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PEER-REVIEWED ARTICLE

Food Protection Trends, Vol 44, No. 3, p. 189–194
https://doi.org/10.1111/FPT-23-029

Examining Age and Food Irradiation Knowledge as Influential Factors on the Purchase of Irradiated Foods: United States, August 2022

ABSTRACT

Foodborne illness affects approximately 48 million Americans annually. Food irradiation is a safe and effective way to kill bacteria and extend a product's shelf life. However, challenges to wider implementation of this technology include consumer hesitancy stemming from misconceptions about safety and lack of knowledge of irradiation's benefits. Research has shown that consumers are more willing to accept irradiation if informed about its safety. Because of increases in multistate foodborne outbreaks and consumers' growing concern about and expectation of food safety, it is an opportune time to reconsider irradiation as a food safety tool. Consumer attitudes toward food safety differ by demographic characteristics; however, research on the association of demographic factors with attitudes on food irradiation are limited. Data collected from a survey (n = 1,009) conducted in August 2022 were analyzed to describe the relationship between age and food irradiation knowledge as influential factors to purchase irradiated foods. More than half (56%) of respondents reported that learning more about irradiation would likely influence purchasing decisions, and older adults were more knowledgeable about food irradiation. These findings suggest that age could be an important factor to consider when tailoring messaging as a prevention strategy around the benefits of food irradiation.

INTRODUCTION

It is estimated that each year about 48 million people in the United States experience foodborne illness, resulting in 128,000 hospitalizations and 3,000 deaths; older adults are at higher risk for severe complications from illness *(4, 5)*. Although food irradiation is considered a safe way to kill pathogens *(22, 23)*, its overwhelming use in the United States is for fruits, grains, and spices *(15)*. Some challenges to wider implementation include consumers' lack of knowledge and misconceptions about irradiation's safety *(2, 10)*, which can affect consumers' acceptance of the technology *(2)*. Reconsidering food irradiation as a food safety tool may be warranted because of increases in multistate outbreaks *(18)* and growing concern about and expectation for food safety

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among consumers *(6, 11, 16, 20)*. Because consumers are more willing to accept irradiation if informed about its safety *(6, 9, 19, 20)* and the severity of foodborne illness varies among age groups, it is important to consider the association between demographic characteristics and attitudes toward food irradiation. A focus group study found that older adults were more familiar than other groups about food irradiation's process and purpose *(1)*; however, generalizable research on associations between demographic factors and attitudes toward food irradiation is limited *(13)*. Therefore, to help inform tailored messaging as a communication prevention strategy, this study assessed the relationship between age and food irradiation knowledge as influential factors in the purchase of irradiated foods.

MATERIALS AND METHODS

During August 8–10, 2022, Porter Novelli Public Services (Washington, D.C.) conducted the PN View 360+ survey, which was programmed and fielded using quota sampling by Big Village. PN View 360+ is a consumer audience survey that can be distributed to adults aged ≥18 years; this survey can be fielded monthly or more frequently, if necessary (https://styles.porternovelli.com/pn-view-panels/). Panel members were recruited nationwide online from the Lucid platform (https://luc.id/marketplace/). Data were weighted by age, gender, region, race or ethnicity, and education to reflect the demographic composition of the U.S. population using Current Population Survey proportions; all frequencies reported are weighted. Respondents were selected among those who elected to participate in polls and surveys online. Among the 3,491 members who opted to participate, 1,009 adults aged ≥18 years completed the survey. All respondents who reported some level of familiarity with irradiation were included to assess food irradiation myths or facts (n = 667).

To assess respondents' familiarity with food irradiation, a 5-point Likert scale of familiarity was used to ask, "How familiar are you with irradiation as a technology used to kill germs during food production?" Respondents rated level of familiarity with statements using the 5-point Likert scale (1 = not familiar: I haven't heard of it; 2 = not too familiar: heard of it, but don't know what it is; 3 = somewhat familiar: heard of it, but only know a little about it; 4 = very familiar: know what it is; 5 = extremely familiar: know what it is and how it works). Responses were dichotomized to not familiar (1) or familiar (2–5).

