Study connects decomposing body's BMI to surrounding soil microbes

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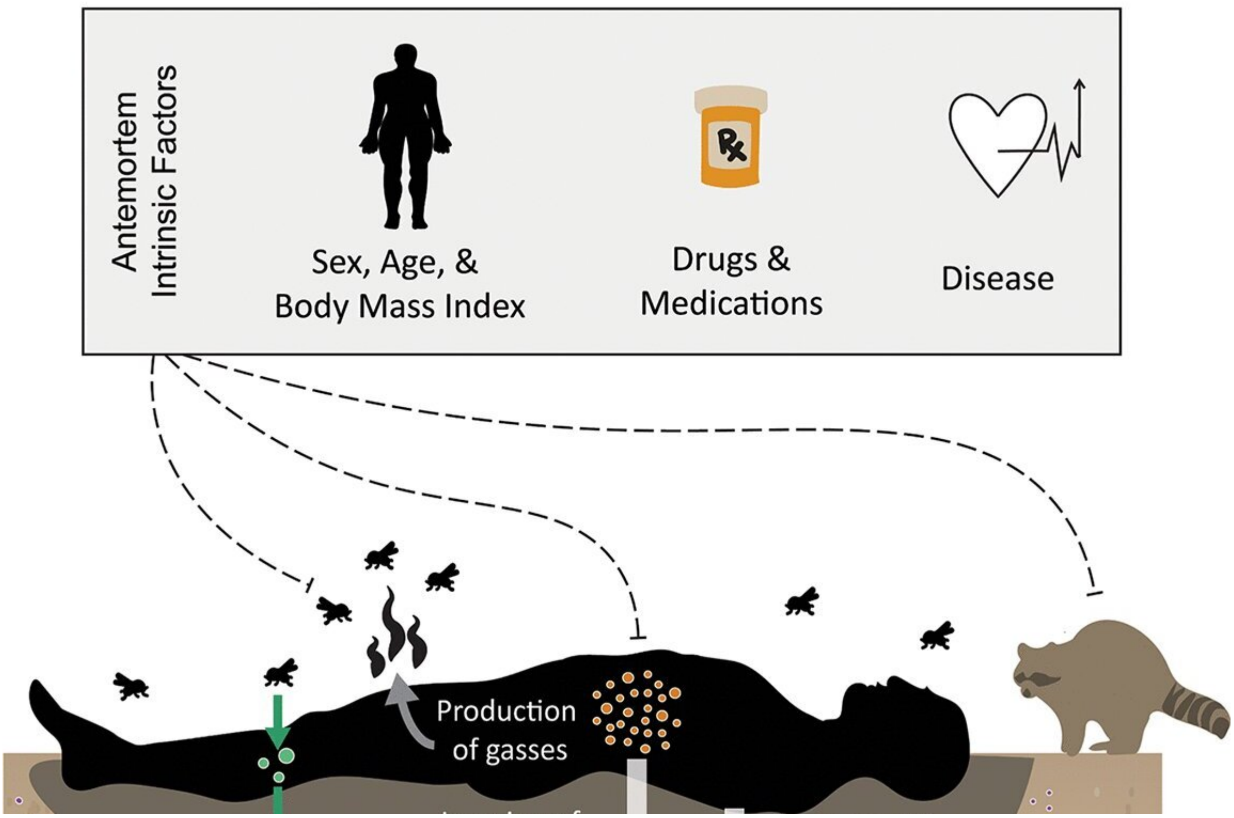

During human decomposition, host-associated microbes, environmental microbes, insects, and scavengers work together to break down body tissues. Liquified decomposition products are flushed into soil where microbes respond to the influx and changes in soil chemistry. Antemortem conditions, such as body mass, age, diet, diseases, or drugs and other treatments, can influence decomposer (i.e., scavengers, insects, and microbes) activity leading to variability in decomposition rate and progression. Credit: *mSphere* (2022). DOI: 10.1128/msphere.00325-22

Research on decomposition often focuses on environmental factors like temperature or humidity, but researchers at the University of Tennessee in Knoxville have taken a closer look at contributions from the inside of the body. One factor that may play an important role is the body mass index (BMI) of a decomposing body, they report this week in *mSphere*.

The researchers investigated how intrinsic factors like disease, BMI or medication load affected microbial life at the university's body donation research facility, specifically established for the decomposition of human remains. They analyzed the bacterial and fungal composition of fluids produced by 19 human bodies, as well as the composition of the surrounding soil, during "active decomposition," which lasts until the carcass stops releasing fluids and the abdomen cavity collapses.

For the new study, they found that in the soil beneath and near individuals who were underweight (BMI less than 18.5) and normal weight (a BMI between 18.5 and 26), the diversity decreased in bacterial communities. In obese and overweight individuals (with BMIs above 26), the diversity remained mostly constant.

"We think about BMI as a proxy for how much fat versus how much muscle we have in our body," said microbial ecologist Jennifer DeBruyn, Ph.D, at the University of Tennessee's Anthropology Research Facility, which is also known as the "Body Farm." Those two biological tissues have different chemical compositions that may affect the soil differently.

"We know from plant litter studies that even slight changes in tissue chemistry can change the microbial decomposers," she said. More fat tissue—in a body with higher BMI—means more moisture and a higher ratio of carbon to nitrogen, relative to a body with a lower BMI.

The study began, DeBruyn said, with observations by researchers who'd worked for years with decomposing bodies at the Body Farm. They noticed that bodies donated and placed on the soil at the same time didn't change in the same way over time. "The bodies experienced identical environmental conditions, but we saw big differences in how quickly they decomposed," DeBruyn said. That suggested that something within the body, rather than in the environment, contributed to the process.

For the mSphere study, the researchers studied 19 bodies that had been donated and placed in the outdoor facility between February 2019 and March 2020. The ages of the donors ranged from 40 to 91, with a mean of 71, and the BMIs ranged from 14.2 to 55.1. Temperature and humidity data were recorded hourly by remote tags, and the researchers collected soil samples at regular intervals throughout decomposition. They also used syringes to collect samples of fluids that had been released by the bodies and pooled in the soil.

The researchers searched the data for connections. Most of the bacterial communities in the pooled fluid belonged to the Firmicutes and Proteobacteria phyla, which include dominant species typically found in the human gut. The majority of the fungal communities in those fluids were associated with the class Saccharomycetes. But those measurements didn't explain the variation in decomposition rates.

In the soil around the bodies, they found more diversity in the soil microbe communities than they'd observed in the decomposition fluids.

"My Ph.D. student Allison Mason spent so much time digging into the data for any explanation of why we saw the differences we did," DeBruyn said. "And then she stumbled on BMI as a predictor."

Understanding the mechanism behind the observation will require more work, DeBruyn said. As will other observations made during the study.

The soil around people who'd been treated for cancer showed less microbial species richness, for example, perhaps because the chemotherapeutic agents inhibited the growth of microbes.

However, DeBruyn cautioned that this study identified connections between intrinsic factors and soil microbial populations—but didn't show causality. It's a first step toward answering the bigger question of how differences in human bodies affects the soil post-mortem, she said.

"The biggest problem with these humans is that we're just a big mixed bag of chemicals, and that's why this kind of study really hasn't been done before," she said. "Our paper is really one of the first to use a large enough sample size of donors to reveal these patterns."

More information: Allison R. Mason et al, Body Mass Index (BMI) Impacts Soil Chemical and Microbial Response to Human Decomposition, *mSphere* (2022). DOI: 10.1128/msphere.00325-22

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