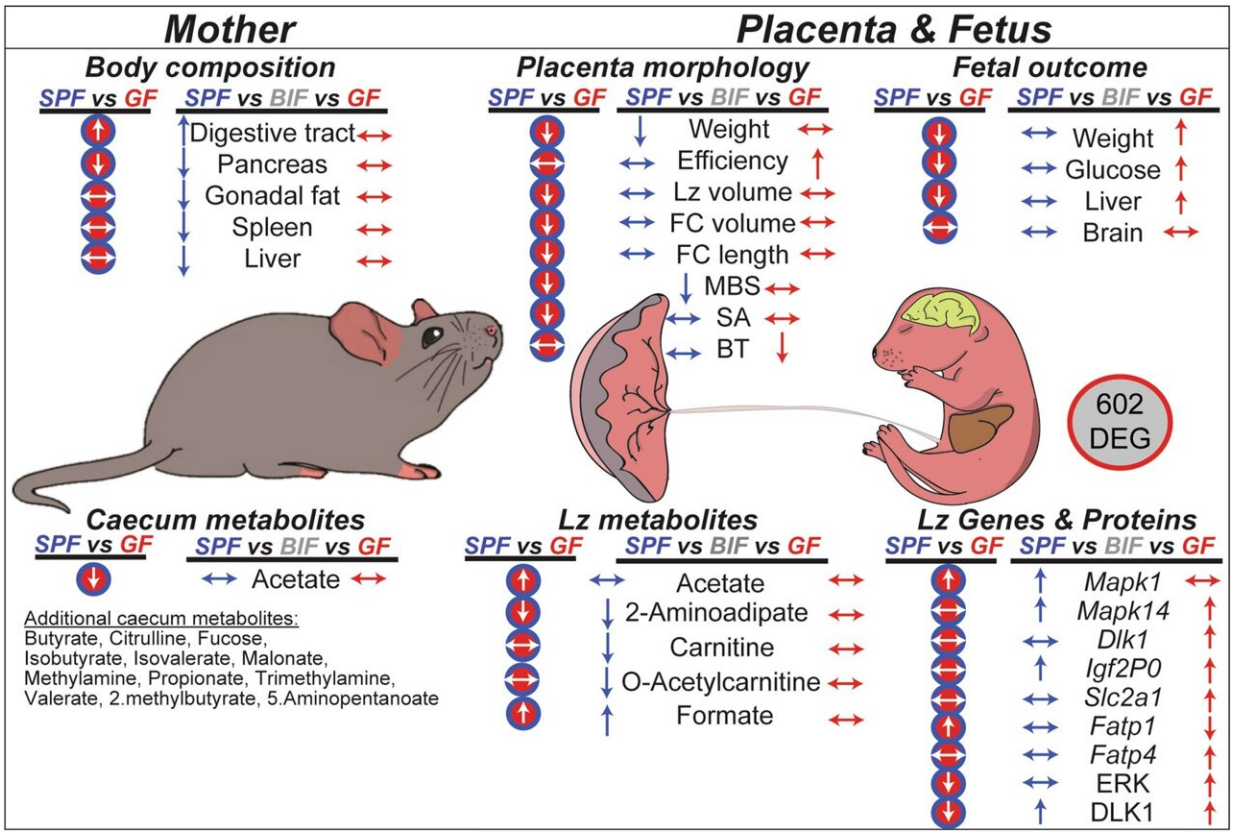
Maternal microbiome promotes healthy development of the baby

June 28 2022



Summary illustration showing the most relevant results on how the maternal gut microbiota and B. breve affects mother, placenta and fetus during gestation. The effects of lacking maternal gut microbiota on maternal, placental and fetal phenotype are shown in red circles (SPF vs GF comparisons). Our results suggest that lacking maternal gut microbiota aside from inducing changes in the maternal digestive tract, pancreas and caecum metabolites, has important implications for the correct growth of the fetus and its placenta. The effects of B. breve administration compared to the SPF and GF groups are shown in blue and red

arrows, respectively. Overall, B. breve induces changes in the maternal compartment that affect the structure, metabolome and function of the placenta in association with alterations in fetal metabolism, growth and hepatic transcriptome. SPF specific-pathogen-free mouse, GF germ-free mouse, BIF germ-free mouse treated with B. breve UCC2003, Lz labyrinth zone, MBS maternal blood spaces, FC fetal capillaries, SA surface area for exchange, BT barrier thickness, DEG differentially expressed genes. Credit: *Cellular and Molecular Life Sciences* (2022). DOI: 10.1007/s00018-022-04379-y

A mother's gut microbes can help in the development of the placenta, and the healthy growth of the baby—according to new research from the University of East Anglia, the Quadram Institute and the University of Cambridge.

Researchers studying mice found that a species of gut bacteria, known to have beneficial effects for health in mice and humans, changes the mother's body during pregnancy and affects the structure of the placenta and nutrient transport, which impacts the growing baby.

