Can vitamin A turn back the clock on breast cancer?

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A derivative of vitamin A, known as retinoic acid, found abundantly in sweet potato and carrots, helps turn pre-cancer cells back to normal healthy breast cells, according to research published this month in the *International Journal of Oncology*. The research could help explain why some clinical studies have been unable to see a benefit of vitamin A on cancer: the vitamin doesn't appear to change the course of full-blown cancer, only pre-cancerous cells, and only works at a very narrow dose.

Because cells undergo many changes before they become fully aggressive and metastatic, Sandra V. Fernandez, Ph.D., Assistant Research Professor of Medical Oncology at Thomas Jefferson University, and colleagues, used a model of breast cancer progression composed of four types of cells each one representing a different stage of breast cancer: normal, pre-cancerous, cancerous and a fully aggressive model.

When the researchers exposed the four breast cell types to different concentrations of retinoic acid – one of the chemicals that the body converts vitamin A into – they noticed a strong change in the pre-cancerous cells. Not only did the pre-cancerous cells begin to look more like normal cells in terms of their shape, they also changed their genetic signature back to normal. Dr. Fernandez's pre-cancerous cells had 443 genes that were either up or downregulated on their way to becoming cancerous. All of these genes returned to normal levels after treatment with retinoic acid. "It looks like retinoic acid exerts effects on cancer cells in part via the modulation of the epigenome," says Fernandez.

"We were able to see this effect of retinoic acid because we were looking at four distinct stages of breast cancer," says Dr. Fernandez. "It will be interesting to see if these results can be applied to patients."

Interestingly, the cells that were considered fully cancerous did not respond at all to retinoic acid, suggesting that there may be a small window of opportunity for retinoic acid to be helpful in preventing cancer progression. In addition, the researchers showed that only one concentration of retinoic acid (about one micro Molar) produced the anti-cancer effects. Lower concentrations gave no change, and higher concentrations produced a smaller effect.

The next step will be to try to learn whether the amount of retinoic acid required can be maintained in an animal model, and if that concentration will have the same effects as Dr. Fernandez observed in cells. If those studies show the same effect, the next step would be to test whether these observations hold true in humans.

More information: M.F. Arisi, et al, "All trans-retinoic acid (ATRA) induces re-differentiation of early transformed breast epithelial cells," International Journal of Oncology, DOI: 10.3892/ijo.2014.2354, 2014.

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