

The Problems with Irradiated Food: What the Research Says

In the course of legalizing the irradiation of beef, chicken, pork, fruit, vegetables, eggs, juice, spices and sprouting seeds - a process that has spanned nearly 20 years - the U.S. Food and Drug Administration has dismissed or ignored a substantial body of evidence suggesting that irradiated food may not be safe for human consumption. The following is a sampling of research - appearing in scientific journals and other publications - that raise questions about the FDA's assertions that people who eat irradiated food have nothing to worry about.

Reproductive Problems, Cancer in Mammals

"A careful analysis by FDA of all [Army] data present (including 31 looseleaf notebooks of animal feeding test results) showed significant adverse effects produced in animals fed irradiated food... What were these adverse effects?... A decrease of 20.7 percent in surviving weaned rats... A 32.3 percent decrease in surviving progeny of dogs... Dogs weighing 11.3 percent less than animals on the control diets... Carcinomas of the pituitary gland, a particularly disturbing finding since this is an extremely rare type of malignant tumor."

- Spiher, A.T. "Food irradiation: An FDA report."
FDA Papers, Oct. 1968.

Fatal Internal Bleeding in Rats (I)

"A significant number of rats consuming irradiated beef died from internal hemorrhage within 46 days, the first death of a male rat coming on the 11th day of feeding. This rat became sluggish on the 8th day of the regimen and started refusing food. He continued [to be] morbid during the next two days, did not eat any food, lost weight and appeared anemic. He was found dead on the 11th day. Post-mortem examination showed hemothorax [chest injury], the blood had not clotted; there was bleeding also in the epididymis [tubes at the back of the testes]."

- Metta, V.C. et al. "Vitamin K deficiency in rats induced by feeding of irradiated beef."
Journal of Nutrition, 69:18-21, 1959.

(Co-sponsored by the Surgeon General of the U.S. Army)

Fatal Internal Bleeding in Rats (II)

"Hemorrhagic death had occurred in all males fed irradiated diets by day 34... There is evidence to suggest that inefficient absorption of vitamins, i.e. vitamin K, from the intestinal tract may contribute to a deficiency state." [Note: *Vitamin K plays a major role in blood clotting.*]

- Mellette, S.J. and Leone, L.A. "Influence of age, sex, strain of rat and fat soluble vitamins on hemorrhagic syndromes in rats fed irradiated beef."
Federation Proceedings, 19:1045-1048, 1960.
(Co-sponsored by the Surgeon General of the U.S. Army)

Fetal Deaths in Mice

"Freshly irradiated diets produced elevated levels of early deaths in [mice fetuses]... The increase in early deaths would suggest that the diet when irradiated has some mutagenic potential."

- Anderson, D. et al. "Irradiated laboratory animal diets: Dominant lethal studies in the mouse."
Mutation Research, 80:333-345, 1981.

Embryo Deaths in Mice

"Feeding of mice for two months before mating with 50 percent of the standard complete diet irradiated with [gamma rays] provokes a significant increase of embryonal deaths,... probably to be interpreted as a dominant lethal mutation associated with gross chromosomal aberrations, such as breaks repeatedly found to be induced by irradiated materials."

- Moutschen-Dahmen, M. et al. "Pre-implantation death of mouse eggs caused by irradiated food."
International Journal of Radiation Biology, 18:201-216, 1970.

Radioactive Organs and Excrement in Rats

"Considerable amounts of radioactivity were present in the liver, kidney, stomach, gastrointestinal tract, and blood serum of rats [fed irradiated sucrose solutions]... Radioactivity was present in urine and feces samples.

- De, A.K. et al. "Biochemical effects of irradiated sucrose solutions in the rat."
Radiation Research, 37:202-215, 1969.

A Thalidomide Warning (I)

"The thalidomide disaster might have been prevented if an easily performed investigation of possible cytotoxic effects in plant cells had been made. It must be acknowledged that any compound causing [cellular] damage must be considered a potential hazard to any living cell or cell system^{3/4}including man."

- Lofroth, G. "Toxic effects of irradiated foods."
Nature, 211:302, 1966.

A Thalidomide Warning (II)

"Irradiating can bring about chemical transformations in food and food components resulting in the formation of potential mutagens, particularly hydrogen peroxide and various organic peroxides... It is now realized, especially since the thalidomide episode, that [older testing] protocols do not detect the more subtle population hazards such as mutagens and teratogens... In view of the serious consequences to the human population which could arise from a high level of induced mutations, it is desirable that protocols for irradiated food should include *in vivo tests* on mammals for possible mutagenicity."

