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A Critical Analysis Risk Assessment: Food Irradiation: Pro or Con?

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The Assignment: Using the categories of risk in the article "Risk Perception and Decision Making" by Bieron as a basis, evaluate the level of acceptability of risk of irradiated food. Write a reasoned argument for or against food irradiation.

This document will discuss the analysis of risk perception versus risk actuality using the food irradiation process as the model subject. Because the process of food irradiation has caused controversy, due to its association with radioactivity, this proves to be a climactic model topic at best. Although food irradiation has been approved by the Food and Drug Administration (FDA), and the World Health Organization (WHO), widespread consumer acceptance of the process has not been achieved because of beliefs and actions of consumer watch-dog groups. In the first part, various articles on food irradiation will be used as source information, and the unfavorable biases towards food irradiation will be the target assessments. In the second part of the document, categories of risk from Joe Bieron's article entitled "Risk Perception and Decision Making" will be used as a basis for evaluating the level of acceptability of risk of irradiating food. Arguments against food irradiation will be evaluated.

Part 1:

Using the website from The Institute of Food Science & Technology and referencing its article entitled "The Use of Irradiation for Food Quality and Safety", and supplementing this information with feature Irradiation articles from the following website: http://www.organicconsumers.org/irradlink.html, the bias towards irradiated foods as being unfavorable will be discussed and assessed.

With the increase of the human population continuing at an exorbitant rate, methods of controlling food spoilage and improving safety become more critical as time passes. Methods of preservation such as drying, salting, pasteurization, canning and freezing are traditional practices, and food irradiation can be added to this list. "However, it should never be used as a substitute for good manufacturing practices" (qtd. In The Institute of Food Science and Technology 2).

Food irradiation is where food is preserved by exposing it to a set amount of ionizing energy, either by machine generated electron beams or gamma rays from cobalt-60. Salmonella and other micro-organisms can be wiped out by this process. The food does not come in contact with the radiation source during the irradiation, nor can radioactivity be introduced into the affected food. The strength of the irradiation source coupled with the time the food is exposed to the ionizing energy determines the irradiation dose the food receives. The most popular food irradiation applications used for reducing food spoilage and improving food safety are:

1. Irradiation of poultry, to reduce food poisoning bacteria such as Salmonella
2. Irradiation of red meats, to reduce Escherichia coli and other food poisoning bacteria
3. Irradiation of some seafoods, to improve their microbiological safety
4. Irradiation of fruits and vegetables, to reduce micro-organisms that cause spoilage
5. Irradiation of herbs and spices, to reduce micro-organisms that cause contamination
6. Irradiation of bulbs, such as sweet potatoes and onions, to prevent sprouting
7. Irradiation of cereals and grains, to kill insects

8. Irradiation to produce sterile foods, such as hospital meals

Even though these irradiation processes may be used with the best of intentions, there are some products that are not suitable for food irradiation, such as foods with high fat contents (changes in flavor and odor occur after irradiation), some dairy products (unpleasant odors and tastes can develop as a result of rancidity from the process), and foods with high protein contents (again, changes in odor and flavor can result).

Food irradiation has been around for a long time. Over 90 years ago, the use of ionizing radiation to preserve foods was patented, and it has become one of the most controversial topics on food treatment. The safety regarding this technology has constantly had to be reevaluated and the public has had to be constantly reassured of its benefits. Although 41 countries have given approval to use the irradiation process on approximately 60 food products, agreement to do so has been on a conditional basis, but these figures are increasing annually. "The main purposes of the treatments were given as control of food-borne pathogens and extension of shelf-life. This change in the US regulations is timely. There have been a number of recalls of large consignments of hamburger meat contaminated with E. coli O157:H7 and this pathogen, among others, is causing concern among the US public" (qtd. In Institute of Food Science & Technology 3). Irradiation was approved for fruits and vegetables, spices, cereals and bulbs such as onions in 1986, but the opinion was re-evaluated in 1987 after submissions from the industry, consumer groups and interested parties. Regulations on irradiated foodstuffs were changed and labels were required to state whether the products had been irradiated. Irradiation facilities were required to meet certain criteria before they could be licensed to process such foods.

