Sugar and Yeast Reactions

Problem/Question

- What sugars and their varied amounts affect yeast growth?

Hypothesis

- If we use sucrose at a higher amount then the yeast will grow at a faster rate because the yeast will respond quicker and multiply faster.

Variables

- Independent Variable:
  - Types of sugars and their amounts.
- Dependent Variable:
  - How much carbon dioxide that the yeast produces in a certain amount of time.
- Controlled Variables:
  - Amount of yeast and water
  - Time given for yeast to grow
  - Water and yeast temperature
  - Size of container and water bottle

Materials

- Sucrose, Dextrose, Fructose, and Lactose.
- Warm Water at 105°F
- Thermometer
- Balloons
- 16.9 fl oz water bottle
- String
- Timer
- Tape measure
- 900 ml container

Materials

- .616 ml measuring spoon
- 1.23 ml measuring spoon
- 2.46 ml measuring spoon
- 3.69 ml measuring spoon
- 4.93 ml measuring spoon
- 59.15 ml measuring cup
- Yeast

Procedure

1. Gather the following supplies: Sucrose, 200 ml beaker, tape measure, .616 ml measuring spoon, 4.93 ml measuring spoon, 59.15 ml measuring cup, yeast, water bottle, and balloons.
2. Fill 900 ml container with 700 ml of water. Record on chart.
3. Take 4.93 ml measuring spoon and measure out yeast and pour into empty water bottle.
4. Take .616 ml measuring spoon and measure out the sucrose and pour into water bottle.

Procedure

5. Take 59.15 measuring cup and fill it with warm water at the temperature of 105°F. Pour the water into the water bottle. Quickly put balloon over the water bottle opening.
6. Let water bottle sit with ingredients and set timer for 60 minutes and then record observations as reaction happens.
7. After 60 minutes record additional observations and then tie string at the bottom of the balloon so no gas escapes.
8. Measure the level of the yeast in centimeters and record as an observation.

Procedure

9. Dunk the balloon in 900 ml container with water by using water displacement method, record the final water level on chart.
10. Subtract the final water level from the original water level and record as volume of gas on chart to get the volume of gas produced.
11. Repeat steps 1-10 with the different measurements
12. Repeat steps 1-11 with Lactose, Dextrose, and Fructose.

Data and Observations

Sucrose .616 ml

Trial	Water Before (ml)	Water After (ml)	Volume of Gas (ml)
1	700	740	40
2	700	750	50
3	700	750	50
		Average	46.6

Data and Observations

Averages for .616 ml

Sugar	Volume of Gas produced (ml)
Sucrose	46.6
Lactose	0
Fructose	43.3
Dextrose	46.6

Averages for 1.23 ml

Sugar	Volume of Gas produced (ml)
Sucrose	116.6
Lactose	0
Fructose	136.6
Dextrose	168.3

Averages for 2.46 ml

Sugar	Volume of Gas produced (ml)
Sucrose	173.3
Lactose	0
Fructose	473.3
Dextrose	320

Averages for 3.69 ml

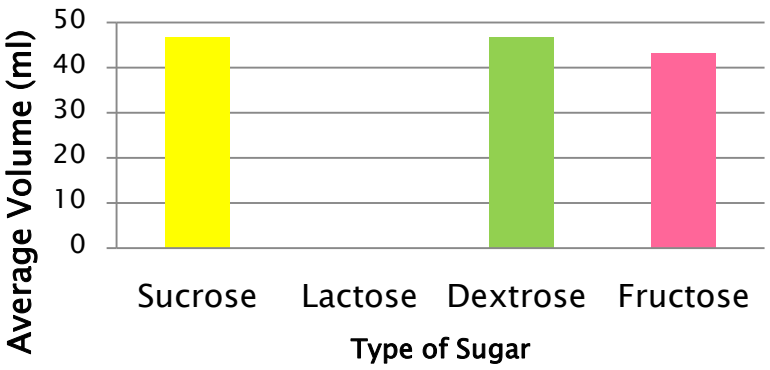
Sugar	Volume of Gas produced (ml)
Sucrose	553.3
Lactose	0
Fructose	506.6
Dextrose	256.6

