# Simple Sugars and Alpha Diversity Changes in the Gut Microbiome

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## Introduction

**How does changes in simple sugar consumption affect microbial composition?**

✶ Microbial speciation in the gut fluctuates according to what nutrients are present.[2,3]

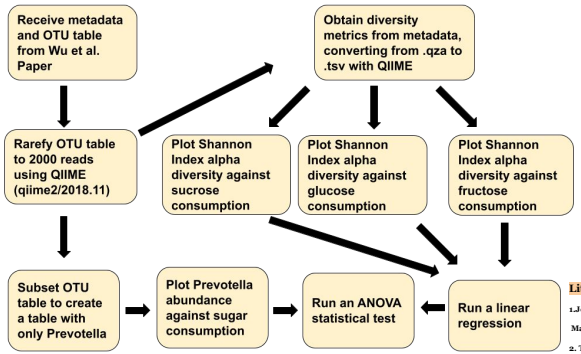
✶ Prevotella abundance is correlated to the amount of carbohydrates present in the diet.[4]

✶ Reducing the amount of added sugars can decrease some of the risk factors associated with the development of metabolic diseases.[1]

**Hypothesis:**

A higher consumption of simple sugars will cause a decrease in overall gut microbiome diversity, with an increase in Prevotella abundance.

## Methods



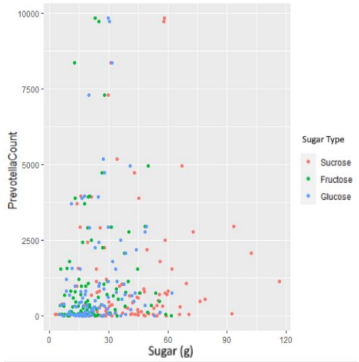




**Figure 1:** Prevotella abundance against individual sugar consumption (g).

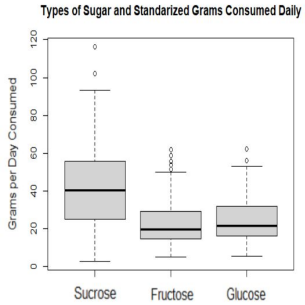



**Figure 2:** Average grams of sugar consumed daily.

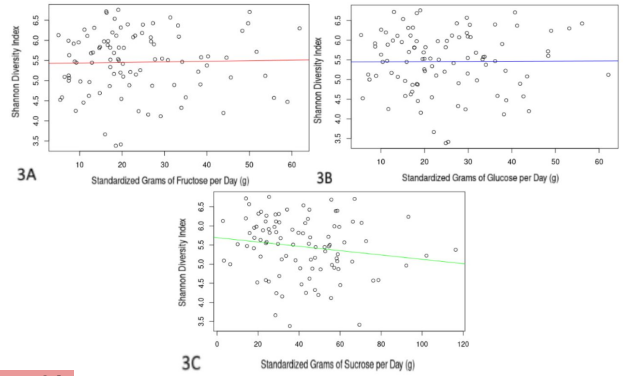



**Figure 3A:** Linear Regression Analysis of Fructose consumption (standardized grams) plotted against alpha diversity (Shannon Index). N=97, b=0.0014.

**Figure 3B:** Linear Regression Analysis of Glucose consumption (standardized grams) plotted against alpha diversity (Shannon Index). N=97, b=0.0003.

**Figure 3C:** Linear Regression Analysis of Sucrose consumption (standardized grams) plotted against alpha diversity (Shannon Index). N=97, b=-0.006.

## Results

✶ Linear regression analyses did not show any significant associations between alpha diversity and the consumption any of the three sugars.

✶ An ANOVA test was performed to compare the mean alpha diversities between the three sugars and found that the three sugars did not have significantly different alpha diversities. (Pr(>F) = 1).

✶ An ANOVA test was carried out to compare mean Prevotella count between the three sugars and found no statistically significant difference between sugars. (Pr(>F) = 1)

✶ This data did not support our hypothesis that samples from diets of higher consumptions of sugar would exhibit lower alpha diversities and increases of Prevotella

✶ In part, these outcomes may have been due to relatively fewer samples in representation of diets with high consumption of the sugars.

