

Seeding and Feeding the Microbiome

How our babies' microbiomes are influenced by pregnancy, birth, and feeding method, and why it matters.

By Janelle Durham, LCCE. Co-author of *Pregnancy, Childbirth, and the Newborn*

What is the microbiome?

The collection of bacteria, viruses, fungi, and other organisms that live in and on the body. We have about 10 trillion human cells in our bodies, and about 100 trillion microbes. We have evolved in tandem with this microbiome for thousands of years. The balance of microbiomes varies throughout our body, and the bacteria found in our mouths is different than on our skin, which is different than in our intestines.

Why does the microbiome matter?

- A balance of microbes leads to optimal health. An imbalance can lead to disease. For example, a vaginal yeast infection occurs when the healthy bacteria are reduced by antibiotics, allowing yeast to overgrow.
- Good bacteria can aid digestion, provide vitamins (K and B12), regulate the bowels, stimulate the development of the immune system, and protect against infection.
- An overgrowth of harmful bacteria can lead to infectious disease.
- Disruption of gut microbiota is linked to inflammatory bowel disease, diabetes, obesity, allergies, and asthma.
- Studies have shown that the presence or absence of specific microbes can cause life-long changes in immunity.

How does a baby's microbiome develop?

- During pregnancy
 - In the past, the womb was believed to be a sterile environment. However, microbes are found in the placenta, amniotic fluid, and in meconium. (The waste that accumulates in the fetal bowels.)
 - Maternal exposure to healthy bacteria may benefit baby. Unhealthy bacteria also affect baby.
 - Maternal diet affects the fetal microbiome, leading to a different balance of bacteria in meconium.
- At birth
 - During a vaginal birth, a baby is exposed to the microbes in mother's vagina. In the third trimester, these are especially high in lactobacilli, which help the baby to digest milk.
 - When a baby is placed skin-to-skin on a parent, they're exposed to the parent's skin microbiome. Baby's skin, mouth, and digestive tract are "seeded" by whatever and whomever they first have contact with.
- Through feeding
 - Breastmilk exposes the baby to more microbes. Several are gut microbes that improve digestion.
 - Breastmilk contains sugars (oligosaccharides) which are not digestible by babies, and whose role appears to be to nourish / feed a healthy microbiome in baby's gut. These are also referred to as *prebiotics*. By helping healthy bacteria to grow, there is less room for unhealthy bacteria.
- Through the environment
 - As the baby starts to explore his world, crawling on the floor, playing outdoors, and putting everything in his mouth, his microbiome shifts and evolves, becoming quite diverse by age 3. The "hygiene hypothesis" states that babies who are exposed to more symbiotic organisms have lower risks of asthma and allergies, and stronger immune systems.

What can interfere with the establishment of a healthy microbiome?

- During pregnancy and labor
 - Antibiotics given to mom can affect the mix of microbes in the placenta, amniotic fluid and vagina. This disrupted microbiome is inherited by the baby.
- At birth
 - Babies born by cesarean are at increased risk of asthma, allergies, obesity, diabetes, and celiac disease. Studies comparing the microbiomes of vaginally born babies with those born via cesarean show differences in gut bacteria as much as seven years after delivery.
- Newborn care

- After cesarean birth, instead of skin-to-skin contact with the parents, the baby's first exposures are often to hospital bacteria and the skin microbes of hospital staff members. After any birth, if baby is wrapped in a blanket, and placed on a clothed parent, the transfer of skin microbes is not complete.
- Early baths remove / reduce protective vernix, vaginal microbiome, and baby's own newly seeded skin microbiome. Those are replaced by hospital microbes.
- If baby is given antibiotics, it reduces microbial diversity, and the number of both harmful and helpful bacteria. The longer the duration of antibiotics, the harder it is for the microbiome to recover. This can have long-term side effects, increasing risk of obesity or inflammatory bowel disease in later life.
- Feeding
 - Formula-fed babies (even those who just had short-term formula feeding in the first few days) had increased harmful bacteria and decreased helpful bacteria.

What can parents and health care providers do to foster a healthy microbiome?

- During pregnancy:
 - A mother can increase exposure to diverse healthy bacteria. Taking probiotic supplements may improve gut diversity (for mom and baby), may reduce gestational diabetes, and may reduce risk of allergy and eczema for the baby. You can eat probiotic foods which introduce healthy bacteria, such as fermented foods and foods with live cultures. And you can eat prebiotics – foods with oligosaccharides which feed healthy bacteria – see the list at the end of this handout.
 - Minimize exposure to unhealthy bacteria, such as food-borne illnesses.
- During pregnancy, labor, and postpartum: Minimize exposure to antibiotics. If they are needed, then the mother could consume probiotics or prebiotics after the course of antibiotics is complete.
- If baby will be delivered by cesarean, a baby's initial seeding is from hospital bacteria and skin microbes rather than vaginal microbes. You can expose the baby to vaginal bacteria by swabbing. Although swabbing does not colonize the baby as well as vaginal birth, it helps. (Swabbed babies had twice as much maternal bacteria as babies who were born by cesarean but not swabbed. Babies who were born vaginally had six times as much maternal bacteria.) Here's the process:
 - Sample mom's vagina: make sure the mother is HIV-negative, strep-B negative, and has an acid, lactobacillus-dominated vagina.
 - Place sterile gauze in the mother's vagina. Incubate gauze for one hour. Remove prior to surgery.
 - After birth, wipe the inside of baby's mouth, baby's face and hands with the gauze.
 - Note: If the caregiver will not do this procedure, the mother and partner can do it themselves.
- After birth, baby should go straight onto the mother's body, skin-to-skin. Wait 24 hours to bathe the baby.
- Feed baby only breastmilk for as long as possible.
- Giving probiotics to a baby can treat antibiotic-induced diarrhea, prevent eczema, reduce colic symptoms, and possibly reduce obesity in later life.
- Let your child explore their world, with plenty of time outdoors, exposure to animals,
- Offer your child diverse foods, including fermented foods and foods with live cultures (Yogurt, buttermilk, sour cream, kefir, sauerkraut and other fermented vegetables, tempeh, miso, soy sauce, kimchi, dosas and sourdough breads, kombucha, etc.) and prebiotic foods that are high in oligosaccharides (onions, garlic, legumes, wheat, asparagus, starchy vegetables like sweet potatoes, winter squash, turnips, parsnips, beets, and plantains.)

For complete source citations, go to www.transitiontoparenthood.wordpress.com/microbiome. Top 3 recommended sources:

- Arrieta, MC, et al. 2014. The intestinal microbiome in early life: health and disease. *Front Immunol.* Sep 5; 5:427. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4155789/>
- Collado, et al. (2012) Microbial ecology and host-microbiota interactions during early life stages. *Gut Microbes.* 3(4): 352-365. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3463493/>
- Reed, Rachel, and Johnson-Cash, Jessie. (2015) The Human Microbiome: considerations for pregnancy, birth and early mothering (blog post) <http://midwifethinking.com/2014/01/15/the-human-microbiome-considerations-for-pregnancy-birth-and-early-mothering/>