

YOGURT MADE SIMPLE

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The smooth, creamy slightly tart taste of homemade yogurt is produced by bacterial fermentation of milk. Yogurt is the most popular fermented milk in the world and can be made

with any type of milk by following simple steps of (1) heating the milk, (2) adding yogurt starter, also known as a “mother culture,” which is the source of bacteria, and (3) then allowing the milk to incubate for 6-8 hours.

Yogurt originated many centuries ago among the nomadic tribes of Eastern Europe and Western Asia, where herdsman began the practice of milking their animals and storing the milk in containers made from animal stomachs. The natural enzymes in the containers curdled the milk, essentially making yogurt. Not only did the milk keep longer, it is thought that people preferred the taste, so the practice continued. Over the centuries the process of making yogurt has evolved into yogurt as we know it today.

Yogurt is a rich source of protein and calcium, and the fermentation process makes these nutrients easier to absorb by our bodies (Figure 1). Ongoing studies continue to reveal the many health benefits of eating yogurt, such as boosting immunity, reducing yeast infections, and lowering the risk of colon cancer (Dairy Council of California 2015).

SAFETY, SPOILAGE, AND SHELF LIFE

Yogurt production has two characteristics that provide barriers to pathogen growth: heat and acidity (low pH). Both of these factors are necessary to ensure a safe product. Recent outbreaks of food poisoning by E. coli O157:H7 that is acidtolerant, brings into question

Nutrition Facts

Serving Size: 1 cup | 8 fl. oz. (245g)

Amount Per Serving

Calories: 149 **Cal from Fat:** 70
% Daily Value*

Total Fat 8g 12%

Saturated Fat 5g 26%

Trans Fat 0g 0%

Cholesterol 32mg 11%

Sodium 113mg 18%

Total Carbohydrate 11g 4%

Sugars 11g

Dietary Fiber 0g

Protein 9g

Vitamin A 12% • Vitamin C 33%

Calcium 11% • Iron 8%

*Percent Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.

Figure 1. The nutrition facts for whole milk yogurt.

the protective mechanism of acidity alone. However, E. coli O157:H7 is easily destroyed by pasteurization (heating), therefore, when making yogurt it is necessary to pasteurize the milk or use commercially pasteurized milk (Nummer 2002).

Yogurt generally has a 10- to 21-day shelf life when made properly, and stored in the refrigerator at temperatures below 40°F. Molds, yeasts, and slow growing bacteria can spoil the yogurt when it is stored over a longer time. To ensure long shelf life, always use clean and sanitized equipment and containers. A best practice is to clean the container with detergent using hot water, then rinse well and air dry.

THE CHEMISTRY OF YOGURT

Yogurt forms when bacteria ferment the milk sugar, known as lactose, into lactic acid. The lactic acid makes the milk more acidic (lower pH) causing the proteins to coagulate. The acidity of yogurt tends to be in the range of pH 4. The more lactic acid produced, the tangier the yogurt will taste. The final taste and consistency of the yogurt can be influenced by the type of yogurt starter used and length of incubation time.

The thickness of the yogurt results from the coagulated proteins determined by the fat content of the milk, the yogurt starter, and amount of milk solids (protein). Adding nonfat milk powder (milk solids) to cold milk before heating will result in a firmer yogurt. However, adding nonfat milk powder to heated milk will cause some proteins to coagulate and form strings.

The yogurt starter is the source of bacteria. The tartness of the yogurt will depend on the bacteria culture that is used, as well as how long the yogurt has fermented. A yogurt starter can be a store-bought yogurt that has active live bacteria, or a previously made batch of yogurt that is about 5 to 7 days old (for the freshest and most active bacteria). Freeze-dried starter or an heirloom culture bacteria in powder form can often be purchased at local natural-food stores or from online vendors.

Only a small amount of fresh yogurt culture is needed to start the fermentation process—about 2 to 3 teaspoons per cup of milk. If too much starter culture is used, the bacteria will be crowded and run out of food (lactose) before the yogurt is set. Too much starter can produce a sour taste, rather than the desired tart taste.