Data and Observations

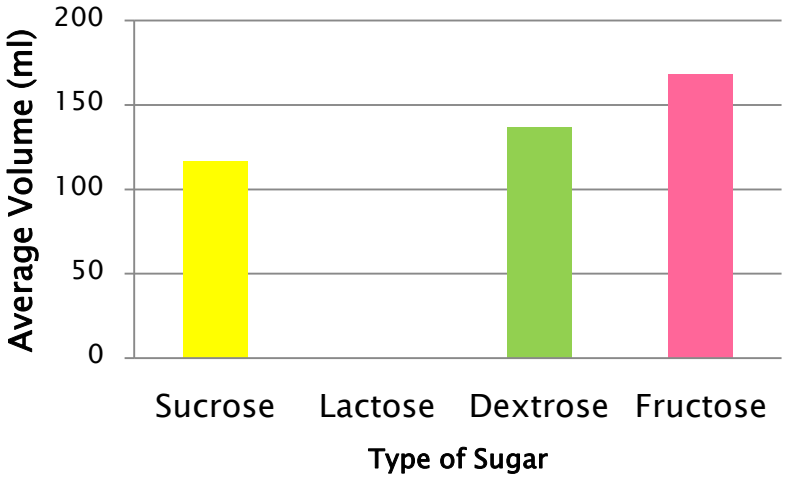
In our experiment we used the water displacement method to determine the volume of gas produced by the yeast. In all of the sugars, except lactose the average time that the balloon was standing upright on its own was 5 minutes. We observed that lactose was almost creating a vacuum because it was sucking the balloons into the bottle. The higher amount of sugar the bigger the balloons got.

