Effects of Different Natural Sugar Sources on Yeast Growth and Viability

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Biology 160: General Biology

Abstract

Our study examined how plant-derived sugars (sucrose, agave, and honey) affect yeast growth over three weeks. The hypothesis was that natural sugars (agave and honey) would have greater yeast growth than the more processed sugar, sucrose. By week three, our data partially supported this hypothesis, as honey produced the highest number of live cells among the sugars tested. However, the water control showed the highest overall cell count, suggesting other things also influence growth. This research is important because it helps us understand how different energy sources impact cell growth.

Introduction

Yeast growth is commonly used as a model to show how organisms obtain and use energy from different sources. Sugar is a primary source of energy for yeast; however, we wanted to test how more processed sugars versus more natural sugars affected yeast growth. The difference can influence how efficiently yeast grow and survive.

Previous research explains that simpler sugars that are easier to digest can lead to faster growth rates (Groves, 2018). Because honey and agave are both primarily monosaccharides, we proposed the idea that they would lead to a higher percent of yeast growth. Whereas sucrose, which is a disaccharide, may be harder to metabolize.

This study examines how different types of sugar affect yeast growth over time. Our independent variable was the type of sugar solution (honey, agave, sucrose, or water as our control). The dependent variable was the yeast growth, measured by both live and dead cell count and percent viability over three weeks.

Methods

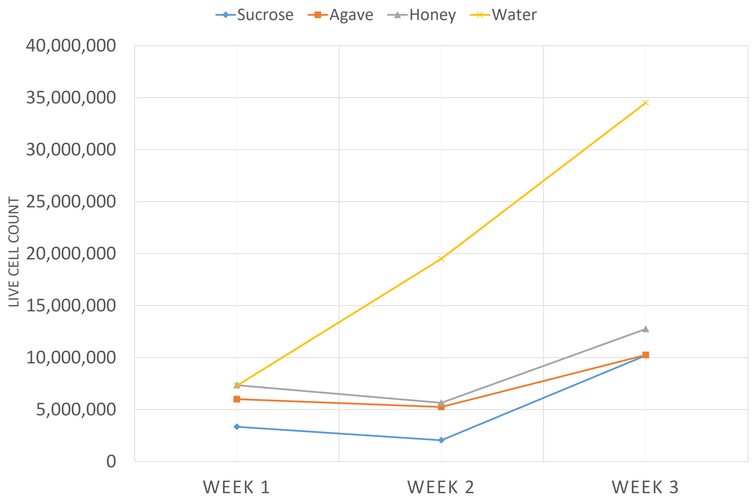
Materials & Location

The experiment was carried out in a biology laboratory using Saccharomyces cerevisiae, a type of yeast. The materials included 20% sugar solutions made of honey, agave, and sucrose, distilled water as the negative control, a solution of yeast, methylene blue, a hemocytometer, pipettes, test tubes, and a microscope, all of which were at room temperature.

Procedure

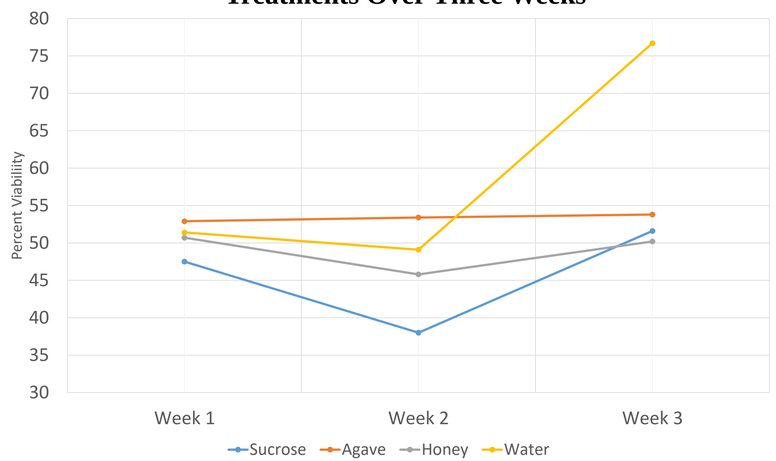
20% (w/v) sugar solutions were prepared for all types of sugar. For each type of sugar, 10 mL of sugar solution was mixed with 10 mL of yeast solution, making a total of 20 mL solution. A negative control sample was prepared by mixing 10 mL of distilled water instead of sugar solution with 10 mL of yeast solution. All these samples were prepared at the beginning of the experiment, and the growth of the yeast was monitored over a period of three weeks. During each time interval, a portion of the sample was taken, while the rest of the sample was kept as it was. Then, the sample was mixed with methylene blue stain, allowing the differentiation between dead and live cells. The count of yeast cells was performed by using a hemocytometer under a microscope at 400x magnification. Five large squares of the hemocytometer were counted, and the results were calculated as averages.

Live Cell Count Under Different Sugar Treatments Over Three Weeks



This data shows changes in cell growth over three weeks for sucrose, agave, honey, and water treatments. Cell count was measured using a methylene blue live/dead staining method and averaged between two counters. The independent variable is time (weeks), and the dependent variable is live cell count (cells/mL). Live cell counts increase over time, with water showing a significantly greater increase than the other treatments.

Percent Viability of Cells Under Different Sugar Treatments Over Three Weeks



This graph shows the percent viability of cells grown in different sugar solutions (agave, honey, sucrose) and water over three weeks. It compares how each treatment affects the proportion of living cells relative to the total cells. Overall, the data shows how different sugar sources and water influence cell survival over time.

Discussion

The results of this experiment partially supported our original hypothesis. Over the three-week period, the yeast growth shown in the honey sugar solution showed the highest live cell count over the other sugar solutions. However, water showed the highest amount of yeast growth, with the most amount of live cell count over the three weeks. In terms of percent viability, water had a high increase by the last week, whereas sucrose had the lowest viability percent.

These results suggest that while natural sugars, such as honey, can increase yeast growth compared to more processed sugar alternative, sucrose, there are likely other factors that influenced our results. One thing that may have happened is that the yeast may have adapted to the low-nutrient conditions of the water, allowing the yeast to continue growing. Another possible explanation for our outcomes may be our measurement techniques or contamination which may have altered the results. A similar study supports these findings with the general idea that simpler sugars lead to more/faster yeast growth (Verhagen et. al., 2025).

There are also known limitations in this experiment. Our first limitation is human error in terms of cell counting because it had to be done manually. Our second limitation is our lack of ability to test different concentrations of sugar because we only tested sugars at 20% in solutions. Our final limitation is possible contamination and varying temperatures, which could have changed the outcome.

Future research could improve our experiment with automatic cell counting and or more trials of counting per slide, therefore reducing error in count. Using multiple different concentrations of sugars and a more secured lab could also give more accuracy for this experiment.

Acknowledgements

We would like to thank our professor for providing guidance and assistance throughout the experiment. Additionally, we would like to thank the WCC lab staff for providing prepped materials such as the diluted sugars.

References/ Work Cited

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