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Not Exactly Rocket Science

Surprises Emerge As More Hunter-Gatherer Microbiomes Come In

4 MINUTE READ



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The study of the human microbiome—the motley assortment of microbes that live in our bodies—has largely been the study of the *Western* microbiome. The research has been heavily biased towards people from Europe, North America, and other WEIRD countries—that is, Western, Educated, Industrialised, Rich and Democratic. It’s like trying to understand how cities work by studying London and New York, and ignoring Mumbai, Mexico City, Sao Paulo, Cairo, and others.

Recognising this problem, scientists are starting to catalogue the microbes of rural populations, including hunter-gatherers. Early last year, I wrote about attempts by Maria Gloria Dominguez-Bello and Cecil Lewis Jr to study the microbiomes of the [Yanomami of Venezuela and the Matsigenka of Peru](#), respectively. A few months later, I covered the first study looking at the microbiomes of [Hadza hunter-gatherers from Tanzania](#). All of these studies found similar trends: rural guts usually harbour microbes that aren’t found in Western guts, and are generally more diverse.

The Hadza guts had a few striking differences. They contained almost no Bifidobacteria, a group that is generally viewed as ‘healthy’, and that makes up to 10 percent of a Western gut microbiome. They also had more *Treponema*, a group that includes the species responsible for syphilis and yaws. These differences aren’t necessarily unhealthy. They just reflect the conditions in that particular corner of the world, its food supplies, water, climate, and more.

Lewis has now published the results of his Peruvian work. His team also found that people who lead traditional lifestyles—both Matses hunter-gatherers and Tunapuco farmers—had higher levels of *Treponema* than a comparable group of Americans. By studying these strains in detail, the team showed that they are distinct from those that cause human diseases, and more closely related to those that help other animals to digest carbohydrates.

These *Treponema* strains are also found in the Hadza and non-human primates, but are totally absent from industrialised populations. As such, the team suggests that they “may represent a part of the human ancestral gut microbiome that has been lost through the adoption of industrial agriculture and/or other lifestyle changes.” In other words, they’re part of an ancient package of microbes that our ancestors shared, and that people from developed countries have somehow broken ties with.

This interpretation fits with the “missing microbes” idea espoused by Martin Blaser, which says that various facets of our modern lifestyles—antibiotics, over-sanitation, poor diets, and more—have left us with depleted microbiomes, bereft of species that once played important roles. This, perhaps, explains the rise of several “diseases of civilisation”, like allergies, asthma, obesity, inflammatory bowel disease, diabetes, and more.

Hold on, though. The Hadza and the Matses are not ancient people, and their microbes are not “ancient bacteria”, as one headline stated. They are *modern* people, carrying *modern* microbes, living in *today’s world*, and practicing traditional *lifestyles*. It would be misleading to romanticise them and to automatically assume that their microbiomes are healthier ones.

After all, we also have *no idea* what's behind the characteristics of their communities. It could be their traditional lifestyles, like their diets or lack of antibiotics. But it could equally be something else like their genes, climate, or parasites. You can't work out which of these factors is important by studying a few scattered groups. Ideally, you'd want to study several groups of people who lead traditional lifestyles, live close to each other, and vary in important traits like diet or genetics.

That is exactly what [Elise Morton](#) from the University of Minnesota has done. She and her colleagues sequenced the gut microbiomes of 64 people from four groups in Cameroon: Pygmy hunter-gatherers, Bantu farmers from two villages, and Bantu from a fishing population. All of them practice subsistence lifestyles—that is, they live off whatever they themselves catch or grow. All of them co-exist in rural areas that are close to tropical rainforests. The results have just been uploaded to the [bioRxiv pre-print server](#).

The team found a lot of variation between the four groups, “indicating that there are multiple signatures of rural, unindustrialized microbiomes”. The Pygmy hunter-gatherers stood out. Compared to the Bantu, their guts had more Proteobacteria, *Succinovibrio* and *Ruminobacter*, and fewer *Ruminococcus*—the same pattern that others saw [when comparing Hadza and Italian guts](#). These microbes “seem to be a specificity of hunter-gatherer populations, rather than reflecting a difference between industrialized European and rural African populations,” Morton wrote.

The team also found that one factor, above all others, heavily influenced the gut microbiomes of their Cameroonian groups. It wasn't diet, ancestry, or location. It was the presence of *Entamoeba*, a parasitic amoeba. It had such a strong effect on the gut that the team could work out whether a person was infected with 79 percent accuracy, just by looking at their gut microbes.

In general, *Entamoeba*-infected guts have a greater diversity of bacteria, higher levels of *Treponema*, and lower levels of groups like *Prevotella*. The reasons behind these patterns aren't clear. We know that our immune system affects the composition of our microbiome, so by triggering immune reactions, *Entamoeba* might indirectly dictate which species get to live in the gut and which do not. Alternatively, it might eat bacteria from dominant groups, creating vacancies that allow others to proliferate, and boosting the diversity in the gut. Or, it might prefer to colonise microbiomes that have already been altered by some other factor.

Regardless, these results throw up some interesting questions. Is the higher diversity of the hunter-gatherer microbiome down to the wider diets of their owners, or to a wider range of parasites? After all, Morton found that if the Cameroonians had a triple-bill of parasites, including a roundworm and a whipworm along with *Entamoeba*, their microbiomes were even *more* diverse. Diversity is generally seen as a good thing. Is it?

Likewise, when other groups see high levels of *Treponema* in the Hadza and Matsigenka, does that just reflect a higher burden of intestinal parasites? Is *that* what they're inadvertently talking about when they say

“ancestral”? And speaking of *Treponema*, Morton found it in all four groups but at very low levels, including in the hunter-gatherers. If it’s really part of some ancestral microbiome that has been abandoned through agriculture and industrialisation, then why is it rare in the Pygmies?

We can only answer these questions by looking at the microbiomes of people from different regions around the world. That’s why studies of the Hadza, Matses, Yanomami, and Pygmies are important. But as results come in, we must be wary of concocting simple narratives to explain characteristics of hunter-gatherer microbes.

References:

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See also:

- My New York Times op/ed: There Is No ‘Healthy’ Microbiome
- Jonathan Eisen’s post on the Matses paper



Ed Yong is a science writer and author of the National Geographic blog [Not Exactly Rocket Science](#).

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