Consumer attitudes to high pressure food processing

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Abstract

As part of an EU-funded research project a representative survey of consumer attitudes concerning high pressure processing (HPP) of foods was carried out. 3000 adults aged 14 years and over, in France, Germany and the UK were interviewed in face-to-face computer assisted personal interviews (CAPI) and asked to indicate their opinion by evaluating 35 positive and 25 negative statements about the new technique, to compare the new technique with the conventional techniques, and they were asked if they would buy products preserved using High Pressure Pasteurization. The concept used for the data analysis was that of a market segmentation model using sociodemographical, geographical and psychographical attributes. The average acceptability rate is discussed with respect to the MAYA threshold value (Most Advanced Yet Acceptable), a pragmatic market research threshold value.

Key words: High pressure, food processing, consumer, survey.

Introduction

HP-treatment is a new preservation method without high temperatures, avoiding undesirable alterations caused by thermal treatment of foods such as vitamin loss, reduced bioavailability of essential amino acids, flavour loss, modification of taste and colour, etc.. Biological effects of high pressure like inactivation of micro-organisms or changing functional properties of food biopolymers, are known for decades, but only in the last ten years foods preserved by high pressure became commercial reality. First products were fruit jams in Japan, now there are a number of products available mainly in America and Japan including fruit juices, guacamole, sauces, oysters and packaged cured ham. However, in Europe the method is more or less unknown for the consumer and food manufacturers face impediments due to the EU novel food regulation. EU, on the other hand, in the last ten years funded a number of research projects on high pressure treatment of food, including this work which partly dealt with consumer attitudes to high pressure food processing.

Methods

Qualitative research was conducted in two workshops of 7-12 participants organized by Adriant, Nantes, France. The two workshops had discussions from different starting points; one form from the quality of food the other from technology and high pressure. The aim was to discern the reservations or motivations of consumers in relation to the use of high pressure in order to construct a questionnaire. It should also provide some of the terms and vocabulary used in the survey. A series of questions were devised and the questionnaire constructed. After reading the introductory show card (Fig. 1), the interviewees were asked a series of questions on seven topics (Fig. 2).

Questions B1 and B2 deal with the feelings the consumers have regarding the process. Question B3 compared high pressure with other preservation methods. Questions B4 and B5 deal with the product, about advantages and disadvantages that the new process might have (effect on taste, quality, price

Conventional methods of preserving food by heating to reduce the number of bacteria and activity of enzymes often produce a number of undesirable changes in foods, such as loss of colour, flavour and nutritional quality. This can be avoided by using alternative minimal processing strategies.

One of these, already being commercialized on a small scale by food industry, is high pressure processing (HPP) in which foods are compressed in the range of 1000 to 5000 bar for a few minutes. (These are pressures comparable to those found in the depth of oceans.).

The process can be used to extend the shelf-live of a range of products, such as juices.

Figure 1. Showcard B0 shown to interviewees at the start of the interview.

etc). Question B6 was about personal advantages and benefits for the consumer. In all, the questionnaire required the interviewees to evaluate 35 positive and 25 negative statements about the new technique. The last topic (Question B7) concerned the interviewee's willingness to buy high pressure treated food products. Under each question were a series of statements and the interviewees were asked to indicate whether they agreed or disagreed with each statement, or for some questions to indicate the statement which best answered the question. There was a total of 80 statements to be evaluated. The survey was conducted by GFM Getas (Hamburg, Germany). Face to face computer assisted personal interviews (CAPI) were conducted with 1000 people in each of France, Germany and UK. Data was analyzed using SPSS Answer Tree (Answer TreeTM 2.0 by SPSS Inc. Chicago, Illinois 60606) with the method of CHAID (Chi-squared Automatic Interactions Detector). This technique is a highly efficient process for data segmentation and the construction of Decision Trees. CHAID uses the significance of statistical tests as criteria to evaluate all the values of a potential predictor variable. It merges values that are judged statistically homogeneous with respect to the target variable and maintains all other values as heterogeneous. It then selects the best predictor value to form the first branch of the Decision Tree. As the process is repeated so the tree grows.

B 0	Information showcard presented by interviewer
B 1	What feeling do you have in general terms with regard to this new process?
B 2	Can you tell me how you feel about this technique? Which of the comments on this showcard do you agree with?
B 3	I'm going to read out various techniques for preserving food wich are currently available. Can you tell me, how you regard this new technique?
B 4	I'm going to read out some advantages and disadvantages that this new process might have. Please tell me for each of these statements how much you agree or disagree.
B 5	In your view: would high pressure preservation of foods results in more expensive products, better tasting andquality, both or none of these?
B 6	Would you say, that for you this new treatment has more advantages or disadvantages? Which statement on this showcards meets your expectations best?
B 7	Would you buy these products?