Graphs

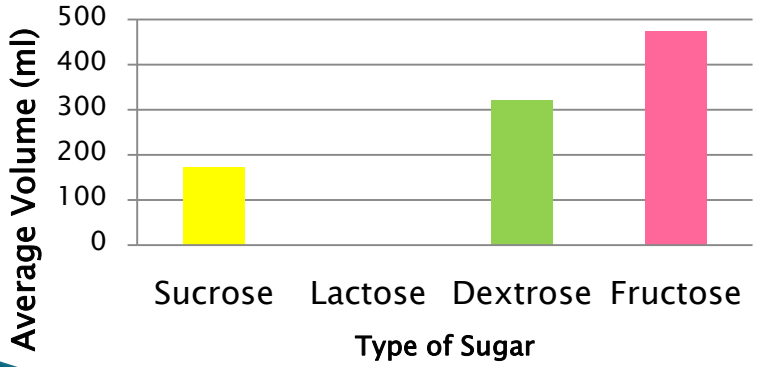
.616 ml



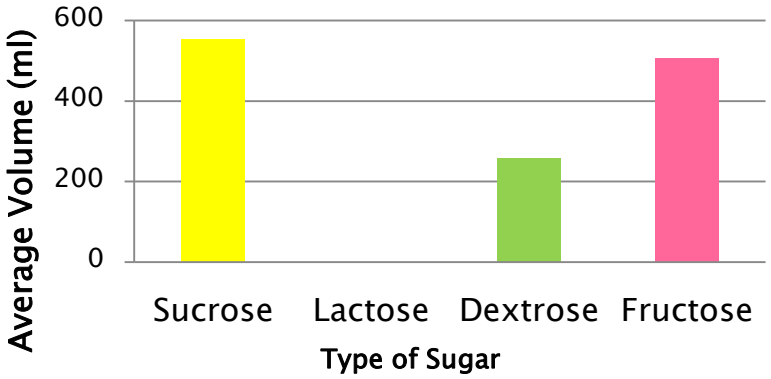
1.23 ml



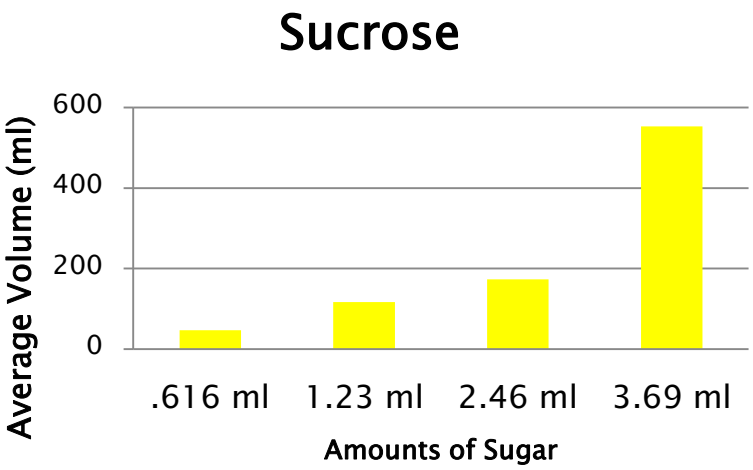
2.46 ml

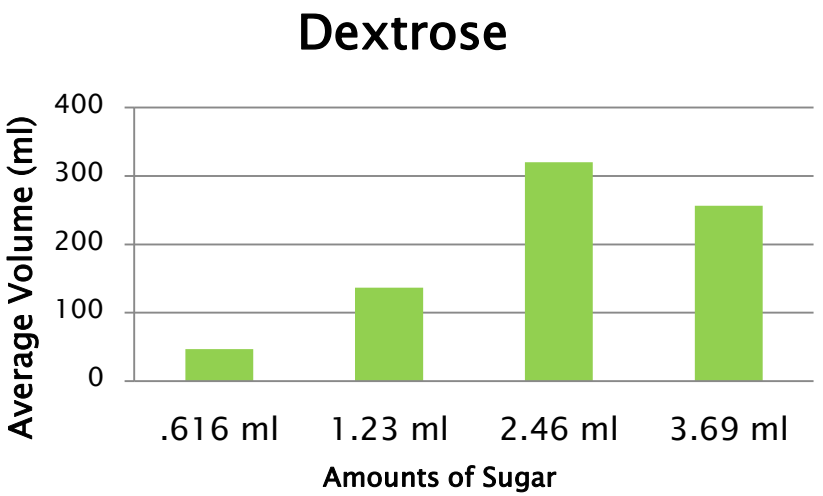


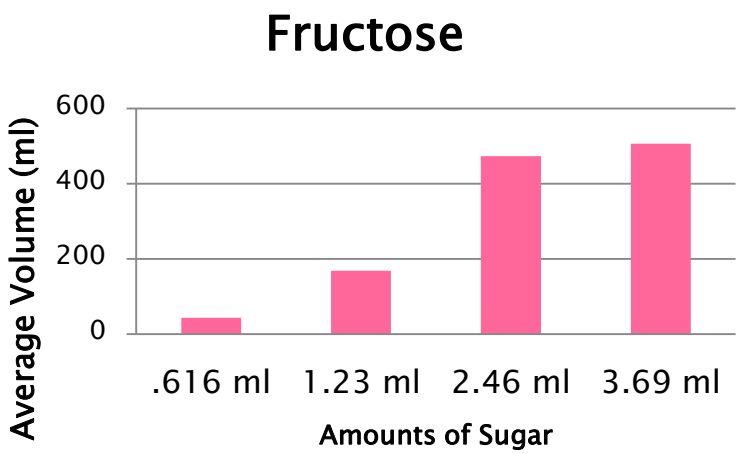
3.69 ml



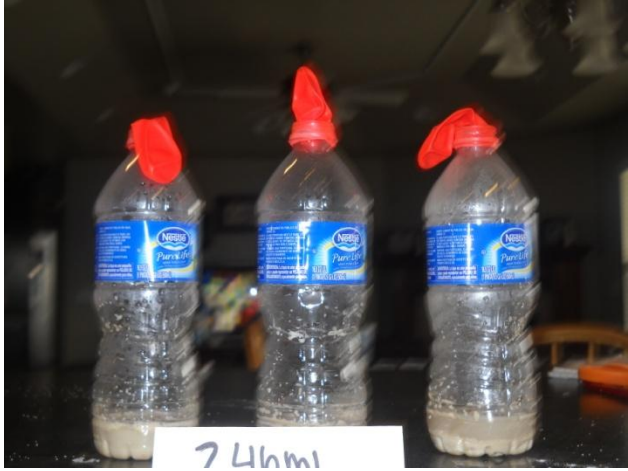
Graphs


Sucrose
Average Volume (ml)
600
400
200
0
.616 ml
1.23 ml
2.46 ml
3.69 ml
Amounts of Sugar


Dextrose
Average Volume (ml)
400
300
200
100
0
.616 ml
1.23 ml
2.46 ml
3.69 ml
Amounts of Sugar


Fructose
Average Volume (ml)
600
400
200
0
.616 ml
1.23 ml
2.46 ml
3.69 ml
Amounts of Sugar

Evaluation of Data



The sugar lactose made the yeast not produce carbon dioxide. It made the balloons shrivel up. With sucrose the higher the amount there was, the more gas was produced. The average gas produced of .616 ml was 46.6 ml and the average amount of gas produced of the amount of 3.69 ml was 553.3 ml. With the sugar dextrose results were similar to sucrose. The .616 ml average was 46.6 ml and the 3.69 ml average was 256.6 ml. But it didn't produce as much carbon dioxide as sucrose. Fructose had similar results, .616 ml average was 43.3 ml and 3.69 ml had an average of 506.6 ml. The data for dextrose tells us that with a small amount of sugar the reaction was slow and then in the middle it had a peak of growth and then slowed down again with the bigger amounts of sugar. Fructose and Sucrose increased in volume as the amounts got higher.

Evaluation of Data

Patterns that we saw were that the higher the amount of sugar the greater the volume of gas was produced in all of the sugars except for lactose. This is because the yeast has more food to get energy from to grow. With the small amounts the yeast didn't have much food to get its energy from to grow. There is not one sugar that dominated in all of the amounts. However, it was usually between fructose and sucrose that produced the most gas. We got the results we did because of the sugar and its amounts.

Conclusion

