

Gut microbe makeup affected by diet: study

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(PhysOrg.com) -- A new study in the US has shown that the type of "good" bacteria that predominate in human stools varies with the diet.

The average [human gut](#) is estimated to contain around three to five pounds of [beneficial bacteria](#), and the [symbiotic relationship](#) we have with this intestinal flora is vital for good health. The microbes, consisting of hundreds, and possibly thousands, of different strains of bacteria, live primarily in the colon, where they help in extracting nutrients and energy from food and in digesting previously undigested foods such as high-fiber carbohydrates. They also produce toxins that help keep non-friendly bacteria in check.

The new research, by James Lewis of the University of Pennsylvania medical school and colleagues, studied 98 healthy American adults who were not obese, and asked them to monitor their [diet](#) for a week before giving a stool sample for analysis. They also completed a questionnaire on their long-term diet. The scientists then identified the types of bacteria present in the samples by using [DNA analyses](#).

Human stools contain massive amounts of bacteria, and co-author Frederic Bushman said estimates are that 99 percent of the DNA found in human stools is bacterial in origin, and the number of [bacterial cells](#) in the human body could outnumber the number of [human cells](#) by a factor of 10 to 1.

This study found marked differences in the makeup of the microbes in the [gut](#) between people who reported eating a diet high in animal

products and fat and those preferring plant-based foods and more carbohydrates. The stools of those eating a more carnivorous diet contained more Bacteroides, while in those favoring more foods derived from plants (and therefore higher in fiber and lower in fat) the Prevotella-type bacteria predominated.

In another part of the study, the researchers asked 10 of the Bacteroides group to live in at the medical school for 10 days. They were split into two groups, one of which was given a low fat/[high fiber diet](#), and the other a high fat/low fiber diet. The amount of calories given to all volunteers was the same.

The results of this second study showed a small effect on the makeup of the bacteria mix in the gut, even after one day, but the Bacteroides bacteria still prevailed at the end of the study period. Dr Lewis said this suggests the makeup of the intestinal flora does not change much during the short term, but that long-term changes in diet would be required. The study was also unable to determine whether the diet caused the differences in bacteria in the gut, or the different bacteria somehow caused the person to prefer one type of diet over another.

The effects, if any, of the different types of bacteria in the gut on the development of diseases are currently poorly understood and more research is needed in this area. Dr Lewis said it is possible that the immune system reacts to some of the bacteria in the gut, causing an inflammatory response that could eventually lead to disease conditions. At present it is not known which of the different types of bacteria in the gut are “good” or “bad.”

Other research reported in [Physorg](#) has linked the microbiota living in the gut with obesity and shown that transplanting bacteria from the guts of obese mice into non-obese mice causes the recipients to become obese.

One theory is that people could become obese because their gut biota have become inefficient at absorbing nutrients, causing the body to compensate for the lack by consuming more food. Another theory is that in some people the gut [bacteria](#) are more efficient at harvesting energy from the food, enabling these people to gain more calories from the same amount of food.

The paper was published yesterday in the journal *Science*.

More information: Linking Long-Term Dietary Patterns with Gut Microbial Enterotypes, Gary D. Wu, Jun Chen, Christian Hoffmann, Kyle Bittinger, Ying-Yu Chen, Sue A. Keilbaugh, Meenakshi Bewtra, Dan Knights, William A. Walters, Rob Knight, Rohini Sinha, Erin Gilroy, Kernika Gupta, Robert Baldassano, Lisa Nessel, Hongzhe Li, Frederic D. Bushman, and James D. Lewis, *Science* 1 September 2011: 1208344 [DOI:10.1126/science.1208344](https://doi.org/10.1126/science.1208344)

ABSTRACT

Diet strongly affects human health, partly by modulating gut microbiome composition. Here, we used diet inventories and 16S rDNA sequencing to characterize fecal samples from 98 individuals. Fecal communities clustered into enterotypes distinguished primarily by levels of *Bacteroides* and *Prevotella*. Enterotypes were strongly associated with long-term diets, particularly protein and animal fat (*Bacteroides*) versus carbohydrates (*Prevotella*). A controlled-feeding study of 10 subjects showed that microbiome composition changed detectably within 24 hours of initiating a high-fat/low-fiber or low-fat/high-fiber diet, but that enterotype identity remained stable during the 10-day study. Thus, alternative enterotype states are associated with long-term diet.

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