

# Consumer attitudes, knowledge and behaviour: a review of food safety issues

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Consumers' attitudes have been shown to influence and predict behaviour. This review highlights the diverse consumer attitudes towards the safety of food. The diversity among consumers is based on a variety of factors, including demographics and socio-economic status. The relationship between consumer attitudes, knowledge and behaviour regarding food safety is also examined in this paper. It indicates that different attitudes do not necessarily lead to behaviours that increase the safety of the food consumed. It can be concluded that there exists the need for professional assistance for consumers regarding food safety issues.  
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We must begin educating the public to the reality that there is no such thing as absolute safety. Regulation can never completely and totally protect the public. Large segments of the American public already accept this fact. But it is time for persons in positions of leadership to strengthen this understanding with more candid discussion on the limits of regulation.

Senator Edward Kennedy—1978

## Introduction

Food is a critical contributor to physical well-being and a major source of pleasure, worry and stress (Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999). Consumers are faced with a wide range of competitively priced food products of consistently high quality. Each food item must be safe, aesthetically pleasing, good tasting, and consistent with the product image. Variations within the same batch or between batches of a product must be kept to a minimum since consumers interpret them as an indication of production faults. As a result, quality control is essential in the food industry, and efficient quality assurance has become increasingly important. Instrumentation and food safety practices are of central importance, with particular emphasis on very high sanitary and hygienic operating standards.

The Government of the United States first introduced the concept of food safety to North American consumers. The Federal Food, Drug and Cosmetic Act of 1908 prohibited additions of any toxic or deleterious substance to food, and the Food Additive amendment of 1938 required that all additives be proven "safe" before addition to food (Francis, 1979). In 1976, The Food Safety Council was born in the US. Its task was to develop new criteria for evaluating the safety of the food supply, whether it was a food ingredient, a food additive, or a basic foodstuff. The Council also developed documents and regulations in response to scientific research related to food safety (Hopper, 1977). The rigorous enforcement of these regulations by the Food and Drug Administration (FDA) and the Food Safety Council, and the constant reassurance of the safety of the food supply, has reinforced the concept of absolute

food safety to consumers (Francis, 1979). However, absolute safety is just not possible. A number of events in the past decade have made this conclusion inescapable (Francis, 1979). In 1990, an average of 120 cases of food borne illness per 100,000 people was reported in 11 European countries (Jouve, Stringer, & Baird-Parker, 1999). Moreover, in 1998, people fell ill within 2 days as a result of *Escherichia coli* O157:H7 bacterial contamination of undercooked meat or unwashed vegetables (Steele, 1998). Overall, an estimated 20,000 Americans are poisoned by this particular strain of *E. coli* annually and, of these, about 250 die, according to the Center for Disease Control and Prevention (Steele, 1998). Although incidences of bacterial contamination of food are occasional, their consequences are vast, resulting in illnesses, deaths, and loss of production and public confidence in the food industry (Harris, 1997).

Consumers' concerns about food are based on worries not only about health but also about agriculture, ecology and food culture (Holm & Kildevang, 1996). Technological and environmental changes associated with modern food production, such as genetic engineering and the use of pesticides, are also of vital importance for society and of increasing interest to consumers (Holm & Kildevang, 1996).

Consumers' attitudes towards food safety and their practices related to food are themes of interest to food producers and retailers, public authorities and health educators. This interest has been reflected in discussions about how food safety should be defined and how consumers perceive food safety and choose food. The correlation between food safety and consumer acceptance has been especially prevalent in North America and Europe (Francis, 1979; Rozin *et al.*, 1999). The comparatively lower number of studies conducted on consumer attitudes towards food safety in the third world countries suggests that this issue may not be of as much interest. This reduced interest towards food safety may be due to a lack of consumer education and training, and a low consumer impact on food safety.

Thus, it is important to educate the consumers to the reality that food safety is an important global issue for all stakeholders, from general public to regulatory agencies. However, prior to educating, it is important to understand the diverse food safety issues relevant to consumers. Thus, this paper attempts a review of the published literature on consumer attitudes towards the safety of food.

This paper first presents the definition of food safety, and food safety issues for the consumers of the 21st century. Next, it reviews the diverse consumer attitudes towards the safety of food. The relationship between consumer attitudes, knowledge and behaviour regarding food safety is also examined. Finally, this paper offers recommendations.

### Food safety in the 21st century

Henson and Traill define food safety as the inverse of food risk—the probability of not suffering some hazard from consuming a specific food (Henson & Traill, 1993). Potential undesirable residues in foods span a broad range, from natural (e.g. mycotoxins) and environmental contaminants (e.g. dioxins) to agro-chemicals (e.g. nitrates and pesticides), veterinary drugs, growth promoters, packaging components, and many more. Microbiological considerations are an even greater challenge to safety of food because potentially harmful micro organisms have the ability either to grow rapidly from very low numbers in food or to proliferate in the human body once ingested (Tent, 1999).