To assess level of agreement with myth or fact statements about food irradiation, a 5-point Likert scale of agreement was used to ask about respondents' perceptions of its use, safety, and health effects. Respondents rated level of agreement with statements using the 5-point Likert scale (1 = strongly disagree; 2 = somewhat disagree; 3 = neutral; 4 = somewhat agree; 5 = strongly agree). Responses were dichotomized to agree or neutral (3–5) or disagree (1 and 2) for irradiation myths and dichotomized to disagree or neutral (1–3) or agree (4 and 5) for irradiation facts. Neutral and agree were considered incorrect options for irradiation myths. Neutral and disagree were considered incorrect options for irradiation facts.

To assess factors that could influence respondents' decision to purchase irradiated foods, respondents were asked, "How likely is each of these to influence your decision to purchase irradiated foods?" followed by a list of influential factors and a 5-point Likert scale of likelihood. Respondents rated the level of likelihood to have their purchasing decision be influenced by a list of factors using the 5-point Likert scale (1 = very unlikely; 2 = somewhat unlikely; 3 = neutral; 4 = somewhat likely; 5 = very likely). Responses were dichotomized to unlikely (1–3), and likely (4 and 5). Literature on general influences on behavior and the consumer food choice model *(12)* were used as guides to establish the list of influential factors used in the survey.

Rao-Scott chi-square tests were performed, and 95% confidence intervals were calculated overall and by age, comparing irradiation knowledge and likelihood of factors influencing purchase decisions of irradiated foods ($P <$ 0.05 was considered statistically significant). Knowledge was determined by respondents' level of disagreement with irradiation myths and level of agreement with irradiation facts. Myth statements were "Irradiation makes food radioactive" and "Irradiated foods are bad for my health in the long term." Irradiation facts were defined as "Irradiated foods are safe to eat," "Irradiated foods are just as nutritious as nonirradiated foods," "Irradiation does not replace existing food safety measures used by food manufacturers," and "Irradiation makes food safer."

This study compared respondents who were familiar versus not familiar with irradiation and assessed level of agreement with each irradiation statement by age group among those familiar with irradiation. Binary analyses were conducted to compare adults aged ≥65 years with adults aged 18–64 years, because older adults are more vulnerable to adverse outcomes associated with foodborne illness *(4)*. All weighted analyses were conducted using survey procedures in SAS (version 9.4; SAS Institute, Cary, NC). This activity was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy. Specifically, the CDC obtained data from Porter Novelli Public Services, whose survey administration methodology was previously reviewed and determined to be exempt research (exemption 2 in 45 CFR 46.101).

RESULTS

Among the 1,009 survey respondents, 66.0% (n = 667, 95% confidence interval [CI] 63.0–69.3) reported some level of familiarity with irradiation. Among those who were not familiar with irradiation, there were no significant differences by age.

TABLE 1. Level of agreement with food irradiation myths or facts among survey respondents who were familiar with irradiation, by age: Porter Novelli, United States, August 2022 (*n* = 667)

	Total	Age group, years				
		18–29, weighted % (95% CI)	30–44, weighted % (95% CI)	45–64, weighted % (95% CI)	65+, weighted % (95% CI)	*P*[a]
Respondents familiar with irradiation	667	18.7 (15.7–21.7)	25.1 (21.9–28.3)	33.4 (29.5–37.3)	22.8 (19.2–26.4)	—
Irradiation makes foods radioactive (myth)						
Disagree	34.1	23.0 (15.7–30.4)	20.3 (14.7–26.0)	35.9 (29.1–42.7)	55.6 (46.4–64.9)	<0.01
Irradiated foods are bad for my health in the long term (myth)						
Disagree	19.8	14.4 (8.5–20.3)	16.5 (11.0–22.1)	19.6 (14.0–25.1)	28.4 (20.3–36.4)	0.02
Irradiated foods are safe to eat (fact)						
Agree	33.6	26.7 (19.0–34.3)	34.6 (27.9–41.4)	33.2 (26.3–40.0)	38.7 (29.9–47.4)	0.24
Irradiated foods are just as nutritious as nonirradiated foods (fact)						
Agree	29.7	23.8 (16.4–31.3)	32.8 (26.1–60.4)	30.0 (23.4–36.6)	30.6 (22.4–38.8)	0.44
Irradiation does not replace existing food safety measures used by food manufacturers (fact)						
Agree	40.2	34.1 (25.7–42.5)	37.6 (30.8–44.5)	38.8 (31.8–45.8)	50.2 (41.0–59.4)	0.04
Irradiation makes food safer (fact)						
Agree	33.2	28.5 (20.7–36.4)	32.0 (25.3–38.7)	32.0 (25.3–38.7)	40.2 (31.3–49.1)	0.22

[a]*P*-value for weighted Rao-Scott chi-square test; $P < 0.05$ indicates significant differences.