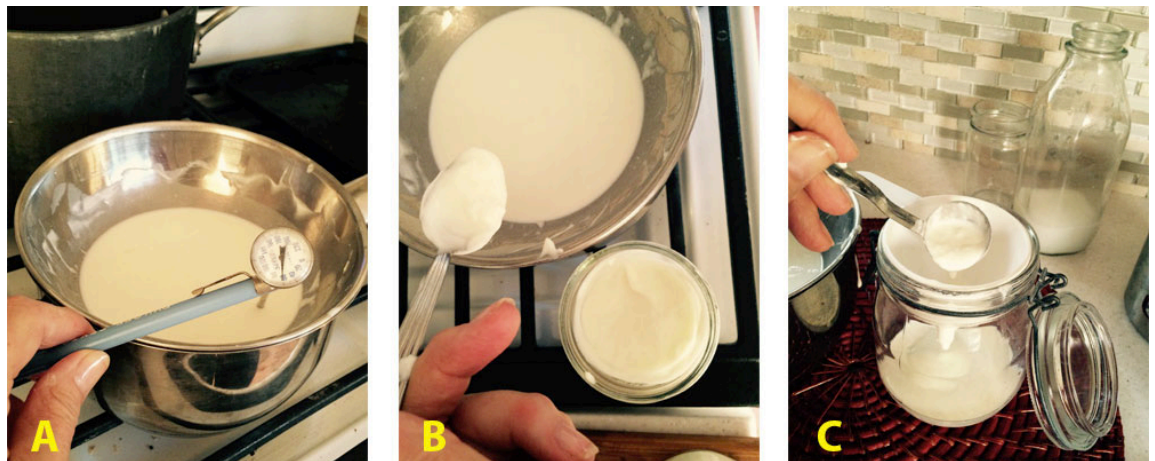


Figure 2. Steps to making yogurt on the stovetop. A) Inoculate milk by heating to 180°F. B) Allow milk to cool to 108°F to 112°F, then add yogurt starter. C) Pour cultured milk into clean containers, cover and place in incubator.

YOGURT MADE SIMPLE: STEP BY STEP ON THE STOVE TOP

Steps for making stove-top yogurt are illustrated in Figure 2.

1. Pour milk of choice into a double boiler and heat to 180°F. This will kill competing bacteria, and the whey proteins will denature and coagulate to enhance the viscosity and texture of the final product. Maintain temperature for 10 minutes for thinner yogurt, 20 minutes for thicker yogurt.
2. After the milk has reached 180°F for the desired time, remove from heat and allow to cool to 108°F to 112°F.
3. When the milk is cooled, scoop out one cup of milk into a small mixing bowl. To this cup of milk, add the 2 to 3 teaspoons of yogurt starter per cup of milk. For example, for a quart of milk add 8 to 12 teaspoons (2½ to 4 tablespoons) yogurt starter.

milk	1 quart	½ gallon	1 gallon
yogurt starter— plain yogurt with live culture	1/4 cup	1/2 cup	1 cup
Nonfat dry milk (optional)	1/3 cup	2/3 cup	1-1/3 cup

Recipe for Plain Yogurt (Casco and Rodgers Dinsté 2011)

4. Pour this mixture back into the larger portion of heated milk and stir gently. Pour milk/yogurt starter into clean, sterilized warm container. Cover and place in incubator.
5. Incubate the yogurt by setting it in a warm place for 6 to 8 hours undisturbed. The goal

is to maintain constant temperature to allow the yogurt to ferment. The time will vary depending upon the size of the inoculation culture, temperature, lactose content of the milk, and/or the freshness (vitality) of the yogurt starter used. Any one or a combination of these factors will increase the time to complete the process.

6. Refrigerate yogurt immediately once the yogurt has congealed to a jell-like consistency. Rapid chilling stops the development of acid.



Figure 3. Yogurt incubation methods: A) Oven method. B) Insulated cooler. C) Crockpot. D) Commercial yogurt machine.

Incubation

There are a number of ways to incubate yogurt, including in an oven, in an insulated cooler, in a crockpot, and in a commercial yogurt machine (Figure 3).

1. **In the oven.** Pre-warm oven to 200°F, then turn off. Turn oven on for short periods so that the temperature does not drop below 100°F. If a gas oven is used, the pilot light may maintain the temperature.

2. **In an insulated cooler.** Fill with warm water and place jars in warm water bath. Alternatively, line the chest with a heating pad and maintain at lowest setting.
3. **In a crockpot.** The crockpot can be used to heat the milk, allowed to cool then add yogurt starter for fermentation. Wrap the crockpot in a towel and allow to set in a warm area.
4. **In a commercial yogurt machine.** These are available to maintain constant temperature. Follow instructions from the manufacturer.