The fear of contracting Bovine Spongiform Encephalopathy (BSE), the extensive illegal use of growth hormones, the outbreaks of *E. coli* O157, the extensive use of artificial chemicals in food manufacturing and many other concerns have severely undermined the confidence of European consumers, not only in beef, but in the food industry in general. Similar, although less marked, trends are observed in North America and Japan, with particular concern about both the new food borne pathogens that have resulted in major food poisoning outbreaks and the presence of pesticide residues in foods (Tent, 1999). Overall, the costs of food borne illness include the cost of medical treatment, productivity loss, pain and suffering of affected individuals, industry losses, and losses within the public health sector (Harris, 1997).

Food borne diseases affect millions of people. In 1991 alone, some 23,000 cases of salmonellosis were estimated to have resulted in an overall cost of £40–£50 million in England and Wales (Center for International Trade Studies, 1997). Health Canada estimates 2.2 million cases of food borne illness each year in Canada, resulting in a social cost of \$1.3 billion annually (Harris, 1997). In United States, each year, food borne diseases affect between 6.5 and 33 million people, with medical costs and productivity losses that have been estimated at 9.3 to US \$12.9 billion (Busby, Roberts, Lin, & MacDonald).

While these statistics appear high, it is questionable whether they accurately represent the number of food-related illnesses. Mead *et al.* (2000) discussed three important difficulties that have a major impact upon the accurate compilation of data. Although the discussion focussed on the US situation, the difficulties would seem to be universally applicable. Firstly, food-related illness, hospitalisation, and death is under-reported because treatment may not be sought, diagnostic testing not done, or test results not forwarded for tabulation. Secondly, pathogens causing food-related illness may also be transmitted from one person to another or through other vehicles such as water. Thirdly, some food-borne illnesses may be caused by currently unrecognised pathogens, and hence not be attributed to food at all.

Important actions have been taken in various countries to improve the safety of food supplied to consumers. In Britain, the 1990 Food Safety Act and the 1995 General Hygiene Act have significantly affected the food safety risk management practices in the food sector, shifting the focus from fraud prevention to a proactive scientific-based food safety approach (Sockett, 1991). In April 1997, the United Kingdom commission approved a communication on “Consumer Health and Food Safety”. One of the highlights of this communication was the increased role to be played by independent scientific researchers in the evaluation of potential hazards for the preparation of community legislation (Tent, 1999). The new Food Standards Agency was created in the UK in April 2000. Its mandate includes the surveillance of food in the retail stores and the coordination of research activities in the food safety area (Tent, 1999). In May 1997, US President Clinton launched a National Food Safety initiative to enhance surveillance, improve risk assessment, inspection and compliance, educate the consumer and conduct important new research (Tent, 1999).

Even with these safeguards, majority of consumers probably does not understand the crucial role of food safety regulations. In order to offer support to vulnerable consumers, it is important to first examine their attitudes toward food safety. A review of consumer attitudes towards food safety follows.

### Consumer attitudes towards food safety

Attitudes, which are relatively permanent and stable evaluative summaries about an item, are an important psychological construct because they have been found to influence and predict many behaviours (Kraus, 1995). One must, however, exercise caution when reviewing the impact of attitudes on behaviours, especially if the research was based upon the responses of students in a laboratory setting, where the research can lead to invalid conclusions (Wells, 1993).

Consumer attitudes towards food safety can be differentiated based on the type of food safety issues of concern. Brewer, Sprouls, and Craig (1994) proposed that six factors dominated respondents' attitudes towards the safety of their food. They include chemical issues, e.g. hormones in milk and food additives; health issues, e.g. cholesterol contents and nutritional imbalances; spoilage issues, e.g. microbial contamination; regulatory issues, e.g. food inspection and labelling; deceptive practices, e.g. weight-reduction diets; and ideal situations, e.g. length of time for pesticide safety assessment.

In their survey of 419 people in Illinois, Brewer *et al.* (1994) showed that there was a marked difference in the ratings of chemical, health or spoilage issues as a concern among respondents who had different intensities of attitudes towards food safety. In general, concerns

about these issues were directly related to the strength of attitudes towards food safety. In contrast, levels of concern about regulatory issues, deceptive practices or ideal situations did not differ significantly ( $P > 0.05$ ) with strength of consumer attitude towards the safety of the food supply. This suggested that, while consumers might have relatively high levels of concern about some food safety issues, they were not excessively concerned about different measures to increase food safety.

