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Conjoint analysis as a tool to identify improvements in the packaging for irradiated strawberries

Tarcísio Lima Filho [a], Suzana Maria Della Lucia [a,*], Rondinelli Moulin Lima [a], Valéria Paula Rodrigues Minim [b]

[a] Centro de Ciências Agrárias, Departamento de Engenharia de Alimentos, Universidade Federal do Espírito Santo (UFES), Alto Universitário, s/n, P.O.Box 16, 29500–000, Alegre, ES, Brazil
[b] Departamento de Tecnologia de Alimentos, Universidade Federal de Viçosa, P. H. Rolfs Av., s/n, 36570–000, Viçosa, MG, Brazil

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ABSTRACT

Consumers have shown aversion for the term "irradiation", obligatorily present in packages of irradiated food. Through ratings based conjoint analysis (RBCA) and modified-choice based conjoint analysis (MCBCA) we quantified the effect of characteristics of packages of irradiated strawberries on purchase intent and likelihood of choosing this product. The factors "explanatory information" and "radura symbol" affected consumer assessment. The factor called "preservation method information" showed no significant effect ($p = 0.405$). Thus, the best packaging should present the information "food treated by ionisation process" or "food treated by irradiation process", "to ensure the freshness and quality for a longer time" and should have the presence of radura symbol. Brazilian and U.S. laws require the use of the term "irradiation". Therefore, changes in legislation may not be necessary. These results assist in the production of packaging for irradiated strawberries, providing important information for assessing the primary factors that result in a greater intent to select and purchase this product.

1. Introduction

Food irradiation is scientifically accepted as an excellent method of preservation and is permitted and regulated by various countries (Diehl, 2002; Eustice, Bruhn, Fan, Sommers, et al., 2010; Fellows, 2006). Nonetheless, the full commercialisation of food irradiation has been limited because a segment of the population fears and consequently rejects its use. Various studies have reported this rejection of food irradiation by a part of the population (Consumers Association of Canada, 2012; Eustice et al., 2010; Gunes & Tekin, 2006; Junqueira-Gonçalves et al., 2011; Lima Filho, 2013).

In the United States, packages of fully irradiated foods must display the radura symbol (symbol of irradiated food) and the statement "treated with radiation" or "treated by irradiation" (Code of Federal Regulation, 2004). Brazilian law does not require the presence of the symbol but requires that labels on irradiated food display the words "Food treated by irradiation process" on the front of packages (Brasil Anvisa, 2001). Such requirements may be leading to the reduced use of irradiation as a method of preservation by food industries, fearing that the term "irradiation" on their food labels may reduce the acceptance of their products (Eustice et al., 2010; Ornellas, Gonçalves, Silva, & Martins, 2006).

Some authors state that the term "irradiation" on food labels may decrease consumer intent to purchase and, in some countries, the replacement of the word "irradiation" by another reference to radiation has been advocated. The following are various suggested options: "cold pasteurisation", "electronic pasteurisation", "ionising energy" and "ionisation" (DeRuiter & Dwyer, 2002; Morehouse & Komolprasert, 2004). Another factor that may affect intent to purchase and consumer choice is label explanatory information regarding the reason for the irradiation process. Research indicates that consumers initially sceptical of irradiation predominantly react positively once they are informed of the benefits and safety of the irradiation process, such as increasing in shelf life of food and elimination of pathogenic micro-organisms. (Lima Filho et al., 2014).

Conjoint analysis is a quantitative method that has been used to assist in the clarification of consumer behaviour regarding a product, especially when seeking to analyse the attributes of product packaging on consumer choice and purchase. Ratings-based conjoint analysis (RBCA), one type of conjoint analysis, uses a score of the intent to purchase packages evaluated on data collection scales. In choice-based conjoint analysis (CBCA), consumers choose one or more packages from a set instead of scoring them separately (Hair Junior, Anderson, Tatham, & Black, 1995). The use of such analysis methods enables the assessment of label or package characteristics that are essential for increasing consumer intent to purchase or choose a product.

The data collected using such methods are valuable to clarify the factors that affect consumer behaviour, thereby assisting in the design of strategies aimed at improving the acceptance of foods and willingness to purchase them. These data are even more important for the study of factors affecting the acceptance of a controversial method of

* Corresponding author. Tel.: +55 28 35528602.
E-mail address: smdlucia@yahoo.com.br (S.M. Della Lucia).

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preservation with a great effect on consumer behaviour, as in the case of food irradiation.

Thus, to determine the package for promoting high purchase intent of irradiated strawberries, the present study used RBCA and CBCA, the last one in a modified way of data collection, called modified choice-based conjoint analysis (MCBCA), to evaluate and quantify the effect of information included on labels for packages of irradiated strawberries on the consumer intent to purchase and likelihood of choosing this product.

