

Abstract

In this experiment we tested the energy drink "Celsius" using fermentation with active dry champagne yeast, to conclude if it speeds up metabolism like it claims. Our hypothesis was "If we increase the amount of Celsius, then the rate of our yeast metabolism will increase." Which is not supported by our data, we found that Celsius increased metabolism less then just sucrose which would be gained through any food intake. This is important because Celsius is claiming that by drinking their drink your metabolism will increase, and we wanted to see if that was true.

Introduction

Yeast is used for many things in science, one way it is used is as a representation of human metabolism. Metabolism is tested by measuring the CO₂ production which tells us the fermentation rate of yeast. Yeast is used because there are a number of key regulatory elements that are highly conserved between yeast and humans. Yeast also is easy to manipulate and cultivates fast making it a good way to study human metabolism (FEMS yeast research)

In this study the fermentation of yeast is standardized by the amount of sugar present. The variables we studied were different concentrations of a popular energy drink that claims to increase metabolism using 20%, 40% , 60, and 80% concentrations. We also included two control groups one being negative, and one being positive. Our research question is how does Celsius affect yeast fermentation rate. Our hypothesis is: if we increase the amount of Celsius then the rate of our yeast metabolism will increase.

Celsius claims on their website that there are thermogenic properties that are proven to increase metabolism and in turn causes you to burn more body fat then you normally would. (“CELSIUS® Energy Drinks”)

Methods



Materials & Location:

For our materials, we used dry champagne yeast, H₂O, orange flavored Celsius, and 20% Sucrose solution. And for equipment we used six 10 ml pipettes, six fermentation tubes, six test tubes, one beaker to mix the dry champagne yeast and H₂O, and a separate container for H₂O. We worked on this experiment for three weeks in Kulshan Hall, biology laboratory 110, Whatcom Community College. We would collect this data during lab from 11:30am to 1:30pm.

Procedure:

First, we mixed 6 grams of dry champagne yeast with 60 ml of H₂O. Next, we added 10 ml of water and 10 ml of the yeast solution to the first test tube at 0% Celsius (negative control). Then for the test tubes with Cesium (20%, 40%, 60%, and 80%) we added 5 ml of Celsius, 5 ml of the 20% Sucrose solution, and 10 ml of yeast solution. And then for the 20% Sucrose solution test tube (positive control), we added 5 ml of 20% Sucrose solution, 5 ml of water, and 10 ml of yeast solution. We transferred each mixed solution into the six fermentation tubes and placed the tubes in an incubator around body temperature of 37 degrees Celsius. We waited on the fermentation tubes in the incubator an average of 20 minutes each experiment round. We repeated this procedure for eight rounds over the span of the three weeks spent testing our hypothesis.

Effect of Celsius on Fermentation and Metabolism

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Discussion

Through our experiment, we found the opposite to our hypothesis. We hypothesized the increase of yeast metabolism when we increase the amount of Celsius introduced to the yeast. Our data shows a decrease in yeast fermentation rate with Celsius present compared to the positive control group.

The data recorded from the four groups where we introduced 5mL of 20% sucrose and 5mL of different concentration of Celsius to 10mL of yeast solution suggests that the drink Celsius does not speed up the rate of fermentation of yeast, compared to our positive control group where only 5mL of 20% sucrose and 5mL of water is present for the same amount of yeast. The data was consistent in showing a negative effect on yeast metabolism, which proves our original hypothesis to be incorrect.

A study has shown that Celsius stimulates thermogenesis to a greater extent than other soft drinks such as diet Coke (Mendel, 2022). Which is mainly due to the fact that Celsius contains 200mg of caffeine for every 12oz of product, placing limitation on our research since we did not test for caffeine effects. For future research, testing for thermogenic effects would be recommended to understand to a better extent how energy drinks like Celsius would affect our body. Studies have shown that caffeine has dose-dependent effects on metabolic rate, future research should consider the several physiologically active ingredients that Celsius contains.