### Consumer attitudes in general

Based on recent surveys of public opinion, there exist diverse concerns about the food consumers eat. Studies undertaken by the Food Marketing Institute of the United States in 1996 suggest that most consumers were confident that the food they purchased was safe to eat (Goodacre, Doel, Habron, & Petruv, 1999). However, the largest group (49%) of respondents considered spoilage of food the greatest threat to food safety. They counted on freshness and expiration dates (22%) and increasingly considered bacteria and contamination as threats (17%). It is interesting to note that consumers surveyed in 1996 were less likely to see spoilage as a threat than consumers surveyed in 1992 (7% vs. 15%, respectively). Similarly, processing and preparation of foods were less common concerns in 1996 than in 1992 (8% and 10%, respectively).

Other studies suggest that the majority of consumers express some degree of concern over the safety of the food supply and some are willing to pay a premium for foods that are safer. McNutt reported in 1986 that the level of food safety concern of respondents averaged 9.60 on a scale of 1–10, where 10 was interpreted as “very important” (Brewer *et al.*, 1994). In a poll conducted in 1990, 30% of Michigan consumers considered food freshness or absence of spoilage as food safety issues that concerned them the most. This was compared to a similar study, which reported only 12% in 1984 (Brewer *et al.*, 1994). Shin reported that for any type of meal that might be contaminated, participants were willing to pay an additional 55 cents to eliminate salmonella and 81 cents to eliminate *Trichinella spiralis* (Shin, Klebenstein, Hayes, & Shogren, 1992). Roberts and van Ravenswaay also reported that consumers were willing to pay more for pesticide-free produce, but not at the expense of appearance (Shin *et al.*, 1992).

### Consumer attitudes based on consumer demographics

The literature indicated that, overall, consumer attitudes towards food safety in general differ according to demographic and socio-economic factors such as gender, age, educational level and economic status.

The American multi-state survey conducted by Altekruze, Yang, Timbo, and Angulo (1999) in 1995/1996 found that men were more likely to report risky practices than women. The survey results also indicated

that the prevalence of most risky behaviours also increased with increasing socio-economic status.

A 1999 survey of 320 fresh meat consumers in Belgium (Verbeke & Viaene, 1999) reported that, compared to female consumers, male consumers attached more importance to the attribute “safety” ( $\chi^2=4.985$ ;  $P=0.026$ ). Furthermore, males below the age of 30 attached significantly less importance to the absence of hormones ( $\chi^2=17.185$ ;  $P=0.001$ ) and harmful substances ( $\chi^2=14.601$ ;  $P=0.002$ ) than did older consumer categories.

In Trinidad and Tobago, the high microbial loads of raw oysters in cocktails have always been a concern. Laloo *et al.* (2000) reported that among the people in Trinidad and Tobago who avoided consuming raw oyster cocktails, only 37.9% did so for fear of falling ill, while others did so because of diverse cultural backgrounds, price, and personal preferences such as taste. In an interview with 300 members of the public in Trinidad and Tobago, Laloo *et al.* (2000) reported that consumption of raw oyster cocktails was more prevalent amongst: males (73.6%) than females (26.4%) ( $P < 0.002$ ), East Indians (63.2%) than other respondents (36.8%) ( $P < 0.001$ ), individuals less than 40 years old (82.1%) than older individuals (17.9%) ( $P < 0.01$ ), and individuals who were aware that raw oysters are considered to be a sexual enhancer (86.8%) than those who did not have this perception (11.3%) ( $P < 0.03$ ). Educational level was not statistically associated with raw oyster consumption.

Burger (1998) interviewed 197 men and 94 women from a coastal population in New Jersey. He found that there were significant gender differences in the perceptions of the safety of fish ( $\chi^2=9.6$ ;  $P=0.008$ ), ducks ( $\chi^2=5.1$ ;  $P=0.08$ ) and deer ( $\chi^2=9.9$ ;  $P=0.007$ ), with women generally believing that it was less safe to eat these foods than men. However, people universally believed that it was safer to eat fish that they caught themselves or bought in a fish store than it was fish from a supermarket.

Unklesbay, Sneed, and Toma (1998) conducted an in-class survey of 824 college students to assess attitudes, practices, and knowledge of food safety among college students in three US geographic locations. Students were asked whether it was the food service establishment’s responsibility to educate their employees on personal hygiene and sanitation, the restaurant management to ensure that the food served in their restaurant was safe to eat, and/or the government’s responsibility to ensure that food was safe to eat. Students of dietetic, food science, nutrition, and health majors had significantly higher attitudes toward food safety than did students majoring in other disciplines ( $P \leq 0.05$ ). In addition, women who had enrolled in at least one college course that included food safety information had significantly higher attitudes towards, and

practices of, food safety ( $P \leq 0.05$ ). Enrolment in this type of course led to both genders having significantly higher knowledge of food safety issues than those who did not take such courses ( $P \leq 0.05$ ).

