Public Perception of Irradiated Food
CIRM 2011

Anuradha Prakash, PhD
Food Science Program
Where’s the catch?

**Retailers**
Don’t think consumers will buy irradiated product

**Producers**
Don’t think retailers will stock irradiated food

**Consumers**
Cannot find irradiated produce in the market
Consumer acceptance

- Driven by risk perception
  - Whether risk is voluntary or involuntary
  - Perception that consequences of a hazard are relatively unknown to experts
  - Uncertainty is being “hidden” by regulators or industry
  - Perception that risk may affect health, the environment, or worker safety
  - Moral and ethical worries
  - Perceived benefits
Socio-demographic and economic factors

- Some college education
- Household income > $30,000
- Men
- Knowledge about irradiation
- Positive or neutral for most
- A minority are opposed
- Consumers more accepting in developing countries

Rollins et al., 2011 Trends in Food Sci & Tech. 22; Frenzen et al JFP 2001
2009 Food & Health Survey

- Quantitative, n=1000
- Questions on irradiation posed for the first time
In general, how favorable are you toward the idea of food irradiation?

n=1064

2009 IFIC Foundation Food and Health Survey
If you knew that irradiated food was safer to eat than non-irradiated food, what impact would that have on your decision to buy and consume the food? n=1064

- More likely to buy or consume: 54%
- Less likely to buy or consume: 7%
- No impact: 18%
- Don't know: 21%

2009 IFIC Foundation Food and Health Survey
Which of the following statements, if any, would improve your opinion of food irradiation? Select all that apply.

- Irradiated foods are not radioactive
  - 30%

- The FDA has approved food irradiation
  - 22%

- The process of food irradiation has been approved in over 40 countries worldwide, including the US
  - 26%

- Food irradiation eliminates harmful bacteria, insects and molds that can make you sick
  - 29%

- None of the above statements will change my opinion about food irradiation
  - 44%

n=143

2009 IFIC Foundation Food and Health Survey
Knowledge

- Information can have positive, negative, or no effect on consumer perception
- While knowledge does not guarantee positive attitudes, lack of knowledge can serve as a major barrier towards acceptance
- Media has a direct effect
- Trust in the source of information
- Labeling: ???
- Brazilian study: Radura symbol “transmits the sensation of confidence and safety”
  
  (Junqueira-Goncalves et al., 2011, Radiat Phy Chem)
Perceived benefits

- Perceived risks outweigh perceived benefits
- Risk benefit ratio is different in different countries
- Advantages are seen to benefit industry
- Personal benefits are not obvious except during times of high profile outbreaks or for **imported foods**
- Availability
- Price
- Convenience
- Specialty and ethnic foods
- Sensory attributes
Irradiated papayas in Brazil

Deliza et al., 2010, J. Sensory Studies

- Retail environment
- Papayas were labeled
- Price was known
- Consumers were able to evaluate the appearance of the papayas
- Acceptance, willingness to purchase
- Appearance was the most important factor
- Irradiation was a negative factor but if appearance was good, irradiation did not matter as much.
- Education and information about irradiation improved consumer acceptance
People buy foods, not technologies
Sensory evaluation, consumer acceptance, and consumer perception

Sensory evaluation is used to evoke, measure, analyze, and interpret reactions to characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing

• The sensory experience plays a key role in a consumer’s food choice

• As we optimize the sensory attributes the value perceived by the consumer increases
  – trial purchase
  – experience
  – repeat purchase
**Effect of dose on quality**

- Fruit harvested and shipped to irradiation facility
- Fruit irradiated at 0, 0.2, 0.4, 0.6, 0.8 kGy
- Quality tests performed at specific days following irradiation
  - Weight loss
  - Internal disorder development
  - Percentage decay
  - **Texture**, pH, Titratable Acidity, Brix
  - **Sensory**
    - Trained panels
    - Consumer panels

**Statistical Analysis**

Difference among treatments tested using Duncan’s multiple range test (P≤0.05, SAS version 9.1)
Two types of sensory tests

• Analytical = Type and degree of difference
• Acceptability = Do you like it?
## Trained Panels

