Abstract

The environment within the human gut contains many types of microorganisms, called human gastrointestinal microbiota. Throughout recent years, many studies have found a strong correlation between the strengths and types of bacteria within the human gut microbiome and the overall health of a person. More specifically, studies have shown that the bacterial composition of an individual’s gut microbiome has an impact on their physiological response to chemotherapy. This year we have completed the first two phases of our project. We have tested the effect of various concentrations of various chemotherapy drugs on the growth of human gut microbiota samples and identified and preserved samples of interest exhibiting moderate growth and samples without treatment. The next phase of the project is to perform DNA extraction upon the preserved samples, and DNA sequence the samples to determine which specific bacterial species were killed by each specific chemotherapy drug. Further examination of these relationships could be utilized to increase the efficacy and decrease the toxicity of common chemotherapy drugs.

Introduction

The human gut microbiome is a complex ecosystem of microorganisms that play a crucial role in human health and disease. The gut microbiome is known to influence various aspects of human physiology, including metabolism, immune function, and the development of certain diseases such as inflammatory bowel disease, obesity, and cancer. The gut microbiota is also known to interact with the host immune system and can be altered by environmental factors such as diet, medication, and infection. In recent years, there has been a growing interest in the effects of chemotherapy on the gut microbiome, and studies have shown that chemotherapy can alter the composition and function of the gut microbiota. This change in the gut microbiota can affect the immune response to chemotherapy and may contribute to the development of chemotherapy resistance.

Results

The results of our trials indicate that higher concentrations (60-80 microliters) of chemotherapy drugs had clear effects on the growth of human gut microbiota communities and most likely affected different bacterial species. We also have concluded that there may be a maximum chemotherapy drug concentration level at which a difference in bacterial composition is seen, as there was not a significant difference in the results seen between the 80 and 100 microliter plates. From the results of our trials, the higher concentrations (60-80 microliters) of chemotherapy drugs showed clear effects on the growth of human gut microbiota communities and most likely affected different bacterial species. Specifically, we expect that in high doses of chemotherapy drugs will have an alteration of the composition of the communities with no treatments, we expect that communities exposed to chemotherapy drug. Further examination of these relationships could be utilized to increase the efficacy and decrease the toxicity of common chemotherapy drugs.

Conclusion

• From the results of our trials, the higher concentrations (60-80 microliters) of the chemotherapy drugs had clear effects on the growth of human gut microbial communities and most likely affected different bacterial species.
• We also have concluded that there may be a maximum chemotherapy drug concentration level at which a difference in bacterial composition is seen, as there was not a significant difference in the results seen between the 80 and 100 microliter plates.

Future Experimentation

• Send the preserved samples of interest for 16S rRNA sequencing
• Use the results to determine which bacterial species are present in each moderate growth well sample and compare it to the bacterial species present in the untreated sample
• Examine which specific bacterial species were affected by each chemotherapy drug
• Repeat the entire research study using a different donor’s gut microbiota sample to ensure replicability and results
• Repeat the entire research study with the addition of probiotics to determine if they modulate the effect of the chemotherapy drugs upon the gut microbiota sample

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References

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