A study of food safety knowledge and practices among the elderly living at home was conducted by Johnson *et al.* (1998). A total of 809 elderly people aged 65 or older from urban Nottingham, UK were interviewed. Approximately 70% of refrigerators in their homes were too warm for the safe storage of food ( $\geq 6^\circ\text{C}$ ). Such storage of foods at inappropriate temperatures was not independent of socio-economic or demographic status, and tended to be more likely among the poorer and those not living alone.

Results of a survey conducted between 1995 and 1996 in Kansas showed that population characteristics determined the self-reported prevalence of high-risk practices (Zhang, Penner, & Johnston, 1999). Consumption of home-canned vegetables was reported by 26.5% of respondents, with higher prevalence in rural residents and those who had children aged 13–17 years. Consumption of undercooked hamburger was reported by 8.7% of the people, with lower prevalence among those with a child from 1 to 4 years old but higher among those who were overweight. Consumption of raw or undercooked eggs was reported by 55.6% of respondents, with higher prevalence among those who had higher education or who had children aged 13–17 years. Lastly, 1.8% of respondents consumed raw pasteurised milk, with higher prevalence among lower income respondents.

In 1995, Klontz, Timbo, Fein, and Levy (1995) observed that the percentage of the 1620 American telephone survey respondents who reported consuming raw foods of animal origin was 53% for raw eggs; 23% for undercooked hamburgers; 17% for raw clams or oysters; and 8% for raw sushi or ceviche. Twenty-five percent of the respondents said that after cutting raw meat or chicken, they used the cutting board again without first cleaning it. Safer food consumption and preparation patterns were consistently reported by persons who were female, at least 40 years old, or with a high-school education or less.

Fein, Lin, and Levy (1995) used two surveys conducted in 1988 and 1993 by the Food and Drug Administration (FDA) to describe consumer perceptions of food borne illness. It was found that in both surveys, people 18–39 years of age were more likely than those in other age groups to believe they had experienced a food borne illness. In 1993, people with at least some college education were more likely to believe they had experienced food borne illness than were people with less education. However, these people had greater awareness of food borne microbes and concern about food safety issues, were more likely to eat raw protein foods from animals, and were less likely to practice safe

food handling than were those who did not perceive that they had experienced such an illness.

Consumer attitudes towards novel measures to increase food safety

In addition to examining consumers' attitudes towards food safety in general, it is important to review consumer attitudes towards novel measures. The latter can be divided into attitudes towards biotechnology and attitudes towards irradiation.

#### *Biotechnology*

Genetic food engineering makes foods tolerant to herbicides and resistant to insect damage via the incorporation of bacterial genes. A large number of novel foods or food ingredients, such as new-leaf potatoes, soya, maize and oilseed rape have been derived through genetic modifications (Moseley, 1999; Robiston, 1997). Consumer acceptance of foods produced through biotechnology remains an important yet controversial issue for food scientists and others. This is particularly true for international markets (Laloo et al., 2000).

Public debate over food biotechnology has occurred in Europe, while the Japanese and American markets have remained comparatively calm as foods containing ingredients developed through biotechnology have begun appearing in stores (Hoban, 1999). Commercially, the notion that the introduction of genetically modified foods would elicit a public backlash predates the introduction of such items into consumers' diets. The reasons for distrusting the technology and its products originate at various levels (Moseley, 1999; Robiston, 1997). At the ethical level, there are concerns about scientists "playing God," such that genetic manipulation breaches the natural boundaries between species that nature has established through the process of evolution. Moreover, there are considerations that genetic manipulation of the technology is expensive and will not be available to "poor" farming communities and that this may even distort the economies of third world countries (Moseley, 1999).

At the consumer level, the primary concern about genetically engineered foods is their safety, even though novel foods undergo extensive assessment for safety before approval is granted (Robiston, 1997). There are also worries about the future safety of the technology, such as the creation of super-weeds and the development of serious illness. Thus far, there have been no reports of illness from the consumption of genetically modified foods (Moseley, 1999).

Consumers around the world differ in their concerns about genetic food engineering. There seems to be much less concern about the consumption of genetically modified foods in the United States and Japan than in Europe (Robiston, 1997). In a study by Hoban (1999),

the results of a 1998 Japanese survey were compared to those of a Japanese survey from 1995 (Hoban, 1996), the results of a 1997 national survey of American consumers (Hoban & Katic, 1998) and of other US surveys, such as those obtained from the Food Marketing Institute (FMI, 1997). When people were asked the open-ended question: "What do you feel is the greatest threat to the safety of the food you eat?", 45% of all Japanese consumers mentioned pesticide residues; 34% mentioned additives or preservatives; and only 7% mentioned microbial contamination. These were different from the American statistics of 16, 2 and 69%, respectively. Only 1% of all Japanese respondents mentioned biotechnology, while no one in the US mentioned it. This was surprising, given the increased media coverage in both countries since 1995. Similar results were obtained when the question was asked in a closed-ended format (Hoban, 1999).

