Deciphering the Radioprotective Effects of the Soy Isoflavone Genistein in Lung Cells

Sridharan, Siddharth (School: Little Rock Central High School)

Radiation-induced lung disease is a potential challenge for thoracic cancer survivors, who received radiotherapy. Hence, research to identify drugs that have selective effects on normal and cancer cells is necessary. Genistein, the major biologically active soy isoflavone possesses potent medicinal properties. This project was aimed to decipher the molecular mechanisms involved in the radioprotective effects of Genistein in normal lung cells and to demonstrate its radiosensitizing/cytotoxic effects in cancer cells. WI38 and A549 cells were used. First, effects of genistein on antioxidant activity (DPPH assay), and TBHP-induced reactive oxygen species (DCDFA assay) were analyzed. Next, after pretreatment with genistein (20 μM, 24 h), cells were exposed to 4 Gy gamma irradiation. 24 h after radiation exposure, cell viability (MTT assay), ROS generation, and protein levels of SOD2, Catalase, GPx, caspases 3,7 and 9 (Western Blotting) were also studied. Molecular docking analysis was also performed. Genistein exhibited a robust free radical scavenging activity and significantly reduced TBHP-induced intracellular ROS. Genistein pretreatment significantly prevented cell death, preserved morphology, decreased intracellular ROS, and maintained protein levels of SOD2, catalase, GPx and enzymes of the apoptotic pathway after radiation exposure. Genistein, either alone or in combination with radiation significantly decreased cell viability and increased ROS levels in cancer cells. To conclude, genistein exhibited robust protective effects against radiation injury in normal lung cells and cytotoxic/radiosensitizing effects in cancer cells. Hence, genistein may be a potential candidate to be considered as an adjuvant drug for patients undergoing radiotherapy.

Awards Won:

Fourth Award of $500

Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient

Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category, FOR 2023 ONLY: EBED WILL HAVE TWO