pasteurization.
4. Take the saucepan off the burner.
5. Allow the milk to cool for 10 to 15 minutes or until the thermometer reads between 43°C and 46°C (105°F and 115°F). Add the yogurt to the milk, stirring gently with a spoon. Do not overmix.
6. Slowly pour the mixture into the insulated container or glass jar. Put the lid in place, but not too tightly.
7. Put the insulated container or glass jar in a warm spot and let it sit for at least 6 hours. The ideal temperature for incubating yogurt is between 43°C and 46°C (105°F and 115°F). If you are using a glass jar, the oven is a good place to let it sit. Heat the oven to the temperature above, turn it off, and put the glass jar inside. Once the oven door is closed, the oven will maintain a good incubation temperature for several hours. Or, you can simply put the insulated container or glass jar near a radiator or in a picnic cooler along with a bottle of hot water.
8. Check the contents of the insulated container or glass jar by turning it sideways. The yogurt is ready when the contents have set and a transparent yellowish liquid has formed. The incubation time will affect the taste of your yogurt. For a milder taste, stop incubating the yogurt once it has set. For a tarter flavour, allow the yogurt to incubate longer.
9. For a thicker, Greek-style yogurt, line a strainer with paper coffee filters and pour the yogurt into the strainer. Let the yogurt drain into a bowl, in the refrigerator, for several hours.
10. Keep the yogurt in the refrigerator. Enjoy it with berries, jam, granola, or a drizzle of maple syrup or honey.

In an airtight covered container, homemade yogurt will keep for two weeks in the refrigerator.



Observations

1. Write down your observations of the milk before and after it was turned into yogurt.

	Milk	Yogurt
What colour is it?		
How does it smell?		
How does it taste?		
What is its consistency (e.g., thin, thick or liquid)?		
Is it smooth or lumpy?		

2. Write down the number of hours it took for the milk to turn into yogurt: _____



Questions

1. What do you think lactic bacteria eat?

2. What environmental conditions do lactic bacteria need to be active and multiply?

3. In your experiment, why is it important to heat the milk?

4. What do you think would have happened if you had added the bacterial culture (yogurt) to the hot milk before letting the milk cool?



5. Lactase is an enzyme. It breaks down milk sugar into two parts, so that our bodies can digest and absorb it.

Humans are the only mammals whose bodies produce lactase throughout their lives. However, a large percentage of the population cannot produce this enzyme once they become adults. In people who are lactase-deficient, or lactose-intolerant, dairy products containing lactose cause diarrhea, cramps and flatulence (intestinal gas).

For people who are lactase-deficient, why do you think yogurt is easier to digest than other dairy products?



Lactic Fermentation Experiment

Answer Sheet

1. What do you think lactic bacteria eat?

Bacteria are very simple living organisms. To stay alive, they need a source of energy, or food. For lactic bacteria, that food is sugar. The sugar found in milk is called lactose. Lactose is a combination of two simple sugars: glucose and galactose. To use glucose and galactose as food, bacteria must break the lactose down.

2. What environmental conditions do lactic bacteria need to be active and multiply?

To be active and multiply, lactic bacteria need heat and humidity. Unlike more complex living organisms, they do not need oxygen. This is why these bacteria can survive in our digestive system.

3. In your experiment, why is it important to heat the milk?

We heat the milk for two reasons. First, the shape of the milk proteins needs to change so that they come together and form chains. This change occurs when the proteins are exposed to heat.

The second reason relates to food safety. Today, only pasteurized milk is sold. Pasteurization involves bringing the milk to a high temperature for a few seconds and then quickly cooling it. This process kills most of the microorganisms that could be in the milk and might make us sick.

Since milk can easily become contaminated after the milk carton or bag has been opened, we need to pasteurize it a second time before turning it into yogurt.

4. What do you think would have happened if you had added the bacterial culture (yogurt) to the hot milk before letting the milk cool?

