Researchers use soy to improve bone cancer treatment

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Researchers in recent years have demonstrated the health benefits of

soy, linking its consumption to reduced risk of cardiovascular disease, obesity, cancer and improved bone health.

Now, WSU researchers are hoping to use the health benefits of the popular legume to improve post-operative treatment of bone cancer.

Reporting in the journal, *Acta Biomaterialia*, graduate student Naboneeta Sarkar and Professor Susmita Bose in WSU's School of Mechanical and Materials Engineering showed that the slow release of soy-based chemical compounds from a 3-D-printed bone-like scaffold resulted in a reduction in bone cancer cells while building up healthy cells and reducing harmful inflammation.

"There is not much research in this area of natural medicinal compounds in biomedical devices," Bose said. "Using these natural medicines, one can make a difference to human health with very minimal or no side effects, although a critical issue remains composition control."

Although rare, osteosarcoma occurs most often in children and young adults. Despite medical advances, patients with osteosarcoma and metastatic bone cancer experience a high rate of recurrence, and osteosarcoma is second leading cause of cancer death in children.

Treatment involves surgery to remove the tumor as well as pre- and post-operative chemotherapy. Large areas of bone need to be removed and repaired, and patients often experience a significant amount of inflammation during bone reconstruction, which slows healing. High doses of chemotherapy before and after surgery can also have harmful side effects.

Researchers would like to develop gentler treatment options, especially after surgery when patients are trying to recover from bone damage at the same time that they are taking harsh drugs to suppress tumor growth.

Bose's team has been studying bone tissue engineering as an alternative strategy to repair the bone, using materials science principles and advanced manufacturing techniques to develop effective biomedical devices.

As part of this study, the researchers used 3-D printing to make patient-specific, bone-like scaffolds that included three soy compounds and then slowly released the compounds into samples containing bone cancer as well as healthy bone cells. Soybeans contain isoflavones, plant-derived estrogens that have been shown to impede cancer cell growth for many types of cancer without being toxic to normal cells. Isoflavones have also been shown to improve bone health and possibly prevent osteoporosis.

One of the soybean compounds caused a 90% reduction in bone cancer cell viability in their samples after 11 days. Two other soy compounds, meanwhile, significantly improved the growth of healthy bone cells. Furthermore, using the soy compounds in animal models also reduced inflammation, which could benefit bone health as well as overall recovery.

"These results advance our understanding in providing therapeutic approaches in using synthetic bone grafts as a drug delivery vehicle," Bose said.

The researchers are continuing the unique area of research, studying the specific pathways of the genetic expression of natural compounds and the benefits of integrating them in biomedical technology. More detailed long-term studies are needed, using animal research as well as other malignant cells, she said.

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More information: Naboneeta Sarkar et al, Controlled release of soy

isoflavones from multifunctional 3D printed bone tissue engineering scaffolds, *Acta Biomaterialia* (2020). DOI: 10.1016/j.actbio.2020.07.006