Antioxidants could provide all-purpose radiation protection

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Two common dietary molecules found in legumes and bran could protect DNA from the harmful effects of radiation, researchers from the University of Maryland report. Inositol and inositol hexaphosphate (IP6) protected both human skin cells and a skin cancer-prone mouse from exposure to ultraviolet B (UVB) radiation, the damaging radiation found in sunlight, the team reported today at the American Association for Cancer Research Centennial Conference on Translational Cancer Medicine.

According to the researchers, inositol and IP6 could decrease the severity of side effects from radiation therapy, saving healthy cells while simultaneously increasing the potency of the treatment against cancer cells. Both molecules are potent antioxidants, the Maryland researchers say, capable of preventing reactive molecules from injuring DNA and turning cells cancerous.

“Both of these potent antioxidants have been shown to have broad-spectrum anti-tumor capabilities, and now our studies confirm the degree to which these molecules protect against the DNA-damaging effects of ionizing radiation,” said Abulkalam M. Shamsuddin, M.D., professor of pathology at the University of Maryland School of Medicine. “Radiation damage is radiation damage, regardless of the source, so there could also be a protective role for IP6 in any form of radiation exposure, whether it is from a therapeutic dose or from solar, cosmic or nuclear sources.”

While both inositol and IP6 are related to B vitamins, they are not considered essential dietary nutrients. In the 1980s, however, researchers discovered that these molecules, abundant within the hulls of seeds and grains, had definitive protective effects against colorectal cancer.

Inspired by reports of a clinical trial begun in 2001 at Clinical Hospital in Split, Croatia, which suggested IP6 enhanced the effectiveness of radiotherapy while lessening the side effects, Shamsuddin and his colleagues sought to investigate the extent of the protective properties of these molecules. With funding from IP-6 Research, Inc., a company formed by Shamsuddin, the researchers began a study to determine how human skin cells responded to UVB radiation when dosed with IP6.

Normally, cells permanently damaged by radiation undergo a genetically programmed process of cell suicide, called apoptosis. Shamsuddin reports that UVB-irradiated human keratinocytes, when treated with IP6, were more likely to survive. Untreated skin cells were more likely to undergo apoptosis, indicating that the DNA in those cells was damaged irreparably and fatally. According to Shamsuddin, the treated cells take an extended pause at the point in the cellular life cycle where innate mechanisms repair DNA before the cell divides.

“IP6 certainly has some interactivity with DNA, but how exactly it works to repair DNA is still something of a mystery. There are reports that IP6 binds with DNA repair molecule Ku to bring about the repair process,” Shamsuddin said. “More importantly, we still don’t know how IP6 can appear to help healthy cells live while also enhancing the ability of radiation to kill cancer cells.”

Shamsuddin and his team found that when mice engineered to be prone to skin cancer were given drinking water containing a two-percent solution of IP6, they were much less likely to develop tumors. Twenty-three percent of treated mice developed tumors, compared to 51 percent

of untreated, or control mice, which developed tumors. Moreover, the mice in the treated group that did develop cancer had only half as many tumors as the control mice.

Similarly, Shamsuddin saw that mice treated with a topical cream containing four percent IP6 plus one percent inositol were also less likely to develop tumors. When they administered the cream an hour before UVB irradiation akin to sun exposure, 62 percent of the treated mice developed tumors compared to 76 percent of the control mice. According to Shamsuddin, their findings indicate that either topical or ingested IP6 might confer protection against ionizing radiation.

Ionizing radiation occurs in the environment in many forms, originating from both natural and human-contrived sources. In humans, exposure to ionizing radiation occurs primarily through therapeutic techniques (such as anticancer radiotherapy), and sunbathing. Astronauts, pilots and passengers of high-altitude aircraft also are inordinately exposed to solar radiation. Such radiation exposures have a cumulative effect, increasing the chances of developing cancer over time, researchers say. “It is possible that people regularly exposed to ionizing radiation, such as airline pilots, frequent fliers or people who handle radioactive materials, might take IP6 prophylactically to prevent possible long term effects of exposure,” Shamsuddin said.

According to Shamsuddin, IP6 could also offer protection against accidents or purposeful incidents involving nuclear material. ”It could also be advisable to use IP6 plus inositol as a cautionary treatment following a nuclear disaster or dirty bomb,” Shamsuddin said.

Source: American Association for Cancer Research