



Are All Bacteria in Food Harmful?

Introduction

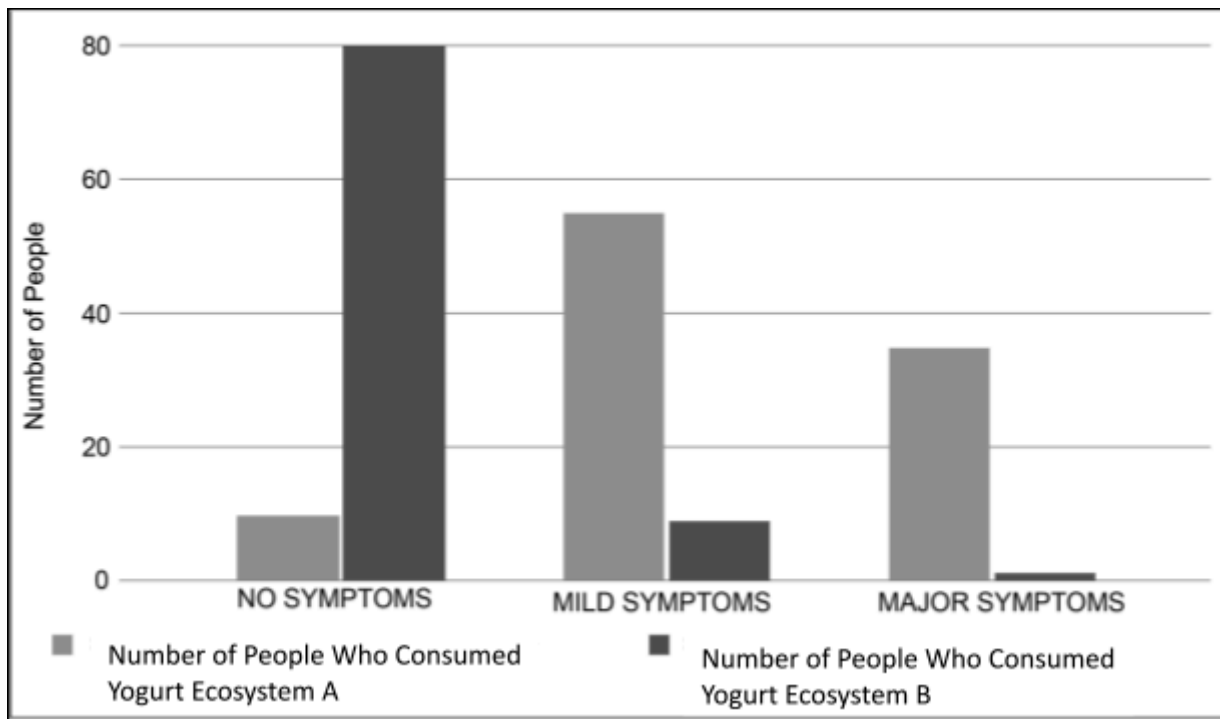
Certain types of bacteria are known to make humans sick, including through food. For centuries, humans have tried to find safe and effective ways to preserve food so humans don't get sick from bacteria. Many people think that having bacteria in our food is always harmful. Are all bacteria harmful for humans, or can some bacteria actually *prevent* food from spoiling and making humans sick?

In this task, you will be investigating two samples of yogurt that are the same in every way except they have different bacteria ecosystems. You will analyze these samples to figure out which types of bacteria in those ecosystems are harmful.

Prompt 1

One group of people consumed Yogurt Ecosystem A and a different group consumed Yogurt Ecosystem B. Look at Source 1 below to compare the symptoms people experienced after eating each food (e.g., stomach cramps, vomiting, and diarrhea).

Source 1. Negative Digestive Symptoms From Consuming Yogurt Ecosystem A and B





- a. Which yogurt ecosystem causes the most negative digestive symptoms and which yogurt ecosystem causes the least negative digestive symptoms?

- b. Make an initial prediction for why there are differences in the digestive symptoms for those who consumed Yogurt Ecosystem A and Yogurt Ecosystem B.



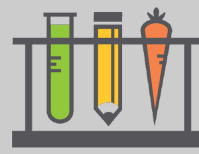
Prompt 2

Now that you know which yogurt ecosystem caused more negative digestive symptoms, analyze more data to help you figure out why. We consider these yogurt samples “ecosystems” primarily because of the presence of various types of living bacteria that consume the sugars in the food. The data table below shows the number of each bacteria present in Yogurt Ecosystem A and Yogurt Ecosystem B.