Among those who were familiar with irradiation *(Table 1)*, adults aged ≥65 years had the highest proportion of disagreement with the irradiation myths listed compared with other age groups. For the "Irradiation makes food radioactive" statement, 55.6% (95% CI 46.4%–64.9%) of adults aged ≥65 years disagreed, followed by adults aged 45–64 years (35.9%, 95% CI 29.1%–42.7%), 18–29 years (23.0%, 95% CI 15.7%–30.4%), and 30–44 years (20.3%, 95% CI 14.7%–26.0%). Moreover, respondents aged ≥65 years were more likely to disagree with this myth than were respondents aged 18–64 years (55.6% vs. 27.7%, $P \leq 0.01$).

Inversely, adults aged ≥65 years had the highest proportion of agreement with irradiation facts compared with other age groups, among respondents familiar with irradiation. For the "Irradiation does not replace existing food safety measures used by food manufacturers" statement, 50.2% (95% CI 41.0%–59.4%) of adults aged ≥65 years agreed, followed by adults aged 45–64 years (38.8%, 95% CI 31.8%–45.8%), 30–44 years (37.6%, 95% CI 30.8%–44.5%), and 18–29 years (34.1%, 95% CI 25.7%–42.5%). Moreover, respondents aged ≥65 years were more likely than respondents who were 18–64 years old to agree that irradiation does not replace existing food safety measures (50.2% vs. 37.3%, $P = 0.01$).

Overall, 59.3% (95% CI 56.2%–62.6%) of the 1,009 respondents reported wanting to learn more about irradiation and 55.6% reported that learning more about the benefits of irradiated foods would likely influence their purchase of them *(Table 2)*. Furthermore, age was significantly associated with

TABLE 2. Likelihood of factor to influence purchase of irradiated foods, by age: Porter Novelli, United States, August 2022 (*n* = 1,009)

	Total	Age group, years				
		18–29, weighted % (95% CI)	30–44, weighted % (95% CI)	45–64, weighted % (95% CI)	65+, weighted % (95% CI)	*P*[a]
All survey respondents	1,009	19.7 (17.2–22.1)	26.0 (23.3–28.7)	32.2 (29.1–35.3)	22.2 (19.2–25.1)	—
Learning more about the benefits of irradiated foods						
Likely	55.6	43.3 (36.5–50.1)	56.6 (50.9–62.3)	54.4 (48.4–60.4)	67.0 (59.7–74.3)	<0.01
Seeing irradiated foods sold in the store where I shop						
Likely	34.3	31.5 (25.1–37.9)	38.1 (32.6–43.6)	34.7 (29.0–40.3)	31.8 (24.4–39.2)	0.45
Knowing that my family and friends purchase irradiated foods						
Likely	28.5	29.8 (23.5–36.1)	31.6 (26.4–36.8)	29.3 (23.8–34.7)	22.7 (16.3–29.0)	0.19
Seeing others purchasing irradiated foods in the store						
Likely	24.7	27.7 (21.5–33.8)	31.3 (26.1–36.5)	22.6 (17.6–27.5)	17.5 (11.6–23.5)	<0.01
Cost of irradiated foods compared with nonirradiated foods						
Likely	40.5	37.6 (31.0–44.2)	42.4 (36.7–48.0)	37.7 (31.9–43.5)	45.0 (37.1–52.8)	0.32
Label that says whether food has been irradiated or not						
Likely	44.1	40.3 (33.6–47.0)	38.4 (32.9–43.9)	43.5 (37.5–49.4)	54.9 (47.1–62.8)	<0.01
Knowing where to buy irradiated foods						
Likely	33.0	30.3 (24.0–36.6)	35.2 (29.8–40.6)	32.3 (26.6–37.8)	34.1 (26.7–41.6)	0.73
Whether I need to cook the food before eating it						
Likely	41.1	39.8 (33.1–46.6)	41.1 (35.5–46.6)	39.3 (33.4–45.2)	44.9 (37.0–52.8)	0.65

[a]*P* for weighted Rao-Scott chi-square test; $P < 0.05$ indicates significant differences.

learning more as an influential factor on purchasing decisions ($P \leq 0.01$). When exploring this significant relationship, this study found that learning more about the benefits of irradiated foods was more likely to influence the purchase decision of those aged ≥65 years than of other age groups (67.0% vs. 52.3%, $P \leq 0.01$).

