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The Promise of Food Irradiation: Will Consumers Accept It?

by Wipon Aiew, Rodolfo M. Nayga, Jr., and John P. Nichols

Despite the high level of safety in the US food supply, microbiological hazards exist. Illnesses and death due to foodborne pathogens cost society billions of dollars due to lost productivity and medical expenses. Although the adoption of Hazard Analysis Critical Control Point (HACCP) in meat plants may explain fewer reported incidences of foodborne infections in the US, we are still far from the public health goals established for 2010. These goals include reducing infections with *Salmonella*, *E. coli* 0157, *Campylobacter*, and *Listeria* to 50% percent of their 1997 incidence (United States Department of Health and Human Services, 1998). To reach this goal, 50% of foodborne diseases now occurring must be prevented—which would require new approaches for prevention.

One prevention approach is the use of food irradiation technology. Like pasteurization of milk and pressure-cooking of canned foods, treating food with ionizing radiation can kill bacteria and parasites that would otherwise cause foodborne disease. The effects of irradiation on food and on animals and people eating irradiated food have been studied extensively. These studies show clearly that when irradiation is used as approved on foods, disease-causing germs are reduced or eliminated, the food does not become radioactive, dangerous substances do not appear in the foods, and foods' nutritional quality and taste are unchanged (Centers for Disease Control [CDC], 2000). The CDC estimated that irradiating 50% of meat and poultry in the US would prevent nearly 900,000 cases of infection, 8,500 hospitalizations, and 350 deaths each year (Table 1). This estimate excludes irradiation of other foods, such as fresh produce that can also cause infection.

The study investigated consumers' willingness to buy and pay for irradiated ground beef. In general, we found that information about the nature and benefits of food irradiation is a major factor affecting consumers' perception and attitudes toward irradiated foods. Many consumers are quite willing to buy irradiated foods. This is particularly true if the purpose of the irradiation is clearly indicated. Consumers showed interest in a process that eliminates harmful microbes from the food and reduces the risk of foodborne disease. This finding reflects the importance of educating the public about the hazards of foodborne pathogens and the potential benefits of consuming irradiated foods. Food irradiation, however, is not a shortcut that means food hygiene efforts can be relaxed. Irradiation does not replace other important efforts, including efforts to improve sanitation on the farm and in the food processing plant and educating the consumers about proper food handling and cooking techniques.

Consumer Responses

In Spring 2002, we conducted a study to assess (a) consumers' knowledge and acceptance of food irradiation, (b) the effects of information about food irradiation on consumer acceptance, and (c) the willingness to pay (WTP) for irradiated ground beef. We conducted face-to-face interviews with 484 consumers at 13 selected stores of a regional supermarket chain in Austin, Houston, San Antonio, and Waco in Texas from March-June 2002. The response rate was roughly 25%, so close to 2,000 consumers were randomly approached at the entrance of the stores and were offered a pound of ground beef as an incentive to participate in the study. The questionnaire took an average of 20 minutes to complete. The total number of completed questionnaires was 474 due to incompleteness in the responses of 10 respondents. About

Table 1. Potential annual public health benefits of irradiating 50% of meat and poultry, by specific pathogen.

Pathogen	Prevented cases	Prevented hospitalization	Prevented major complications	Prevented deaths
E. coli 0157:H7	23,000	700	250 cases	20
Campylobacter	500,000	2,600	250 cases	25
Salmonella	330,000	4,000	6,000 cases	140
Listeria	625	575	60 miscarriages	125
Toxoplasma	28,000	625	100-1000 cases	94
Total	881,625	8,500	6,660 illnesses	352

58% of our sample is female, 34% is older than 50 years old, and 49% is between 30 and 50 years old. In terms of income, about 57% of our sample has annual household income lower than $50,000 and about 30% has incomes between $50,000 and $100,000. Participants consumed ground beef an average of 2.64 times per week at home and 2.12 times per week away from home.

