

How Alternative Sugars Affect Fermentation Rates in Active Dry Yeast

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Biology 160: General Biology

Abstract

Our focus was to test which sugar substitutes would be best making bread. We hypothesized that traditional table sugar (sucrose) and coconut sugar would react the most with our yeast samples. The data collected proved our hypothesis to be correct, with table sugar reacting slightly more than coconut sugar. With this knowledge, people looking for a healthier option to table sugar should try coconut sugar the next time they decide to make bread from scratch.

Introduction

Recently there's been a surge to find healthy substitutes for the foods we love, without sacrificing the taste. Bread is an essential part of many of our diets, but it's not exactly the most healthy thing we consume. Some research had already been done on the topic of making bread without sugar (Sanchez 2021) as well as whether or not yeast can metabolize with artificial sweeteners (Tarziu 2023). However, we decided that comparing natural and artificial sweeteners would be useful information for all bakers to know. Our group decided to find if there were any alternate forms of sugar that could pose as a healthier option to sucrose, while still reacting with yeast efficiently enough to make a tasty loaf of bread.

Methods

Materials & Location

This lab was conducted in a biology lab and used an incubator which was set at 37 degrees Celsius. Other materials included 20% concentration solutions of coconut sugar, stevia, monk fruit, and sucrose, 5g of active dry yeast per trial, a scale, a graduated cylinder, a beaker for weighing and mixing the yeast solution, a spatula for incorporating the yeast solution, 5 test tubes for each trial, pipettes for measuring sugar solutions, and 5 fermentation tubes per trial. Data was collected in the lab using a data table that recorded the start and end times, and measured the duration of time each solution was in the incubator, CO₂ production in mL, and fermentation rate.

Procedure

Weigh 5g of active dry yeast and mix with 50 mL of water. Stir to combine. Label five test tubes and five fermentation tubes appropriately. Add 10 mL of each sugar solution to the appropriate test tube, including one test tube with 10 mL of water as a control. Add 10 mL of yeast solution to each test tube. Transfer the contents of each test tube to the appropriate fermentation tube. Mix each fermentation tube to ensure there are no bubbles at the top of the tube. Transfer all fermentation tubes to the incubator and observe at 5-minute intervals. Record data and repeat five times.

Test 1 Data

Test 1	Water	Coconut Sugar	Monk Fruit	Stevia	Sucrose
Start	10:57	10:57	10:57	10:57	10:57
End	11:41	11:12	11:41	11:17	11:12
Duration	44 min	15 min	44 min	20 min	15 min
CO ₂ (mL)	1.1 mL	6.9 mL	1 mL	7.4 mL	9.9 mL
F Rate	0.025	0.46	0.022	0.37	0.66

Table 1. This is a table that shows the data from the first of 5 trials we completed. Start time, end time, duration of time in the incubator, CO₂ production, and fermentation rate were all recorded and measured.

Fermentation rate of active dry yeast vs. Sugar alternatives

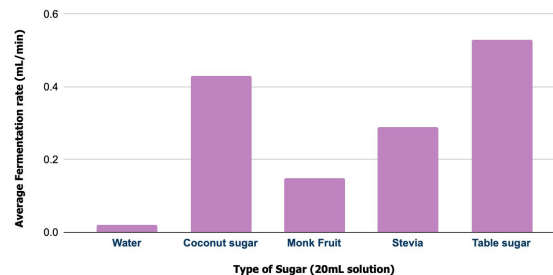


Figure 2. Depicts a bar graph of the four types of sugar tested and water as the controlled variable. The graph shows that Table sugar had the Highest fermentation rate, as Coconut sugar and stevia followed suit.

Discussion

When researching what types of sugar that yeast could feed off of and use to complete the fermentation process, we found that table sugar (sucrose), coconut sugar (fructose), and Stevia, were capable of fermenting active dry yeast. We originally hypothesized that our yeast would only respond to the sucrose and fructose solutions, as they are both naturally occurring sugars and have been used throughout the history of baking. Our results partially supported our hypothesis, as table sugar and coconut sugar had the highest fermentation rates, however we did not predict to see such a similar rate of growth from our stevia and yeast mixture.

Upon further research there have been other tests and trials of the use of alternative sugars in yeast, specifically in the terms of baking. One test kitchen found that natural sugar alternatives performed well when baking bread, noting the slight differences in color and texture but still a great taste (Sanchez, 2021). Another source we found also stated that sugar substitutes can be effective in baking, but argued that white table sugar was the best solution because it was the quickest and easiest to use (Tarziu, 2023). Through more time and resources we would have studied how different temperatures affected yeasts fermentation with substitute sugars.

Our information from this study is very valuable to communities of people who have blood sugar dysregulation, as well as those who are looking for less sugar in their diet. The great thing about stevia being capable of speeding up the process of yeast fermentation is that it doesn't increase blood sugar in the same way that added sugars and the sugars found within fruits can. In fact, A 2013 study on rats that consumed stevia daily had noticeably lower blood sugar levels (Shivanna, 2013). In future studies, Looking into how sugar substitutes react with other essential baking ingredients, such as eggs, baking soda, and flour would be beneficial to market our research to our targeted communities.

References/ Work Cited

- Gill, P., Jang, C., Mesbahnejad, M., & Siu, J. (2021). Effects of white sugar and sugar substitutes on the growth of active dry yeast. *The Expedition*, 12. <https://ojs.library.ubc.ca/index.php/expedition/article/view/196829>
- Sanchez, R. (2021). *Can you make bread without sugar?* Kitchen Seer. <https://kitchenseer.com/can-you-make-bread-without-sugar>
- Shivanna, N., Naika, M., Khanum, F., & Kaul, V. K. (2013). Antioxidant, anti-diabetic, and renal protective properties of stevia rebaudiana. *Journal of Diabetes and its Complications*, 27(2), 103–113. doi: 10.1016/j.jdiacomp.2012.10.001
- Tarziu, C. (2023). *Can yeast metabolize artificial sweeteners?* Oculyze. <https://www.oculyze.net/can-yeast-metabolize-artificial-sweeteners>