



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> <b>Evaluating the Effects of Artificial Sweeteners and Caffeine on Human Gut Microbiota to Prevent Glucose Intolerance</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Non-caloric artificial sweeteners (NAS) are among the most commonly used food additives in the world. These artificial sweeteners can actually lead to obesity indirectly by affecting the plethora of microbiota in the human gut and affecting glucose intolerance. Instead of testing on living subjects, this research uses an in-vitro approach in testing the direct effects of sweetener on the microbiota. In addition to NAS, caffeine is often consumed along with these additives. If NAS inhibits bacteria growth and caffeine promotes it, this research examines if the two food additives could possibly cancel out the effects of each other.</p> <p><b>Methods/Materials</b> Using a standardized in-vitro digestion method, the sweeteners and caffeine are digested and then exposed to three types of bacteria found in abundance in the gut: Escherichia Coli, Staphylococcus Epidermidis, and Enterobacter Aerogenes. The growth curves of these cultures are plotted using absorption spectroscopy, and the curves are compared to a control curve. This experiment consists of nine experimental groups. The nine groups are as follows: control, sucrose, saccharin, sucralose, aspartame, two different concentrations of caffeine, a combination of aspartame and caffeine, and a combination of sucralose and caffeine. Each trial is done for each type of bacteria and repeated three times for statistical analysis.</p> <p><b>Results</b> Aspartame increases bacteria growth for all three species while saccharin and sucralose inhibit growth. Caffeine consistently increases growth even with lower concentrations. When combined, aspartame and caffeine result in an even higher growth rate and the combination of sucralose and caffeine balance out bacteria growth towards the control. The standard deviations for each trial are plotted on the graphs as error bars and ANOVA tests were run on each set of data to assure statistical significance.</p> <p><b>Conclusions/Discussion</b> The combination of aspartame and caffeine is so common in America, yet it could be causing significant changes to the composition of the gut. However, since the effects of sucralose and caffeine balance each other out, that combination could be less of a health hazard than previously assumed. Further studies on the effects of aspartame versus sucralose in the context of the entire mixture being consumed could help the food industry make wiser choices about their sweeteners.</p>	
<b>Summary Statement</b> This research tests the effects of artificial sweeteners and caffeine on human gut bacteria to evaluate the negative changes in bacteria populations in order to prevent consumers from developing glucose intolerance and diabetes.	
<b>Help Received</b> The advanced science research class at Los Gatos High School taught by Catherine Messenger.	