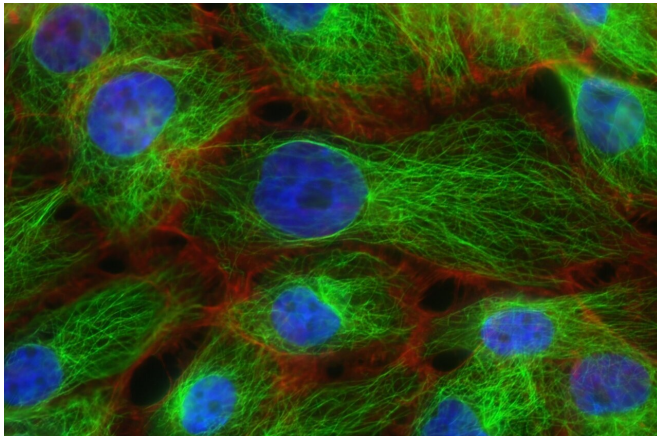


Researchers find evidence that diet can alter the microbiome to affect breast cancer risk

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When people think of microbiome, they typically think about the gut, but there's also a breast microbiome, and the role it plays in breast health and breast cancer isn't thoroughly understood. A microbiome is the collection of microorganisms that live in a particular environment in the body.

In 2018, scientists at Wake Forest School of Medicine, part of Wake Forest Baptist Health, showed that diet can influence the breast microbiome, demonstrating that like the [gut microbiome](#), the breast microbiota can respond to diet.

Now, new research shows that diet, including [fish oil supplements](#), can alter not only the breast microbiome, but also [breast cancer](#) tumors. The study appears online in *Cancer Research*, a journal of the American Association for Cancer Research.

To gain a better understanding of the relationship between microbiome, diet and cancer risk, researchers undertook a multi-prong approach to study both animal models and breast cancer

patients.

"Obesity, typically associated with a high-fat diet consumption, is a well-known risk factor in postmenopausal breast cancer," said Katherine L. Cook, Ph.D., assistant professor in the surgery—hypertension and cancer biology departments at Wake Forest School of Medicine. "But there's still a lot we don't know about the obesity link to microbiomes and the impact on breast cancer and patient outcomes."

In the first part of the study, mice susceptible to breast cancer were fed either a high-fat or a low-fat diet. Mice consuming the high-fat diet had more tumors, which also developed more quickly and were larger than the tumors in the group receiving the low-fat diet.

Next, to study the microbiome, researchers performed fecal transplants. Mice consuming the low-fat diet received the high-fat diet microbiome transplant, and mice consuming the high-fat diet received the low-fat diet microbiome transplant. Surprisingly, mice that consumed the low-fat diet and received a high-fat diet microbiome had just as many breast tumors as mice that had consumed the high-fat diet.

"Simply replacing the low-fat diet gut microbiome to the microbiome of [high-fat diet](#) consuming animals was enough to increase breast cancer risk in our models," Cook said. "These results highlight the link between the microbiome and breast health."

What's the significance for breast cancer patients? Researchers also conducted a double-blind placebo-controlled clinical trial with [breast cancer patients](#). Patients either received placebo or fish oil supplements for approximately two to four weeks before lumpectomy or mastectomy.

Results showed that fish oil supplementation significantly modified the breast microbiome in both

non-cancerous and malignant breast tissue. For example, scientists found longer-term administration of fish oil supplements (four weeks) increased the proportional abundance of *Lactobacillus* in the normal tumor-adjacent breast tissue. *Lactobacillus* is a genus of bacteria shown to decrease breast cancer tumor growth in preclinical models, suggesting potential anti-cancer properties of this intervention. Researchers also found decreased proportional abundance of *Bacteroidales* and *Ruminococcus* microbes in the breast tumors of patients taking the supplements, but the significance is unknown.

"This study provides additional evidence that diet plays a critical role in shaping the gut and breast microbiomes," Cook said. "Ultimately, our study highlights that potential dietary interventions might reduce breast [cancer risk](#)."

Cook's team is also conducting additional studies on whether probiotic supplements can affect [microbiome](#) populations in mammary glands and in breast tumors.

More information: David R. Soto-Pantoja et al. Diet alters entero-mammary signaling to regulate the breast microbiome and tumorigenesis. *Cancer Res* (2021) [DOI: 10.1158/0008-5472.CAN-20-2983](https://doi.org/10.1158/0008-5472.CAN-20-2983)

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