Figure 2. Questionnaire "Preserving foods". Interviewees were asked to consider seven topics and answer a series of questions about each

Results and Discussion

Following the qualitative study it was agreed that the large scale survey should contain certain key elements: (1) An outline of high pressure processing which should present the interviewee with basic information in a neutral format. (2) Determine views about high pressure technology and how it compares with existing treatments. (3) Perceptions of advantages and disadvantages to the consumer. (4) Indication of the requirements of consumers to become buyers of high pressure treated foods. Figure 3 shows the distribution of interviewees between the buying and non-buying groups. Non-buyers included those who were uncertain and those who would not buy at all.

All the collected data were used to build a predictive model which examined perceptions about high pressure in relation to the consumers willingness to buy high pressure treated foods. In market research an acceptability threshold is set for new technologies described as the Most Advanced Yet Acceptable (MAYA) threshold, experience has set the value at 60%. From the survey an acceptability value was calculated as the sum of the conditional and unconditional sub-groups of buyers (see Fig. 3). These were found to be 74% in Germany, 71% in France and 55% in UK, with an overall average value of 67%. This suggests that, without personal experience and based largely on information provided on the statement card, high pressure processing was acceptable to the majority, with some reservations in the UK.

The majority of the potential buyers were conditional buyers i.e. they will buy if there are advantages (or no disadvantages perhaps) for them. The data suggest which conditions are most important (Fig. 4). There was similar behaviour of the British and the Germans. For both it was most important that the products are not more expensive than for conventional products
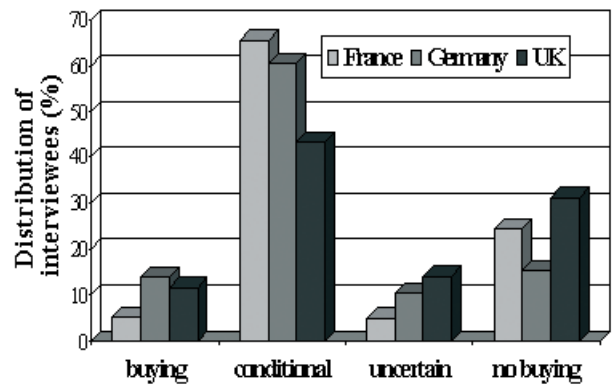

Figure 3. Interviewees grouped as buyers or non-buyers of high pressure treated foods.Buyers were subdevided into unconditional or conditional (will buy if...)

and that there is a health benefit. The French were more prepared to pay a bit more for the products, while both the Germans and the British were more reluctant to pay more. For the gastronomically aware French, quality was clearly important (a condition for 50% compared to less than 10% in Germany and the UK). Increased shelf-life was also a French concern. Buyers were allowed to choose more than one condition To investigate the data further for predictions of consumer behaviour, a factorial analysis was performed on the data of the public opinion poll using SPSS software. In this case we wanted to detect differences between the non-buyer group (including the undecided) and the buyer group (including conditional buyers). The data (Fig. 5) was subdivided into the same three factors for both groups: The upper part of the table deals with the positive properties of the process The middle deals with negative properties and fears. The bottom compares the process with other food preservation technologies.

The table shows the importance of single variables given by the values in the right hand row. Such a ranking could be used directly to determine advertising strategies.

The result suggests that both the buyers and non-buyers perceive high pressure to be similar to sterilisation, pasteurisation and UHT treatments. Also both groups were aware of the positive properties, like retention of vitamins, real taste and natural quality. However, the non-buyers expressed more fears and concerns. For example: „I would be concerned" is loading with 0.64 instead of 0.49 for the buyers.

To determine consumer attitudes a hypothesis was formulated: Consumer acceptance of high pressure processing is likely to depend on whether individuals perceive that the benefit to them (e.g. reduced risk of microbial contamination) outweighs any negative perceptions (e.g. loss of quality or perceptions of dangers inherent in the process). Acceptance of novel technologies are dependent upon perceptions of advantage or need as well as risk. These perceptions are important if predictions regarding consumer acceptance are to be made. Further statistical analysis, using SPSS software was applied to develop AnswerTrees. This was used to determine the best predictor for the buying behaviour in the three countries (Fig. 5). In the first node of the table all information is given about all the participants (2120 or 66.6% potential buyers and 1063 or 33.4% potential non-buyers. At the next level AnswerTree searches for the best predictor variable to form the first branch in the decision tree, which was the variable 72 from Question
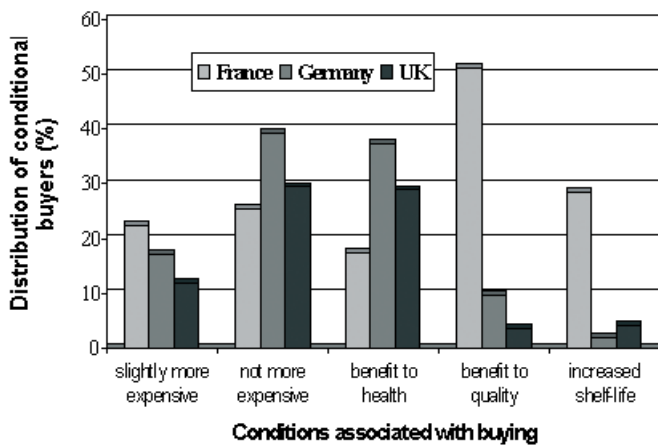
Figure 4. Conditional buyers grouped by condition and country.

