Public perception of a range of potential food risks in the United Kingdom

Sara Kirk[1]
Darren Greenwood[1]
Janet Cade[1*]
Alan Pearman[2]

1 Nutrition Epidemiology Group, Nuffield Institute for Health, 71-75 Clarendon Road, University of Leeds LS2 9PL
2 Leeds University Business School, Maurice Keyworth Building, The University of Leeds LS2 9JT

* corresponding author: Sara Kirk. Tel 0113 233 6946, fax 0113 233 3952, e-mail: s.f.l.kirk@leeds.ac.uk

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Abstract

This study aimed to use a standard questionnaire to obtain a nationally representative sample of opinions on a range of potential food risks. Participants were a national sample of 1182 subjects selected using three different approaches: random and sentinel postal samples and a telephone survey. A modified psychometric questionnaire (the Perceived Food Risk Index) was administered to subjects on three occasions, spanning five time-points. Baseline data collection was undertaken from October to December 1998 (phase 1). The second wave of data collection was undertaken over three time-points in February, April and July 1999 (one third of respondents to phase 1 at each time-point - data combined as phase 2), and the final phase of data collection was between October and December 1999 (phase 3). Principal components analysis was used to assess the intercorrelations between the items on the questionnaire. Two main components were identified as 'dread' and 'knowledge'. Saturated fats were perceived as the least dreaded and the most known of the potential risks considered. BSE and salmonella were dreaded the most. There was a slight perception that the potential risks had become more known over the year, especially for growth hormones. This study has raised a number of important issues for risk communicators. In particular, people perceived saturated fats to be least dreaded perhaps because they were most known. Despite current policy aimed at reducing fat intake, this will be difficult to achieve at a population level since people are not worried about its impact. BSE and salmonella were the risks that were dreaded most. However, salmonella was also viewed as more known so any adverse future public concern relating to salmonella may be less.

Introduction

A common belief expressed by both social and political observers is that society is becoming more risk aware. This belief has been supported over the last twenty years by social science research which has consistently found a considerable gap between how risk assessment experts think about, define and evaluate risks in comparison with members of the lay public (Traavik, 1999). More specifically, the general finding is that while, on average, the view of the lay public is that life is becoming increasingly risky, experts hold the view that the world is becoming a safer place (Pidgeon & Beattie, 1997). Any attempts to manage food-related risks therefore need to be based both on technical risk assessments and assessment of the public perception of risk. The ability to explain this distinction between experts' and the lay public's view of risk has been the general goal of risk perception research to date. However, the need to understand this distinction and act upon its implication, is a message only slowly being adopted by hazard managers in both the public and private sectors. In the meantime, the social and economic costs incurred as a result of this difference in perception are high. In the longer term, changes in dietary habits as a result of increasing interest in potential food risks may have public health implications (Cade J *et al*., 1998). Thus, information on how the public routinely perceive food risks may enable appropriate measures to be taken to address inconsistencies.

Previous research using the psychometric approach has demonstrated its utility in the field of risk perception (e.g. Kraus and Slovic, 1988) and has led to the development of the Perceived Food Risk Index (PFRI) specifically to explore risk perception in the domain of food (Fife-Schaw and Rowe, 1996). The PFRI has proved useful in monitoring public perception of risk, despite a number of methodological limitations in its application, including the issue of test-retest reliability and validity (Fife-Schaw and Rowe, 2000). However, its use has been confined to single application postal surveys, rather than routine surveillance. We have recently completed a study, evaluating the use of a modified version of the PFRI across a range of sampling strategies, to investigate the most cost-effective approach for obtaining regular, reliable and valid consumer views of food risk. Results of the effectiveness of the sampling strategies used are described in another paper and are therefore not reported here. Instead, this paper reports on the findings of the study in relation to risk perception and compares our findings with previous work.

Method

Subjects were obtained using two postal sampling approaches and also telephone sampling and were contacted on three occasions over a one year period.

Postal samples

Subjects were randomly selected from the Electoral Roll on the basis of postal area to give a nationally representative sample of 1000 subjects. Geographical locations were also selected to act as sentinel samples to reflect urban and rural areas in Scotland, England and Wales, along with a site in London. The sites selected were Glasgow and Inverness in Scotland, Nottingham and Lincoln in England, Cardiff and Llandudno in Wales and postal area SE19 in London. 150 subjects from the Electoral Roll in each of these areas were then randomly selected to receive the questionnaire.

Telephone Sample

Subjects were selected by random-digit dialling using a Computer Aided Telephone Interview (CATI) system. Subjects answering the telephone were then asked if they would take part in the survey. Non-contactable subjects (i.e. where the telephone was engaged or there was no answer) were not necessarily re-contacted. This has been taken into account when calculating response rates.

