

Study shows an ancient crop effective in protecting against a 21st century hazard

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Flax has been part of human history for well over 30,000 years, used for weaving cloth, feeding people and animals, and even making paint. Now, researchers from the Perelman School of Medicine at the University of Pennsylvania have discovered that it might have a new use for the 21st century: protecting healthy tissues and organs from the harmful effects of radiation. In a study just published in *BMC Cancer*, researchers found that a diet of flaxseed given to mice not only protects lung tissues before exposure to radiation, but can also significantly reduce damage after exposure occurs.

"There are only a handful of potential mitigators of radiation effect, and none of them is nearly ready for the clinic," says the principal investigator Melpo Christofidou-Solomidou, PhD, research associate professor of Medicine, Pulmonary, Allergy and Critical Care Division. "Our current study demonstrates that dietary flaxseed, already known for its strong antioxidant and anti-inflammatory properties, works as both a mitigator and protector against radiation pneumonopathy."

In several separate experiments, the researchers fed one group of mice a diet supplemented with 10 percent flaxseed, either three weeks before a dose of X-ray radiation to the thorax or two, four, or six weeks after [radiation exposure](#). A control group subjected to the same [radiation dose](#) was given the same diet but receiving an isocaloric [control diet](#) without the flaxseed supplement. After four months, only 40 percent of the irradiated control group survived, compared to 70 to 88 percent of the irradiated flaxseed-fed animals. Various studies of blood, fluids, and

tissues were conducted.

Dr. Christofidou-Solomidou and her colleagues found that the flaxseed diet conferred substantial benefits regardless of whether it was initiated before or after irradiation. Mice on flaxseed displayed improved [survival rates](#) and mitigation of radiation pneumonitis, with increased blood oxygenation levels, higher body weight, lower pro-inflammatory cytokine levels, and greatly reduced pulmonary inflammation and fibrosis.

The latter finding is especially exciting, because while radiation-induced inflammatory damage can be potentially treated with steroidal therapy (in radiotherapy patients for example), lung fibrosis is essentially untreatable. "There's nothing you can give to patients to prevent fibrosis," Dr. Christofidou-Solomidou points out. "Once a lung becomes "stiff" from collagen deposition, it's irreversible. We have discovered that flaxseed not only prevents fibrosis, but it also protects after the onset of radiation damage."

Dr. Christofidou-Solomidou and her colleagues are focusing further research on the bioactive lignan component of flaxseed, known as SDG (secoisolariciresinol diglucoside), which is believed to confer its potent antioxidant properties. The lignan component also "regulates the transcription of antioxidant enzymes that protect and detoxify carcinogens, free radicals and other damaging agents", she says.

Flaxseed boasts many other qualities that make it particularly attractive as a radioprotector and mitigator. "Flaxseed is safe, it's very cheap, it's readily available, there's nothing you have to synthesize," Dr. Christofidou-Solomidou notes. "It can be given orally so it has a very convenient administration route. It can be packaged and manufactured in large quantities. Best of all, you can store it for very long periods of time." That makes it especially interesting to government officials

looking to stockpile radioprotective substances in case of accidental or terrorist-caused radiological disasters.

Co-author Keith Cengel, MD, PhD, assistant professor of Radiation Oncology at Penn, explains that in such cases, "a big issue is the 'worried well' -- all the folks who probably weren't exposed but are concerned and want to do something." Many potential radioprotectors, however, could have risky side effects. Dr. Christofidou-Solomidou adds, "When you give something to 4 or 5 million 'worried well,' you have people with preexisting medical conditions. You can't give just anything to people with heart disease, for example. But this is absolutely safe. In fact, it is known to increase cardiovascular health, a finding shown by another group of Penn investigators a few years ago. It's loaded with omega-3 fatty acids."

Along with other researchers at the Perelman School of Medicine, the authors are conducting further pilot studies on the potential of flaxseed for mitigation of lung damage in patients awaiting lung transplants and those undergoing radiation therapy for the treatment of intra-thoracic malignancies. Dr. Christofidou-Solomidou is even conducting a pilot study for NASA on the benefits of flaxseed for astronauts on extended deep space missions. Lengthy space exploration missions require that the astronauts perform extravehicular activities (EVAs) for repairs, during which they can face exposure to high levels of solar and galactic radiation with the added risk factor of breathing 100 percent oxygen. "Hyperoxia superimposed with radiation could potentially cause some lung damage and some reason to worry for the astronauts," she says. "We are one of a handful of teams in the US that can study radiation in addition to hyperoxia. So now we're adding another level of complexity to the one-hit, [radiation](#) damage studies; the double-hit model is something novel, nobody has done it before."

The researchers are already convinced enough to incorporate [flaxseed](#)

into their own routine. "I actually eat it every morning," says Dr. Cengel, noting, "The potential health benefits are significant and there is no known toxicity—it just makes good sense to me."

Provided by University of Pennsylvania School of Medicine

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