Source 2. Number of Each Bacteria Present in Yogurt Ecosystem A and B

Type of Bacteria	Number of Bacteria Present in Yogurt Ecosystem A	Number of Bacteria Present in Yogurt Ecosystem B
<i>Salmonella</i>	100 million	20 million
<i>Coliform</i>	400 million	50 million
<i>E. coli</i>	200 million	30 million
<i>Lactobacillus</i>	0	600 million

- a. First look at the total number of bacteria in the two yogurt ecosystems. Why are the total number of bacteria the same in the two yogurt ecosystems? Use what you know about ecosystems and their resources to support your response.



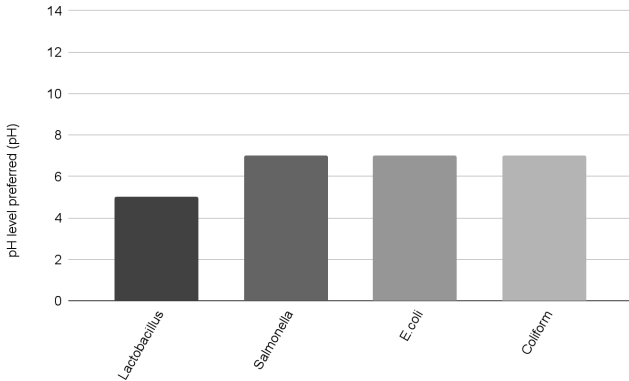
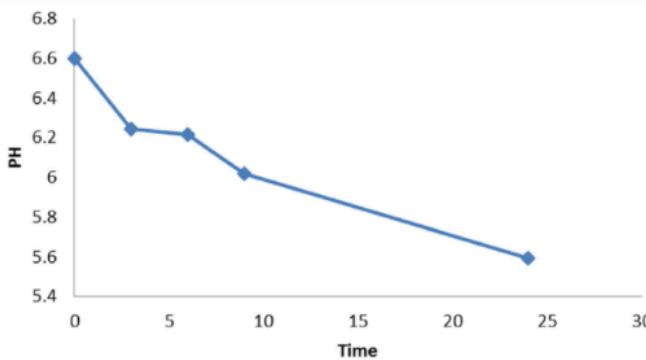
- b. Next, compare the bacteria that make up Yogurt Ecosystems A and B. Cite data from the table to summarize the main differences in the numbers of bacteria in the two yogurt ecosystems.

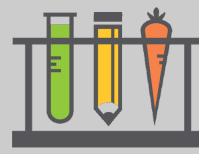
- c. Based on the data, which of these bacteria are more harmful and which are less harmful to humans? Use data from **both** Source 1 and Source 2 to support your response.



Prompt 3

Now that you know which bacteria are more and less harmful to humans, let's investigate conditions that allow each of these types of bacteria to survive. The bacteria in the yogurt ecosystems require certain pH to survive, as shown in Source 3. Source 4 shows what happens to pH when *lactobacillus* is present.

<p>Source 3. Preferred pH Level for Each Bacteria</p>  <table border="1"><thead><tr><th>Bacteria</th><th>Preferred pH Level</th></tr></thead><tbody><tr><td>Lactobacillus</td><td>5</td></tr><tr><td>Salmonella</td><td>7</td></tr><tr><td>E. coli</td><td>7</td></tr><tr><td>Coliform</td><td>7</td></tr></tbody></table>	Bacteria	Preferred pH Level	Lactobacillus	5	Salmonella	7	E. coli	7	Coliform	7	<p>Source 4. pH Level Over Time When <i>Lactobacillus</i> is Present in Yogurt Sample</p>  <table border="1"><thead><tr><th>Time</th><th>pH</th></tr></thead><tbody><tr><td>0</td><td>6.6</td></tr><tr><td>3</td><td>6.25</td></tr><tr><td>6</td><td>6.2</td></tr><tr><td>9</td><td>6.0</td></tr><tr><td>25</td><td>5.6</td></tr></tbody></table>	Time	pH	0	6.6	3	6.25	6	6.2	9	6.0	25	5.6
Bacteria	Preferred pH Level																						
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<p>a. Use Source 3 to describe the differences in the pH levels that each bacteria prefers.</p>	<p>b. Use Source 4 to describe how <i>lactobacillus</i> affects the Yogurt Ecosystem.</p>																						
<p>c. Based on new evidence from Sources 3 and 4, why do you think there aren't high numbers of harmful bacteria in <u>both</u> yogurt ecosystems? Use what you know about factors that affect carrying capacity to support your response.</p>																							



Prompt 4

Many people think that having bacteria in our food is *always* harmful. Construct your own argument to explain how certain bacteria can actually be used to make food safer for humans to eat. Include the following in your argument:

- A claim for why certain bacteria can be helpful to humans
- How one type of bacteria can change the conditions of the food ecosystem and impact the carrying capacity for other types of bacteria present
- Specific evidence to support your argument