Our hypothesis was, if we use sucrose at a higher amount then the yeast will grow at a faster rate because the yeast will respond quicker and multiply faster. Our data did support our hypothesis. With the amount 3.69 ml in sucrose the average gas volume was 553.3 ml, which was the highest volume of all the trials. Fructose did come close with an average of 506.6 ml and dextrose had an average volume of 256.6 in the 3.69 ml amount trial.

Analysis and Reflection

In this experiment we learned that sucrose produces the most gas with the higher amount of sugar. We learned that the higher the amount of sugar the more gas is produced. We saw this in the data collected in every type of sugar. We also learned that lactose does not react with yeast at all because the balloons did not inflate, instead they shriveled up.

Errors we made in our experiment were the placement of the balloon. We saw this when the balloon wasn't centered over the opening of the water bottle so the balloon didn't blow up as well as when the balloon was centered. Sometimes our measuring wasn't as accurate as other times. This affected our results because the yeast didn't show that it produced as much gas as it could have with the accurate measuring or placing of the balloon. Humidity of the air and the temperature of the room could have also affected our results. Also when we tied the balloon off a couple times we didn't tie it tight enough so some of the gas escaped. That is why some trials have unusual numbers.

Application and Future Experimentation

This experiment applies to real life because sucrose produced more gas than any other sugar. This shows that in making bread sucrose works better than any other sugar. This makes it easier so you don't have to buy a certain kind of sugar to make your yeast raise more.

For future experimentation you could test different kinds of sugars and more household sugars like brown sugar, powdered sugar, etc. You could also test how unsweetened sugars react with yeast to see if you could use those in bread making. You also could make bread with these types of sugar and see if it affects taste or the appearance of the bread.