Consumer buy-in to food irradiation is not reaching wide acceptance levels in the US. While some European countries such as Belgium, France, The Netherlands and Portugal are in favor of irradiation, other countries such as Denmark and Germany remain opposed. Many consumers have misconceptions about the technology, such as the concern that the affected food may be radioactive.

Some of the main reasons food irradiation is being opposed include, but are not limited to:

1. Irradiation only covers up situations in slaughterhouses that cause meats to become contaminated with bacteria that causes illnesses.
2. "Irradiation forms new chemicals in food that are known or suspected to cause cancer and birth defects; destroys vitamins and other essential nutrients; and corrupts the flavor, and texture of food. A wide range of health problems have been observed in animals fed irradiated foods, including premature death, stillbirths, mutations, fatal internal bleeding, organ damage, immune system dysfunction, stunted growth and nutritional deficiencies" (qtd. In Critical Mass Energy and Environment Program/Why Oppose Food Irradiation? 1).
3. Irradiated foods don't need to be labeled as such when served in hospitals, nursing homes, restaurants or schools.
4. Irradiation adds to the consolidation of the food industry; food shelf-life is extended, and agribusiness can move their businesses overseas where costs are cheaper, but environmental standards are weaker.
5. Irradiation facilities create air pollution and other safety threats.
6. "Despite thousands of comments from parents, teachers, students and concerned citizens that overwhelmingly opposed the purchase of irradiated food for the National School Lunch Program, the USDA chose to include irradiated ground beef in federal nutrition programs" (qtd in Critical Mass Energy and Environment Program/Safe School Lunches 1). Irradiated beef also costs more than non-irradiated beef, but school officials in each district can choose whether or not to purchase it for their schools.
7. In legalizing food irradiation, the FDA and the WHO are ignoring research

suggesting that irradiated foods are not safe for people to eat.

The potential dangers of food irradiation include harmful effects to consumers and possible terrorist strikes against irradiation plants, as stated by Peace Prize nominee Helen Caldicott. Caldicott also mentioned that food that undergoes irradiation is processed with enough radiation to kill a person. Along with the threats of eating foods exposed to radiation, having irradiation plants in your town can pose dangers. "Irradiation is designed to kill food bacteria and fungus, which Caldicott said has become a problem because of 'sloppy, inefficient factory farms.' Because the cobalt 60 must remain cool, she said, 'a terrorist wouldn't even need a bomb or a gun.' 'All they would have to do is fly or drive into a cooling pond,' she said. 'That would cause the release of 30 times the amount of radiation in a single rod.'" (qtd. In Organic Consumers Association/Helen Caldicott speaks against food irradiation 1). Caldicott feels that food irradiation is the consequence of a society that wastes energy.

Food irradiation may also be the ticket for certain foods to be on your table without your even being aware of their infestations and other health-driven consequences unless you do your homework. Take the light skinned Okinawan sweet potato, for example. This vegetable is irradiated in Hilo, Hawaii because growers are faced with the need to replace methyl bromide, which currently kills specific pests associated with the sweet potato, and will eventually be phased out because of environmental agreements. A company called Hawaii Pride urged the USDA to approve irradiation of the Okinawan sweet potato so that the purple potato would be a big market for big stateside retailers. "The happy news doesn't reassure consumer groups. Public Citizen, which opposes food irradiation, said the USDA didn't do enough research to see whether the dosages would kill specific pests associated with sweet potatoes, and it didn't look closely enough to see whether the Okinawan would harm the domestic industry. 'We see this as another bad decision as our own government exercises poor judgment on the issue of food irradiation,' said Wenonah Hauter, director of Public Citizen's Energy and Environment Program. California growers aren't pleased either. They know they can't keep out shipments from another state, but they are worried about the pests that come with them" (qtd. In Organic Consumers Association/Approval of Irradiated Sweet Potatoes Has Critics Steamed 2).