## Conclusion

**Prevotella does not utilize simple sugars as a nutrient to maintain and expand its genus composition**

✶ These findings suggest that Prevotella utilize complex carbohydrates in their metabolism, not simple sugars.

## Future Directions

✶ **As our data was insignificant, increased sample sizes and further tests would be a good step to proceed with to make sure the association wasn't due to a small sample.**

✶ Associated experiments into sugar effects on the microbiome non-exclusive to Prevotella may be helpful, as this bacteria in this research is just one type of major bacteria specimens out of the large variety of gut microbiota bacteria.

**Literature Cited:**

1.Jensen, T., Abdelmalek, M.F., Sullivan, S., Nadeau, K.J., Green, M., Roncal, C., Nakagawa, T., Kuwabara, M., Sato, Y., Kang, D.-H., et al. (2018). Fructose and sugar: A major mediator of non-alcoholic fatty liver disease. Journal of Hepatology 68, 1063–1075.
Manor, O., Dai, C.L., Kornilov, S.A. *et al.* Health and disease markers correlate with gut microbiome composition across thousands of people. *Nat Commun* 11, 5206 (2020). https://doi.org/10.1038/s41467-020-18871-1
2. Townsend, G. E., 2nd, Han, W., Schwalm, N. D., 3rd, Raghavan, V., Barry, N. A., Goodman, A. L., & Groisman, E. A. (2019). Dietary sugar silences a colonization factor in a mammalian gut symbiont. Proceedings of the National Academy of Sciences of the United States of America, doi.org/10.1073/pnas.1813780115
3. Wu, G. D., Chen, J., Hoffmann, C., Bittinger, K., Chen, Y.-Y., Keilbaugh, S. A., Bewtra, M., Knights, D., Walters, W. A., Knight, R., Sinha, R., Gilroy, E., Gupta, K., Baldassano, R., Nessel, L., Li, H., Bushman, F. D., & Lewis, J. D. (2011). Linking long-term dietary patterns with gut microbial enterotypes. Science (New York, N.Y.), 10.1126/science.1208344

# Criteria:

**Poster Rubric**

| Criteria | Ratings | | | Pts |
|---|---|---|---|---|
| Introduction/Background<br>Does the poster relate the research project to an important issue or a gap in knowledge? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Approach and Methodology<br>Is it easy to understand how the data were collected and the analyses were performed? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Data figures and tables<br>Are the data graphed or presented in an appropriate form? Are the data figures easy to interpret? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Use of figures, images, and diagrams<br>Are the visuals useful and relevant to the overall message of the poster? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Results and conclusions<br>Does the poster clearly state the main findings of the study? Are the conclusions supported by the data? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Context for findings & follow-up work<br>Does the poster relate the findings to what was already known and suggest appropriate follow-up work? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Organization and Layout<br>Is the poster well-organized and easy to read, with an appropriate layout? Is the text sufficient to explain the graphics, but not overwhelming to the reader? | 10 to >8.0 pts<br>Strong | 8 to >6.0 pts<br>Satisfactory | 6 to >0 pts<br>Weak | 10 pts |
| Visual Appeal<br>Do the chosen colors and fonts enhance the poster's impact? Is the text free of errors? | 5 to >4.0 pts<br>Strong | 4 to >3.0 pts<br>Satisfactory | 3 to >0 pts<br>Weak | 5 pts |

Total Points: 75

**Literature Cited:**


1. Manor, O., Dai, C.L., Kornilov, S.A. *et al.* Health and disease markers correlate with gut microbiome composition across thousands of people. *Nat Commun* 11, 5206 (2020). https://doi.org/10.1038/s41467∗020∗18871∗1
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3. Wu, G. D., Chen, J., Hoffmann, C., Bittinger, K., Chen, Y. ∗Y., Keilbaugh, S. A., Bewtra, M., Knights, D., Walters, W. A., Knight, R., Sinha, R., Gilroy, E., Gupta, K., Baldassano, R., Nessel, L., Li, H., Bushman, F. D., & Lewis, J. D. (2011). Linking long ∗term dietary patterns with gut microbial enterotypes. Science (New York, N.Y.), 10.1126/science.1208344