

# Water quality concerns and acceptance of irradiated food: a pilot study on Mexican consumers

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## Abstract

**BACKGROUND:** Poor quality irrigation water is a major cause of disease transmission for urban inhabitants consuming fresh produce in many developing countries. Irradiation of food is an alternative approach to reducing health risks for consumers, but its implementation depends heavily on consumer acceptance.

**RESULTS:** In this pilot study, we show that most respondents consider the water quality of Mexico City to be poor and a health risk, and would be willing to pay for irradiated food as a means of pasteurizing fresh iceberg lettuce.

**CONCLUSION:** Irradiated food could, potentially, be accepted in developing countries that have problems with water quality. Such acceptance would presumably be due to the perception that such a novel technology would (1) alleviate water impairment, and (2) lead to economic improvement. It is then possible that the public considers that water quality is a more pressing concern than any potential side effects of food irradiation.

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**Keywords:** water quality perception; irradiated food acceptance; Mexican consumers; pilot study

## INTRODUCTION

Wastewater irrigation is a very common activity in developing countries. In fact, about three-quarters of the total irrigated areas in the world are located in developing countries and from this total, about 10% uses wastewater.<sup>1</sup> This poor-quality water is a major cause of disease transmission and, although this is a major public health issue, wastewater treatment is not a widespread practice in many developing countries. Hence, alternative or complementary methods to cope with this issue in large urban populations that consume crops irrigated with wastewater are needed. One approach is the use of alternative pasteurizing methods to reduce health risks on consumers; and one of these technologies is food irradiation.

Food irradiation is a pasteurization method used to extend the shelf life of fruit and vegetables, and can also be used for food sterilization. Such methods are not as widespread among developing countries as it is in industrialized countries. As with any new technology, especially when food safety or quality is involved, the implementation of food irradiation depends heavily on consumer acceptance. Hence, this paper attempts to approach for the first time a common problem in developing countries: agricultural water quality and acceptance of a new technology for pasteurizing food.

## EXPERIMENTAL

We carried out a framed field experiment<sup>2</sup> pilot study in Mexico City which comprised a sample of 44 consumers who voluntarily agreed to participate in our survey but statistical analyses were performed

with 39 observations. (A more detailed description of the methods is given in unpublished data by Ibarra *et al.* and is available upon request from the authors.) We used face-to-face willingness-to-pay (WTP) dichotomous choice questions in randomly selected supermarkets.<sup>3</sup> Fresh iceberg lettuce was employed as the product of interest since this is frequently consumed in Mexican homes.

Four different questionnaires were randomly applied to respondents. The main difference among these was the quantity of information given to consumers before asking their willingness to pay:

- *Questionnaire I:* information on both water quality and food irradiation
- *Questionnaire II:* information on water quality but none on food irradiation
- *Questionnaire III:* information on food irradiation but none on water quality
- *Questionnaire IV:* no information

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Data obtained from these four questionnaires were arranged in six statistical treatments for analysis. We defined treatments as:

- *Treatment 1* is equal to 1 if the subject received complete information (i.e. both on water quality and on irradiation) and equal to 0 if no information at all was provided (i.e. questionnaire I vs. questionnaire IV).
- *Treatment 2* is equal to 1 if the subject received partial information (i.e. only on irradiation) and equal to 0 if no information at all was provided (i.e. questionnaire III vs. questionnaire IV).
- *Treatment 3* is equal to 1 if the subject received partial information (i.e. only on water quality) and equal to 0 if no information at all was provided (i.e. questionnaire II vs. questionnaire IV).
- *Treatment 4* is equal to 1 if the subject received complete information (i.e. both on water quality and on irradiation) and equal to 0 if partial information (i.e. only on irradiation) was provided (i.e. questionnaire I vs. questionnaire III).
- *Treatment 5* is equal to 1 if the subject received complete information (i.e. both on water quality and on irradiation) and equal to 0 if partial information (i.e. only on water quality) was provided (i.e. questionnaire I vs. questionnaire II).
- *Treatment 6* is equal to 1 if the subject received partial information (i.e. only on irradiation) and equal to 0 if partial information (i.e. only on water quality) was provided (i.e. questionnaire III vs. questionnaire II).

We assessed consumers' perception of water quality and food information through a five-point Likert scale for three main topics: water quality perception, confidence towards food labels, and importance of food and water quality information. Demographic data on educational level, income and age were obtained as well.

A Student's *t*-test that assumed equal variances was applied. This test reports a probability level, in order to verify our null hypothesis: whether the treatment means being compared are equal or not.

