



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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| Name(s) Sydney Adcook | Project Number S2101 |
| Project Title Silver Nanoparticle Exposure Effect on the Growth of 13 Common Strains of the Human Gut Microbiota | |
| <p style="text-align: center;">Abstract</p> <p>Objectives Many products advertise silver nanoparticles as an immune supplement. The purpose of this experiment was to evaluate the potential toxicity of silver nanoparticles marketed as a dietary supplement on beneficial bacterial strains (known as probiotics) commonly found in the human gut microbiome.</p> <p>Methods Bacteria were first cultured in 3 mL Luria broth vials, and were then plated using the streak plate technique on Lactobacilli MRS agar. The agar plates contained a total of 144 trials. Silver nanoparticle dilutions ranging from 500 parts per million to 0 parts per million were calculated and created before inoculation. The measure of the substance's antimicrobial effects were observed through the use of the agar well diffusion assay. Measurements (in mm) on areas of inhibition were taken over a period of six days.</p> <p>Results Areas of inhibition formed, thus indicating an antimicrobial effect. It was found that the increase in silver nanoparticle solution concentration correlated with a greater antimicrobial effect. The areas of inhibition for the most concentrated solution, 500 ppm, had an average diameter of 7.3mm, while there was no area of inhibition for the control group. An increase in antimicrobial effect was seen throughout the testing period, as areas of inhibition were only observed after the second day. This increase is most likely due to silver ion (free radical) buildup in the agar.</p> <p>Conclusions It was observed that ingesting abnormal amounts of silver nanoparticles would lead to a decrease in bacteria in your gut. Disruptions in this microbiome could lead to imbalances between the two major phylums of gastrointestinal bacteria: the Firmicutes and Bacteroidetes. As a result, the person will be more susceptible to irritable bowel syndrome as well as an increased risk for obesity. In summary, while the antimicrobial properties of silver nanoparticles were observed in vitro, their effectivity depends on the frequency of ingestion. With infrequent or one time- consumption, antimicrobial properties would be nullified by the time needed for the particles to release enough silver ions to have any substantial adverse effect on neighboring probiotic colonies. However, if the supplement is ingested frequently, there are potential adverse effects on not only the stomach microbiome, but surrounding tissues as a result of silver ion buildup. Based on this, it is concluded that the use of dietary silver nanoparticles is likely to be more harmful than beneficial.</p> | |
| Summary Statement I determined the toxicity of colloidal silver nanoparticle exposure on the beneficial strains of bacteria in the human gastrointestinal microbiome. | |
| Help Received My science teacher provided many essential materials as well as a classroom to conduct my experiment in. | |