The Comparison of Natural and Artificial Sugars in Yeast Protein Growth

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Abstract

This project investigated how natural and artificial sugars affect protein concentration in yeast using the Bradford protein assay. We compared coconut sugar, powdered sugar, and sucrose to a control group with only water. We hypothesized that natural sugars, such as coconut sugar, would lead to higher protein concentration than artificial sugars. Our results showed that coconut sugar generally produced higher protein levels compared to the other treatments, which supports our hypothesis. This research is important because it highlights how different dietary sugars may influence yeast protein production, such as retention of protein and nutrients, providing insights relevant to food science and health.

Introduction

Research question/topic: How do natural and artificial sugars affect protein growth in yeast differently?

Hypothesis: We found that natural sugars would produce higher protein concentrations compared to artificial sugars because they may provide more nutrients/protein retention that yeast can use for protein synthesis.

Independent: Different types of sugars(coconut,powdered,control groups)

Dependent: Protein concentrations

Previous studies support this rationale: recent research shows that yeast responds differently to gradients of sugars such as glucose, fructose, and sucrose, indicating that the type of sugar significantly influences yeast metabolic activity (Verhagen et al., 2025). This suggests that natural sugars may indeed promote stronger protein production compared to refined sugars.

Methods

Materials & Location

All of our experiments were conducted in the WCC Laboratory (KUL 110). Materials that we used include PPE (goggles, gloves), PBS tubes, Bradford Assay reagents, cuvettes, yeast, micropipettes and serological pipettes with pumps, test tubes, microcentrifuge tubes, analytical balance, distilled water, 20% sugar solutions (coconut, powdered, sucrose), an incubator, and laptop. The absorbance was measured with a spectrophotometer calibrated using an online software.

Procedure

- Weigh 1 gram of yeast using an analytical balance and transfer into a test tube.
- With a serological pipette that has a pipette pump attached, measure out 10 mL of each sugar solution (sucrose, coconut sugar, powdered sugar, water, and a control) and add to separate tubes that contain yeast.
- Mix each sample gently, and place all tubes into an incubator for 20 minutes.
- Once 20 minutes have passed, transfer 1 mL of from each tube into separate microcentrifuge tubes and vortex each for a minute.
- Then, add 20 µL of yeast to the PBS tube, and add 980 µL of the Bradford Reagent to a cuvette. After that, add 20 µL of the yeast solution (diluted in PBS) to the cuvette. (Repeat for each sugar sample)
- Invert the cuvettes and let them sit for 2-3 minutes.
- Put the cuvettes into a calibrator for an online spectrophotometer program, and then obtain the absorbance readings.

Sugar Average Protein Concentration in Yeast

Type	Average
Control	0.000
Distilled Water	0.684
20% Sucrose	0.575
20% Coconut	0.673
20% Powder	0.446

Table 1. This table is displaying the absorbance values from the Bradford Assay, comparing the average yeast protein concentrations a using distilled water, 20% sucrose, 20% coconut sugar, 20% powdered sugar.

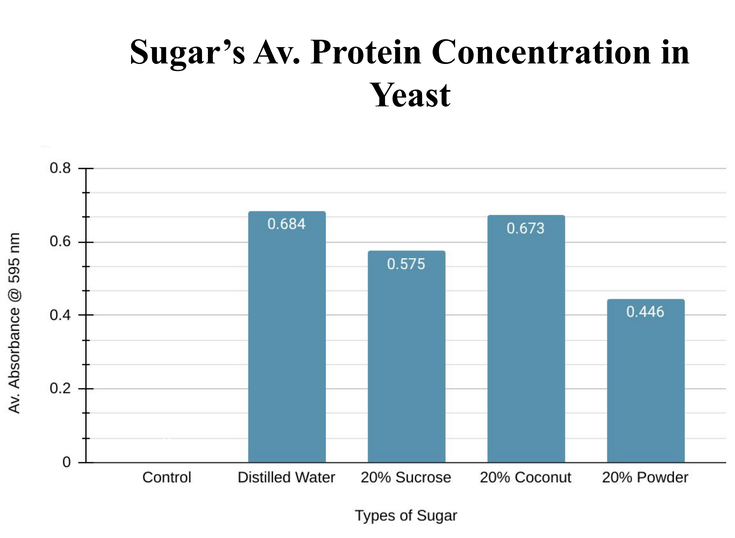

Figure 2. Illustrates our sample of natural sugar, which was 20% Coconut, to have an average higher protein concentration (0.673) than the fake sugars (20% Sucrose and Powder), which had 0.575 and 0.446. Interestingly, our control group of distilled water had a higher protein concentration than all of them (0.684).

Discussion

The results partially supported the original hypothesis that natural sugars, specifically coconut sugar, would produce a higher protein concentration compared to other sugars. Across four trials, coconut sugar yielded an average protein concentration of 0.673, which was higher than that of sucrose (0.575), our control variable (0.000), and powdered sugar (0.446). However, water produced the highest average protein concentration at 0.684, slightly surpassing coconut sugar. This shows that while coconut sugar outperformed the other unnatural sweeteners tested, it did not achieve the highest overall concentration.

These findings align with the journal review by Mahmood et al. (2022) in *Heliyon* from the National Library of Medicine, which reported that: "Sugars from natural sources (unrefined sugar) include a variety of bioactive compounds, minerals, fibers, antioxidants, and phytochemicals that help to decrease inflammation as well as enhance endothelial function." (Mahmood et al., 2022). In this experiment, coconut sugar performed better than sucrose and powdered sugar. However, the difference and the unexpectedly high protein concentration in the water control show that other factors may have influenced it. Some possibilities include the background protein levels in the ingredients or cross-contamination, the interaction of sugars with proteins during heating/incubation, and the accuracy of the protein concentration method (Bradford Assay). A key difference from the *Heliyon* findings is that their conclusions focused minerals, antioxidants, and bioactive compounds, while this experiment focused only on protein content related to yeast. This difference in nutrient focus, along with the controlled environment for the experiment, may explain why a larger advantage for coconut sugar was not seen in lab or praised for its health benefits.

While this study did not rank coconut sugar as the best sugar for maximizing protein concentration, it does suggest that it retains more protein than refined sugars during cooking. This highlights the importance of considering the type of sweetener in recipes where nutrient retention is desired, especially for those who want more calories or protein. Knowing this, separate sources such as kitchen website, *Restaurantware,* theorized that natural sugars don't actually pose that much of an advantage from unnatural sugars, stating: "While honey, maple syrup, and coconut sugar have minimal trace minerals, they don't offer a significant health advantage over white sugar." (Restaurantware, 2025). Future research should examine a wider range of sweeteners, including other natural sugars that are popularly used, such as date sugar and maple sugar, while also incorporating larger sample sizes and more accurate protein detection methods besides the Bradford Assay. Studies should also explore additional health-relevant topics, including vitamin, mineral, and antioxidant levels, overall learning how different cooking methods and temperatures influence nutrient retention across various sugars.

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