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Radiation Physics and Chemistry 71 (2004) 493–497
Radiation Physics and Chemistry
www.elsevier.com/locate/radphyschem

Business paper

Dissemination of the food irradiation process on different opportunities in Brazil

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Abstract

Food irradiation can be applied to several kinds of food with different purposes. Although it has been studied since 1950s its public acceptance seem to grow slowly worldwide. Several market trials, consumer studies, and related surveys have been carried out worldwide to quantify the knowledge about food irradiation and its benefits as well as its acceptance. In Brazil, there is little information about public knowledge of food irradiation, even the process got its approval in 1973. This paper report the findings obtained from different trials where food irradiation process was divulged. Some perception, attitude change and opinion about the process were measured.

Keywords: Dissemination; Gamma irradiation; Irradiated food

1. Introduction

Food irradiation can be applied to several kinds of food with different purposes. Although it has been studied since 1950s, to a lay person it is a new technology. Besides the natural concern about new technology, the commercial use of food irradiation process in the whole world has been slow due to people's concern by the association of the food irradiation with radioactivity and nuclear plants (International Consultative Group on Food Irradiation, 1999b). When asked specifically about irradiation, people express concern about safety, nutritional quality, potential harm to employees, and potential danger from living near an irradiation facility (Bruhn, 1995). Bord and O'Connor (1989) concluded that the extension to which the public accepts or rejects irradiated food depends on the presence or absence of information. A survey carried out in a "Radiation Fair", Japan, indicated that if correct information about radiation sciences and technology are transferred at the right stage of education, consumers' image toward food irradiation changes from negative to positive (Furuta et al., 1998).

Food irradiation has been studied worldwide and demonstrated benefits as being a treatment to prevent post-harvested losses and to assure the hygienic and sanitary quality of the food.

Correct information about radiation and related technology showed to be effective in gaining public acceptance, as shown in several surveys and market tests carried out by different countries, mainly in United States (International Consultative Group On Food Irradiation, 1999a; Fox, 1998; Furuta et al., 1998; Bruhn, 1995, 1998; Xu Zhicheng et al., 1993; Curzio and Croci, 1990). Other opportunities have been used to make people aware of food irradiation benefits and about the security of the process. Idaho Section of the American Nuclear Society has hosted four dinners in which irradiated foods were featured, in order to make members, community, and local press conscious of this technology for preserving food without changing taste and texture of the food (Herring et al., 2000). Although accurate science-based information about food irradiation is now reaching consumers in the United States, the level of public knowledge in other countries is extremely low (Bruhn, 1995). In Brazil, there is little information

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doi:10.1016/j.radphyschem.2004.03.081

about public knowledge of food irradiation, even the process got its approval in 1973.

This paper reports the findings obtained from different opportunities where food irradiation process was divulged and some perception and opinion about the process were measured.

2. Experimental and results

2.1. Educational trial

A survey was carried out with students from "Terceiro ano do Ensino Médio" of a public school (corresponding to senior year of high school). The questionnaire asked about five food-processing methods: chemical treatment (as chlorinating water, vegetables), food irradiation, freezing, canning, food preservatives. Initially, each student had to answer the question: "If your food is treated by these methods how do you feel?" The alternatives varied from "very comfortable to extremely concerned". Once they filled the forms, the students watched an approximately 20 min video about food irradiation and its benefits (issued by International Atomic Energy Agency). After some discussion they were asked to return on the questionnaires and answer their new perception about food irradiation and to assign it. To calculate the scores the following values "1", "3", "5", "7" and "9" were assigned to the alternatives "very comfortable", "comfortable", "normal", "concerned" and "extremely concerned", respectively. The weighed average was calculated to generate the scores. The participants were 119 and their ages were between 16 and 18 years old, belonging to a social class very low. Before receiving any kind of information, the students were concerned with food irradiation treatment in the same level of canning treatment or food preservatives. As Table 1 shows, the score related to food irradiation pre video (5.2) was similar to canning and food preservatives (4.9 and 5.1, respectively). This level of score represents a "normal" concern alternative about food treatments among those

Table 1
Average for each treatment calculated from the students' answers

Treatment	Average
Chemical treatment	2.8
Food Irradiation (pre video)	*5.2*
Freezing	3.5
Canning	4.9
Food preservatives	5.1
Food irradiation (post video)	*2.8*

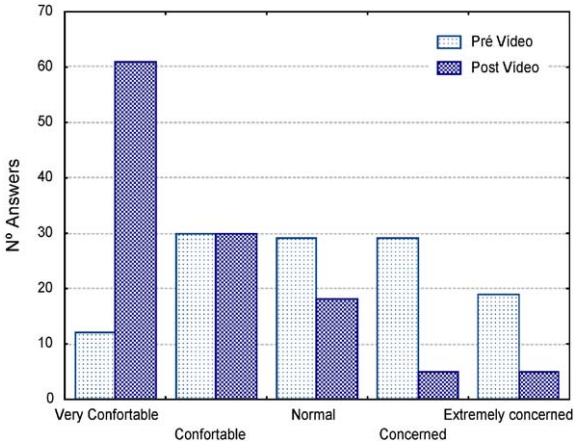

Fig. 1. Answers obtained for Food Irradiation treatment before and after the video exhibition.

the survey evolved. After the video exhibition, the students' perception about food irradiation process switched to 2.8 (close to "comfortable" alternative).

