Effects of Coca-Cola Varieties on Yeast Protein Synthesis

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Abstract

The Bradford Assay was used to measure protein synthesis in yeast exposed to Mexican Coke, Diet Coke, Regular Coke, water as the negative control, and a 20% sucrose solution as the positive control. We hypothesized that Mexican Coke would produce the highest protein concentration. Absorbance at 595 nm showed that Regular Coke had the greatest protein content, A595 = 0.367, refuting the hypothesis. All Coke treatments exceeded both controls. These findings provide evidence that beverage composition influences protein synthesis in yeast, with potential implications for human cell responses.

Introduction

Soda has been widely studied for health impacts, including increased obesity risk, type II diabetes, and cardiovascular disease. Yet little is known about how it affects protein production in cells. Protein synthesis is essential for cell growth, repair, and normal function. Yeast can be used as a model for human cells because the process is very similar. In our experiment, the type of liquid given to yeast was the independent variable, with different Coca-Cola products, a 20% sucrose solution as a positive control, and water as a negative control. The dependent variable was the amount of protein made, measured using a Bradford assay and a spectrophotometer. We hypothesized that yeast fermenting Mexican Coke would have the highest protein content.

Methods

Materials & Location

In this experiment we used disposable gloves, safety goggles, PBS, plastic cuvettes, labels, a laptop, and a spectrophotometer. A vortex, Bradford reagent, and yeast samples from another group were also used. We collected four sets of data at the WCC laboratory over three separate days.

Procedure

We first put on gloves and goggles for safety. Then added 1 mL of the yeast sample to a yellow centrifuge tube that had glass beads. After that, we vortexed it for 1 minute. The next step is to add 20 µL of yeast to the tube labeled PBS, which already had 980 µL of PBS. Next, we added 980 µL of Bradford reagent to a cuvette. Then we added 20 µL of the yeast in PBS to the cuvette with Bradford reagent together. We capped the cuvette and inverted it 3 times. You should let it sit for 2-3 minutes. To keep things organized we made sure to label.

For our measurements, we opened the Spectral Analysis program and chose “Absorbance vs. Concentration (Beer’s Law)”. The spectrometer has to warm up which takes about 90 seconds. The wavelength was set to 595 nm, and the absorbance of each sample was measured and recorded in a notebook. Measurements are supposed to be taken within 30 minutes!

Averages of Protein Concentration

Mexican Coke	Diet Coke	Regular Coke	Water	Sucrose 20%
.325	.276	.367	.227	.266

Table 1. These numbers are averages we gathered from the trials, data was collected using a spectrophotometer.

Spectrophotometer Absorbance Results

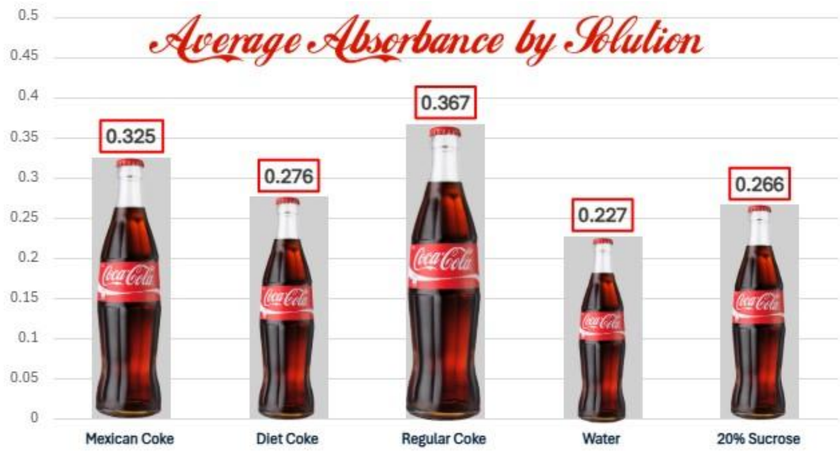

Figure 1. This tasty graph represents the average protein concentration by solution. The results are in light wavelength nanometers as measured by the spectrophotometer. The negative control (water) and the positive control (20% sucrose solution) are on the right.

Discussion

Our hypothesis stated that we expected the yeast fermenting Mexican Coke to have the highest protein content. However, findings after four rounds of testing indicated that the yeast and Regular Coke solution had the highest protein content with an absorbance at 595nm of 0.367, which did not support the hypothesis. The negative control (water) had the lowest level of protein synthesis, and the positive control (20% sucrose concentration) had the next lowest. Every type of yeast and Coke mixture had a higher protein concentration than either the positive or negative controls.

Yeast was an acceptable stand-in for human cells for the purposes of this experiment, thus we can extrapolate that human cells and yeast cells would react similarly when synthesizing proteins from Coca-Cola variations. The fact that every type of Coke concentration gave higher readings on the spectrophotometer than either the positive or negative controls provides evidence that yeast cells, and by extension, human cells, can make proteins more efficiently with any of the tested Coca-Cola variations than with either water or sucrose concentrations, even when taking into account artificial sweeteners. Our hypothesis was disproven by the results here, though one of the four data points for the Regular Coke appeared to be an outlier. This could have skewed the results higher. The downside of only having four data points per individual type of solution means that if outliers were to exist, they would weigh heavily on the final results.

The implication of these findings on health is that human cells are not lacking the ability to synthesize protein when consuming Coke. In fact, they appear to do a better job than they would by consuming water or sucrose. Future experiments in this vein may find it useful to perform multiple rounds of spectrophotometer measurements per batch of fermented yeast in order to reduce the likelihood of outliers.

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References/ Work Cited

Bradford, M. M. (1976). A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein–dye binding. Analytical Biochemistry, 72(1–2), 248–254. https://doi.org/10.1016/0003-2697(76)90527-3

Clark, M. A., Douglas, M., & Choi, J. (2018). Biology 2e. Houston, TX: OpenStax. https://open.umn.edu/opentextbooks/textbooks/167

Goldring, J. P. D. (2019). Measuring protein concentration with absorbance, Lowry, Bradford Coomassie Blue, or the Smith bicinchoninic acid assay before electrophoresis. In B. T. Kurien & R. H. Scofield (Eds.), Electrophoretic separation of proteins (Methods in Molecular Biology, Vol. 1855, pp. 31–39). New York, NY: Humana Press. https://doi.org/10.1007/978-1-4939-8793-1_3