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EXTENSION

Making and Understanding Yogurt

Fact Sheet 9.336 | Food and Nutrition Series | Health

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Learning to make yogurt at home can be a satisfying, affordable way to keep a supply of this versatile and nutritious staple on hand. Yogurt can be made safely at home without specialized equipment.

Background

Yogurt is a fermented dairy product made by adding live bacterial cultures to milk, which causes the conversion of milk sugar (lactose) into lactic acid. The name yogurt originates from Turkey where it is spelled yoghurt. Yogurt may have been discovered accidentally by nomadic tribesmen traveling across the Middle East. Milk from their animals was stored in pouches made from animal stomachs. Bacteria present in the pouches produced acid, causing the milk to coagulate. Further curdling of the milk occurred due to action of naturally occurring rennet enzymes found in the stomachs of ruminant animals. The acidity helped protect the sour cream-like product from growth of spoilage and harmful bacterial organisms.

Making Yogurt

The process of making yogurt uses heat to alter the milk proteins, encourages the growth of beneficial bacteria, and produces acid that limits the growth of harmful bacteria. 'Traditional' yogurt is made using a thermophilic, or heat-loving, culture.

Equipment

- Incubator. A consistent temperature of 110°F, plus or minus 5°F, must be maintained over several hours using one of the following methods:
  - Yogurt maker/incubator. Follow manufacturer's directions.
  - Electric pressure cooker. Follow manufacturer's directions.
  - Oven. Heat a deep pan of water to 110°F (a roasting pan works well). Place filled yogurt containers into pan; water level should be at least halfway up the containers. Set oven temperature at its lowest point to maintain water temperature at 110°F. Monitor water temperature throughout incubation, making adjustments as necessary.
  - Ice chest/cooler. Warm water to 130°F and pour into a clean insulated (hard-sided) ice chest or picnic cooler. Carefully set filled yogurt containers in the cooler; water level should come at least halfway up the containers. The temperature of the water in the cooler must be at least 110°F. Close the cooler lid, place in warm room, and let sit undisturbed.
  - Thermos. Pre-warm a clean thermos with boiling water. Empty water and pour in cultured milk. Add lid and let yogurt set. After incubation is complete, transfer yogurt to another container for refrigeration. A thermos placed directly into the refrigerator will not cool fast enough to stop further acid development.

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Quick Facts

- Yogurt is a calcium-rich dairy product made by fermenting milk with a special bacterial culture.
- Yogurt can be made safely at home without specialized equipment
- This tart, lower calorie food can substitute for high-fat ingredients in cooking and baking.
- The yogurt making process described in this paper must be made using pasteurized cow, goat, or sheep's milk and will not work with plant-based milk alternatives.

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- Incubation or storage containers for yogurt. These can be canning jars or cups with lids.

- Thermometer. Use a food thermometer that accurately measures temperatures up to 220°F. It is helpful to have one that can be clipped on the side of the pan.

- Large double boiler or regular saucepan. The pan capacity should be 2 to 3 quarts when using 1 quart of milk. Using a double boiler decreases the likelihood of burning the milk, which could negatively impact the yogurt flavor and quality.

- Whisk or mixing spoon; measuring cups.

Recipe for Plain Yogurt

Pasteurized milk from animal sources can be used, including cow, goat, or sheep. This process does not work for non-dairy milks, (soy, rice, almond, oat, or coconut milk) because additional procedures and thickeners are required to set effectively. Milk source and fat content will yield different consistencies and flavors. Whole milk will result in thicker yogurt, while reduced fat or nonfat milk will produce thinner, runnier, yogurt. Nonfat dry milk (NFDM) powder can be added to thicken yogurt. This recipe makes 4-5 cups of plain yogurt, which can be used to make other flavors or varieties.

Ingredients

- 1 quart pasteurized milk (any level of fat or reconstituted dry milk)
- Yogurt starter culture: 1/4 cup commercial, unflavored yogurt with live and active cultures (Lactobacillus delbrueckii subspecies bulgaricus (L. bulgaricus) and Streptococcus thermophilus (S. thermophilus) at room temperature, or dry starter culture (follow package instructions).

  Optional: Nonfat dry milk powder: 1/3 cup when using whole or low-fat milk or 2/3 cup when using skim or reconstituted NFDM

Procedure

1. Start with clean hands, equipment and work space. Thoroughly wash all equipment in dishwasher or in hot soapy water and rinse well.

2. Heat milk. This is an essential step, required to 'set' the milk proteins instead of forming curds and whey. It also destroys competing spoilage microorganisms. Monitor temperature closely at higher altitudes to avoid boiling.
   a. Put cold pasteurized milk into the top of a double boiler or heavy bottomed pot.
   b. Optional: Stir nonfat dry milk into cold milk until dissolved.
   c. Gradually heat milk to 185 to 200°F stirring frequently. Use a thermometer to monitor temperatures throughout heating.
   d. Hold at 185°F for 10 minutes for thin yogurt or 20 minutes for thicker yogurt, adjust stove temperature and stir as needed to avoid burning.

2. Cool. Adding starter culture to very hot milk can kill the active bacteria and disrupt the process.
   a. Place the pot or top pan of double boiler in cold ice water; stir to cool milk rapidly to 115°F.