This perception change can be better visualized in Fig. 1. The incidence of answers "very comfortable" after watching the video increased significantly whereas the alternatives "normal", "concerned" and "extremely concerned" diminished. This indicates the real importance of educating and disseminating specific information about one technology in order to increase its acceptance. A similar study, with a comparable number of participants, was carried out by Purdue University (Pohlman et al., 1994) consisted in showing a tape to many groups in Indiana. Initially, about half of the sample of 178 were willing to buy irradiated foods. After viewing the 8 min video (The Future of Food Preservation, Food Irradiation) subject knowledge and willingness to buy irradiated food increased to 90%.

2.2. Tasting test

Tasting tests were carried out in two different meeting: International Nuclear Atlantic Conference, INAC (Rio de Janeiro, 11–16/August/2002) and 15ª Reunião Anual do Instituto Biológico—RAIB ("Annual Meeting of Biological Institute", São Paulo, 4–8/November/2002). We have to mention INAC meeting evolved people related to nuclear area in general (reactors, nuclear fuels, nuclear applications and similar) and participants from RAIB were related to biological and agricultural area. The coded samples were offered to circulating people of both meetings. The participants were required to taste both samples (irradiated and control) and to fill a form containing a five point hedonic scale, with their perceptions related to the

alternatives: "I disliked very much", "I disliked", "normal", "I liked" and "I liked very much". To calculate the results the following values "1", "3", "5", "7" and "9" were assigned to the five earlier alternatives (Carpenter et al., 2000). The weighed average was calculated to generate the scores.

The samples for INAC meeting were papayas and honeys, at the doses 1 and 5 kGy, respectively, irradiated in a ^{60}Co commercial plant (Companhia Brasileira de Esterilização, CBE, Jarinu, São Paulo, Brazil).

The samples for RAIB meeting were tangerines, papayas and honeys, at the doses 0.5, 1 and 5 kGy, respectively, irradiated in a ^{60}Co Panoramic from AECL (Instituto de Pesquisas Energéticas e Nucleares, IPEN, São Paulo, SP, Brazil).

The scores obtained with the participant answers from the two meetings are shown in Tables 2 and 3. In general, irradiated honey and irradiated papaya received a good score for both parameters and both populations, varying from 7.50 until 8.58, representing perception between "I liked" and "I liked very much". Tangerines irradiated and control received lower scores for both parameters, varying from 5.84 until 6.95, representing perception between "normal" and "I liked".

The scores obtained from two different populations constituted 10 cases. From 10 cases studied, four presented significant difference ($p<0.05$), three of them being cases where irradiated papaya/honey got higher score compared to control. The other scores (six cases) presented no significant differences ($p<0.05$) between irradiated and control. These results indicated a good acceptance of irradiated fruits and honey.

2.3. Opinion poll

An opinion poll was carried out in two different meetings cited before (see Tasting Test): International Nuclear Atlantic Conference, INAC and 15[a] Reunião Anual do Instituto Biológico, RAIB.

The questionnaire distributed to the participants consisted of:

- One question with a five point hedonic scale: "*When you buy a food which information in the labels do you read and with which frequency*?" with the alternatives: "*ever*", *almost ever*", "*sometimes*", *almost never*" *and* "*never*"; to which we attributed the values "1", "2", "3", "4" and "5".
- Five yes-no questions and open space to comments: (1) "*Have you ever heard about food irradiation*?"; (2) "*Would you buy a food treated by irradiation*?"; (3) "*Do you know that there is a Brazilian legislation about irradiating food*?"; (4) "*Knowing the following facts (a brief description about food irradiation, its benefits and its legislation were given) would you buy a*

Table 2
Scores obtained for honey and papaya during INAC meeting

	Attribute	N	Scores (according irradiation dose)	
			Control	Irradiated
Honey	Appearance	51	8.23±1.38 (a)	7.96±1.34 (a)
	Taste	51	8.19±1.33 (a)	7.50±2.09 (b)
Papaya	Appearance	49	7.88±1.35 (a)	8.32±1.11 (b)
	Taste	49	7.76±1.33 (a)	8.48±1.05 (b)

Means in the same row with different letters are significantly different ($p<0.05$).
N is the number of tasters.