The comparison showed that the majority of Japanese and American consumers remained positive about the use of biotechnology. The level of Japanese support for agricultural biotechnology in 1998 remained higher than comparable American support. In 1998, 75% of Japanese respondents supported the use of biotechnology in agriculture compared to 72% of American respondents. In 1995, the figures were 82 and 66%, respectively (Hoban, 1999).

Regarding the specific applications of biotechnology to food, Japanese consumers overall remained positive or neutral in 1998, but some decline was evident from the very high levels noted in 1995. The most acceptable products were foods with lower fat or more vitamins, as well as crops that reduced the need for pesticides, when compared to traditional crop breeding. Generally acceptable to consumers were farm animals that resisted disease, enzymes used in food production, and higher-quality soy sauce or tofu. Less accepted was the application of biotechnology to food ingredients, such as flavourings. A significant increase in acceptance of the application of biotechnology to soybeans (i.e. the herbicide-tolerant soybeans) was noted when respondents were provided with more information about the product (Hoban, 1999).

Hoban (1999) showed that both Japanese and American consumers remained quite likely to purchase fruit and vegetable produce developed through biotechnology. More than two-thirds of both Japanese and American consumers said they would be likely to purchase produce that tasted better or fresher or produce that was protected from insect damage and required less pesticide application once they had been informed that the government had demonstrated that it was safe. Moreover, assuming that cooking oil of the same price, taste and nutrition was made from new plants developed by biotechnology, 37% of Americans said the use of biotechnology would have a "positive effect", and

almost 46% said it would have “no effect” on their purchase of such oil. The figures for Japanese consumers were 28 and 33% respectively, while 23% said it would have a negative effect (Hoban, 1999).

#### Food irradiation

Irradiation, carried out under conditions of Good Manufacturing Practices (GMPs), is recommended as a safe and effective food processing method that can reduce the risk of food poisoning and preserve foods without detriment to health and with minimal effect on nutritional quality (The Institute of Food Science and Technology, 1999). Food irradiation is the process of exposing food to a carefully controlled amount of ionising energy (Mosser & Drake, 1990). Applications to different foods, such as meats, seafood and vegetables, have been recommended to improve microbiological safety and reduce spoilage or sprouting (Mosser & Drake, 1990).

Food irradiation appears to be gaining consumer acceptance in the US, but it is slow to gain support within many parts of Europe, including the UK (Olsen, 1999). Many surveys and market studies have been carried out to assess consumer attitudes to food irradiation. Results from these studies have consistently shown that many consumers have misconceptions about the technology in the sense that irradiation could make the food radioactive (Mosser & Drake, 1990). Interestingly, when consumers were given information on the irradiation process and a chance to try irradiated products, as in market trials, they were much more likely to accept this technology (Mosser & Drake, 1990). One of the most successful trials was carried out in 1991 in a small food store in Chicago, where US irradiated strawberries, oranges and grapefruits outsold the non-irradiated fruits by a 9:1 ratio. In the following season, irradiated strawberries became the best selling fruit in that store with the ratio expanding to 20:1 over the non-irradiated product. This positive experience encouraged approximately 60 stores in Indiana, Illinois and Ohio to sell a variety of irradiated foods (Mosser & Drake, 1990).

Consumers indicated in focus group discussions that the most important information on food irradiation was the safety and wholesomeness of irradiated food, the effectiveness of the process to destroy bacteria and protect against food borne illness, and the safety endorsement by health authorities (Bruhn, 1998). Consumer studies consistently demonstrated that, when provided with scientific information, a high percentage of consumers preferred irradiated foods (Bruhn, 1995). Thus, there is a role for professional bodies to educate consumers on the advantages and limitations of the technology so that they can make informed and rational decisions about buying and eating irradiated food (Bruhn, 1998). Examples of the upsurge in support of food irradiation in the US include the positive statements

regarding irradiation from a number of professional organizations, such as the American Dietetic Association and the American Medical Association. These organizations support the use of irradiation to enhance the safety and quality of the food supply and see their role as assisting in the education of consumers about the technology (The Institute of Food Science and Technology, 1999).

#### Consumers attitudes, knowledge and behaviour towards food safety

Not only consumer attitudes but also consumer behaviour towards food has been studied by applying approaches such as the Ajzen–Fishbein model of reasoned action and the health belief models (Axleson & Brinberg, 1989; Conento & Murphy, 1990). These approaches argue that individuals make rational decisions about health behaviour when they are *aware* of associated health problems, have some *knowledge* concerning these problems, and have some *judgement* as to the level of *risk* involved in not changing their behaviour. Thus, the willingness to change behaviour is determined by perceptions and beliefs. In order to change, people have to perceive that their current behaviour endangers their health and that taking action has a strong likelihood of reducing their risk. This is shown by a 1993 nation-wide survey in the UK, which found that 45% of consumers claimed to have been discouraged from eating some food because of the possible risk of food poisoning (FDF-IEHO, 1993). Perceptions and beliefs are shaped by knowledge, which in turn is a product of exposure to information sources and personal effort in obtaining information (McIntosh, Christensen, & Acuff, 1994).