B6 ("For me this new treatment has more advantages") (fig.6). The chi-square value of 973 was very high. Dividing the sample between those who agreed with this statement and those that disagreed produced groups of roughly similar size.

*The group of the people who saw more personal advantages contained over 90 % potential buyers. There is no need for a further split.

* The group of the people who do not see more personal advantages contained nearly 60% non-buyers.

The answers to question B7 were correlated with other responses throughout the questionnaire. The statement that "For me, this treatment has more advantage" was found to be the best predictor of buying habit.

The group that did not agree that the process offered them more advantage were further split (Fig. 7). The first node is again that of the 1561 people who did not see more personal advantages**.** AnswerTree found the best predictor variable to form the first branch of this decision tree was the variable 43 from Question B2 with a high chi-square value of 157. Variable 43 was "High Pressure Processing (HPP) sounds like an environmentally-friendly process". This question splits the sample into one large and one small group:

* Those that agree with this statement form the smaller group and nearly of them were 80 % potential buyers. In a further split this percentage rises to 87% for people who think the process preserves the real taste (B4_59).

v In the larger group of people, who do not see the process as environmentally friendly over 65% were non-buyers. In a further split this percentage rose to 71% for people who did not think the process preserves vitamins (B4_59).

* These analyses help to show perceptions and misconceptions about novel technology. The other important consideration required to improve the appeal of pressure treated products, was the target group. What kind of people were the non-buyers? What were the socio-demographic differences between the group of non-buyers and buyers? Age was a key factor, 22% of non-buyers were under 30 years while 28% of buyers were in that age group. Conversely 27% of non-buyers were over 59 but 20% of buyers were in that age group. The remaining age group (30 to 59) were evenly divided, 50 and 51% non-buyers and buyers respectively. Education was another important factor, people in the buyers group generally had a

non buyers + undecided		buyers + conditional buyers	
B4_61: vitamin	0.71	B4_59: real taste	0.72
B4_60: nutritional qualities	0.71	B4_61: vitamin	0.71
B4_63: natural qualities	0.65	B4_60: nutritional qualities	0.71
B4_59: real taste	0.62	B4_63: natural qualities	0.70
B4_62: freshness	0.50	B4_67: fewer additives	0.55
B4_67: fewer additives	0.44	B4_62: freshness	0.50
B2_43: friendly process	0.42	B5_69: better tasting	0.50
B6_72: more advantages	0.41	B6_72: more advantages	0.44
B4_65: risk of damage	0.66	B2_47: it changes the products	0.58
B2_46: I would be concerned	0.64	B4_65: risk of damage	0.55
B2_47: it changes the products	0.60	B2_46: I would be concerned	0.49
B2_51: do not know	-0.53	B1_29: quality must damage	0.38
B1_40: no answer	-0.51	B2_42: comfortable	0.33
B4_64: more processing	0.49	B2_44: environm. risk	0.32
B4_66: limited shelf-life	0.42	B1_27: high temperatures	0.29
B1_25: unnatural technique	0.40	B4_66: limited shelf-life	0.28
B2_44: environm. risk	0.38	B1_25: unnatural technique	0.27
B1_29: quality must damage	0.31	B1_31: benefits	0.24
B3_53: pasteurisation	0.73	B3_55: sterilisation	0.69
B3_55: sterilisation	0.68	B3_53: pasteurisation	0.68
B3_58: ultra high temp.	0.68	B3_58: ultra high temp.	0.65
B3_54: canning	0.61	B3_54: canning	0.47
B3_52: deep freezing	0.57	B3_57: irradiation	0.46
B3_57: irradiation	0.53	B3_52: deep freezing	0.42

Figure 5. Factorial analysis (SPSS) of public opinion poll. Participants form two groups: buyers and non-buyers. The table shows the relative importance of factors grouped according to 1. the positive properties of the process; 2. negative properties and fears 3. comparison of the process with other food preservation methods. Numbers (e.g. B4_61) refers to the question within the questionnaire. Rotation method: varimax with Kaiser-Normalizing; Extraction method: Principal Component Analysis; Rotation converged in 5 iterations.

higher level of education or better qualifications than those in the non-buyer group.

