

## **The impact of the microbiome and microbial health on pregnant women, fetuses, and infants**

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### **Abstract**

#### **The impact of the microbiome and microbial health on pregnant women, fetuses, and infants**

Pregnancy and childbirth are not only a critical stage in shaping a person's physical, cognitive, and emotional development, but also play a key role in determining their long-term health. Recently, many studies have been conducted on the role of microbiota in human diseases, but their application to disease or health is relatively limited. Many bacteria that were previously recognized as pathogens are now recognized as essential partners in maintaining human health.

During pregnancy, the different microbiomes of the mother's body and any changes in the microbiomes of the vagina, intestine, and other parts can affect the health of the pregnancy and affect the transmission of bacteria to the baby. Clostridium species, known as the gut microbiome, can play an important role in the occurrence of reproductive disorders. These bacteria are known to cause systemic inflammation, which may lead to impaired ovarian function and changes in the menstrual cycle. Also, some of these species can affect hormonal balance and cause infertility problems and other disorders related to the female reproductive system.

#### **Changes in the microbiome during pregnancy**

The maternal gut microbiome is similar to that of a non-pregnant woman in the first trimester, but in the third trimester, the diversity of *Proteobacteria* increases to provide more energy for the fetus. Hormonal changes (estrogen and progesterone) affect the mother's metabolism.

#### **Effects on the fetus and newborn**

In humans, the placental microbiome is similar to that of the mother's mouth and includes *Lactobacillus* and *Bifid bacterium*, which support fetal neurodevelopment. Maternal microbial metabolites (such as short-chain fatty acids) cross the placenta and

shape fetal brain development, immune system, and metabolism. Vaginal delivery transfers vaginal microbes (*Lactobacillus*), while cesarean section increases the risk of obesity and allergies. After birth, vaginal delivery transfers beneficial vaginal microbes and reduces the risk of metabolic diseases, while cesarean section is associated with reduced diversity and increased Clostridium.

Dysbiosis is associated with low birth weight, NEC, and asthma. The Mediterranean diet and probiotics improve microbial diversity. In infants, this imbalance leads to NEC, sepsis, obesity, and neurodevelopmental disorders. Contributing factors include pre-pregnancy BMI, high-fat diet, stress, and antibiotics, which reduce diversity.



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Agent	Impact on the mother's microbiome	Effect on the fetus and newborn
High-fiber diet	Increase in Bifid bacterium	Reduced asthma and allergies
Antibiotics	Decrease in diversity	Increased risk of infection
Vaginal delivery	Transfer of Lactobacillus	Stronger immunity
Cesarean section	Dominance of Proteobacterium	Risk of obesity

A mother's diet, probiotic consumption, and avoidance of unnecessary antibiotics can promote a healthy microbiome. Maintaining a balanced maternal microbiome through nutrition and lifestyle ensures the long-term health of both mother and child.

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