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Study suggests vitamin therapy may be harmful to breast cancer patients

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(PhysOrg.com) -- A recent University of Georgia study indicates that a common vitamin used to treat breast cancer victims might actually be harmful to patients. The study, by Jason Zastre, an assistant professor in the UGA College of Pharmacy, was published in the December issue of *Cancer Biology and Therapy*.

Zastre's studies focus on the uptake and function of thiamine, or vitamin B1, which is essential for the functioning of the heart, muscles and nervous system, and helps the body's cells convert carbohydrates, including glucose, into energy.

"Supplemental thiamine therapy is often recommended when breast cancer patients suffer from anemia caused by their chemotherapy treatment," said Zastre. "Taking thiamine helps maintain red blood cell function so the body can ward off anemia and other deleterious effects that result from thiamine deficiencies commonly associated with cancer."

Supplementation of thiamine in advanced breast cancer patients, however, might prove to be harmful and actually promote disease progression of solid tumors, according to Zastre, whose research has revealed findings about thiamine uptake by cancer cells that have never been previously published.

Tumor cells, in general, use glucose in conjunction with oxygen to produce energy for rapid cell growth, he said. In solid tumors, such as

breast cancer, the rapid and continuous cell proliferation within the tumors can lead to an underdeveloped and dysfunctional vascular network throughout the tumor. The result is termed hypoxia, a condition in which cancer cells are subjected to reduced oxygen supply since they are not in close proximity to blood vessels. These hypoxic regions within the tumor can enhance the aggressiveness of cancer, increase its potential to metastasize or cause disease relapse.

Hypoxic stress also causes a metabolic shift within the cells, which then require additional nutrients and growth factors, such as thiamine, in order for them to adapt and survive in the low oxygen environment. Zastre's research focuses on what transpires during the metabolic shift in a hypoxic environment and what nutrients are involved in the process.

Since thiamine's ability to enter cells is dependent on transporter proteins, he hypothesized that if the number of thiamine transporters increases in hypoxic cells, the amount of thiamine able to enter the cells should also increase.

"In our lab we observed that the metabolic shift associated with hypoxic cells resulted in the enhanced expression and function of thiamine transporters, which allowed for a greater increase in thiamine uptake than is seen in non-hypoxic breast cancer cells," said Zastre, who has received funding for the past three years from the Georgia Cancer Coalition to study cancer therapeutics and drug transporters. "Thiamine may then promote growth in these hypoxic cancer cells in much the same way as in healthy tissue.

"Studying the involvement of enzyme co-factors, such as vitamin B1, in hypoxic cancer cell metabolism is not normally a focus of cancer research, so our work has been novel and encouraging," he noted.

Understanding what processes allow for the enhanced production of

thiamine transporters and what role the increased thiamine uptake may be in supporting survival of hypoxic cancer cells are questions that have yet to be answered.

“The big questions are what role does increased thiamine transport and delivery to hypoxic breast cancer cells contribute to malignant progression and how can we exploit this knowledge for therapeutic benefit,” Zastre said.

Due to thiamine’s potential as an essential co-factor in the metabolic shift that occurs in hypoxic cancer cells, thiamine might not be an appropriate supplementation for advanced cancer patients, he added.

Provided by University of Georgia