Conclusions

High pressure processing was acceptable to the majority of consumers interviewed in France and Germany, UK produced an acceptability value below the market research threshold. The overall average value of 67% suggests that, without personal experience and based largely on information provided on the statement card, high pressure processing was acceptable to the majority, with some reservations in the UK. The majority of the potential buyers were conditional buyers. Concerning which conditions are most important there was similar behaviour of the British and the Germans. For both it was most important that the products are not more expensive than for conventional products and that there is a health benefit. The French were more prepared to pay a bit more for the products, while both the Germans and the British were more reluctant to pay more. For the gastronomically aware French, quality was clearly important (a condition for 50% compared to less than 10% in Germany and the UK). Increased shelf-life was also a French concern. Those who perceived the greatest personal advantage from the technology were most likely to buy the products. This group tended to include a higher proportion of young educated people.
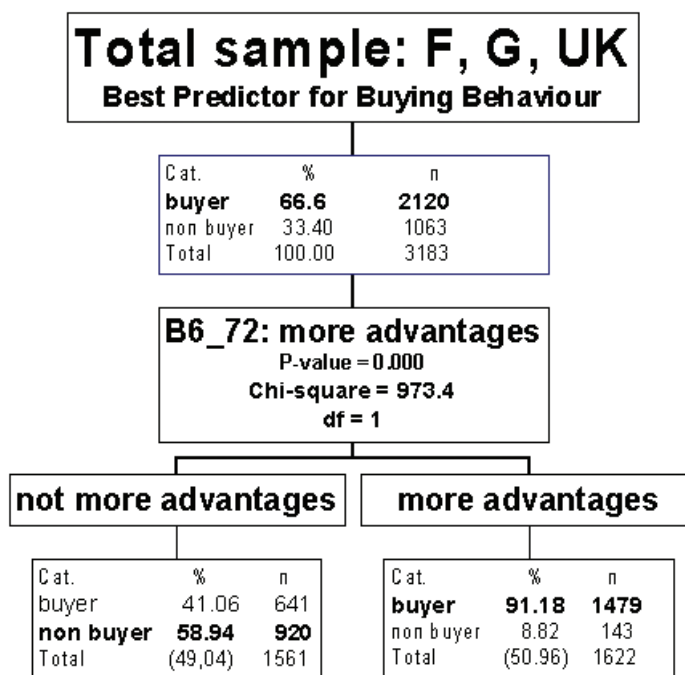
Figure 6. AnswerTree derived from SPSS analysis of data from international survey of public perception of high pressure food processing. To determine the best predictor of buying behaviour.
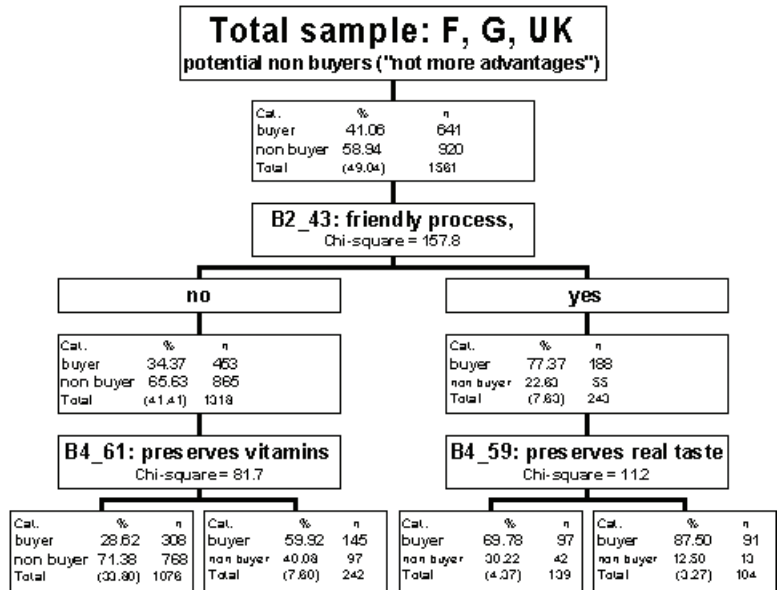
Figure 7. AnswerTree derived from SPSS analysis of data from international survey of public perception of high pressure food processing. Sub-division of the group who saw no personal advantage in high pressure processing.