Soybean compounds enhances effects of cancer radiotherapy

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A Wayne State University researcher has shown that compounds found in soybeans can make radiation treatment of lung cancer tumors more effective while helping to preserve normal tissue.

A team led by Gilda Hillman, Ph.D., professor of radiation oncology at Wayne State University's School of Medicine and the Barbara Ann Karmanos Cancer Institute, had shown previously that soy isoflavones, a natural, nontoxic component of soybeans, increase the ability of radiation to kill cancer cells in prostate tumors by blocking DNA repair mechanisms and molecular survival pathways, which are turned on by the cancer cells to survive the damage radiation causes.

At the same time, isoflavones act to reduce damage caused by radiation to surrounding cells of normal, noncancerous tissue. This was shown in a clinical trial conducted at WSU and Karmanos for prostate cancer patients treated with radiotherapy and soy tablets.

In results published in the journal *Nutrition and Cancer* in 2010, those patients experienced reduced radiation toxicity to surrounding organs; fewer problems with incontinence and diarrhea; and better sexual organ function. Hillman's preclinical studies in the prostate tumor model led to the design of that clinical trial.

Soy isoflavones can make cancer cells more vulnerable to ionizing radiation by inhibiting survival pathways that are activated by radiation in cancer cells but not in normal cells. In normal tissues, soy isoflavones

also can act as antioxidants, protecting those tissues from radiation-induced toxicity.

During the past year, Hillman's team achieved similar results in non-small cell lung cancer cells in vitro. She recently received a two-year, $347,000 grant from the National Cancer Institute, part of the National Institutes of Health, to investigate whether those results also proved true for non-small cell lung tumors in mice, and has found that they do. Her findings, which she called "substantial" and "very promising," appear in the November 2011 edition of the journal Radiotherapy and Oncology.

Hillman emphasized that soy supplements alone are not a substitute for conventional cancer treatment, and that doses of soy isoflavones must be medically administered in combination with conventional cancer treatments to have the desired effects.

"Preliminary studies indicate that soy could cause radioprotection," she said. "It is important to show what is happening in the lung tissue."

The next step, she said, is to evaluate the effects of soy isoflavones in mouse lung tumor models to determine the conditions that will maximize the tumor-killing and normal tissue-protecting effects during radiation therapy.

"If we succeed in addressing preclinical issues in the mouse lung cancer model showing the benefits of this combined treatment, we could design clinical protocols for non-small cell lung cancer to improve the radiotherapy of lung cancer," Hillman said. "We also could improve the secondary effects of radiation, for example, improving the level of breathing in the lungs."

Once protocols are developed, she said, clinicians can begin using soy isoflavones combined with radiation therapy in humans, a process they

believe will yield both therapeutic and economic benefits.

"In contrast to drugs, soy is very, very safe," Hillman said. "It's also readily available, and it's cheap.

"The excitement here is that if we can protect the normal tissue from radiation effects and improve the quality of life for patients who receive radiation therapy, we will have achieved an important goal."

Provided by Wayne State University