- Schubert, J. "Mutagenicity and cytotoxicity of irradiated foods and food components."
Bulletin of the World Health Organization, 41:873-904, 1969.
(Co-sponsored by the U.S. Atomic Energy Commission
and Food and Drug Administration)

A Host of Problems

"Numerous studies have been carried out to ascertain whether cytotoxic effects occur when unirradiated biological test systems are cultured or fed with irradiated media or food. In such studies, adverse physiological (growth retardation and inhibition), cytological (mitotic [cell division] inhibition and chromosome aberrations) and genetical (forward and reverse mutations) effects have been observed in a wide range of test systems, ranging from bacteriophages to human cells... The available data suggest that [a variety of free radicals] may act as the toxic and mutagenic agents."

- Kesavan, P.C. and Swaminathan, M.S. "Cytotoxic and mutagenic effects of irradiated substrates and food material."
Radiation Botany, 11:253-281, 1971.

A Cancer Warning

"An increase in concentration of a mutagen in food by irradiation will increase the incidence of cancer... It will take four to six decades to demonstrate a statistically significant increase in cancer due to mutagens introduced into food by irradiation... When food irradiation is finally prohibited, several decades worth of people with increased cancer incidence will be in the pipeline."

- Tritsch, G.L. "Food Irradiation."
Nutrition, 16:698-701, 2000.

Mutations in Fruit Flies

"An increase in the rate of mutation has been found in *Drosophila melanogaster* [fruit flies] reared on a basic medium that was irradiated with a sterilizing dose (150,000 rads) of cobalt-60 gamma rays... Visible changes were two to six times more frequent in the irradiated series than in the controls,... [such as] half-thorax, vestigial wings and incurved wings." [Note: *Fruit flies have long been a dependable bellwether for determining the potential mutagenicity of substances.*]

- Swaminathan, M.S. et al. "Mutations: Incidence in *Drosophila melanogaster* reared on irradiated medium."
Science, 141:637-638, 1963.

Fatal Vitamin E Deficiency in Rats

"A considerable number of the second litter of the experimental group [of rats that ate irradiated beef] died... Symptoms observed were marked edema [fluid buildup] of the face, ruffled hair coat, general incoordination, spastic hopping gait, and sometimes complete loss of movement with dragging of the hind quarters. Those pups most severely affected often became completely prostrated a short time before death... In no case were these symptoms noted in the control group... The probability [is that the pups] were suffering from the characteristic muscular dystrophy syndrome (commonly referred to as nutritional muscular dystrophy) known to result from a marginal vitamin E intake."

- Poling, C.E. et al. "Growth, reproduction, survival and histopathology of rats fed beef irradiated with electrons."
Food Research, 20:193-214, 1955.

Chromosomal Damage to Human Cells (I)

"Irradiated sucrose solutions ... were extremely toxic to human lymphocytes [white blood cells]. Mitoses [cell divisions] were inhibited... Degenerated mitoses were observed and the chromosomes were grossly damaged. The chromatin [DNA] material was clumped or the chromosomes appeared shattered or pulverized... In contrast, treatment with unirradiated sucrose at the same concentration had no apparent effect on the mitotic rate and the chromosomes were not visibly damaged." [Note: Such "in vitro" experiments are often used to determine the mutagenicity of substances.]

- Shaw, M.W. and Hayes, E. "Effects of irradiated sucrose on the chromosomes of human lymphocytes in vitro."
Nature, 211:1254-1255, 1966.

Chromosomal Damage to Human Cells (II)


"Leukocyte [white blood cell] cultures from four different healthy human males [underwent] a considerable inhibition of mitosis and chromosome fragmentation. [Additional] research would be extremely prudent."

- Kesavan, P.C. and Swaminathan, M.S. "Cytotoxic and radiomimetic activity of irradiated culture medium on human leukocytes."
Current Science, 16:403-404, 1966.

Toxic Chemical Formed in Food Containing Fat

"When food containing fat is treated by ionizing radiation, a group of 2-alkylcyclobutanones [toxic chemicals] is formed... To date, there is no evidence that the cyclobutanones occur in unirradiated food... *In vitro* experiments using rat and human colon cells indicate that 2-dodecylcyclobutanone (2-DCB)... is clearly cytotoxic and genotoxic."

- Delincee, H. and Pool-Zobel, B. "Genotoxic properties of 2-dodecylcyclobutanone, a compound formed on irradiation of food containing fat." *Radiation Physics and Chemistry*, 52:39-42, 1998.
(Co-sponsored by the International Consultative Group on Food Irradiation)

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