3. Inoculate. Introduce yogurt-producing bacterial cultures into prepared milk.
   a. In a separate bowl, remove one cup of the warm milk and blend it with the yogurt starter culture using a wire whisk.
   b. Add and stir this mixture into the pot of remaining warm milk. The temperature of the inoculated milk should now be 110°F, plus or minus 5°F.

4. Incubate. Carefully control temperature for lactic acid fermentation and coagulation of milk; too hot or too cold can hinder culture growth.
   a. Pour inoculated milk immediately into clean containers (pot, jars, or cups). Cover and place in prepared incubator (see options on page 1).
   b. Close the incubator and let ferment undisturbed for 4 to 12 hours at 110°F, plus or minus 5°F. Yogurt will set (become firm) as it becomes acidic (optimally pH 4.6).

Longer incubation usually results in thicker, more sour-tasting yogurt. However, incubating yogurt beyond the point of becoming 'set' will produce a more tart or acidic flavor and eventually cause the whey to separate.

5. Refrigerate. Rapid cooling of set yogurt is necessary to stop acid development and slow down microbial activity.

a. Once yogurt has set to desired consistency, cover and refrigerate immediately.

b. Homemade yogurt will keep for about 10 to14 days when stored at 40°F or lower (discard if mold is observed). Yogurt can also be kept frozen for several months if stored in an air-tight, freezer-safe container. It can be safely consumed frozen or thawed for immediate use. Note that freezing will alter the texture, causing the yogurt to separate and become grainy when thawed.

Trouble Shooting

- **Yogurt tastes or smells bad.**
  - Old milk or contaminated starter culture: use fresh milk or obtain a new starter culture for the next batch.
  - Incubated too long (over-set): refrigerate immediately after setting to avoid continued acid production.
  - Overheating or boiling of the milk: monitor temperatures when heating, as overheating or boiling milk can cause an off-flavor.

- **Yogurt does not coagulate (set) properly.**
  - Poor incubation temperature control.
  - Inactive starter culture: contaminated, old, or killed by adding culture prior to milk cooling.

- **Whey collects on the surface of the yogurt, a process known as syneresis.**
  - Some is natural, but excessive separation of whey can be caused by:
    - Incubating too long.
    - Agitating the yogurt while it is incubating.
    - Inadequate heating of milk: not heated to correct temperature or not held at temperature.

Using Yogurt

Homemade plain yogurt can be used to make the following styles of yogurt or products:

- Set yogurt: cultured milk firms in individual container(s) rather than a large vat and is not disturbed. This results in an unstirred, thicker product.
- Stirred yogurt: after incubation yogurt is dispensed into smaller containers. The "set" is broken and the texture becomes less firm.
- Fruit yogurt: fruit, fruit syrup, or pie filling is added to the yogurt. Fruit is placed on top, bottom, or stirred into the yogurt.
- Drinkable or drinking yogurt: stirred yogurt is blended with fruit and milk to make a drinkable product.

  1. Add fruit or fruit syrups to taste. Mix in milk to achieve the desired thickness.
  2. Some whey separation will occur and is natural. Shake before consuming. Shelf life shortens to 4 to 8 days since pH is raised by addition of fresh milk.
- Strained yogurt or yogurt cheese: liquid whey is strained from the yogurt to produce a thick, creamy, concentrated product. If using a commercially available yogurt, do not use yogurt made with gelatin added. Gelatin will inhibit whey separation. Two cups of yogurt will yield about 1 cup of strained yogurt.

  1. Line a colander or strainer with a double thickness of cheesecloth.
  2. Place colander over a bowl and pour in the yogurt. Cover with plastic wrap, refrigerate, and allow whey to drain for 8 hours.
  3. Empty the whey from the bowl.
  4. To create a thicker product, fill a plastic zip-lock bag with water, seal and place on top of the plastic wrap over the yogurt to weigh it down. Refrigerate undisturbed for for up to 8 hours. The longer the yogurt is allowed to sit, the thicker the finished yogurt cheese will become.
  5. Wrap and refrigerate at 40°F or lower. Use within 7-14 days.

Plain yogurt can be enjoyed as is, or flavored to taste. Commercially available flavored yogurts are often higher in calories and sugar than what you flavor on your own. Try adding fresh or cooked fruit, fruit canned in juice or low sugar, or low sugar preserves or sauces.

Plain yogurt may be substituted for sour cream or mayonnaise in most recipes. The final product may taste less rich and more tart; yet will be lower in calories and fat, and higher in protein and calcium. Try topping a baked potato or your favorite ethnic cuisine with plain yogurt or substitute plain yogurt for some or all of the mayonnaise in dips, dressings, or creamy salads.

Plain or flavored yogurt may be substituted for some or all of the liquid in baking recipes. The result will often be creamier or softer in texture, and the yogurt flavor may also be imparted. Adjust leavening by adding ½ teaspoon baking soda and reducing the baking powder by one teaspoon per cup of yogurt used.

Be creative! Plain or flavored yogurt can be used as a topping for fruit, pancakes, waffles, granola, desserts, vegetables, meats, or soups. Plain or flavored yogurt can be mixed with other ingredients to make a smoothie. Plain or flavored yogurt can be frozen as a cold treat.

See the following Extension fact sheet for information on the health benefits of yogurt:
Yogurt: Probiotics and Health Benefits

Resources & References

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