Gut Bacteria and Breast Health

Is There a Link?

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The incidence of breast cancer is increasing world-wide. According to the American Cancer Society, in 2009 there were 192,370 new cases of invasive breast cancer and 40,170 deaths from breast cancer in the United States. Currently, breast cancer in women is the second most common type of cancer and the risk of a woman having invasive breast cancer some time during her life is approximately 1 in 8. Furthermore, breast cancer is the second leading cause of cancer death in women.[1]

Although at first glance it seems as if the gut and breast health are two unrelated topics, a new study is investigating a potential role of the beneficial bacteria found in the intestines, commonly called probiotics, in the reduced risk of breast cancer. Researchers at Rush University Medical Centre in Chicago are evaluating the possibility that tilting the balance of the GI tract in favor of harmful intestinal bacteria may explain the increase in the incidence of breast cancer. Although the study is currently in progress, the hypothesis the study authors have made is worth noting since they developed their hypothesis on the basis of past research that indirectly suggests that alterations in intestinal bacteria may play a role in breast cancer susceptibility.[2] The researchers also suggest that the intestinal flora passed from mother to child may provide another familial link not previously addressed in genetic breast cancer-risk models. In addition, the investigators propose that if this link is verified, it offers a new therapeutic intervention for reducing breast cancer risk by optimizing the gut bacteria with probiotic supplementation.

How Probiotics Affect Breast Health

There are several factors that indicate that the hypothesis that gut microflora play a role in breast health is plausible. One factor is that high-fat diets are associated with an increased risk of developing breast cancer and high-fat foods are known to alter the composition of flora in the intestines.[3-4] In fact, one study found nearly a 4-fold increase in the risk of breast cancer in women who ate a high-fat diet compared to women who ate a low-fat diet.[5] Animal studies have shown that mice fed high-fat diets had earlier onset of a second mammary tumor, a two-fold greater incidence, and a greater number of multiple tumors in the breast tissue compared to mice fed a low-fat diet, suggesting that high-fat diets play a role in breast cancer tumor promotion.[6]

It is proposed that changes in intestinal flora may alter either estrogen metabolism or carcinogen exposure. Increased estrogen exposure is a risk factor for the development of breast cancer.[7] Estrogen is excreted through the kidneys as well as via bile excretion into the intestines. The estrogens and the bile salts in the intestines are partially reabsorbed back into the body to be recycled through enterohepatic circulation. Intestinal bacteria directly affect bile acid metabolism by converting primary bile salts into secondary bile salts as well as impact the physiological activity of bile acids.[8] Depending on the species of bacteria, bile salt modifications differ, making optimal flora balance important. Sequestering of bile acids by probiotic bacteria may result in their effective removal after excretion.[9] One study found that supplementation with the probiotic Lactobacilli in rats suppressed the reabsorption of bile acids into the enterohepatic circulation and enhanced the excretion of acidic steroid hormones in the feces.[10] If optimal bacteria can reduce the reabsorption of estrogens by promoting bile excretion from the body, it would reduce excess estrogens associated with increased breast cancer risk.

One interesting study evaluated the association between dietary fat:fiber ratio and estrogen metabolism to attempt to explain the association between diet and breast cancer risk. In this study, half of the women were put on a high-fat, low-fiber diet and the other half were given a low-fat, high-fiber diet. The results showed that the women on the high-fat, low-

fiber diet had significantly increased total estrogens measured in the urine. The study also showed that total fat intake correlated significantly with plasma levels of specific forms of estrogens including estrone, estradiol, urinary 2-hydroxyestrone, 2-hydroxyestradiol, 2-hydroxyestrone:4-hydroxyestrone ratio and total urinary estrogens, even after adjusting the data to account for total fiber intake. The study found that dietary fat affects estrogen metabolism more than fiber intake, and that one mechanism resulting in high estrogen values is an increased reabsorption of estrogens into enterohepatic circulation.[11]

The intestinal bacteria also directly react with chemical compounds in the intestines such as hormones.[12]

Additionally, data indicates that certain probiotics such as bifidobacteria decrease fecal enzymes such as beta-glucuronidase, beta-glucosidase, nitroreductase and urease, which are involved in the metabolic activation of some carcinogens.[13] Data also suggests that lactic acid probiotics may exert cancer-suppressing activity due to interactions with other bacteria in the intestines. Lactic acid bacteria may inhibit the growth of bacteria that convert procarcinogens into carcinogens, thereby reducing the amount of carcinogens in the intestine.[14]

Probiotics

More than 400 strains of bacteria are found in the intestines. These bacteria are necessary for optimal health and provide numerous physiological functions such as improving the barrier function of the intestines, competing with and suppressing pathogenic bacteria and yeast, modulating or stimulating the immune response, reducing inflammation and playing a role in nutrient and enzyme synthesis and absorption.[15-16]

The potential of probiotics to play a role in breast health as well as their ability to optimize overall health indicates that supplementation with these beneficial bacteria can result in improved health. Common probiotic supplements include *Lactobacillus rhamnosus* GG (found in Culturelle®), and *Lactobacillus acidophilus* (DDS-1), *Bifidobacterium bifidum, Bifidobacterium longum, Bifidobacterium infantis* and *Bacillus coagulans* (found in BioPRO™). Numerous factors can deplete the levels of beneficial bacteria such as drinking chlorinated water, low-fiber diets or using antibiotics or other medications, thus making it important to replace them regularly for optimal health.

BioPRO also includes prebiotics, which are substances such as plant sugars that selectively promote the growth and function of beneficial bacteria in the colon. Prebiotics, such as fructooligosaccharides (FOS), are converted in the intestines to short chain fatty acids (SCFAs) by intestinal bacteria. SCFAs, particularly butyrate, provide several beneficial functions such as provide energy for the cells that line the colon, promote mucosal cell restoration, protect the mucosal lining from damaging intestinal contents and stimulate mucous production that is an important part of the intestinal mucosal barrier.[17-19] Furthermore, research suggests that butyrate may inhibit tumor formation in animal models of breast cancer. One study showed that rats fed a high-fat diet supplemented with butyrate and exposed to chemicals to induce breast cancer showed a decrease in tumor incidence by 20-52 percent compared to the rats fed the high-fat diet alone.[20]

Conclusion

Research is currently underway to evaluate the possible role that pathogenic intestinal bacteria may play in the development of breast cancer as well as the role that beneficial intestinal bacteria may play in protecting breast health. Previous research provides indirect evidence suggesting that this hypothesis is plausible. Data supporting this possibility indicates that high-fat diets affect both intestinal bacteria and breast cancer risk; intestinal bacteria affect bile and estrogen reabsorption; probiotics can directly affect hormone metabolism; and probiotics can bind to carcinogens in the colon. Thus, probiotics may offer additional beneficial activity protecting breast health.

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