CAUSES AND SOLUTIONS FOR COMMON PROBLEMS

Yogurt may not turn out as expected for a number of reasons. Following are a number of common problems and suggested solutions (Luedecke 1983).

Watery separation of whey and curd:

- The incubation time is too long, allowing the formation of too much acid. Shorten the incubation time and refrigerate yogurt as soon as it becomes firm.
- Milk has not been heated adequately. Either milk was not heated to 180°F or it was not held 20 minutes at this temperature. Heat treatment changes the milk proteins so the yogurt is firmer and whey does not separate easily.

Yogurt does not become firm:

- Inactive culture. Commercial unflavored yogurt used for starter must be fresh and contain live bacteria. Use fresh yogurt starter every 5 to 6 batches since the bacteria activity decreases over time. Yogurt starter can be frozen for future batches.
- Incubation temperature too high or too low. The temperature must be 108°F to 112°F for yogurt bacteria to grow properly. Too high a temperature inactivates bacteria; too low a temperature prohibits growth.
- Inhibitor substances such as detergent from dishes. Wash and rinse dishes well before making yogurt.

Off-flavors:

- Off-flavored milk. Use fresh unflavored milk.
- Bad tasting bacteria grow along with yogurt bacteria. Use a fresh yogurt culture.
- Wash dishes well before starting. Keep culture covered while incubating.

YOGURT CHEESE

Strained yogurt, or yogurt cheese, also called Labneh or Greek yogurt, is yogurt which has been strained in a cloth or paper filter to remove the whey. This provides for a consistency between that of yogurt and cheese, while preserving yogurt's distinctive tart flavor.

Some commercial yogurts have added gelatin, vegetable gum, or food starch to prevent the "set" from breaking down during packaging. Small companies can produce yogurt made right in the container you purchase, so no stabilizers are needed. Avoid stabilizers if making yogurt cheese, since the stabilizers prevent whey from separating out. Yogurt cheese can be used as a substitute for cream cheese, mayonnaise, and sour cream in dips, sauces, and spreads (Baker 1993).

Equipment and Ingredients for Yogurt Cheese

- Funnel, strainer, plastic coffee filter
- Paper coffee filter or double cheesecloth
- Bowl or tall glass to catch liquid whey
- Plain, low-fat yogurt (no stabilizers)



Figure 4. Steps for making yogurt cheese. A) Line a strainer with cheesecloth. B) The whey will separate from the yogurt, producing a cheese-like texture.

Instructions: Line funnel or strainer with coffee filter or cheesecloth (Figure 4). Place funnel or strainer over bowl or glass. Spoon yogurt into filter. Cover with plastic wrap and refrigerate 8 to 24 hours until whey has drained and yogurt is spreadable or “cheese like.” The longer straining period makes for a thicker cheese. After straining off the whey, about 1/2 to 2/3 of the original amount of yogurt remains.

Yield: 1 quart (32 oz) yogurt = 1 1/2 to 2 cups yogurt cheese

Nutritional value: 1 tablespoon = 1 gram protein, less than 1 gram fat, 30 mg calcium

Creative Uses for Yogurt Cheese

- Add chopped fresh chives or green onion for a potato topper
- Mix with dry salad dressing mix for dips (1 envelope to 2 cups yogurt cheese)
- Add smoked salmon or a bit of blue cheese for a dip or spread
- Add mustard, onion and a bit of brown sugar for potato salad dressing

Maple Yogurt Crème

1/2 cup nonfat yogurt cheese
1 to 2 tablespoons toasted chopped walnuts
1 tablespoon maple syrup

Swirl syrup and nuts through yogurt.

Serve as dessert or topping on pancakes or muffins. It's a surprisingly tasty treat, making a nice snack with graham crackers.

Raspberry Yogurt Dressing

1/4 cup nonfat yogurt cheese
1 tablespoon raspberry jam
1 tablespoon raspberry vinegar

Mix together and serve with fruit salad.
Add 1/4 cup reduced-fat mayonnaise for variation.

Good with bananas, pineapple, melon.

FURTHER READING

Katz, S. 2012. *The Art of Fermentation*. Chapter 7: Fermenting Milk. pp 186-192. White River Junction, VT: Chelsea Green Publishing.

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