

# The risks of eating and drinking

Consumer perceptions and 'reality'

Susan B.T. Wilkinson, Gene Rowe & Nigel Lambert

Life is full of risk—everyday we encounter all sorts of hazards, some of which are unavoidable. Eating and drinking are paramount to maintaining life, but unfortunately, are also coupled with a multitude of potential and sometimes fatal health risks. These risks are not to be taken lightly, which is highlighted by the current increase in obesity and related diseases in the developed world, a trend that has the World Health Organization worrying about a growing epidemic of obesity (WHO/FAO, 2003). Similarly, public health officials are increasingly concerned about a dramatic increase in diabetes and coronary heart diseases that are caused by an inappropriate and ultimately hazardous diet. But food holds many more health risks, and recognizing these would greatly benefit human health.

**...obesity has become a leading cause of death in the USA, second only to smoking**

The extent to which consumers identify and appreciate food-related risks, and allow this knowledge to direct their eating and drinking behaviour, is therefore of great research interest. In this article, we first detail the most significant sources of food and drink health risks and discuss the implications of consumers' perceptions of these hazards. This discussion touches on generic research on how people perceive risks and considers the reasons behind apparent 'misperceptions' of risks. We also want to emphasize that, in the face of limited scientific knowledge, consumer concerns may be well grounded,



and that scientists and policy makers would do well to consider the basis for consumer beliefs in order to preempt future food- and drink-related health and policy crises.

A comprehensive list of all hazards associated with eating and drinking would clearly be beyond the scope of this article. Furthermore, the nature and degree of the different food and drink hazards is often specific for both time and culture. For instance, the lack of clean drinking water without microbial contamination is no longer a serious public health problem in the UK. But it was a problem as recently as 150 years ago and it continues to be so today for large parts of the developing world. We therefore concentrate on the most prevalent hazards in today's food supply, focusing on UK examples, although they are liable to be pertinent to other developed countries too.

According to the UK Food Standards Agency (2000), most cases of microbial food contamination are caused by five types of bacteria: *Salmonella*, *Campylobacter*, *Escherichia coli* O157, *Listeria monocytogenes* and *Clostridium perfringens*. There were at least 81,000 cases of microbial food poisoning in the UK in 2000, with *Campylobacter* and *Salmonella* responsible for 63,000 and 17,000 cases, respectively. Symptoms usually develop within 12–36 hours and commonly include abdominal pain, diarrhoea, fever and vomiting. Microbial contamination typically causes 100–200 fatalities per year, mostly in young children and the elderly. However, the real number of food-borne illnesses may be higher as many cases go unnoticed and/or unreported. One of the most serious food contaminations is the infection of cattle with bovine spongiform encephalopathy (BSE) and the resulting risks of developing variant Creutzfeldt–Jakob disease (vCJD), a fatal human illness with no known cure that has caused more than 100 deaths in the UK so far.

Recent examples of chemical contaminations of food include high amounts of mercury in fish and elevated levels of the known carcinogen acrylamide, introduced through the cooking process into some popular foods such as chips and crisps. Similarly, barbecuing certain foods creates carcinogenic dioxins and nitroso-compounds. Finally, the contamination of foods with physical objects, such as glass, metal, wood, insects and other objects, remains a major concern especially for food processors and packagers.

Many foods contain colourants, flavourings, preservatives and antioxidants, some of which have been associated with

adverse health consequences. The common sweetener aspartame has been linked to such conditions as brain tumours, multiple sclerosis, Parkinson's disease, Alzheimer's disease, arthritis and attention deficit disorder (Chivers, 2000). The preservative sulphite can cause asthma and urticaria (Allergy Clinic, 2003). Another preservative, butylated hydroxytoluene (BHT), although not toxic itself, may interact with other substances to increase cancer risk (Magnuson, 1997).

**...barbecuing certain foods creates carcinogenic dioxins and nitroso-compounds**

A food allergy is an immune response to a food that the body mistakenly believes to be harmful. Symptoms are usually quick to develop and can range from mild itching and rashes to more severe swelling of the mouth and throat through to anaphylaxis, circulatory collapse and death within a few minutes. In theory, any food can cause an allergy, but in the UK 90% of all allergic reactions are due to milk, eggs, peanuts, tree nuts, fish, shellfish, soy and wheat. Although relatively uncommon, the incidence of food allergies is increasing; hospital admissions due to anaphylaxis have increased sevenfold over the past decade and food allergy is one of the most common causes. At present, there is no cure for food allergies other than avoidance.

