

Sugar compounds in breast milk relieve uncomfortable side effects caused by chemotherapy

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Two Vanderbilt researchers have isolated sugar compounds in breast milk that can relieve hidden yet life-altering negative side effects of

cancer treatment. Traditional chemotherapy destroys cancer by killing rapidly growing cancer cells has several visible, relatively minor side effects—rashes, hair loss and bruising. More severe patient reactions to chemotherapy include diarrhea, nausea, abdominal pain, bleeding and malnutrition. These symptoms are caused by mucositis—inflammation that destroys epithelial cells and can lead to ulceration in the upper digestive tract and the small intestine. Mucositis is highly likely to result in decreased quality of life and interruption of cancer treatment.

Steven Townsend, associate professor of chemistry, and Fang Yan, research professor of pediatrics and cell and development biology, have discovered how a sugar in [human breast milk](#), 2'-fucosyllactose, mitigates damage to the small intestines caused by chemotherapy-induced mucositis.

In the early stages of their research, Townsend and Yan, also a member of Vanderbilt Institute for Infection, Immunology, and Inflammation, were interested in the ability of human breast milk to support a healthier gastrointestinal system in breastfed babies compared with formula-fed babies. From there, they hypothesized that breast milk sugars could decrease damage in the intestinal lining of cancer patients undergoing chemotherapy. After inducing intestinal mucositis, Yan and Townsend administered 2'-fucosyllactose and found that the sugar successfully prevented epithelial cell death in mice. These results indicate that 2'-fucosyllactose is a promising compound to prevent chemotherapy's most uncomfortable side effects.

Further, there are no threats of toxicity in heavy exposure to these milk sugars, according to Townsend. "Babies consume 20-25 grams of these compounds a day from breast milk. There is no toxicity associated with the aspect of breast milk," he said.

Why it matters

Cancer is a powerful disease, affecting patients and their loved ones and caretakers. Discovering various strategies to improve the therapeutic experience of cancer patients, particularly treatment of tiresome side effects, works to benefit all.

"Intestinal mucositis is a well-kept secret. A vast majority of patients receiving chemotherapy experience inflammation in the gastrointestinal tract lining, but there are no effective treatments for the condition," Townsend said. Patients often have trouble discussing this side effect of chemotherapy with their doctor because of the magnitude of the choice they must make: to tolerate the side effect or to stop chemotherapy. Consequently, many cancer patients suffer in silence. To improve the physical health of cancer patients who experience intestinal mucositis, therapies are in demand for this invisible aspect of the disease.

What's next

In addition to mucositis, Townsend and Yan will expand the therapeutic targets of milk sugars to diseases like inflammatory bowel disease. This autoinflammatory disease has become a public health challenge with growing incidence worldwide.

A possible limitation with this project is the potential for breast milk to become inferior by utilizing milk sugars for alternative purposes. Milk sugars that mitigate chemotherapy-induced diseases also act as antibiotics; overuse of these sugars may evolve bacteria that are resistant to the effects of 2'-fucosyllactose in babies. One way Townsend plans to bypass this limitation is by using medicinal chemistry to identify similar compounds with the same effects as 2'-fucosyllactose. Townsend will begin researching the roughly 200 other sugar compounds in [breast milk](#) to search for even stronger results in preventing death of healthy cells.

The research was published in *Cellular and Molecular Gastroenterology and Hepatology*.

More information: Gang Zhao et al, 2'-fucosyllactose ameliorates chemotherapy-induced intestinal mucositis by protecting intestinal epithelial cells against apoptosis, *Cellular and Molecular Gastroenterology and Hepatology* (2021). [DOI: 10.1016/j.jcmgh.2021.09.015](https://doi.org/10.1016/j.jcmgh.2021.09.015)

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