Perceived Food Risk Index Questionnaire (PFRI)

The PFRI is a psychometric questionnaire, which aims to provide a valid and reliable instrument for assessing consumer perceptions of food-related risk (Fife-Schaw & Rowe, 1996). For each potential risk it measures 10 different items which could influence public perceptions. The PFRI was adapted in this study for use over the range of sampling techniques used. In particular the questionnaire was shortened to five risks instead of 10 to facilitate faster completion of the questionnaire. These were chosen, to be representative of current or potentially topical food risks, and were:

- Food containing growth hormone residues (unknown risk with the potential to be used as a marker for a high degree of risk-awareness)
- Food containing the prion that causes BSE (well-known risk that was the subject of intense media coverage prior to the commencement of this study)
- Food that has been genetically modified (relatively new risk that was the subject of intense media coverage over the period of data collection for this study)
- Food containing salmonella bacteria (long-established risk with sporadic media coverage over the lifetime of the project)

- Food containing saturated fats (long-established risk with sporadic media coverage over the lifetime of the project but generally of less concern to most people)

This gave rise to an eight page postal questionnaire, consisting of the 10 items from the original PFRI on which the five risks described above were rated. The 10 items considered were: likely harm to health; worry about potential risks; scientist's knowledge; ease of telling if food contains substance; whose responsibility is it to protect you from harm; how common are the foods; does harm depend on how much consumed; control over eating the foods; are risks natural or fault of mankind; seriousness of harm to health. Additional questions were included at the end of the phase one questionnaire to determine the demographic characteristics of the respondents, i.e. age, gender, predictors of socio-economic status. Questions also asked about dietary patterns. The second phase questionnaire included the same ten questions by five risks, along with additional questions related to understanding of these risks and ability to quantify the risks in relation to other risks, such as being involved in a road traffic accident. The third phase questionnaire included additional questions on risk communication, such as sources of trustworthy information and suggestions on how risks might be better managed.

In addition, further amendments had to be made to enable the questionnaires to be used for telephone interviewing. The main change was to make them briefer, as piloting showed that it took an average of 18 minutes to complete one interview over the telephone. To overcome this problem, the Computer-Aided Telephone Interviewing (CATI) system was set up to randomly select three of the five risks to be presented to each respondent. This reduced the average length of interviews to a more acceptable time of around 13 minutes. If this questionnaire were to be used for rapid monitoring of perceptions, then telephone interviewing would most likely be needed. However, this medium is more invasive and the questionnaire needed to be restricted to a more reasonable length as a consequence. A greater response rate was achieved by telephone (either because of the medium or the fewer questions) and this mitigated the loss of information caused by each subject only responding to three risks.

Data collection took place over three phases, spanning five time-points. Baseline data collection was undertaken from October to December 1998 (phase 1). Second wave data collection was undertaken over three time-points in February, April and July 1999 (one third of respondents to phase 1 at each time-point - data combined as phase 2), and the final phase of data collection was between October and December 1999 (phase 3).

Data were analysed using SPSS version 9.0 (SPSS Inc. 1998). Repeated measures analysis of variance was used to test for linear responses over time, and differences between age or sex. Principal components analysis was carried out using Stata version 6 (StatCorp, 1999) to assess the intercorrelations between the 10 items on the PFRI, reducing the 10 items to their main components.

Results

Response rates

For the purposes of this paper, the results from the three samples have been combined, since differences between methods of sampling and contact are the subject of another publication and do not affect the overall conclusions from this analysis. The overall response at baseline was 1182 subjects out of 3569 invited to participate, a response rate of 33%. Although this was a little disappointing, repeat mailing in phases 2 and 3 have produced a higher response (61% for both phases) from those who had answered the baseline questionnaire.

Sample characteristics at baseline

The mean age of respondents was 52 years (sd 16) and was similar across the three survey methods. Women were more likely to respond to the questionnaire than men, particularly within the telephone sample, with the percentage of responders who were female being 64% overall. The percentage of subjects who had a degree or higher was 18%, which is slightly higher than the national average of 14.8% (Department for Education and Skills, 2000). In terms of marital status, 14% were single, 38% described themselves as working full-time and 18% worked part-time. 1% were unemployed, 10% were housewives, 28% were retired and 5% were students. Sample characteristics in subsequent phases were essentially the same as baseline (data not shown).

Baseline scores for items from the PFRI

Overall, the questions which provoked the most extreme responses were question 9 on risks being natural or the fault of mankind - man being mostly to blame; and question 4 on how easy it is to tell if a food contains the potential risks - you can only occasionally tell. Scores for the items from the PFRI for saturated fats tended to differ from the other risks. People were least worried about saturated fats (question 2) and yet thought saturated fats were most common (question 6) (table 1).