Food intolerances are due to enzyme deficiencies and other mechanisms that mimic allergic reactions. These reactions are rarely life-threatening. Intolerances to wheat (gluten intolerance or coeliac disease) and milk (intolerances to lactose or milk proteins) are the most common in the UK. In Asia and Africa, most adults are lactose intolerant. Sufferers of various conditions also need to avoid specific foods. For example, individuals with diabetes must closely regulate their glucose intake to avoid hypo- and hyperglycaemia, which can have both severe acute and chronic adverse effects. Sufferers of the genetic disorder phenylketonuria must avoid phenylalanine in their food, and individuals with coronary heart disease (CHD) are strongly advised to limit their cholesterol intake to reduce the risk of heart attacks.

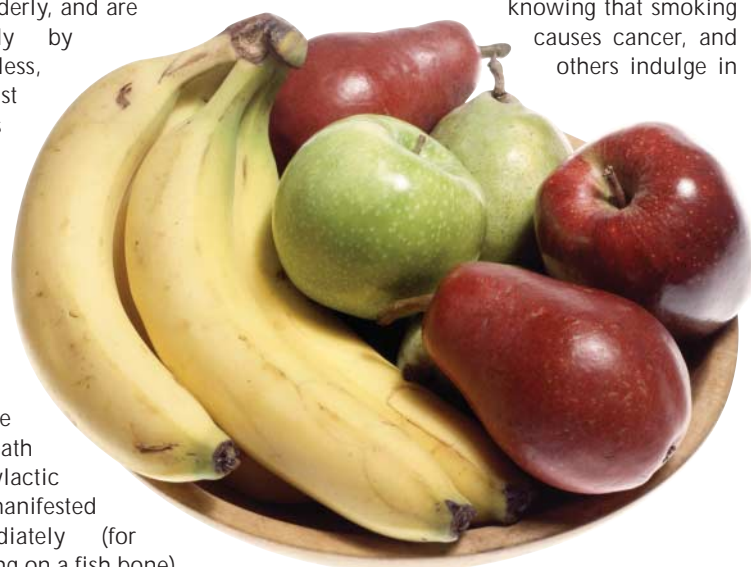
Public health policies linked to food are increasingly focusing on the hazards from eating a nutritionally sub-standard diet (Department of Health, 2000). Current 'Western diets' with their relatively high amounts of fat, sugar and salt and low amounts of fruits and vegetables, are risk factors for the development of numerous cancers and heart diseases; as many as 1 in 3 of all cancers may be diet-related. Furthermore, such diets have contributed to the astonishing threefold rise in obesity over the past 20 years. At present, nearly half of the UK population is either overweight or obese, which is a major risk factor for both CHD and diabetes. In March this year, Secretary Tommy G. Thompson of the US Department of Health and Human Services warned that obesity has become a leading cause of death in the USA, second only to smoking (*The New York Times*, 2004). This situation is chronic in that it is the continual consumption of an inappropriate diet over decades that leads to these health hazards. There are further risks, perhaps of less immediate severity, associated with consuming such a diet; for example, an increased level of tooth decay.

This list is by no means comprehensive; it does not include risks from drinking alcoholic beverages for instance. Indeed, any ingested substance, even water, is potentially harmful if consumed in large enough quantities. Furthermore, there are about 16,000 cases of choking per year in the UK that are serious enough for a hospital visit. These most commonly involve children (under four years of age) and the elderly, and are caused mostly by food. Nevertheless, what the list does reveal is how diverse the potential risks from eating and drinking are, with consequences varying from the mild (nausea) to the extreme (death from anaphylactic shock), and manifested either immediately (for example choking on a fish bone),

or delayed from a day or two (vomiting after microbial food poisoning) to years or even decades (CHD from the continual consumption of an inappropriate diet). One important source of variance is the extent to which people themselves can control their level of exposure. It is probably fair to say that at this moment in history, the food and drink in the developed world is as safe as it has ever been, due to improved food production practices and public hygiene standards. However, in some cases, inappropriate behaviour continues to put consumers at significant risk from a variety of the hazards indicated. To improve consumer health and reduce food and drink risks, it is therefore important to understand consumers, particularly why they act as they do.

**...any ingested substance, even water, is potentially harmful if consumed in large enough quantities**

While some food-related behaviours are simply habitual, and others are driven by a lack of knowledge, such as inappropriate storage and cooking of foods, the way people perceive and judge the risks of specific hazards may lead them to behave seemingly perversely in some situations. Many people voluntarily engage in hazards with considerable levels of risk, while they may go to great lengths to avoid hazards that pose only little risk. Still, many people choose to smoke, knowing that smoking causes cancer, and others indulge in



high-risk sports knowing the danger of breaking bones. The UK has seen a substantial decline in parents inoculating their children with the combined MMR (measles, mumps, rubella) vaccine for fear of inducing autism in spite of evidence to the contrary, and thereby increasing the risk of a serious national measles epidemic (Murch, 2003). Evidence suggests that in some cases consumer responses to food and drink hazards are similarly 'illogical'—although perhaps not to the extent they at first seem.

