CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S1612

Project Title

The Effect of Different Probiotic Bacterial Strains on Ammonia (NH3) Production Levels

Abstract

Objectives/Goals

The chief objective of this experiment is to distinguish which probiotic bacterial strain, Bifidobacterium longum, Lactobacillus bulgaricus, and Streptococcus thermophilus, has the greatest capacity to decrease the most ammonia (NH3). We hypothesized that Lactobacillus bulgaricus will have the greatest capacity to decrease ammonia because of its ability to foster natural antibiotics and acids to neutralize the toxin.

Methods/Materials

50 billion CFU Custom Probiotics Strain Bifidobacterium longum, 50 billion CFU Custom Probiotics Strain Lactobacillus bulgaricus, 50 billion CFU Custom Probiotics Strain Streptococcus thermophilus, MRS Broth Powder, 0.1 Mol Ammonia Solution, 800 mL Distilled Water, Ammonia Test Paper (0.0-6.0 ppm), Incubator

We prepared a solution of 50 billion CFUs for each live probiotic bacterial strain dissolved in 10 mL of MRS broth in test tubes to grow in an incubator at 37°C. After 24 hours, we added 3 mL of 10 ppm ammonia solution to each solution of live probiotics. For three 24 hour intervals, we used test strips to measure the amount of ammonia in each test tube solution.

Results

After analysis of the data, the strain Streptococcus thermophilus possesses the best ammonia reduction abilities with an averaged 6.66 ppm ammonia reduction over the course of 48 hours, a 66.66% decrease. Lactobacillus bulgaricus broke down an average of 6.34 ppm of ammonia after 2 days (a 63.4%). The probiotic strain Bifidobacterium longum reduced the least amount of ammonia at 6 ppm or 60% after 2 days.

Conclusions/Discussion

All three probiotic strains exemplified an ambient ammonia reduction of over 60%, revealing its alleviating abilities for ammonia toxicity levels. By conducting our experiment in the human body temperature (37°C), Streptococcus thermophilus performed in its optimal temperature, followed by Lactobacillus bulgaricus, whose optimal temperature is 48°C to 46°C, and finally Bifidobacterium longum. Streptococcus thermophilus portrays its detoxifying enzymes that break down ammonia into urea and amino acids, but all strains portray similarly strong properties of ammonia reduction. Our experiment opens up new opportunities for investigations into ammonia toxicity therapy for liver diseases like hepatic encephalopathy.

Summary Statement

This experiment investigates the capacity of probiotic bacterial strains on reducing environmental ammonia levels and exemplifies the mitigating abilities of probiotics on ammonia toxicity.

Help Received

My partner and I set up and designed the experiment ourselves, including the selection of the probiotic strains to test. Our mentor, Mrs. Yi, provided us with the laboratory materials to conduct our experiment (graduated cylinders, Erlenmeyer flasks, electronic balance, incubator shaker and other basic materials).