Irradiation, when carried out under the correct processing guidelines, may be perceived as a safe way to reduce levels of food poisoning and a good way to preserve foods, but the examples stated in this portion of the document clearly point to the proof that the risks of irradiation outweigh its benefits. Hence the bias towards irradiated foods is unfavorable.

Part 2:

Using the categories of risk in the article from Joe Bieron entitled "Risk Perception and Decision Making," an evaluation of the level of acceptability of risk of irradiating food will be researched. Arguments against food irradiation will be addressed.

Opinions and information gathered from life experiences and classroom knowledge help us to make decisions about topics such as food irradiation, which are greatly influenced by risk perception. Background information on risk perception, distinctions of risk perception, and reasons why chemical-based technologies such as food irradiation tend to be seen as having unacceptable risks will be discussed.

Food irradiation requires the use of chemicals and our society can benefit from the process in some ways, but there are also many risks associated with it. Either our environment suffers or our health and well being in general can diminish from its use. While food irradiation increases the shelf-life of some food stuffs, kills insects and bacteria that can be detrimental to crops and consumers, and increases food production, several problems can still arise.

"Various experimental tests have revealed extensive damage to animals fed irradiated food.

Early trials failed when the laboratory animals dropped dead from no apparent cause. As far back as 1948, experimental rats fed on irradiated foods showed impairment or loss of fertility, increased mortality in litters, abnormal eyes, hemorrhages, and hearts with enlarged left ventricles, which frequently resulted in death. In other tests, offspring of rats fed irradiated chickens and beans were born blind, and had a shortened life span. Dogs fed irradiated eggs produced fewer litters or became sterile. Mice developed enlarged hearts and breast cancer. Many test animals exhibited marked symptoms of vitamin deficiencies" (Hunter 72). Fruits, vegetables, spices, meats, dairy products and just about any food that goes through the irradiation process will develop off-flavors and scents, there will be a change in firmness and texture, and vitamins will be stripped as the affected foods go through their chemical changes, including the destruction of nutritional elements in the foods.

The risks of food irradiation need to be outlined, the characteristics of risk perception explained, and external factors influencing risk perception need to be identified. These stepping stones will allow for us to evaluate the level of acceptability of risk regarding food irradiation.

Risk is a calculation of the probability and level of detriment to human health. Determination of risk is a scientific process performed in areas such as public health. Risk is measured in terms of probabilities, and statistical analysis is a critical factor in the accuracy of the assessment of the risk. The risk to human health from food irradiation is determined by whether the affected food has a high enough concentration to cause damage by routes of exposure such as absorption, ingestion or inhalation. The exposure level is an important factor because no chemical is free from toxicity to humans. Since irradiated foods aren't necessarily required to be labeled, we don't always know when we are exposed to food irradiation. The human body can tolerate exposure to small amounts of irradiation with no harmful effects, but at elevated levels, there can be health hazards, as outlined earlier in this document. Consequences can even be fatal. The measure of risk associated with food irradiation presents an unacceptable risk because observations of fatal or unacceptable consequences in the number of test animals, as shown in the preceding paragraphs, is shown to be repeatedly elevated to a large extent over the control population.

Perception of risk and characteristics of risk perception help determine the acceptability of the risk. Outside influences also mold our perception of the risk of irradiation. "Most experts predict that it will be used, but the extent will depend on many factors, including regulatory actions, consumer attitudes toward irradiation and toward other processes used for the same purposes, the economics of irradiation and competing processes, and the nature of labeling requirements. Some people have claimed that there must be little interest in irradiation in the United States, since no one has ever taken advantage of the FDA approval of irradiation for sprout inhibition of white potatoes or insect disinfestation of wheat products. However, good inexpensive alternatives to both of these irradiation treatments have been available, so there has been little economic incentive to irradiate. Furthermore, it may not be economically feasible to operate an irradiation facility for only these two processes, because a food irradiation facility must be utilized for large quantities of food, on a year-round basis, in order to be economically viable. Irradiation is not likely to become common in the United States until FDA approves it for a wide variety of purposes and agricultural commodities…" (McCuen 94).