If you had added the culture to the milk when it was still hot, the bacteria would have been killed and the milk would not have been changed into yogurt. The high heat required for pasteurizing the milk would kill all bacteria, good or bad.



5. For people who are lactase-deficient, why do you think yogurt is easier to digest than other dairy products?

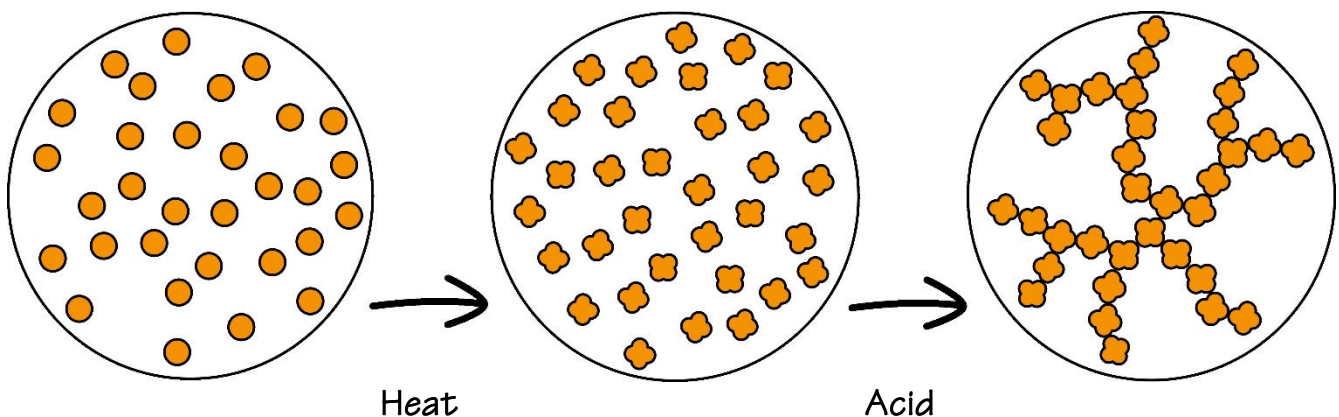
The lactic bacteria that change milk into yogurt feed on lactose. Fermented dairy products like yogurt contain much less lactose than unfermented dairy products like milk and ice cream. For this reason, lactase-deficient people find yogurt easier to digest. In addition, once the lactic bacteria are in our intestines, they keep on releasing lactase enzymes that continue to help us digest lactose.

Now you know

To the naked eye, milk looks like a plain white liquid. But milk is actually a combination of various particles suspended in water. This type of mixture is called a colloid. Milk contains proteins called caseins. It also contains fat globules, sugar (in the form of lactose), vitamins, minerals, enzymes, and sometimes even microorganisms.

Caseins form small spheres that bump up against each other and bounce off each other again. But in the presence of acid, when these spheres meet, they begin to stick together instead of pushing apart. This process is called coagulation. In unheated milk, casein spheres that come together form short chains. The resulting curdled, granular mass cannot retain liquid.

For yogurt to have a smooth texture, the milk must first be heated. Heat changes the shape of the casein spheres. In the presence of heat, then acid, casein spheres that come together form long chains. The resulting mass is like a sponge. The components of yogurt — fat, sugars, uncoagulated proteins, enzymes, vitamins, minerals and live bacteria — are imprisoned in the holes of the casein sponge.



BREAKFAST SMOOTHIE

250 ml	probiotic yogurt	1 cup
250 ml	fresh or frozen fruit	1 cup
½	banana	½
250 ml	100% pure orange juice	1 cup
125 ml	milk	½ cup
45 ml	wheat germ	3 tablespoons

Equipment

- blender
- measuring cups

Instructions

Blend all the ingredients in a blender. Serve cold.

This recipe makes approximately four 250 ml (1 cup) servings.

For more protein and a different taste, try adding a spoonful of nut butter or seed butter (peanut, almond, cashew, soy, sunflower seed, pumpkin seed, etc.).