Table 3
Scores obtained for tangerine, honey and papaya during RAIB meeting

	Attribute	N	Scores (according irradiation dose)	
			Control	Irradiated
Tangerine	Appearance	38	6.95±1.94 (a)	6.42±2.18 (a)
	Taste	38	6.26±2.25 (a)	5.84±2.44 (a)
Honey	Appearance	24	8.08±1.44 (a)	8.42±0.93 (a)
	Taste	24	7.42±2.21 (a)	8.58±0.83 (b)
Papaya	Appearance	19	8.05±1.22 (a)	8.16±1.66 (a)
	Taste	19	7.63±1.34 (a)	8.26±0.99 (a)

Means in the same row with different letters are significantly different ($p<0.05$).
N is the number of tasters.

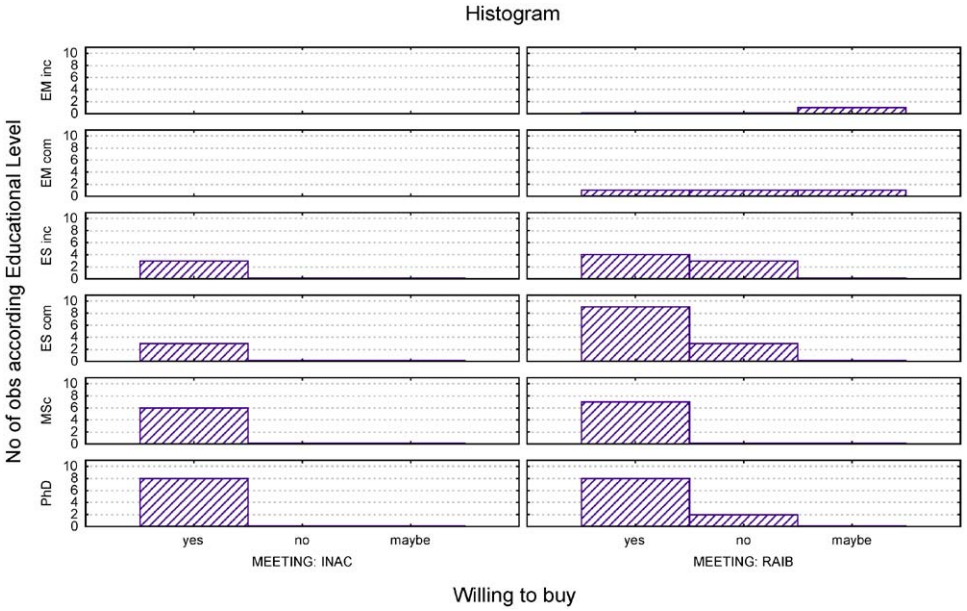

Fig. 2. Histogram for INAC and RAIB population related to willingness to buy irradiated food and categorized according to their educational level.

irradiated food?''; (5) *Have you seen this symbol* (*radura symbol*)?'';

- One association question: ''*Which facts do you associate with food irradiation*? (*you can assign more than one*)'' with the options ''*microorganisms reduction*'', coolness increasing'', ''*sprout inhibition*'', ''*Chernobyl*'', *Caesium/Goiânia*'', ''*radioactivity*'', ''*food treatment*'', ''*other*''/*comment*.

The frequency that people (participants) read information in the labels was higher to ''validity'' with score of 1.10 (''ever''), followed by ''weight'' (1.86, ''almost ever''). The others alternatives remained with scores from 2.49 to 3.22, representing ''sometimes''.

The willingness to buy irradiated food showed a trend to be higher as people have a higher educational level as we can see in the histogram (Fig. 2).

Although 83% of the respondents had already heard about food irradiation, only 17% had seen/known the radura symbol that showed the low level of dissemination and information on food irradiation process.

The legislation knowledge is low and even for people working in nuclear technology (INAC population) 40% said they do not know there is a Brazilian legislation about food irradiation treatment.

Only four people (two from each meeting population) associated food irradiation with Chernobyl and only two (one from each meeting population) with Cesium/Goiânia. From these four people, three said they would buy irradiated food if they receive more information.

3. Conclusion

The results from these trials presented an initial perspective in food irradiation acceptance and knowledge. Although more work has to be done, these opportunities permitted us to reach around 400 people, and more those that only watched these experiments, in order to disseminate food irradiation information.

Acknowledgements

Authors are grateful to Fundação de Amparo à Pesquisa do Estado de São Paulo—FAPESP, for the financial support, to Companhia Brasileira de Esterilização –CBE, for the irradiation operations; to MN Própolis, for the honeys samples; to Instituto Biológico and to Associação Brasileira de Energia Nuclear, ABEN, for the opportunity to use the installations in the 15ªRAIB and in the INAC meetings, respectively.

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