CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

J1604

Project Title

A Quantitative Assessment of Nutrients and Their Impact on the Microbiome Health

Abstract

Objectives/Goals

The objective of this project was to to quantify how good or bad a nutrient is for microbiome health.

Methods/Materials

Tested how health-promoting nutrients (protein, vitamin C, fiber) and disease-promoting nutrients (glucose, salt, oil) affected the growth of probiotic bacteria (Lactobacillus acidophilus) and pathogenic bacteria (Escherichia coli). Measured the growth of bacteria with a spectrophotometer and recorded the OD650. Developed a quantitative score for each nutrient based on how well it promoted the probiotic or pathogenic bacterial growth.

Results

Vitamin C was found to promote microbiome health because it inhibited E. coli growth, but not L. acidophilus. In contrast, sodium chloride made a negative impact because it slowed L. acidophilus growth, but not E. coli. All the other nutrients did not significantly affect bacterial growth. Percent growth values for each nutrient were used to calculate a Microbiome Health Index (MHI), quantifying the impact of a nutrient on the microbiome. VitaminC has an MHI of 89%, while sodium chloride has an MHI of -35%.

Conclusions/Discussion

This study demonstrated that specific nutrients have health-promoting or disease-promoting effects on the microbiome, and those effects can be quantified in a microbiome health index. The biggest impact observed occurred by slowing the growth of one bacteria over the other. In the human body, both L. acidophilus and E. coli are growing together, competing with each other to colonize the intestinal mucosa. By reducing the growth rate of one species, the other species has an opportunity to flourish, creating health-promoting or disease-promoting conditions.

The finding that Vitamin C promoted microbiome health by reducing E. coli growth, but leaving L. acidophilus unaffected, may be explained by the environment it created. L. acidophilus produces lactic acid, and as a result grows well in acidic environments, similar to the one created by Vitamin C, or ascorbic acid. Salt, on the other hand, does not affect the acidity level, so its impact on inhibiting L. acidophilus growth likely occurs through another means, such as sodium regulation.

Vitamin C and salt are nutrients with large MHIs, but are often ignored in weight loss diets based on calorie counting. These MHI scores could be used as additional information on food labels, to help people make smarter dietary decisions that also consider microbiome health.

Summary Statement

I tested the impact of different nutrients on the microbiome, and developed an index to quantify how good or bad a nutrient may be for microbiome health.

Help Received

I did the testing myself. I got help from my father in getting required materials like my bacteria strains. Also my father watched me do all the testing with bacteria (my father is a scientist).