The Effect of Alternative Sugars on Yeast Reproduction

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Biology 160

Abstract

The present experiment has studied the impact of different types of sugars on yeast (Saccharomyces cerevisiae) growth. Different sugars including aspartame were given to yeast and their growth rates were taken. We selected this kind of research to study the artificial sweetness' effect on the cells, thus giving us a clearer vision of their influence on our body. It is presumed that in the case of aspartame, yeast growth should be less than the other sugars, thus demonstrating that certain sweeteners might hinder the process of cell reproduction.

Introduction

Yeast have become a popular choice among scientists as a model organism for their research on fermentation and microbial growth under various sugar conditions. In one research, the effect of glucose, maltose, and the artificial sweetener aspartame on the growth and respiration of the yeast Saccharomyces cerevisiae was tested over a duration of 24 hours. They noted variations in cell viability and metabolic output according to the type of sugar used (Naredla et al., 2019). In another experiment, the impact of aspartame and other additives on the growth and survival of the spoilage yeast Zygosaccharomyces bailii was investigated under acidified, low-sugar conditions, and it was found that aspartame changed growth kinetics and stress responses (Gliemmo et al., 2013). Drawing from this evidence, the current study aims to look into the effects of various alternative sugars on yeast reproduction, with the main hypothesis stating that yeast will grow less when using aspartame as one of the alternative sugars than when using other alternative sugars.

Methods

Materials & Location

For this lab to be successful, we used a variety of materials necessary for preparing yeast solutions and measuring their reproduction for our experiment. The biological materials included active dry yeast packets, which were mixed with distilled water to create our starter solution. The alternative sweeteners tested in the experiment were Sucrose, Zero Calorie Sweetener, Sweet'n Low, Stevia, and Aspartame. The laboratory equipment used included a pipette, serological pipettes, micropipettes, plastic tubes, a hand tally counter, methylene blue stain, a hemocytometer, and a compound microscope. All experimental work was conducted in our classroom laboratory over a few weeks.

Procedure

We began the experiment by preparing 50 mL of a yeast-and-water mixture using active dry yeast packets, and the lab staff created additional mixtures containing each sweetener. The following week, each mixture was diluted 1:5 with methylene blue, and a small sample was transferred to a hemocytometer. Using a microscope and hand tally counter, we counted live and dead cells in one grid square following standard boundary rules. We then calculated the corrected cell concentration by applying the dilution factor and multiplying by 10,000, followed by determining total cells and percent viability. In Week 2, we repeated the same process using a 1:10 dilution, and in Week 3, we repeated it again with a 1:20 dilution. All steps were performed consistently across the weeks to compare yeast reproduction across different sweeteners.

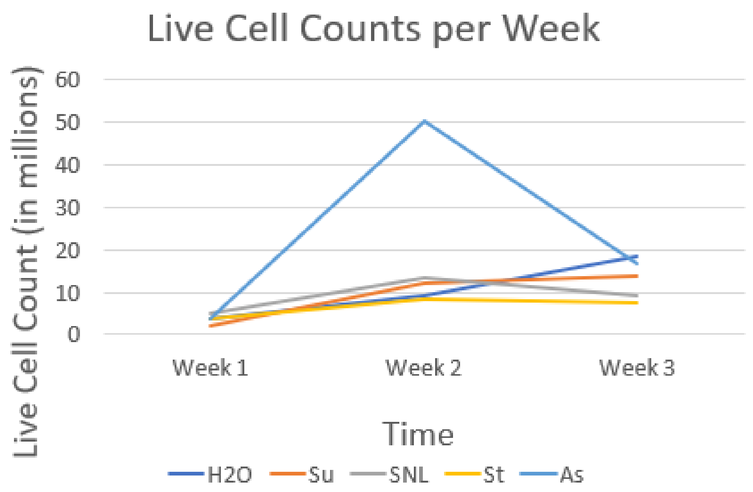

Figure 1. This figure illustrates the count of live yeast cells per week, averaged between two counts of sixteen squares on the hemocytometer, with different colored lines to differentiate the various sugar types included, being the control water (H2O), Sucrose (Su), Sweet'N Low (SNL), Stevia (St), and Aspartame (As). Cell counts are represented in millions, e.g. 10 equals 10,000,000.

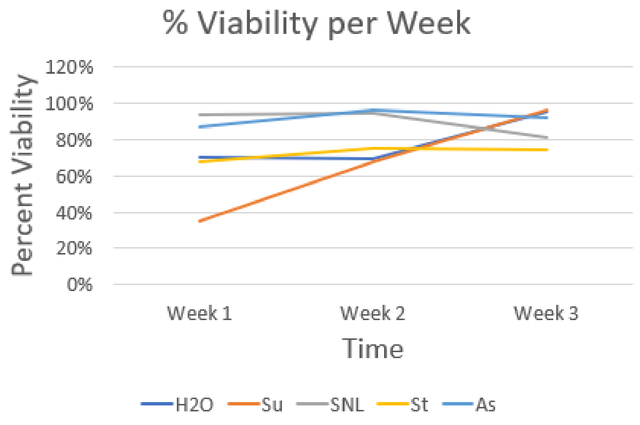

Figure 2. This figure shows the variation in percent viability per week. Categories are once again broken into each kind of sugar and the control.. Percent viability is calculated by live cells divided by total cells per week, averaged between two counts of sixteen squares on the hemocytometer.

Discussion

The experiment clearly indicated a strong correlation between yeast reproduction and the type of sugar consumed. The yeast given sucrose did the best, having the highest live-cell count and percent viability over three weeks. When given Sweet'N Low the yeast performed moderately, and when given aspartame the yeast cells had the lowest cell counts and viability. These findings supported our original hypothesis, of which being that aspartame would lead the yeast to produce the lowest live-cells and the lowest viability.

These results align with other studies that show artificial sweeteners do not serve as effective metabolic substrates for *Saccharomyces cerevisiae*. These studies concluded fermentable sugars support yeast respiration and growth (Naredla et al., 2019), while artificial sweeteners are unable to be metabolized via typical glycolytic pathways (Glimeno et al., 2013). This explains why little yeast reproduction was shown in our experiments when the yeast was given artificial sweeteners, whereas the yeast reproduced well in an environment with fermentable sugars. The Sweet'N Low performed moderately, which is also supported by the findings of other studies, as these studies showed that saccharin does not supply usable carbon sources necessary for efficient cell division. While our results were supported by published research, certain limitations may have impacted our results, leading to slight inconsistencies. These limitations may have included variations in mixing, inoculum size, or counting errors. Our experiment was conducted in a classroom, so fluctuations in classroom temperature may have also impacted our results.

These findings show that artificial sweeteners do a substantially worse job at supporting yeast metabolization as compared to natural sugars, leading to lower levels of reproduction and worse viability. In future research there should be a focus on how different concentrations of sweeteners affect yeast reproduction, as well as how combinations of fermentable sugars and artificial sweeteners support metabolization. Future studies should also test a wider range of artificial sweeteners in order to improve reliability of the findings.

Acknowledgements

We would love to acknowledge our lab staff who acquired our random sugar selection for this experiment. Their support behind the scenes has made this project possible, and while we don't necessarily know their names, their assistance is much appreciated. We would also like to thank Lauren for support throughout this class and project. It's been an absolute joy taking this class and having someone so knowledgeable to guide us.

References/ Work Cited

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