Kentucky Summative Assessments

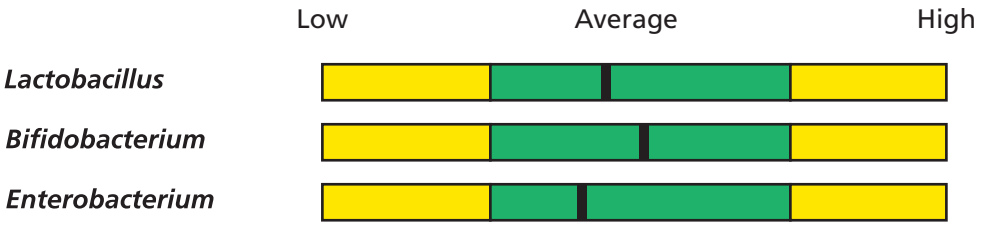
Grade 11 Science

Released Items

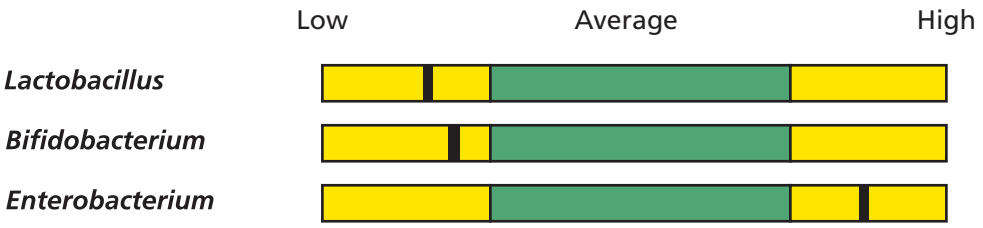
2022

Mr. Smith is a healthy 40-year-old man. He was interested in losing a few pounds, so he decided to eliminate all table sugar from his diet and replace it with a new kind of low-calorie artificial sweetener. However, Mr. Smith has suffered from diarrhea after the change. Mr. Smith's doctor checked his stool (feces) for abnormalities. The results of his labs are compared to normal results.

Normal Results



Mr. Smith's Results



The gastrointestinal tract in humans is an ecosystem that involves complex interactions between bacteria and other abiotic and biotic factors. Three species of bacteria present in the gastrointestinal ecosystem are *Lactobacilli*, *Bifidobacteria*, and *Enterobacteria*. All three species of bacteria consume carbohydrates in order to survive and reproduce.

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BI1701_02_1,2

Based on the change observed after the introduction of the sweetener to Mr. Smith's diet, which of these claims would it be reasonable to investigate?

Select **two** correct answers.

A A lower number of *Lactobacilli* might be the cause of his illness.

B A lower number of *Bifidobacteria* might be the cause of his illness.

C A lower number of *Enterobacteria* might be the cause of his illness.

D An increased number of *Bifidobacteria* might be the cause of his illness.

E A change in the total number of bacteria might be the cause of his illness.

Mr. Smith's doctor reads about a study done on the impact of the sweetener on intestinal bacteria. Four trials were done in the study:

Trial 1: Cultures of the three bacteria were placed in an environment with 100% artificial sweetener under environmental conditions that supported their growth for 72 hours.

Trial 1

Bacteria Colonies	Time = 0	Time = 72 hours
Lactobacillus	1	0
Bifidobacterium	1	0
Enterobacterium	1	0

Trial 2: Cultures of the three bacteria were placed in an environment with a 50% mix of the artificial sweetener and ordinary table sugar under environmental conditions that supported their growth for 72 hours.

Trial 2

Bacteria Colonies	Time = 0	Time = 72 hours
Lactobacillus	1	75–100
Bifidobacterium	1	75–100
Enterobacterium	1	75–100

Trial 3: Cultures of the three bacteria were placed in an environment with 100% ordinary table sugar under environmental conditions that supported their growth for 72 hours.

Trial 3

Bacteria Colonies	Time = 0	Time = 72 hours
Lactobacillus	1	>3,000
Bifidobacterium	1	>3,000
Enterobacterium	1	>3,000

Trial 4: The bacterial colonies that were grown in Trial 3 were counted and then fed with the artificial sweetener and counted again after 72 hours.