2. Materials and methods

The study was approved by the Research Ethics Committee of the Centre for Health Sciences of the Federal University of Espírito Santo (UFES), ES, Brazil, under number 242.830.

The participants of this study were recruited through personal approach in Alegre, ES, Brazil. We selected only strawberry consumers who had the habit of shopping in supermarkets. A sample of 144 strawberry consumers participated in the analyses, including residents of Alegre, ES, Brazil, and students and staff of the Centre for Agricultural Sciences, UFES.

The RBCA was conducted initially to evaluate and quantify the effect of label factors associated with irradiated strawberry packages on consumer intent to purchase the berries. Subsequently, the same consumers participated in the MCBCA, which was conducted to evaluate the effects of the label factors and their levels on the choice of irradiated strawberries.

After their participation in the MCBCA, the consumers responded to a questionnaire with sociodemographic questions regarding strawberry consumption, food shopping habits and their knowledge of irradiated foods and intent to purchase them.

2.1. Assessment of factors regarding irradiated strawberry packages and their respective levels

The assessment of three labelling factors, each at two levels, was performed based on the results of three focus group sessions conducted by Lima Filho (2013) in a preliminary study. The factors and their respective levels that were considered most relevant for package labels on irradiated foods were preservation method information at two levels, that is, “food treated by irradiation process” or “food treated by ionisation process”; explanatory information at two levels, that is, “to increase preservation” or “to ensure freshness and quality for a longer time”; and the radura symbol at two levels, either the presence or absence of the symbol.

2.2. Data collection and experimental array

The data were collected using the complete profile method (Green & Srinivasan, 1978), and a complete factorial treatment array was used (Carneiro, Silva, & Minim, 2013). Therefore, eight treatments were applied, as outlined in Table 1.

2.3. Package label production

The experimental labels appropriate for irradiated strawberry packages were produced by a professional specialising in label production, based on labels from existing commercial products and in agreement with Brazilian food labelling standards. The strawberry brand used was fictitious. The design was produced from a photograph of a strawberry package, with the prepared label added to the front of the package. The images were printed on A4 office paper using a colour laser printer. In Fig. 1 two examples of packaging labels produced are shown: (a) treatment 1 and (b) treatment 8.

2.4. Package label (treatment) evaluation

2.4.1. Ratings-based conjoint analysis (RBCA)

The images of the treatments were shown to the consumers encoded within the plastic envelopes of a catalogue folder. The consumer conducting the ratings was instructed to pass a plastic envelope at each evaluation so that all the treatments were assessed monadically. Fifteen seconds was allowed for the evaluation of each treatment, followed by another 10 seconds to complete the answer sheet and transition to the next envelope. An unstructured, horizontal linear scale of nine centimetres with two anchors (“definitely would not buy” and “definitely would buy”) was used on the test sheet to assess the intent to purchase.

The first image of a package that was shown was the same for all the consumers and consisted of an image identical to that in all the treatments, albeit with no information regarding the study factors. Thus, this image was intended to remove the effect of the first sample (package) on the evaluation of the next sample (Deliza, 1996).

After the first package image, the study treatments were displayed following the experimental design proposed by MacFie, Bratchell, Greenhoff, and Vallis (1989) to remove the effect of the order of display and the residual effect regarding the influence of one treatment on the evaluation of the next treatment.

The experimental design used contained 48 different possibilities for ordering the display of treatments, sufficient to estimate the three main effects (information on the preservation method, explanatory information and the radura symbol) composing the analyses in an unbiased fashion. Each consumer present in a session represented a design repetition; the study was conducted in three sessions, totalling 144 consumers participating in the study.

2.4.2. Modified choice-based conjoint analysis (MCBCA)

In the present study, we performed a modification in the treatments evaluation protocol of the traditional methodology of choice-based conjoint analysis (CBCA). In the evaluation of treatments of the traditional method it is conducted in an experimental design in which treatments are typically divided into groups (choice sets); the treatment groups (choice sets) are presented in a monadic way to consumers, who must choose, or not, a treatment of each group. In the modified choice-based conjoint analysis (MCBCA), used by us in this study, all the eight treatments were presented at the same time to consumers (and not

Table 1
Study treatments.

Treatment	Preservation method information	Explanatory information	Radura symbol
1	Food treated by irradiation process	To increase preservation	Absence
2	Food treated by irradiation process	To increase preservation	Presence
3	Food treated by ionisation process	To increase preservation	Absence
4	Food treated by ionisation process	To increase preservation	Presence
5	Food treated by irradiation process	To ensure freshness and quality for a longer time	Absence
6	Food treated by irradiation process	To ensure freshness and quality for a longer time	Presence
7	Food treated by ionisation process	To ensure freshness and quality for a longer time	Absence
8	Food treated by ionisation process	To ensure freshness and quality for a longer time	Presence