Research on risk analysis and the perception of risk has been done, and findings from Paul Slovic, a psychologist at the University of Oregon, show that one's perception of risk is based on characteristics of risk other than estimates of annual fatalities and the like. These characteristics are: exposure, effect, alternatives, knowledge of consequence, occupational encountered, image of hazard, severity of consequence and controllability. Any of these characteristics can be deemed acceptable or unacceptable based on a given sequence of events. For instance, food irradiation can be seen as ranging from completely voluntary (acceptable) to completely involuntary (unacceptable). By looking at it this way, it is easier to comprehend why food irradiation is viewed as an unacceptable technology. Nearness to an irradiation plant is involuntary (somebody else put it there), unfamiliar

(I've never been in a food irradiation plant), uncontrolled ("they" are in charge), has fatal potential (if the irradiation plant has a melt down, we're doomed), has a low level of knowledge (irradiated food is unsafe to eat, and we are in jeopardy by being exposed to the resultant radiation), is irreversible (once irradiation of foods is part of the system, there's no turning back), effects are not immediate (irradiated food may not hurt you now, but you run the risk of contracting cancer, becoming sterile, and a whole myriad of other health and environmental issues), and alternatives are available (we have other means of preserving our food supplies). Food irradiation has all the characteristics of being an unacceptable risk. The public sees it as being an unsafe technology. Even though food irradiation helps increase crop yields, kills deadly bacteria in our food supplies, and prolongs the shelf-life of certain foods, the irradiation plants pose a threat as they are unsafe situations to many people; their existence and the consequences of meltdowns and radiation exposure convey the image of risk with many of the undesirable characteristics mentioned above. Food irradiation has many unknown variables, the process has dreaded and delayed consequences, and exposure is not controllable. As Slovic's work implies, basic perceptions and understandings regarding food irradiation have shown that lack of knowledge of the food irradiation process, biased media coverage, biased personal life experiences and fears generated by the challenges of life result in the denial of uncertainty, risks to be mistrusted and judgments of fact to be skeptical at best.

A society free of the risk from food irradiation is not realistic. We need to manage the risks involved in order to extract the benefits from this technology. It would be nice to be able to eliminate all the environmental and health threats of food irradiation, but what we can do instead is to distinguish a zero risk from a safe environment. Risks will never be able to be completely eliminated, but they can be minimized. The presence of toxicity from food irradiation in our environment does not necessarily guarantee a threat to our health. One needs to take into account the concentration and routes of exposure, as well as affected toxic levels. Also, the consequences of food irradiation run the risk of being grossly over exaggerated, and perceived as even more unacceptable and unsafe if the public is not adequately informed. "Exposure of the body to ionizing radiation produces free radicals that are involved in chemical changes, resulting in carcinogenic, mutagenic, and teratogenic effects. Intensive doses cause radiation sickness. The effects of irradiation exposure through food contamination would vary with the half-life of the isotope. If short half-life radionuclides are employed in food irradiation, the risk is small, whereas products contaminated with longer half-life radionuclides would be hazardous. The World Health Organization assures us that food irradiated under approved conditions does not become radioactive, and that the treatment does not alter the food in any way that could be harmful to people. Public acceptance of this reassuring statement will be hampered by the fears of accidental exposure to unapproved excessive doses of irradiation, and a lack of information regarding regulatory legislation and governmental controls" (Millichap, 115). These issues are not to be taken lightly; they are complex and require the attention of a self-educated and proactive population.

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