

# Gut microbiome fluctuates throughout the day and across seasons, finds study

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The balance of microbes in the human gut varies substantially from morning to night and even more by season—with profound fluctuations completely transforming the microbiome from summer to winter, according to a study to be presented at Digestive Disease Week (DDW) 2023.

The microbiome—bacteria that live in and on the body—accounts for

about half of the cells that make a human, and fluctuations in the makeup of the microbiome could have wide-ranging implications for health and medicine.

"The [seasonal variations](#) we see in conditions like allergies or the flu occur in context of completely different microbiomes," said Carolina Dantas Machado, Ph.D., the study's lead author and a researcher in the laboratory of Amir Zarrinpar, MD, Ph.D., at University of California, San Diego. "We may need to put our understanding of how seasons affect health and disease in context of a microbiome that is much more variable and dynamic than we have previously thought."

For this study, researchers reviewed data for about 20,000 [stool samples](#) collected by the American Gut Project, the world's largest citizen science microbiome project, from countries around the world between 2013 and 2019. Analyzing the collection time, date and location, researchers found nearly 60% of the phyla—related groups of bacteria—have a distinct 24-hour cycle. Seasonal fluctuations were even more pronounced, with certain types of bacteria following one of two distinct patterns over the course of a year.

Two examples illustrate some of the numerous daily and seasonal trends identified: The number of organisms known as Actinobacteriota fluctuated during the day, with lower levels in samples taken in the morning and much higher levels found toward the end of the day. Over a year, Proteobacteria consistently dip to low levels in the winter and steadily rise until peaking in the summer.

Dr. Zarrinpar and his colleagues think that diet and sleep are likely big factors in daily fluctuations.

"You can imagine that the gut environment is radically different in terms of nutrient and [water availability](#) and pH when the person is sleeping

compared to right after they eat breakfast," Dr. Zarrinpar said. Seasonal variation is harder to explain, but researchers are exploring data by latitude and climate, which could indicate whether light and temperature play a role. Pollen and humidity are among other possible influences.

The findings are important not only for other researchers studying the microbiome but also those whose research could be affected by variation in the microbiome, such as medication studies where the microbiome may have a role in metabolizing medicines. Researchers need to be aware that the timing of stool sample collection could influence research results in unexpected ways, especially for smaller studies.

Dr. Dantas Machado will present results of the study, "The [human gut microbiome](#) displays diurnal and seasonal rhythmic patterns," abstract 395, on Sunday, May 7, at 11:20 a.m. CDT.

**More information:** Conference: [ddw.org/register/registration/](https://ddw.org/register/registration/)

Provided by Digestive Disease Week

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