#### Consumer knowledge

Knowledge is associated with current practices, which in turn affects willingness to change current practices if it is learned that current practices are unsafe (McIntosh *et al.*, 1994). However, actual food handling practices are known to differ from self-reported practices (Jay, Cormar, & Govenlock, 1999). This is important as studies by Djuretic *et al.* (1996) and Evans *et al.* (1998) have shown that the main factors responsible for the outbreaks of food poisoning in England and Wales during 1992–1994 and 1995–1996, respectively, were inappropriate storage, inadequate cooking or reheating, and cross-contamination. Many consumers are unaware that at least 60% of food poisoning originates in the home, believing that the responsibility lies instead with food manufacturers or restaurants (Worsfold & Griffith, 1997a).

Socket (1995) points out that many people do not know the basic rules of food hygiene. In contrast, surveys conducted in 1986 and 1995/1996 illustrated that respondents did know which foods were at high risk

from food poisoning, but knowledge about how a food could be made safe to eat was limited (Raab & Woodburn, 1997). Williamson, Gravani, and Lawless (1992) conducted a nation-wide postal survey in the US and showed that there was a lack of consumer knowledge about the types of food poisoning organisms, foods that were at risk from these organisms, the importance of proper cooking, and the need to avoid cross-contamination.

Similarly, Woodburn and Raab (1997) showed that respondents were not good at identifying either the food borne illness or the groups of people particularly at risk for food poisoning. They also found that 40% of the 100 Oregon food preparers either believed that contaminated foods could not be made safe to eat or they did not know how to do so. After observing 108 consumers during all stages of the purchase, preparation, cooking and storage of one of four recipes, Worsfold and Griffith (1997b) saw multiple examples of poor food handling practices leading to great potential for cross-contamination and subsequent food poisoning. A total of 58% of the consumers stored chilled ingredients above 5°C, 66% did not wash hands before work, 41% did not wash vegetables, and 60% used a single board for all cutting tasks. On the other hand, a study found that food safety was rated as significantly more important, when food shopping, by main meal planners who had one or more household members belonging to higher risk groups (Woodburn & Raab, 1997).

Awareness, knowledge and judgement can also be affected by the habits and other perceptions that result from social, cultural, and economic influences (Rozin & Fallon, 1980). These may develop at an early age and become deeply ingrained. This can sometimes be due to the stereotype behaviour, where attitudes are developed without direct experience with the food in question (Cardello, Bell, & Kramer, 1996). Other examples of influences include food prices, status of hunger, cooking habits that may have developed, and sensory preferences such as taste, texture or tenderness (Lozano, Crites, & Aikman, 1999; McIntosh *et al.*, 1994). Wierenga (1983) (cited in Holm and Kildevang, 1996) interviewed 20 Copenhagen families and found that personal preferences might serve as a “filter” through which more general views on foods are formed. When foods were liked, no further attention to other quality parameters was needed. Thus, food safety concerns were used mainly to legitimise personal preferences. On the other hand, a discrepancy between consumer preference and choice often seems to result from compromises that people have to make due to personal shortcomings such as a lack of time or money (Worsfold & Griffith, 1997a).

Lifestyle changes have also been shown to be influential in consumers’ attitudes towards the safety of food handling. In April 1996, the American Meat Institute commissioned a study of 1000 adults in the US and

concluded that lifestyle changes affected food behaviour. These include an increasing number of women in the workforce, limited commitment to food preparation, and a greater number of single heads of households. Consumers appeared to be more interested in convenience and saving time than in proper food handling and preparation (American Meat Institute, 1996; Collins, 1997).

Furthermore, according to economic theory, the demand for food safety is determined by consumers’ willingness to pay for additional safety, and it is assumed that they are willing to pay less for each successive unit of safety (i.e. increasing marginal costs but diminishing marginal benefits). On the other hand, supply of safety is determined by the cost of producing safety by profit-seeking firms. Thus, the market for food safety will be in equilibrium when the price consumers are willing to pay for increases in safety is equal to the price at which suppliers are able to produce the increases. At such equilibrium, the level of safety supplied by the market will reflect a level of risk which is non-zero but acceptable. Extrapolating from this, it is suggested that consumer demand for food safety is increased when the gross production of a country (gross domestic product) is increased, since the average consumer is equipped with higher purchasing power (Tangermann, 1986).