Of the list of potential hazards discussed in the previous section, only a relative few have been studied from a consumer perspective. This choice perhaps reflects contemporary concerns, rather than any attempt to measure and compare different risks and hazards systematically. Nevertheless, these studies show that consumers' behaviour and attitudes towards these hazards indicate a different ranking of risks in their minds. If we take contaminants as an example, consumers can be highly sensitive to information about relatively minor incidences of physical contamination in foods—such as epoxidized soya bean oil, used to seal jars of baby food, that was found to seep into the product (BBC, 1999)—and consequently avoid the relevant products. However, it is likely that a high proportion of these same people do not wash their hands after going to the lavatory—in spite of having some knowledge of the risks involved in this activity—thereby increasing the chance of microbiological food contamination. Although determining an exact figure is difficult, it is estimated that 17% of women and 31% of men do not regularly wash their hands after using the toilet (Food Standards Agency, 2000).

Similar cases of apparent overreaction have been found regarding food allergies. Some sources have suggested that as many as 20%–30% of adults in the UK believe they have a food allergy or intolerance, but official figures are 1%–2%. Likewise, some parents readily attribute hyperactivity in their children to various additives in confectionery, despite only tenuous evidence for such a link (Food Commission, 2002). Conversely, cases of 'under-reaction'—that is, under-consumption of the recommended daily



intake of fruit and vegetables—are apparent in inappropriate nutrition, which occurs in spite of people knowing, at least at a qualitative level, what a 'healthy' diet is.

In other cases, such as with choking and food intolerance, there is only limited information about consumer perceptions. One interesting example of apparent misperception concerns an issue that does not even appear in our list of food hazards, namely, genetically modified (GM) foods. European consumers remain deeply concerned about GM foods, as shown time and again by various surveys (Shaw, 2002). This is despite an absence of scientific evidence that anyone has or will be adversely affected (GM Science Review, 2004).

Other research has taken a comparative approach, looking at relative perceptions of a variety of food hazards, which also reveals instances of apparent perceptual discrepancies. For example, Fife-Schaw & Rowe (1996) found that people were more concerned about botulism than about saturated fats and cholesterol, in spite of the risks of the latter being greater. Kirk *et al* (2002) found a similar pattern, with saturated fats being the least dreaded hazard and *Salmonella* among the most dreaded.

These studies show that consumers' perceptions of risk do not necessarily correspond with scientific assessments. Consequently, the risk communication field has traditionally assumed that consumers are ignorant, in some cases hysterical, and

**Certainly, past encounters with food scares have left consumers with an understandable level of caution...**

for the most part misinterpret statistical likelihood. From this perspective, the so-called 'deficit model', the appropriate presentation of 'the truth' is all that is needed to dispel 'faulty' beliefs and induce 'correct' behaviour (Hansen *et al*, 2003). However, reality is more complex than this: although in some cases apparent misperceptions appear to be related to cognitive limitations, in other cases consumers' beliefs seem to be based on alternative, sensibly informed frameworks.

People frequently use a number of quick decision-making rules when dealing with uncertain situations. In many cases these so-called heuristics, or 'rules of thumb', allow people to function successfully in everyday life by making the most efficient use of limited cognitive abilities and time, and their inability to cope with vast amounts of information. Cognitive research suggests five situations in which people may be prone to using such rules: when they are overloaded with information; when they do not have enough time; when the issues are not overly important to them; when they have little knowledge or information on the topic; and when a specific shortcut comes to mind easily (Pratkanis & Aronson, 1992). Tversky & Kahneman (1974) identified several of these heuristics including availability, representativeness, and anchoring and adjustment. If we take the availability heuristic as an example, this leads people to judge the likelihood of an event based on how easily they can recall similar past cases. Often this



is a good rule to use. However, recall can be influenced by many factors, one of which is how vivid is an event. Images of personal suffering from vCJD are highly dramatic, perhaps more so than images of people suffering from heart disease as a possible consequence of poor diet. Consequently, using the availability heuristic alone may lead people to overestimate some risks and underestimate others.

Optimistic bias is another phenomenon associated with apparent misperception of risks (Weinstein, 1980). Research has found that people tend to believe that they are less likely to experience negative events and more likely to experience positive events when compared with other people. For example, people may believe themselves less at risk from the effects of a diet rich with high-fat foods than similar others, therefore reducing the need to change their behaviour. The underlying causes of this are still in dispute, and range from the cognitive to the motivational or some combination of the two (Miles & Scaife, 2003).

