EXPERIMENT 10

Applications in Food Microbiology

INTRODUCTION

Food microbiology is the study of the microorganisms that grow in or contaminate the foods that humans consume. In general, food microbes could be considered either beneficial or a nuisance depending on their effects. Beneficial bacteria that are physiologically important to humans are essentially termed **probiotics**. While other microorganisms are essential to the *production* of food including yogurt, cheese, pickles, breads, beer, wine, sauerkraut, kimchi, vinegar, saki (rice wine), and other many culturally significant foods. Cheese varieties are often based on the types and combinations of molds and other microbes that ferment the food and produce their characteristic flavors.

Food safety is a major aspect of food microbiology and focuses on the pathogenic bacteria and the toxins they produce that can possibly contaminate food. Although this field is extremely important, we will focus on applying beneficial microbes in the production of popular and vital food products.

The key aspect of beneficial food microbiology involves taking advantage of bacteria ability to ferment. **Fermentation** is the bacterial process that uses up sugars to produce acids and gases. A useful application of fermenting food products is that it can extend the shelf life of foods. Fermentation creates a less hospitable environment for invading microbes including pathogens and spoilage-inducing bacteria. Yeast and bacteria can ferment alike and in this experiment we will be taking advantage of bacteria to produce yogurt.

Microorganisms involved in the production of products like yogurt belong to a category of bacteria that can process the milk sugar, lactose, and convert it into lactic acid. Some common strains of bacteria used for this process are *Streptococcus lactis, Streptococcus cremoris, Lactobacillus plantarum, Streptococcus thermophilus, Lactobacillus bulgaricus, Lactobacillus and acidiophilus*.

Materials WEEK 1:

1. **(5) 250 ml Styrofoam cups/beakers safe for food consumption, covered with foil**
2. **Incubators at 4°C, 25°C, 37°C (control), 37°C Coiled, and 44.5°C**
3. **Milk**
4. **Hot plate**
5. **Sterile tongue depressors for tasting**
6. **(1) 250ml beaker**
7. **Thermometer (°C)**
8. **Stirring rod**
9. **Starter culture or active yogurt from the local store and from home (brought in by students)**
10. **Fruit preserves for Week 2 (Optional)**

Procedures for WEEK 1:

1. Label FOUR Styrofoam cups with the following temperatures: 4°C, 25°C, 37°C, 44.5°C (Control), and 37°C boiled. Keep cups covered.

2. Carefully pour 100ml of fresh milk into each cup.

3. Inoculate each beaker with a small amount of the yogurt provided or the yogurt from home as indicated by your TA, using the same amount for each cup. Use a sterile stirring rod in order to mix in the yogurt.

4. Cover all cups back with foil.

5. Grab the cup labeled “37°C boiled” and place into a glass beaker and set above a Bunsen burner in order to boil at 100°C for 2 minutes without over boiling or burning. Remove from heat and allow to cool.

6. Incubate each cup and the beaker at the appropriate temperature.

7. Gram stain a sample of your original yogurt source used. Record your data in your worksheet.

Procedures for WEEK 2:

1. Obtain your cups and beaker that were incubated at varying temperatures.

2. Use a sterilized tongue depressor in order to stir and taste your yogurt.

3. Gram stain a sample from the 44.5°C control cup by placing a loopful of yogurt and allowing to dry onto a slide. Record your data in your worksheet.

Part I. Production of Yogurt
Directions: Score your yogurt outcome (texture, smell) and taste using +++, ++, +, -

Condition	Outcome	Taste
4°C		
30°C		
37°C		
37°C Boiled		
44.5°C (Control)		

Part II. Microscopic Observation
Directions: Record your cellular morphology drawings and gram stain results.

Source	Morphology	Gram Reaction
Commercial Yogurt		
DIY Yogurt		

Part II. Questions

1. Why is the shelf life of pasteurized yogurt longer than that of unpasteurized yogurt?

2. What was the optimum temperature for the production of the common food we call yogurt? Why do you suppose the other temperatures were not successful?

3. What were the consequences of boiling your milk after inoculation? What does this tell you about the pasteurization process in yogurt making?

4. List and explain THREE other factors can affect the proper formation of yogurt.

    a. .

    b. .

    c. .

5. Were there any differences in the gram stain between the commercial yogurt and the DIY yogurt? Under the microscope, which bacterium appears to be more dominant in your stain? Is there a possible reason for this?