#### Disparity between knowledge and behaviour

Raab and Woodburn (1997) point out that there is a disparity between food safety knowledge and self-reported practices. In a study of the knowledge and behaviour of hamburger meat of 1439 consumers in Texas, McIntosh *et al.* (1994) concluded that while better-educated people tend to choose health and safety as their reason for cooking preference, these respondents are more likely to prefer their hamburgers to be less well cooked. Thus, the reasons for cooking preferences may be unaffected by either knowledge or mass media exposure. Furthermore, many individuals may not associate what they know about the risks of improperly cooked hamburger with their own practices. The correlation between the knowledge of safe practices and that of food borne diseases from the study, while significant, was only 0.151. This, and the findings from other work, indicates that the public perceives the main food safety risks they need to worry about are derived from food additives and adulterations that originate in manufacturing (Groth, 1991; Lee, 1989).

In a telephone survey of 100 Oregon food preparers, Woodburn and Raab (1997) found that even with high awareness of food-borne illness, 20% of respondents reported unsafe practices in their food preparation. This is despite the fact that 56% of the respondents knew that they could thoroughly cook food contaminated with salmonella to make it safe to consume and 59% knew this for *E. coli*.

From the results of a telephone survey of US residents in late 1992/early 1993, Altekruuse, Street, Fein, and Levy (1996) concluded that specific groups of consumers (specifically males, young adults, occasional food preparers, and those with more than 12 years of education) possessed knowledge of food safety issues similar to that of the sample overall, but lower rates of self-reported safe practices. Eighty-six per cent of respondents knew that hand washing reduced the risk of food poisoning, but only 66% washed their hands after handling raw meat or poultry. In addition, 80% were aware that serving steak on a plate that had held the raw steak increased the risk of food poisoning, but only 67% cleaned a cutting board after contact with raw meat or poultry. However, 67% knew that cooking meat until well done reduces the risk of food poisoning, and 71% served adequately cooked hamburgers at home. Thus, only two-thirds of the respondents used safe practices for these three food-handling principles, leaving one-third who did not. This is similar to the data in a recent UK National Food Safety Report, in which 40% of the respondents claimed to store food according to recommended practices and over half of the sample indicated that they did not follow food manufacturers' instructions for preparing and cooking food (Worsfold & Griffith, 1997b). Altekruuse et al. (1996) also found that respondents able to specify a food vehicle for the transmission of *Salmonella* sp. were more likely to report taking food safety precautions, suggesting that a basic knowledge of microbiology may motivate consumers to use safe food-handling practices.

Johnson et al. (1998) showed that only 41% of elderly respondents of 65 years or older who lived at home purchased frozen foods without a clear appreciation of safe storage duration. Within a smaller sub-sample, knowledge of the "use by" and "sell by" dates of food products was good but 45% of these respondents reported difficulty reading food labels.

#### Optimistic bias

The disparity between food safety knowledge and food handling practices of consumers can be attributed partly to optimistic bias effects, where people believe that they are less at risk from a hazard than other people (Miles, Braxton, & Frewer, 1999). Optimistic bias may be caused by the fact that most members of the public are rarely given personalized information about their vulnerability to a hazard. Instead, they get information about risk to the population in general and infer their own risk status. This may result in a noticeable difference between people's perceived personal risk and their actual risk status (Frewer, Shepherd, & Sparks, 1994).

Optimistic bias has been found for food poisoning from food prepared in the home and food prepared by others. Raab and Woodburn (1997) found that about

one quarter of respondents believed that food eaten at home was at a lower risk of causing food poisoning than that eaten out. Frewer et al. (1994) also found that respondents considered that they had substantial control over the risks; they perceived low personal risk and high knowledge about food poisoning in the home. Optimistic bias is important, in that it may hinder efforts to promote risk-reducing behaviour. People may ignore risk communications, assuming that these messages are aimed at more vulnerable individuals, or that they are in control of the potential hazards and they know enough to deal with them effectively.

#### Discussion

It is apparent that consumers' attitudes towards food safety are not an independent issue. Rather, they are linked to consumers' demographic and socio-economic status, culture, personal preferences and experience. However, the reviews also indicate that different attitudes do not necessarily lead to behaviours that increase the safety of the food consumed. It can be concluded that there exists the need for professional assistance for consumers regarding food safety issues.

The following recommendations are forthcoming from this review: (1) the need to learn more about consumer attitudes and behaviours, (2) the need to create awareness of safe food handling practices, (3) the need to promote public trust and credible information sources, (4) the need for food safety education, (5) the need to create familiarity, and (6) the need to incorporate everyday context.

