Kangaroo fecal microbes could reduce methane from cows

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Baby kangaroo feces might help provide an unlikely solution to the environmental problem of cow-produced methane. A microbial culture developed from the kangaroo feces inhibited methane production in a cow stomach simulator in a Washington State University study.

After researchers added the baby kangaroo culture and a known methane inhibitor to the simulated stomach, it produced acetic acid instead of methane. Unlike methane, which cattle discard as flatulence, acetic acid has benefits for cows as it aids muscle growth. The researchers published their work in the journal *Biocatalysis and Agricultural Biotechnology.*

"Methane emissions from cows are a major contributor to greenhouse gases, and at the same time, people like to eat red meat," said Birgitte Ahring, corresponding author on the paper and a professor in with the Bioproducts, Sciences and Engineering Laboratory at the WSU Tri-Cities campus. "We have to find a way to mitigate this problem."

Reducing the burps and farts of methane emissions from cattle is no laughing matter. Methane is the second largest greenhouse gas contributor and is about 30 times more potent at heating up the atmosphere than carbon dioxide. More than half of the methane released to the atmosphere is thought to come from the agricultural sector, and ruminant animals, such as cattle and goats, are the most significant contributors. Furthermore, the process of producing methane requires as much as 10% of the animal's energy.

Researchers have tried changing cows' diets as well as giving them chemical inhibitors to stop methane production, but the methane-producing bacteria soon become resistant to the chemicals. They also have tried to develop vaccines, but a cow's microbiome depends on where it's eating, and there are far too many varieties of the methane-producing bacteria worldwide. The interventions can also negatively affect the animals' biological processes.

The WSU researchers study fermentation and anaerobic processes and had previously designed an artificial rumen, the largest stomach compartment found in ruminant animals, to simulate cow digestion. With many enzymes that are able to break down natural materials,

rumens have "amazing abilities," said Ahring, who is also a professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering and in Biological System Engineering.

Looking to investigate how to outcompete the methane-producing bacteria in their reactor, Ahring learned that kangaroos have acetic acid-producing, instead of methane-producing, bacteria in their foregut. Her students tracked down some kangaroos, took samples and learned that the specialized acetic acid-producing process only occurred in baby kangaroos—not in adults. Unable to separate out specific bacteria that might be producing the acetic acid, the researchers used a stable mixed culture developed from the feces of the baby kangaroo.

After initially reducing the methane-producing bacteria in their reactor with a specialized chemical, the acetic acid bacteria were able to replace the methane-producing microbes for several months with a similar growth rate as the methane-producing microbes.

While the researchers have tested their system in the simulated rumen, they hope to try it on real cows sometime in the future.

"It is a very good culture. I have no doubt it is promising," Ahring said. "It could be really interesting to see if that culture could run for an extended period of time, so we would only have to inhibit the methane production from time to time. Then, it could actually be a practice."

More information: Supriya C. Karekar et al, Reducing methane production from rumen cultures by bioaugmentation with homoacetogenic bacteria, *Biocatalysis and Agricultural Biotechnology* (2022). DOI: 10.1016/j.bcab.2022.102526

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