**consumers can be highly sensitive to information about relatively minor incidences of physical contamination in foods**

Although human cognitive limitations may at times lead to faulty judgments about risk, at other times—or perhaps even simultaneously—differences between consumer estimations and expert-derived statistics may be a consequence of alternative framings of, or emphasis on, the issue. In essence, consumers do not understand 'risk' in the same way as do scientists. This discovery of Paul Slovic and colleagues has been replicated in different ways by other researchers and demonstrates that, when judging risk, consumers take into account other qualitative aspects beyond the likelihood of ensuing harm. For example, Slovic *et al* (1980) reported that two dimensions were important when laypeople judge risks: the first aspect being the extent to which a hazard is 'dreaded' (severe, likely, uncontrollable, involuntary, catastrophic) and the second being how 'known' the hazard is (known to science, new, has delayed effects). Sparks & Shepherd (1994), using a similar methodology to consider food hazards, found three perceptual dimensions that they termed 'severity', 'unknown' and



'number of people exposed', which subsequent research has largely replicated (Fife-Schaw & Rowe, 1996).

In real terms, this means that consumers are frequently interpreting risk in a non-statistical manner, which is arguably quite sensible in incorporating uncertainty. Taking GM foods as an example, while it may be true that scientific evidence suggests that the actual risk is minimal, consumers may be considering the novelty of the technology and hence assume that there may well be risks that have not yet been identified. When there are familiar and relatively risk-free alternatives to GM foods available, who is to say that consumer avoidance of GM foods is illogical? Certainly, past encounters with food scares have left consumers with an understandable level of caution; for example, when UK authorities maintained in the early days of the BSE crisis that eating beef was safe, which then turned out to be otherwise. This example highlights the important role of risk communicators as sources of information, and indicates how consumer perceptions can mediate reactions to their messages.

Public reactions to risk communications are frequently determined by factors other than just information, such as the credibility and trustworthiness of the information source. Indeed, trust in industry and government can be such an important factor in risk perception in some cases that it may supersede the inherent characteristics of the specific hazard (Senauer, 1992). Clearly, trust has a crucial influence on risk perception, although the exact relationship between trust, perceived risk and hazard acceptability is less clear (Eiser *et al*, 2002). Its relevance to the food domain was shown

in a large US study, which found that trust in the regulation of pesticides was positively correlated with the perceived benefits of such products (Dittus *et al*, 1993). Bord & O'Connor (1992) reported similar results with food irradiation.

Unfortunately, the main communicators of food hazard information are not particularly well trusted: in general, medical sources are the most trusted and government and industry the least. However, consumers frequently expect food hazard information to come from government sources (Frewer *et al*, 2001), and also expect the government to make risk decisions on their behalf when needed (Earle & Cvetkovich, 1995). But if these sources are not trusted, this creates both a communication and policy dilemma. Lack of consumer trust thus has important implications for the communication of food hazard information and subsequent health policy.

**European consumers remain deeply concerned about GM foods... despite an absence of scientific evidence that anyone has or will be adversely affected**

In summary, while consumers are faced with numerous different food hazards, their perceptions of the risks associated with them do not always correspond to scientific risk estimates, although the levels of risk associated with many of these hazards are scientifically uncertain. Past risk communication strategies assumed that these differences were essentially a consequence of consumer ignorance of 'the facts' and that presentation of 'the truth' would cure misjudgements. However, although cognitive limitations occasionally do hamper consumer judgements of risks, at other times, consumers' judgements are often understandable and consider many other qualitative factors than are accounted for in a standard risk assessment. It is therefore important for scientists, communicators and policy makers to consider the basis of these qualitative consumer beliefs, both to preempt future food-related health and policy crises and to communicate more effectively before, during and after such events.

ACKNOWLEDGEMENTS

The authors would like to acknowledge funding from the Core Strategic Grant of the UK Biotechnology and Biological Sciences Research Council.

