The Effects of Sugars on *Lactobacillus casei* Growth

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Abstract

The Western culture tends to deem the Eastern culture as obese and unhealthy due to the large amounts of saturated fats and abundance of sugars that it consumes. Some studies argue that *Lactobacillus casei* can alter health and researchers are attempting to prove that different sugars, natural or artificial, have different effects on the growth of *L. casei* [1]. *L. casei* was chosen as the experimental model due to easily replicable growing conditions and the importance of the bacteria in the gut microbiome.

Figure 1. *Lactobacillus casei*. *L. casei* is a bacteria that is located in the small intestine. Source: www.devbio.biology.gatech.edu

Sugar-bacteria solutions were created and their turbidities were taken to quantify the amount of bacteria growth after 24 hours of incubation. We hypothesized that the lactose would result in greater proliferation of *Lactobacillus casei* than glucose, sucrose, and saccharin, respectively. However, we found that all the additional sugars added to the bacteria have an inhibitory effect on the growth of *L. casei*. By identifying the effects that different sugars have on the concentration of bacteria within the gut microbiome, it will then be possible to manipulate diets and understand the effects that both natural and artificial sugars will have on the body.

Materials and Methods

Create Solutions → Incubation → Decanting → Resuspension → Turbidity Assay

- MRS Plate An MRS Plate was created to grow *L. casei* colonies.
- MRS Broth MRS Broth was made as a growing solution for the *L. casei*.
- Turbidity Assay A turbidity assay allows for the concentration of the bacteria solutions to be quantified.

Figure 2. Sugar-Bacteria Solutions

Creation of Standard Curve

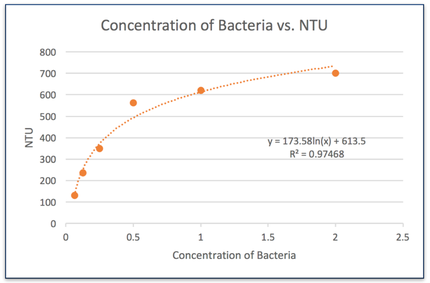

Figure 3. Concentration of Bacteria vs. NTU A bacteria concentration of 0.25 would produce an NTU of ~300, which is an ideal concentration of bacteria needed in order to produce an accurate turbidity.

Turbidity Results

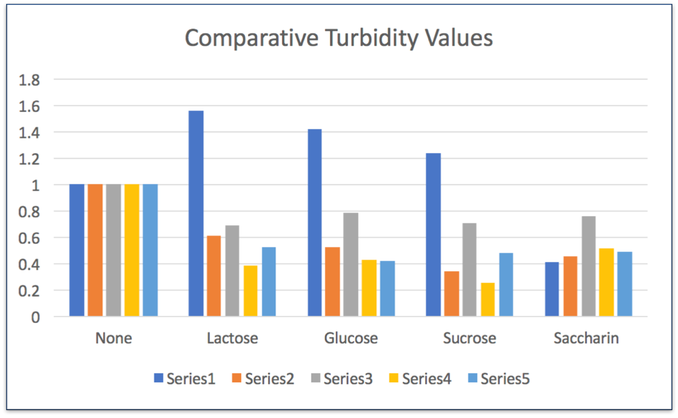

Figure 4. NTU Normalized to No Additional Sugar Added The raw turbidities of all experimental replicates were normalized to the turbidity of the no sugar added control.

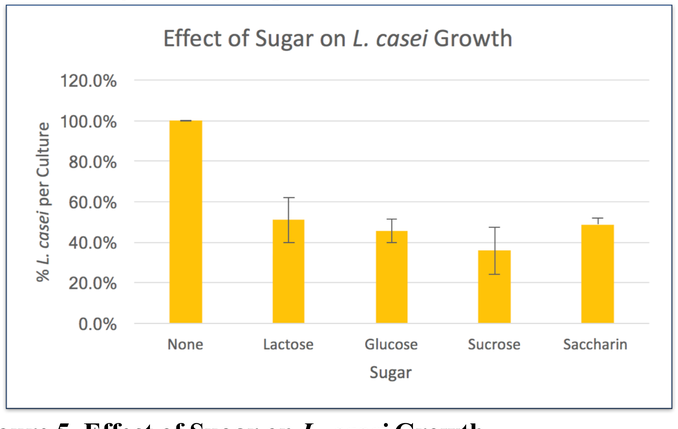

Figure 5. Effect of Sugar on *L. casei* Growth This figure compares the average turbidities of all experimental replicates to that of the no sugar added control. The outlying runs from Figure 4 were removed from this graph.

Conclusions

- Death of *Lactobacillus casei* occurred with the addition of lactose, glucose, sucrose, and saccharin.

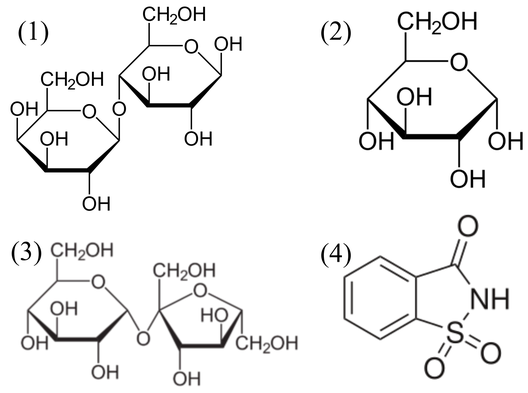

Figure 6. Sugar Structures The chemical structures of lactose (1), glucose (2), sucrose (3), and saccharin (4).

- The additional sugars were added to the MRS broth which already contained an ideal amount of sugar for *L. casei* growth. This combination could have caused a "sugar-overload" resulting in the death of bacteria.
- Too much sugar could be detrimental to the gut microbiome.
- Consuming diet sodas is no more beneficial or detrimental to your health than consuming naturally sweetened drinks.

Future Directions

- Simulate the gut microbiome by creating an environment with many different types of bacteria. We will identify the differential sensitivity of the sugars.
- Create the MRS broth from scratch, leaving out the dextrose, allowing us to control the amount of sugar within the broth. Through titration of the sugars, we will identify the point at which the bacteria "overload" on sugar.

Literature Cited

[1] Guarner, F., & Malagelada, J. R. (2003). Gut flora in health and disease. *The Lancet*, *361*(9356), 512-519.

Acknowledgments

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