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Fermentation Rate of Yeast

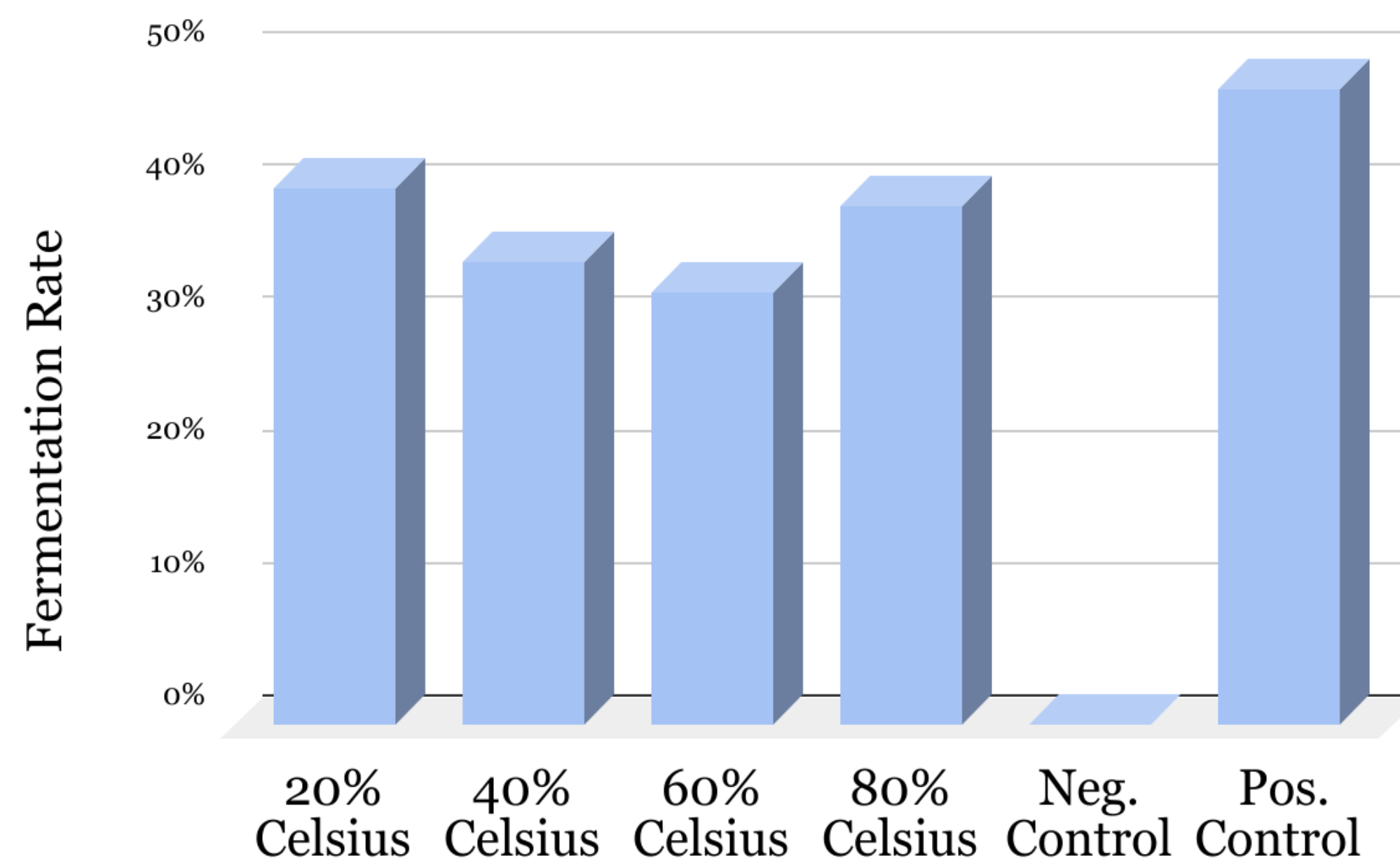


Figure 1. The average fermentation reaction rate of six groups, consisting of two controlled groups, one positive controlled group with no Celsius and only sucrose present, one negative controlled group with only H₂O. The rest with 20%, 40%, 60%, and 80% Celsius and sucrose present.

Round Eight Experiment Data

Percentage of Celsius/Positive & Negative Controls	Celsius/Water/Yeast solution/Sucrose	Duration in Incubator	Volume of Co2	Fermentation Rate ml Co2/min And Percentage
Test/Fermentation Tube #1: 0% (Negative Control)	10 ml water/10 ml Yeast Solution	22 minutes	0 ml	0 %
Test/Fermentation Tube #2: 20%	5 ml Celsius/5 ml 20% Sucrose/10 ml Yeast Solution	22 minutes	9 ml	41%
Test Tube #3: 40%	5 ml Celsius/5 ml 20% Sucrose/10 ml Yeast Solution	22 minutes	9 ml	41%
Test/Fermentation Tube #4: 60%	5 ml Celsius/5 ml 20% Sucrose/10 ml Yeast Solution	22 minutes	8 ml	36%
Test/Fermentation Tube #5: 80%	5 ml Celsius/5 ml 20% Sucrose/10 ml Yeast Solution	22 minutes	13 ml	59%
Test/Fermentation Tube #6: 20% Sucrose (Positive Control)	5 ml Sucrose/5 ml Water/10 ml Yeast solution	22 minutes	6.4 ml	29%

Figure 2. This table represents our last round of data, Round Eight. It shows our positive and negative controls, and the percentage of Celsius used in each test tube, and fermentation rate. We recorded our fermentation rate along with its percentage. In all previous tests 20% sucrose had a fermentation rate of above 40%