Cooperative Extension Service
C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

Foods and Nutrition
Nov. 1998
FN-3

Food Irradiation

Technology that can Enhance Food Safety and Hawaii's Economy

Papayas . . . starfruit . . . mangoes . . . guava . . . you name the exotic fruit, Hawaii's got it. Like a luscious fruit basket, the state has an abundance of produce. But Hawaii also has serious pests, like the fruit fly, that force a quarantine treatment on these delicacies before they can be exported to the U.S. mainland and Japan.

Vapor-heat, high-temperature forced-air, and irradiation are currently the only quarantine treatments available. Because they use heat, vapor and forced-air treatments are inferior to irradiation regarding fruit quality both before and after treatment. Irradiation allows fruit to be treated at a riper, tastier stage than the heat treatments, which slightly cook produce, further reducing its savoriness and freshness.

Irradiation, in contrast to heat treatments, does not change the raw character of the produce while it eliminates the pests that may infest it. Irradiation disrupts the genetic material of the pests' cells, inactivating insects and larvae while preserving plant tissue. This technology also controls pathogenic microorganisms such as *E. coli* and *Campylobacter jejuni*, which can be carried in spices and raw animal foods such as ground beef and chicken.

Moreover, irradiation hinders food spoilage, prevents sprouting of vegetables, and delays fruit ripening. For example, irradiated ground beef and strawberries may last days longer than their non-irradiated counterparts. This can benefit Hawaii's produce, which takes longer to reach its export destinations than produce shipped within the continental United States. Irradiation allows foods to remain fresh longer, extending shelf life in stores and after purchase. Irradiated fruits could be exported on a commercial scale, boosting the state's economy, helping ensure the livelihood of local farmers, and promoting Hawaii's agriculture on the mainland and overseas.

Since 1995, Hawaii has used irradiation as a quarantine treatment on tropical fruits such as papayas and lychees for test markets on the U.S. mainland. (A special government permit allows limited quantities of these fruits to be exported, without prior quarantine treatment, to the mainland, where they are irradiated). Consumer acceptance of these fruits has been very favorable. In fact, test marketing of irradiated mango and papaya in Florida (1986) and in California (1987) showed that consumers preferred irradiated fruits to non-irradiated ones by a ratio of 10 to one.

Irradiation will not be a substitute for good agricultural and manufacturing practices. Nor will it take away consumers' and food-service workers' responsibility to properly handle food. But it can enhance the safety and quality of food, reducing the risk of foodborne illness, delaying food spoilage, and satisfying the necessary quarantine requirements for exported Hawaii produce without harming its quality.

Similar to the debate over milk pasteurization in the 1920s, irradiation is a proven, beneficial process in the midst of a public-relations crisis.

Opposition to irradiated food has been built upon unfounded claims about unique radiolytic by-products, compromised nutritional value, increased bacterial virulence, and danger to workers' health. Prior to approving specific foods for irradiation, the FDA makes sure that the radiolytic, microbiological, toxicological, and nutritional safety of these foods in their irradiated state are addressed to its satisfaction. There are no major chemical, physical, or sensory changes in foods that have been irradiated.

Radiation treatment does not make foods radioactive. The FDA has reviewed the radiolytic safety of all foods irradiated with the currently approved sources (co-

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balt-60, cesium-137, electron beams, and X-rays). Only a small number of harmless radiolytic by-products are formed by irradiation, and these are similar to by-products formed by cooking or other food processes. No radiolytic by-products of any health concern have ever been found.

Irradiation does not cause pathogens to mutate and become more virulent. No evidence of increased virulence has ever been discovered. In fact, researchers believe that radiation is much more likely to *reduce* the virulence of any surviving pathogens.

Nutrient losses due to irradiation are much less than those from other food processes, such as cooking. According to research, irradiation does not affect the nutritional content of foods treated at low doses (up to 1 unit, or kilogray). Fruit, for example, is irradiated at low doses. Even at higher doses (10–50 kGy), losses of vitamins in irradiated foods, if they occurred, would not be enough to be a nutritional health concern.

On the basis of nearly 50 years of research, the World Health Organization, the Food and Agriculture Organization of the United Nations, and the International Atomic Energy Agency concluded in a joint meeting in 1997 that foods irradiated at any dose are safe and wholesome for human consumption. The agencies also concluded that foods irradiated above 10 kGy (1) will not lead to toxicological changes in their composition that would have an adverse affect on human health, (2) will greatly reduce microbiological risk to the consumer, and (3) will not lead to nutrient losses that would have an adverse affect on the nutritional status of humans.

Finally, no evidence shows that exposure to an irradiation facility poses any threat to human health or the environment. Workers are no less safe at an irradiation plant than at any other workplace. U.S. irradiation facilities have an excellent record of safety and are carefully monitored.

An irradiator in Hawaii could be used not only for quarantined fruits but also for foods associated with foodborne illness outbreaks, such as ground beef and chicken. Irradiation may give Hawaii residents greater confidence in purchasing these foods. A 1992 study revealed that consumers were willing to pay up to $0.81 more per meal to reduce the risk of foodborne illness, an amount more than 10 times the estimated cost of treating the food.

Successful sale of irradiated produce in four U.S. grocery stores since 1993 indicates consumer acceptance. A survey reported in the February 1995 *Journal of Food Protection* indicated that “the majority of consumers will respond positively to irradiated foods when the advantages of the process are explained and when safety, nutritional value, and worker and environmental concerns are addressed.”

About 30 developed and developing countries use irradiation to process a variety of foods, including spices, sausage, rice, fruits, and vegetables. In addition to WHO, FAO, FDA, and IAEA, other organizations supporting irradiation include the Institute of Food Technologists, the American Medical Association, and the American Dietetic Association.

Aurora S. Hodgson
Department of Food Science and Human Nutrition