Trial 4

Bacteria Colonies	Time = 0	Time = 72 hours
Lactobacillus	>3,000	750
Bifidobacterium	>3,000	810
Enterobacterium	>3,000	1,700

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BI1701_03_2,3

Which of these claims about the impact of the sweetener could reasonably be investigated based on the pattern seen in the data?

Select **two** correct answers.

A The artificial sweetener increases growth of *Enterobacteria, Lactobacillus* and *Bifidobacteria*

B The artificial sweetener limits growth of *Enterobacteria*, *Lactobacillus* and *Bifidobacteria*

C Artificial sweetener has a less negative impact on *Enterobacteria* than *Lactobacillus* and *Bifidobacteria*

D The artificial sweetener does not impact *Lactobacillus* and *Bifidobacteria* but limits *Enterobacteria* growth

E The artificial sweetener does not impact *Enterobacteria* but limits *Lactobacillus* and *Bifidobacteria* growth

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BI1701_04_4

Which trial in the study was **most likely** performed to investigate the claim that a lower number of *Lactobacilli* and *Bifidobacteria* might be the cause of Mr. Smith's illness?

A Trial 1

B Trial 2

C Trial 3

D Trial 4

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BI1701_05_1

Which trial in the study provides the **best** evidence that the artificial sweetener functions as a low-calorie sugar substitute (i.e., does not provide usable carbohydrates) to Mr. Smith's intestinal bacteria population?

A Trial 1

B Trial 2

C Trial 3

D Trial 4

BI1701_00c

Mr. Smith's doctor suggests to him that the addition of the artificial sweetener to his diet is the reason the stability of his internal ecosystem has been disrupted.

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BI1701_09_4

Which experimental result shown on Tab 2 (Study Results) **best** supports the claim that the addition of artificial sweetener to Mr. Smith's diet is the cause of his illness?

A In Trial 1, none of the bacteria could grow in the environment composed of 100% artificial sweetener.

B In Trial 2, all the bacteria were able to grow equally in a mix of sugar and artificial sweetener.

C In Trial 3, all the bacteria were able to grow equally in an environment composed of 100% table sugar.

D In Trial 4, when the three types of bacteria were fed the artificial sweetener, the *Enterobacteria* were less affected by the artificial sweetener.

BI1701_00d

Mr. Smith usually considered ecosystems on a much larger scale and was surprised to learn that it was possible to have a functioning ecosystem inside his body. The doctor explained that the relationship between the different bacteria inside his intestine was similar to the dynamics of other ecosystems.

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BI1701_07_2

Which example from a different ecosystem **best** illustrates the situation happening inside Mr. Smith's intestine?

A Flooding allows nonnative fish in a pond to escape into rivers and reproduce.

B Runoff from mining inhibits grass growth, causing the moss population to increase.

C A slow change in climate causes established species to migrate to a different elevation.

D A new predator migrates into an ecosystem, eats too many rabbits, and the fox population declines.

Mr. Smith is considering several possible treatment options to resolve his symptoms due to the imbalance in his intestinal ecosystem. He is resistant to removing the sweetener from his diet because he is afraid of gaining weight, but he only has a limited amount of money to pay for other options.

Treatment Option	Cost	Benefit	Negatives	Mechanism
Removing sweetener from Mr. Smith's diet	no additional cost	Removes harmful factor that is likely causing his illness	Recovery time is long because the bacteria return to normal levels slowly	Normal return to environmental conditions within his intestinal ecosystem
Using over-the-counter bacteria replacements (probiotics)	moderate	Supplements normal, healthy ecosystem inhabitants (bacteria) quickly	Can cause gas, bloating	Restores healthy bacterial balance to his intestinal ecosystem quickly
Using broad-spectrum antibiotics (available by prescription)	high	Can stop growth of harmful bacteria quickly	Can cause side effects including allergic reactions, gastrointestinal distress	Reduces the population of all bacteria in the body, including those causing distress in his intestinal ecosystem
No change, continue using the sweetener	no additional cost	No unknown side effects from untried drug or treatment options	Diarrhea will probably continue or worsen	N/A
Substitute another type of artificial sweetener	low	Removes likely factor causing his illness	Will probably not improve the imbalance in his intestinal ecosystem quickly	Removal of factor causing the bacterial imbalance

GO ON ▶

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BI1701_08

Evaluate the treatment options. Explain which **two** treatment options you think are **best** and the reasons for your choices. Describe how important you considered each of the criteria listed (cost, benefit, negatives, mechanism) in deciding which treatment options were best.

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