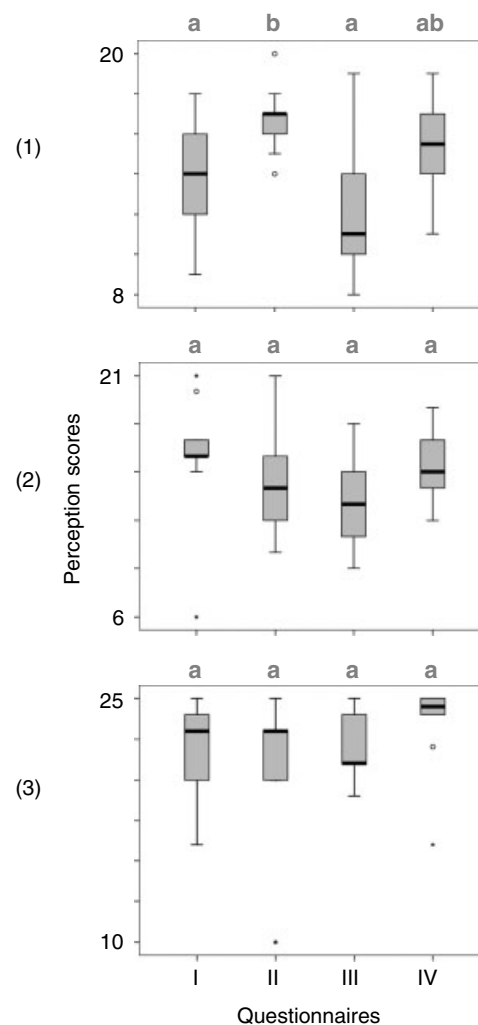
## RESULTS AND DISCUSSION

Consumers demonstrated differences in WTP for irradiated lettuce, depending on the information given at the beginning of the questionnaire. Fifty-one % of subjects declared they would accept paying the random price presented for an irradiated iceberg lettuce. With respect to the expected WTP ( $E[WTP]$ ), 80% of consumers who were provided with full information would pay, 50% of consumers given only water quality information would pay, 44% of consumers given only irradiation information would pay, and 30% of consumers with no information at all would pay. Table 1 shows that average treatment effects for  $E[WTP]$  was statistically significant ( $P < 0.05$ ) only for Treatment 1.

Differences among treatments after performing the Student's *t*-tests on perception scores were found only for the water quality perception score. Confidence on labels and the importance of information about food and water quality issues showed no significant differences. The water quality score was statistically different ( $P < 0.05$ ) between questionnaires I and II, and between questionnaires II and III (Fig. 1). In other words, when information on irradiation was presented, the water quality score was lower than when water quality information was provided to respondents. It seems then, that consumers might think that if a new technology for pasteurizing fresh produce is needed, then water quality problems are worse than what they expected. It is then

**Table 1.** Results of the average treatment effect for the expected WTP treatments

Treatment number	Average treatment effect (grouped variance)	Student's <i>t</i> -test <i>P</i> value
1	0.500 (0.206)	0.0239
2	0.200 (0.254)	0.5413
3	0.200 (0.256)	0.3880
4	0.300 (0.225)	0.1211
5	0.300 (0.228)	0.1769
6	0.000 (0.278)	0.8213



**Figure 1.** Boxplots showing the resulting perception scores for each questionnaire (represented in roman numerals): (1) water quality perception, (2) confidence towards food labels, and (3) importance of food and water quality information. Boxplots with the same letter represent no statistical difference ( $P < 0.05$ ) between questionnaires.

possible that consumers are more preoccupied by environmental problems, especially water impairments, than the perception of food irradiation effects. A similar result was found by a study<sup>4</sup> with US consumers, where irradiation was of less concern in comparison to pesticide residues, animal drug residues, growth hormones, food additives and bacteria. Besides, novel technologies are often

seen as necessary improvements for economic development in many developing countries.<sup>5</sup> Both considerations would explain an easier acceptance of new food technologies in developing nations, such as genetically modified food<sup>6</sup> and, in our case, food irradiation.

It has been shown that inhabitants of Mexico City are willing to pay a higher water bill for having better water services.<sup>7</sup> This concern was reflected in our survey as most respondents considered that the water quality in Mexico City is rather poor and represents health risks. This perception might have had a role in the acceptance of food irradiation as a way of preventing water-borne diseases.

Other factors, apart from perception on water quality and information on irradiation, that influenced consumers in our study, included educational level and income, which is a standard result in both developed<sup>8</sup> and developing countries.<sup>9,10</sup>

Finally, the size of the sample employed in our analyses does not allow us to generalize on the behavior of Mexican consumers towards irradiated food. Therefore, our results should be taken with caution and considered only as a pioneer study to empirically explore a relationship between water quality concerns and the acceptance of the use of irradiated-food technology among Mexican consumers.

## CONCLUSIONS

Our findings suggest that irradiated food, as a novel technology, will likely be accepted in developing countries with similar water quality issues as Mexico City. It could be a consequence of the perception that consumers might have of a new technology for pasteurizing fresh produce needed for avoiding problems with water quality. It is then possible that water quality could be more a pressing concern to them than any potential concerns on the possible side effects of food irradiation. Furthermore, accepting a new technology such as irradiated food in developing countries might also be related to a perception of economic improvement.

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