The need to learn more about consumer attitudes and behaviours

Food manufacturing companies seeking support for their decisions, as well as government agencies and consumers are keen to receive information about the safety of both marketed and novel foods. In both instances, pursuit of this goal should take into account not only safety considerations, but also the *acceptability* of such foods by the public (Mossel, Weenk, Morris, & Struijk, 1998). In other words, one needs to understand consumers' attitudes and behaviours prior to providing information to them. For example, specific risky food-handling and food-consumption practices can be used to identify high-risk populations such as the elderly, and understanding their behaviour and attitudes may help professionals to develop educational efforts, and evaluate progress toward risk reduction (Altekruuse et al., 1999).

The need to create awareness of safe food handling practices

To promote safe food handling practices, consumers should be encouraged to accept various food safety measures. Communication of food safety should be



expressed in the simplest way possible to facilitate understanding (Mossel *et al.*, 1998). The growing popularity of the Internet should also be used to communicate risks associated with foods to the public.

In terms of the means to communicate food-related risks to consumers, McIntosh *et al.* (1994) found that the mass media was the most common source of external influence. The use of television as a source of information about food safety led to a greater knowledge of food-borne disease and a greater willingness to change cooking practices, while the use of print media had a similar effect on willingness to change.

The need to promote public trust and credible information sources

Consumers' attitudes towards the safety of foods are strongly associated with how much they trust not only the food industry but also government agencies that are responsible for ensuring food safety. Unfortunately, public trust is often eroded by the hesitation and indolence of government agencies to adopt or enforce consumer protection strategies (Day, 1997), largely due to legislation changes and budgets. Former US President Clinton is probably one of the pioneers to address this problem, with constant reinforcement of the need to pursue the management of microbial hazards in foods (Marwick, 1997).

The loss of public confidence is also associated with food recalls and outbreaks of infectious diseases associated with food-borne micro organisms (Mossel *et al.*, 1998). In the case of novel foods, such as genetically modified foods and irradiated foods, acceptance by consumers is often delayed because the public has embraced scientifically unsubstantiated concerns about their safety (Burke, 1995; Hoban, 1996).

To enhance credibility, a credible source should be used to admit the uncertainty associated with novel foods in a freely given (approved scientific data) rather than an unexpected way (Breakwell, 2000). Consumer concerns over the safety of foods should be addressed promptly, honestly, and expertly. Informed professionals should redress scientifically unjustified anxiety fuelled by irresponsible media reports through timely interventions. This may involve issuing reports generated by groups of respected, third party specialists. On the other hand, the media may be supportive and useful, as sound media reports often result in the public becoming aware of hazards with which they were previously unfamiliar (Mossel *et al.*, 1998).

The need for food safety education

Consumers would benefit from home food safety education, including information about temperature control, correct home food preparation practices and cross-contamination. Effective communication of product efficacy and safety data to physicians and health

care professionals can also be a deciding factor in whether a food product is recommended or consumed (Innis, Bahlo, & Kardinaal, 1999). Consumer education messages should also include the ubiquity of micro organisms, a comprehensive description of food-borne illnesses, and prevention strategies. Product labels should contain food-handling information and warnings for special populations, and foods processed by newer safety-enhancing technologies should be more widely available. Knowledge of the consequences of unsafe practices can enhance motivation and adherence to safety guidelines. These are the responsibilities of the health community, food industry, regulators and the media (Bruhn, 1997). Educational efforts should also be focused on high-risk groups, as well as those preparing food for people in these groups. In particular, academic education and training should take food hazard control into account.

The need to create familiarity

It is assumed that, when new information becomes available, it must first trigger attention, then achieve comprehension, and only then can it influence decision-making. However, studies have shown that changes in the level of knowledge about a food safety hazard are not found to correlate simply with modifications in behaviour. Familiarity with, and becoming accustomed to, food safety hazards are particularly likely to reduce the effectiveness of hazard warnings (Breakwell, 2000). This concept is illustrated by the Social Amplification of Risk Framework (SARF), where risk and risk events associated with foods interact with psychological, social, institutional and cultural processes in ways which intensify or attenuate risk perceptions and concerns and thereby shape risk behaviour, influence institutional processes and affect risk consequences (Breakwell, 2000; Kasperson, 1992).

The need to incorporate everyday context

Deciding which foods to buy, serve and eat is not based on uniform principles such as food safety or health. Rather, this decision is embedded in a complexity of social relations and cultural concepts, which attach meaning and status to meals. Personal shortcomings, such as hunger, lack of money and/or inability to access different foods also contribute to different food behaviours. With the fact that quality attributes are independent, it is important to study consumers' views on foods in an everyday context (Holm & Kidevang, 1993; Mennel, Murcott, & van Otterloo, 1992). Even with the same potential hazards, different populations studied at different times will undoubtedly result in different risk perceptions, which in turn will lead to different food behaviours (Sparks & Shepherd, 1994). If hazards become more familiar to the public, if scientific uncertainty decreases, and/or if new risk

information about hazards emerges from the scientific literature, then public perceptions and demands for risk mitigation are likely to change (Soby, Simpson, & Ives, 1994).

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