REFERENCES

Allergy Clinic (2004) Food allergy and additive intolerance. [www.allergy-clinic.co.uk/food\\_allergy\\_for\\_doctors.htm](http://www.allergy-clinic.co.uk/food_allergy_for_doctors.htm)

Bord RJ, O'Connor RE (1992) Determinants of risk perceptions of a hazardous waste site. *Risk Anal* **12**: 411–416

BBC News Online (1999) Baby food toxic chemical alert. 15 Sept. <http://news.bbc.co.uk/1/hi/health/448122.stm>

BBC News Online (2003) Anti-allergy foods 'more popular'. 13 Mar. <http://news.bbc.co.uk/1/hi/health/2842611.stm>

Chivers L (2000) Can we tell if aspartame is safe? 7 Jan. <http://serendip.brynmawr.edu/bb/neuro/neuro00/web2/Chivers.html>

Department of Health (2000) The NHS Plan: a plan for investment, a plan for reform. London, UK: The Stationery Office

Dittus KL, Hillers VN, Beerman KA (1993) Attitudes and behaviours about pesticide residues, susceptibility to cancer, and consumption of fruits and vegetables. *J Nutr Edu* **25**: 245–250

Earle TC, Cvetkovich GT (1995) Social trust: towards a cosmopolitan society. Westport, CT, USA: Praeger

Eiser JR, Miles S, Frewer LJ (2002) Trust, perceived risk and attitudes toward food technologies. *J Appl Soc Psychol* **32**: 2423–2433

Fife-Schaw C, Rowe G (1996) Public perceptions of everyday hazards: a psychometric study. *Risk Anal* **16**: 487–500

Food Commission (2002) Additives do cause temper tantrums. 25 Oct. [www.foodcomm.org.uk/additive\\_2002\\_full.htm](http://www.foodcomm.org.uk/additive_2002_full.htm)

Food Standards Agency (2000) Handwashing. 11 Feb. [www.foodstandards.gov.uk/hygcampaign/keepingfoodsafe/handwashing/](http://www.foodstandards.gov.uk/hygcampaign/keepingfoodsafe/handwashing/)

Frewer LJ, Salter B, Lambert N (2001) Understanding patients' preference for treatment: the need for innovative methodologies. *Quality in Healthcare* **13** Mar, i50–54

GM Science Review (2) (2004) Final Report. [www.gmsciencedebate.org.uk/report/pdf/gmsci-report2-pt1.pdf](http://www.gmsciencedebate.org.uk/report/pdf/gmsci-report2-pt1.pdf)

Hansen J, Holm L, Frewer L, Robinson P, Sandoe P (2003) Beyond the knowledge deficit: recent research into lay and expert attitudes to food risks. *Appetite* **41**: 111–121

Kirk SFL, Greenwood D, Cade JE, Pearman AD (2002) Public perception of a range of potential food risks in the United Kingdom. *Appetite* **38**: 189–197

Magnuson B (1997) What is the evidence for a link between preservatives and cancer and other toxic effects? 13 Mar. <http://ace.orst.edu/info/extoxnet/faqs/additive/preserca.htm>

Miles S, Scaife V (2003) Optimistic bias and food. *Nutr Res Rev* **16**: 3–19

Murch S (2003) Separating inflammation from speculation in autism. *Lancet* **362**: 1498–1499

Pratkanis AR, Aronson E (1992) *The Age of Propaganda: The Everyday Use and Abuse of Persuasion*. New York, USA: WH Freeman

Shaw A (2002) "It just goes against the grain". Public understandings of genetically modified (GM) food in the UK. *Public Understanding Sci* **11**: 273–291

Senauer B (1992) Consumer food safety concerns. *Cereal Foods World* **37**: 298–303

Slovic P, Fischhoff B, Lichtenstein S (1980) in *Societal Risk Assessment: How Safe is Safe Enough?* (eds Schwing RC, Albers WA) pp 181–216. New York, USA: Plenum

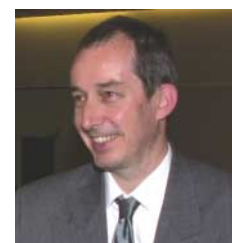
Sparks P, Shepherd R (1994) Public perceptions of the potential hazards associated with food production and food consumption: an empirical study. *Risk Anal* **14**: 799–806

*The New York Times* (2004) Death rate from obesity gains fast on smoking. 10 Mar p A16

Tversky A, Kahneman D (1974) Judgement under uncertainty: heuristics and biases. *Science* **185**: 1124–1131

Weinstein ND (1980) Unrealistic optimism about future life events. *J Personality Social Psychol* **39**: 806–820

WHO/FAO (2003) Diet, nutrition and the prevention of chronic diseases. Joint report of the WHO/FAO Expert Consultation. Geneva, Switzerland: World Health Organization



Susan B.T. Wilkinson, Gene Rowe and Nigel Lambert are at the Institute of Food Research in Norwich, Norfolk, UK. E-mail: [susan.wilkinson@bbsrc.ac.uk](mailto:susan.wilkinson@bbsrc.ac.uk) doi:10.1038/sj.embor.7400225