1.2 Micro-organisms

Good Microbes

Learning Outcomes
All students:
• Will understand that good microbes can help keep us healthy
• Will know that bacteria can be put to good use

Background Information
Bacteria are single-celled organisms most of which are helpful or beneficial although some of these cause illness and disease. One of the main ways in which bacteria are beneficial is in the food industry. Cheese, bread, yogurt, chocolate, vinegar and alcohol are all produced through the growth of bacteria. The bacteria used to make these products cause a chemical change known as fermentation – a process by which the bacteria break down the complex sugars into simple compounds like carbon dioxide and alcohol. Fermentation changes the product from one food to another. When the bacteria Streptococcus thermophilous or Lactobacillus bulgaricus are added to milk they consume the sugars during growth, turning the milk into yogurt. So much acid is produced in fermented milk products that few potentially harmful microbes can survive there. Lactobacillus bacteria are generally referred to as good or ‘friendly’ bacteria. The friendly bacteria that help us digest food have been termed probiotic bacteria, literally meaning ‘for life’. It is these bacteria that we find in our yogurts and probiotic drinks.

Materials Required
Per student
- SW 1
- SH 1
Per group
- 1 pint of whole pasteurised milk
- 1 carton of plain yogurt
- Fruits, jams and other flavourings
- Powdered skim milk
- Measuring spoons and cups
- Thermometer
- Hot plate
- Aluminium foil
- Oven resistant cups

Advance Preparation (10 min)
1. Copy SW 1 and SH 1 for each student.
2. Purchase a carton of fresh plain yogurt, powdered skimmed milk and an array of flavouring materials.

Top Tip
You may want to take the mixture home to incubate in your oven for 9-15 hours or set up a water bath in the classroom if available.

Health and Safety
- It is recommended that a supervisor boil the mixture.
- During cooking, students should wear protective aprons.
1. Begin the lesson by explaining that microbes can have both harmful and beneficial effects on our health. Ask the class what they know about good or ‘friendly’ bacteria. Many children will have already heard about probiotic bacteria in yogurts.

2. Explain that microbes are helpful in the breakdown of dead animals and plants, in helping animals and humans digest foods and in turning milk into yogurt, cheese and butter.

3. Highlight that yogurt is made from milk by helpful bacteria. The bacteria eat the sugars present in food and produce acids. These acids change the taste, smell and form of the original foodstuff.

4. Tell the class that in this activity they are going to see exactly how we can use good friendly bacteria to make yogurt from milk.

**Main Activity (25 min)**

1. This activity can be done as an entire class or in smaller groups. If done in smaller groups, it is important to have at least one responsible adult to supervise each group.

2. Supply the class or groups with the yogurt recipe (SH 1).

3. Highlight to the students that there are good live bacteria known as Lactobacillus in yogurt. These good or ‘friendly’ bacteria are known as probiotics and they help us by
   
   a. Defending us against the bad bacteria that can cause disease
   b. Helping us digest some food types

4. Tell the class that the source of friendly bacteria used in making the yogurt will be the bacteria found in the plain yogurt bought in the supermarket.

5. Use one of these samples in step 6 (SH 1) for observation purposes. Have the class record their observations on the student worksheet (SW 1).

6. When the recipe is complete, have students observe the yogurt and record their observations on the student worksheet (SW 1).

**Plenary (10 min)**

1. Check for understanding by asking the class the following questions:
   
   a. What is the process by which the milk is changed to yogurt? *Bacteria growing and using the sugars for energy.*
   
   b. What would have happened if there were no live bacteria in the plain yogurt? *Nothing, it’s the growing bacteria that cause the breakdown of sugars and the change in the milk to occur.*
   
   c. Why was the mixture kept warm overnight? *Most microbes prefer to grow at 37°C and will multiply faster if grown at this temperature. The faster the microbes grow the more breakdown of sugars will occur and the quicker the milk will change into yogurt.*
   
   d. What other food products are made using bacteria or fungi? *Cheese, bread, wine, beer, sour cream.*

**Extension Activity**

1. Provide the class with a copy of SW 2.

2. Each student should go home and search in their kitchen for food they think may contain microbes, they should label whether they think these foods should be kept in the cupboard or in the fridge to slow down growth of bad microbes which may be present.
Add two teaspoons (30 ml) of powdered, skimmed milk to one pint (500 ml) of whole milk.

Bring the mixture to a boil over medium heat for 30 seconds, stirring constantly to kill any unwanted bacteria present.

Cool to 46–60°C.

Place 1–2 teaspoons (5–10 ml) of live yogurt in the cool milk mixture.

Stir this mixture well using a spoon previously sterilized through boiling or left to stand in very hot water.

Pour the mixture into sterilized cups or dishes and cover them with aluminium foil.

Incubate the mixture at 32–43°C for 9–15 hours until desired firmness is reached.

Add jams, sugars, nuts, fruits etc to add flavour to your yogurt – yummy!

Eat and Enjoy!
1. Follow the instructions in the yummy yogurt recipe.

My Observations

<table>
<thead>
<tr>
<th>Before Incubation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How thick is the milk mixture?</td>
<td></td>
</tr>
<tr>
<td>What does the milk mixture smell like?</td>
<td></td>
</tr>
<tr>
<td>What colour is the milk mixture?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After Incubation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How thick is the milk mixture now?</td>
<td></td>
</tr>
<tr>
<td>What does the milk mixture smell like now?</td>
<td></td>
</tr>
<tr>
<td>What is the colour of the yogurt?</td>
<td></td>
</tr>
</tbody>
</table>

How has the milk mixture changed?

My Conclusions

1. What caused a change in the milk?

2. What did the yogurt that you added to the milk contain?

3. What is this process called?

4. What other food products are the result of bacteria or fungi growing and changing substances?

Fascinating Fact
There are several trillion friendly bacteria in the average human gut.
Look in your kitchen cupboards at home. How many foods can you see that either contain microbes or were produced with the help of microbes?

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Microbe Present</th>
<th>Where should this item be stored?</th>
<th>Tick if in your home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw chicken</td>
<td>Bacteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw meat</td>
<td>Bacteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue cheese</td>
<td>Fungi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td>Bacteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>Bacteria on dirty carrots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast cereal</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td>Yeast used in bread making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salad</td>
<td>Bacteria or viruses if unwashed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemonade</td>
<td>None if not open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginger beer</td>
<td>None if not open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>Yeast in pizza dough</td>
<td></td>
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</tr>
</tbody>
</table>

HINT: remember that many salad dressings contain vinegar and that some cakes and pizza bases are made from dough.

1. Were you surprised to find microbes in your food?
   ______________________________________________________
   ______________________________________________________

2. Which foods surprised you?
   ______________________________________________________
   ______________________________________________________

3. Were there any foods that required special storage, e.g. in the fridge?
   ______________________________________________________
   ______________________________________________________

4. Would any of these make you ill if not stored properly?
   ______________________________________________________
   ______________________________________________________