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Pregnancy Alters Resident Gut Microbes

Women's third-trimester microbiota resembles that of people at risk of diabetes

By Monya Baker and Nature magazine | August 2, 2012

Changes to gut microbes seen in pregnancy prepare a woman to nourish her child. Image: PhotoAlto/Alamy

Women's gut microbe populations change as pregnancy advances, becoming more like those of people who might develop diabetes. These changes, which do not seem to damage maternal health, correspond with increases in blood glucose and fat deposition thought to help a mother nourish her child.

Although scientists have profiled microbial communities around the world and throughout the human body, this is the first time they have tracked the gut microbiome during pregnancy, says Ruth Ley, a microbiologist at Cornell University in Ithaca, New York, who led the work[1].

Ley had previously explored the interplay of gut microbiota with metabolic syndrome[2], a precursor to diabetes that is characterised by high levels of inflammatory markers, blood sugar and fats. **Because similar changes occur during pregnancy,** she wondered whether the gut microbiota might reflect this. She and her colleagues sequenced microbial DNA from stool samples collected early and late in pregnancy, and found consistent shifts in the bacterial communities.

Overall, the diversity of gut bacteria declined between the first and third trimesters, but the abundance of *certain types, such as the Proteobacteria and Actinobacteria, increased.* These are also more common in people who are obese or have metabolic syndrome, says Ley. "**Proteobacteria** in particular are often the bad guys in these studies. **They are associated with inflammation."**

"This is the next step in describing how completely normal states of health can have profound changes," says Kjersti Aagaard, an obstetrician at Baylor College of Medicine in Houston, Texas, who was not involved in the research. The fact that the observed shift

occurred by the third trimester of pregnancy makes sense, she says. “That's when babies start packing on the pounds.” Earlier this year, Aagaard and her co-workers published work comparing vaginal microbiomes in pregnant and non-pregnant women; those in the pregnant women were dominated by L*actobacillus* species, which are thought to prevent the growth of harmful bacteria and aid human digestion[3].

One size fits all

Although the shifts in microbial diversity did not affect mothers’ health, stools collected during the third trimester contained more inflammatory markers than those collected during the first trimester. What’s more, the trends held true regardless of whether women were of normal weight or overweight before falling pregnant, had actually developed diabetes, or had taken antibiotics or probiotics (supplements taken to provide or boost populations of 'healthy' bacteria) during pregnancy. Meanwhile, after birth, the children’s microbiotas resembled those of the mothers' first trimester samples.

When Ley and her colleagues transplanted bacteria from stool samples into mice that had been raised under sterile conditions, they found that mice receiving microbiota from third-trimester samples became fatter and less sensitive to insulin than mice that were given first-trimester samples.

“That is pretty suggestive that the microbiome is at least contributing to the change, or maybe driving it,” says David Relman, a microbiologist at Stanford University in California who is looking for associations between pregnancy microbiomes and pre-term birth.

Ley speculates that physiological changes that occur during pregnancy alter the microbial community, which, in turn, creates a positive-feedback loop sustaining conditions seen in metabolic syndrome. “The body might be using the microbes as a tool,” she says. “You alter the microbiota, and they give you the changes in metabolism that you want.”

Distinguishing cause and effect will take a lot of work, says Relman. But such studies will be valuable regardless of the outcome. “It may be a mirror or monitor of the changes in the human host, and for that reason alone, it could provide novel insight into the physiology of pregnancy,” he says.

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