DISCUSSION

In this survey, more than half of respondents expressed wanting to learn more about food irradiation and indicated that learning more would likely influence their decision to purchase irradiated foods. Past research has shown that acceptance of food irradiation is more likely among consumers who are more educated about the process

(6). Older respondents were most knowledgeable about irradiation, perhaps because of greater awareness of past irradiation efforts *(1, 21)*. Furthermore, older adults are among the most vulnerable populations for severe foodborne illness and are at higher risk for complications from illness *(4, 5)*. Therefore, increasing the availability of irradiated foods could help efforts to lower the risk of foodborne illness among older adults by leveraging their increased acceptance of and likelihood to purchase irradiated foods.

Research has shown that consumers' knowledge of irradiation is correlated with their willingness to buy irradiated foods *(2)*. For food irradiation to be more widely adopted, it is important for consumers to feel assured that it is safe *(20)*. Past challenges include consumer misconceptions. The two misconceptions included in the survey were "Irradiation makes food radioactive" and "Irradiated foods are bad for my health in the long term." These misconceptions may stem from consumers' lack of trust in irradiation technology because of misunderstanding of perceived risks and benefits *(2)* and lack of confidence in the food industry to address food safety *(6)*. Straightforward and clear messaging on irradiation's safety based on scientific research and facts is needed to increase consumer knowledge and acceptance of food irradiation *(2)*. Learning more about the benefits of irradiated foods was one of the most significant influential factors on purchasing decisions. This factor was more likely to influence the purchase decision of those aged ≥65 years than of other age groups. The consumer food choice model *(12)* identifies various influential factors on one's food choices, such as cost, convenience, and taste. Applying these concepts to factors that influence a person's decision to purchase irradiated foods could be helpful in tailoring prevention messages. Because more than half of total survey respondents reported wanting to learn more about irradiation, this study emphasizes the importance of increased knowledge and education about irradiation to help influence consumers to purchase irradiated foods.

Younger respondents were less knowledgeable about irradiation and less likely to disagree with common irradiation myths compared with older adults. This could result from the lack of current messaging on food irradiation. Food irradiation efforts peaked about 20–30 years ago; this may explain why younger adults have not been exposed to information about irradiation *(21)*. Creating educational resources and using communication channels that reach younger audiences could help increase knowledge in this population *(21)*. Studies have shown that younger adults tend to get food safety messages through social media like Facebook *(17)* and online platforms like Reddit *(8)*, whereas older adults prefer printed materials *(3, 14)*, such as booklets and brochures *(3)*. Highlighting the benefits of irradiated foods through appropriate platforms can help younger adults become more informed and can increase consumers' acceptance *(7)*. For prevention strategies to be effective, it is important to consider the population, their views, their preference for receiving information, and their motivating factors when developing educational resources and messaging, because these considerations may influence consumers' purchasing decisions of irradiated foods.

The findings in this report are subject to at least three limitations. First, responses were self-reported and could be subject to response bias. Second, survey data were weighted on five demographic characteristics but might not be representative of the U.S. population on other characteristics. Lastly, directionality could not be established in consumer influence to purchase irradiated foods. Although consumers may indicate some factors likely to influence their purchase of irradiated foods, it is not known whether it would influence them to purchase or not purchase irradiated foods. Mis- or disinformation about irradiated foods could result in consumers avoiding the purchase of irradiated foods.

These findings can guide retailers and agencies to reconsider messaging around food irradiation as a food safety tool to help consumers make informed decisions and to prevent foodborne illness.

ACKNOWLEDGMENTS

The authors thank survey respondents; Fred Fridinger, Office of the Associate Director for Communication at the CDC; and Deanne Weber of Porter Novelli Public Services.

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