Potential buyers' of irradiated foods can be grouped as *strong buyers*, *interested*, *doubters,* and *rejecters*. During the interview process, we provided each respondent with Information I (nature and benefits of food irradiation) and Information II (difference between use of electron beam and gamma rays to irradiate food products; details about Information I and II are available from the authors upon request). The respondents were asked to self-identify their segment, before and after the presentation of information. We also asked those respondents willing to buy irradiated ground beef about their willingness to pay (WTP) a premium for the irradiated product.

Willingness-to-Pay Experiment

To assess how much consumers valued the added assurance of safety afforded by food irradiation, we measured each consumer's willingness to pay more for irradiated products. We gave each respondent a pound of nonirradiated ground beef and money as a gift for survey participation. The respondent was then asked his or her willingness to exchange a pound of nonirradiated ground beef and the given money (representing first bid amount) for a pound of irradiated ground beef. If the respondent accepted the exchange offer, the given money (first bid amount) represented the respondent's WTP value and the experiment was ended. If the respondent rejected the exchange offer, he or she was asked a follow-up offer about his or her willingness to exchange a pound of nonirradiated ground beef and half the value (second bid) of the money originally given, for a pound of irradiated ground beef. If the answer was "Yes," the second bid value was recorded as his or her WTP; otherwise, the WTP was assumed to be lower than the second bid value. Only the respondents who did not accept the first bid were given the second bid.

Information Effects

Information plays an important role in consumer buying decisions. Before Information I and II were presented, about 45% of our sample had no knowledge of food irradiation, 51% would not buy irradiated ground beef, and only 8.5% considered themselves strong buyers. After the presentation of Information I and II, 94% of the respondents were willing to buy irradiated ground beef. Figure 1 shows the percentage of respondents belonging to a consumer segment before and after the presentation of Information I and II. The percentage of strong buyers increased from 8.51% to 42.23%, while the percentage of doubters or rejecters decreased significantly from 14.32% to 3.15% for doubters and from 3.94% to 0.63% for rejecters (Figure 1).

Figure 2 shows segment movement after presentation of information. About 68% of the respondents who were strong buyers prior to receiving the information remained in the strong buyer segment after receiving the information, while 43% of the interested buyers switched to strong buyers after the presentation of information. The reason for the lower-than-expected percentage of respondents (68%) originally in the strong buyer segment that remained in the strong buyer segment after receiving the information is not clear. However, it is possible that the respondents who switched from being a strong buyer to another segment after the

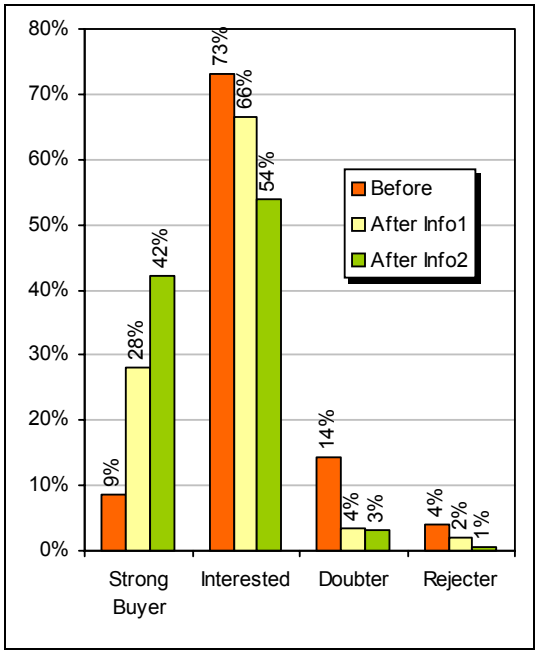

Figure 1. Percentage of respondents belonging to a consumer segment.