<table>
<thead>
<tr>
<th>Questions of Interest</th>
<th>Type of Panelists</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do products differ in specific attributes?</td>
<td>Trained for ability to distinguish differences and determine intensity of product attributes</td>
</tr>
<tr>
<td>Magnitude of differences</td>
<td>5-20+ panelists needed</td>
</tr>
</tbody>
</table>
# Trained Panel Peach attributes

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Aroma</th>
<th>Texture</th>
<th>Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothness</td>
<td>Overall Peach Aroma</td>
<td>Firmness Whole</td>
<td>Overall Peach Flavor</td>
</tr>
<tr>
<td>Bruising</td>
<td></td>
<td>Firmness Cut</td>
<td>Sweet</td>
</tr>
<tr>
<td>Flesh Color</td>
<td></td>
<td>Skin Firmness</td>
<td>Tart</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mealiness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ripeness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Juiciness</td>
<td></td>
</tr>
</tbody>
</table>

**Texture**

Firmness to Touch – use fingertips to evaluate whole peach

![Texture Scale]

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*CHAPMAN UNIVERSITY*
## Consumer Panels

<table>
<thead>
<tr>
<th>Question of Interest</th>
<th>Type of Panelists</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well are products liked or which products are preferred?</td>
<td>Screened for product use, untrained</td>
</tr>
<tr>
<td></td>
<td>50-50,000 panelists needed</td>
</tr>
</tbody>
</table>
Consumer Test Methodology

75-100 consumers of fruit

Attributes: Overall Appearance, Overall Flavor, Overall Texture, Overall Liking, Preference

9 point hedonic scale

1. Considering ALL characteristics (Appearance, Flavor, and Texture) indicate your OVERALL OPINION by checking one box.

   □ □ □ □ □ □ □ □ □
   Dislike Extremely    nl/nd             Like Extremely
Consumers preferred Irradiated Peaches

9 Point Hedonics

Overall Appearance: Day 7 Titan Control = a, Day 7 Titan Irradiated = b

Overall Flavor: Day 7 Titan Control = a, Day 7 Titan Irradiated = b

Overall Texture: Day 7 Titan Control = a, Day 7 Titan Irradiated = b

Overall Juiciness: Day 7 Titan Control = a, Day 7 Titan Irradiated = b

Overall Liking: Day 7 Titan Control = a, Day 7 Titan Irradiated = b

Preference

Day 7: Titan Control = b, Titan Irradiated = a

Day 13: Titan Control = a, Titan Irradiated = a

n=57
n=47
Navel oranges after 28-day storage

Control

commercial storage stored at 3 C

0.2KGY

0.4KGY

0.6KGY
Bartlett Pears

Day 7
Day 14

Appearance

Control
800 Gy

Overall liking

Control
0.8 kGy

Day 7
Day 14

Control
800 Gy

Day 7
Day 14
Blueberries stored at 3°C

Day 26

Day 19

Day 12

Control  | 0.4kGy  | 0.6kGy  | 0.8kGy
Consumer evaluation of blueberries

Appearance

Day 12: [Bar graph showing appearance scores for 0 kGy and 0.8 kGy]
Day 26: [Bar graph showing appearance scores for 0 kGy and 0.8 kGy]

Liking

Day 12: [Bar graph showing liking scores for 0 kGy and 0.8 kGy]
Day 26: [Bar graph showing liking scores for 0 kGy and 0.8 kGy]
Beyond survey research

- Consumers need to see and taste irradiated product
- Market tests must be combined with sensory evaluation
- Be transparent-label the product
- Consumers respond positively when informed
- Focus on the product and its benefits, rather than the technology: increased safety, insect disinfestation
- Emphasize that it is used on top of other techniques as a necessary risk reduction strategy
- Use people/institutions that the public has trust in
- Educate supermarket CEOs, managers, and clerks
- Outreach to growers, producers, and distributors
Summary

• People purchase and eat irradiated food

• Most (but not all) will buy when given the opportunity

*Perceived lack of consumer acceptance!*
Anuradha Prakash
prakash@chapman.edu
(714) 744-7826