The bacteria, Bifidobacterium breve, is widely used as a probiotic, so this study could point to ways of combating pregnancy complications and ensuring a healthy start in life across the population.

Microbes in our gut, collectively called the gut microbiome, are known to play a key role in maintaining health, by combating infections, influencing the immune system and metabolism of the host's body.

They achieve these beneficial effects by breaking down food in our diet and releasing active metabolites that influence cells and body processes.

Scientists are now starting to unpick these metabolite-mediated interactions between microbes and the body from birth through to how

they affect aging, but so far little is known about how these influence fetal development and baby's health pre-birth.

The growing fetus receives nutrients and metabolites from its mother, but to what extent those metabolites are influenced by the maternal microbiome, and how this influences pregnancy, haven't been explored.

To address this, the team analyzed how supplementation with Bifidobacterium breve affected pregnancy in mice.

Prof Lindsay Hall, from UEA's Norwich Medical School and the Quadram Institute, has been studying Bifidobacterium and the microbiome in very early life, previously showing how providing specific probiotics can help premature babies.

These bacteria rise in numbers in the microbiome during pregnancy in humans and mice, and alterations in its levels have been linked to pregnancy complications.

Prof Hall said: "Our findings reveal that the maternal microbiome promotes development of the placenta and growth of the fetus.

"We think that this is linked to the altered profile of metabolites and nutrients, which affects nutrient transport from mother to baby across the placenta. Excitingly it appears that adding in a probiotic Bifidobacterium during pregnancy may help to boost how the placenta functions, which has positive effects on the baby's growth in utero."

Dr. Amanda Sferruzzi-Perri, from the University of Cambridge, said: "Pregnancy disorders affect around one in ten pregnant women. This is worrying as pregnancy complications can lead to health problems for the mother and her baby even after the pregnancy.

"This study carried out in mice, identifies a new player in the communication between mother, placenta and fetus, which is the maternal microbiome. Finding out how this form of communication works and how to improve it may help many women who develop pregnancy complications, as well as their developing child.

"Germ-free" mice can be bred lacking any microbes, allowing comparisons with other mice that have a "normal" microbiome. These comparisons provide valuable insights into the role of the microbiome in health and such studies can't be carried out in humans.

In this study, which was funded by the Wellcome Trust and the Biotechnology and Biological Sciences Research Council, they also looked at the effect of feeding germ-free mice the probiotic Bifidobacterium breve.

Their findings are published in the journal *Cellular and Molecular Life Sciences* and show that the maternal gut microbiome and Bifidobacterium breve specifically, have a role in regulating fetal growth and metabolism.

In the germ-free mice, the fetus did not receive adequate sugar and failed to grow and develop properly. Excitingly, providing Bifidobacterium breve to germ-free mice improved fetal outcomes by restoring fetal metabolism, growth and development to the normal levels.

Lacking the maternal microbiome also hampered the growth of the placenta in a way that would affect fetal growth, and more detailed analysis identified a number of key cell growth and metabolic factors that appear to be regulated by the microbiome and Bifidobacterium breve.

"The placenta has been a neglected organ despite it being vital for the

growth and survival of the fetus. A better understanding of how the placenta grows, and functions will ultimately result in healthier pregnancies for mothers and babies," said Dr. Lopez-Tello, from the University of Cambridge.

The researchers also found that the microbiome affected key nutrient transporters, including those for sugars within the placenta that would also influence the growth of the fetus.

These findings are strong indicators of a link between the microbiome of the mother and the development of the baby, but in this first study of its kind there are limitations.

This study focused on one single bacterial species, and whilst this showed that Bifidobacterium breve had positive effects on germ-free mice during pregnancy, this is not a natural situation. Future studies are needed to confirm these effects in a more natural and complex microbiome.

The study was carried out in mice and cannot automatically be translated into treatments for humans. The knowledge provided in this proof-of-concept animal study is critical for guiding future studies in humans that will uncover whether the human maternal microbiome has similar effects.

Certainly, if that is the case, it could provide a relatively simple and low-cost way to help improve pregnancy outcomes with positive benefit for the life-long health of the mother and her child.

"Maternal gut microbiota Bifidobacterium promotes placental morphogenesis, nutrient transport and fetal growth in mice" is published in the journal *Cellular and Molecular Life Sciences* on June 28, 2022.

More information: Jorge Lopez-Tello et al, Maternal gut microbiota Bifidobacterium promotes placental morphogenesis, nutrient transport and fetal growth in mice, *Cellular and Molecular Life Sciences* (2022). DOI: 10.1007/s00018-022-04379-y

Provided by University of East Anglia

Citation: Maternal microbiome promotes healthy development of the baby (2022, June 28) retrieved 27 April 2024 from https://phys.org/news/2022-06-maternal-microbiome-healthy-baby.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.