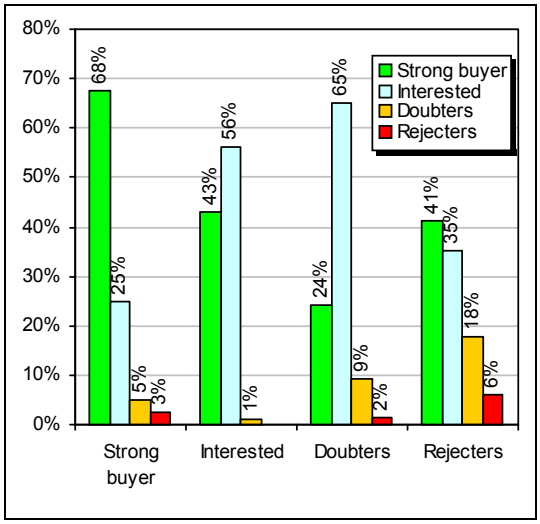

Figure 2. Consumer segment movement after presentation of information.

presentation of information may have had false impressions or understanding of the technology, and the information presented may have provided them with a different or unexpected view of the irradiation technology that they do not like or perceive positively. On the other hand, about 24% of doubters and 41% of rejecters switched to the strong buyer segment after the presentation of information.

Willingness to Buy Irradiated Ground Beef

Before the presentation of information, about half of the respondents indicated willingness to buy irradiated ground beef. After Information I, 88.5% of the respondents were willing purchasers. Even more (94.12%) indicated a willingness to buy irradiated ground beef after Information II. These willingness-to-buy percentages appear higher than estimates from the FoodNet Population Survey (1998-1999). The CDC also estimates that at least half will buy irradiated food, if given a choice between irradiated and nonirradiated products. If consumers are first educated about irradiation, about 80% will buy irradiated products.

In a separate analysis on the same sample, we also examined the effect of consumer demographics on the probability that a consumer would buy irradiated ground beef after presentation of information about the nature and benefits of food irradiation. Results generally indicate that females are less likely to buy irradiated ground beef than males. White respondents are more likely to buy irradiated ground beef than black respondents. Married respondents also are more likely to buy irradiated ground beef than unmarried respondents (see Aiew, Nayga, and Nichols, 2003, for more details).

Results From Willingness-to-Pay Experiment

The willingness-to-pay experiment on the first bid values show that 97.3% responded "Yes" to receiving 10 cents more per pound of irradiated ground beef. As the bid values increased, the proportion of respondents responding "Yes" declined (Table 2). In the second bid offer, among those who responded "No" to the first bid offer (once we reduced the offer to half), 100% responded "Yes" to the 5 cents per pound offer and 67% responded "Yes" to the 20 cents per pound offer.

Some Perspective

Our results suggest that information about the nature and benefits of food irradiation is a major factor affecting consumers' perception, attitudes, and willingness to pay for irradiated foods. Hence, proponents of food safety and food irradiation should educate the public about the nature and benefits of the technology. Information about irradiation could be disseminated by university exten-

Table 2. Percentage of respondents accepting/rejecting bid offers.

First bid offer (cents)		10			40	60	80	120
Accept		97.3%			72.2%	69.8%	56.9%	46.2%
Reject		2.7 %			27.8%	30.2%	43.1%	53.8%
Second bid offer (cents)	**5**		**20**	**30**	**40**	**60**		
Accept	100%		66.7%	75%	59.9%	42.9%		
Reject			33.3%	25%	40.1%	57.1%		

sion personnel, state organizations, and through workshops (for example, the World Irradiation Congress), to name a few.

A good extension of this study is the evaluation of both positive and negative information about food irradiation on consumers' perceptions and buying decisions. When consumers receive both types of information, negative effects may mask the positive ones (Fox, 2002). The manner in which information is presented might also produce judgmental effects, even when the value of information is controlled. Because this study was conducted in one state, replicating it in other states or nationwide would help to evaluate the robustness of the findings.

For More Information

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Wipon Aiew is a graduate assistant, Rodolfo Nayga, Jr. is an associate professor, and John P. Nichols is a professor at the Department of Agricultural Economics, Texas A&M University.