There were differences in responses between men and women on a number of items for a range of risks. In particular, women were more worried than men about all the potential risks

and they thought that the risks were likely to harm their health more seriously than men. Women also thought that all the potential risks, except for saturated fats, were more common than did the men.

Younger subjects thought that it was easier to tell if foods contained saturated fats or if they had been genetically modified than did older subjects. Younger respondents also thought that more was known about saturated fat by scientists and that they were more common but that people had more control over whether they ate them, compared with the older subjects. Younger subjects felt that man was more to blame for any risk from growth hormone residues than did older subjects. Older subjects, however, felt that the Government had more responsibility to protect them from risks to Salmonella bacteria than did the younger subjects. These findings were true for both men and women. The mean dread and knowledge scores for older and younger subjects, and for men and women are shown in table 2.

Principal components analysis

To reduce the 10 questions to their underlying dimensions, and so summarise the information they contain, we carried out Principal Components Analysis (PCA)(Manly, 1994). Only two components explained more variation in results than a single question (i.e. their eigenvalues were greater than 1). These two components were the only ones with meaningful interpretations, and matched the two components, dread (or severity) of the risk and knowledge (or familiarity) of the risk, identified by Fife-Schaw and Rowe in their development of the PFRI questionnaire (Fife-Schaw & Rowe, 1996). Table 3 shows the loadings for the two principal components identified. The “dread” component mainly comprised questions relating to level of worry, likelihood of harm, responsibility of the Government, how much it is the fault of mankind and the seriousness of harm associated with the risk. The “knowledge” component comprised how much scientists knew about the risk, how easy it is to tell whether a food contains the risk and the level of control we might have over the risk. The two components explained 43% of the variation in responses.

Women dreaded all the five potential risks more than the men, these were all statistically significant differences except for salmonella (table 2). The knowledge component was similar for men and women except for saturated fats where women felt they knew more than men. Splitting the sample into three different age groups (18-39, 40-64, 65-89 years) uncovered some differences by age. In terms of the dread component, younger subjects dreaded growth hormones and salmonella less than the older groups. Younger subjects also thought they knew more about genetically modified food, salmonella and saturated fats.

PCA was carried out for each survey type separately and these two components held true for each survey (data not presented). The principal component scores were calculated for each of the five sources of potential risk using standard methods (Manly, 1994), standardised across all survey types, potential food risks and time phases to enable fair comparisons between risks.

Figure 1 shows that saturated fats were considered both least dreaded and most known of the five potential food hazards. Salmonella was more known about than GM food, BSE and growth hormones, but had approximately the same level of dread. In summary, the public appeared to dread the consequences of BSE and Salmonella most, and saturated fats least. They thought that least was known about growth hormones, BSE and GM food, but quite a lot was known about saturated fats.

Trends over time

Figures 2 and 3 show the magnitude of any trends over time in dread and knowledge for the five potential food hazards, along with their statistical significance. Figure 2 shows that saturated fats were alone in being dreaded much less than any of the other food risks, which were all dreaded to about the same amount. No dramatic trends over time were apparent, with the largest change in dread score over time between phase one and phase three being just 0.09 SD for salmonella. Figure 3 shows that saturated fat was felt to be more known about than the other food risks, followed by salmonella. Trends over time for knowledge appeared to be slightly upwards if anything, demonstrating that the public considered most food risks to have become more "known" over the year. The largest change in knowledge score was 0.23 SD for GM foods. The telephone survey gave the lowest dread scores and knowledge scores were also less extreme for the telephone survey than for the others. These relationships were unchanged with adjustment for age and educational level. There was evidence that the people in the study thought that growth hormones became more "known" over the year ($p=0.02$).

Care should be taken in interpreting these results, due to the large number of comparisons being made, relative to the number of observations.

Discussion

This study has implications for communicating risk messages to the general public. Perceptions varied according to the type of potential risk being considered, so that any process to inform the public about food risks needs to take these variations into account. Changes in dietary intakes which result from food 'scares', such as the BSE crisis may have

important public health implications (Cade J *et al*., 1998). A full understanding of public views is important to ensure clear communication of the issues.

Response to the baseline questionnaire was rather low at 33%, however, this is similar to other studies which have used the PFRI (Fife-Schaw & Rowe, 1996). Response to the repeat contacts was higher especially for the telephone survey group. Overall, more women responded to the questionnaire than men. There is a well established difference in risk perception between men and women, with women tending to perceive more risk from a hazard than men (Grobe *et al*., 1999; Frewer, 2000). Even so, risk communication messages need to take these differences into account, especially since, in general, women tend to have responsibility for food purchasing.

Younger subjects have been shown to distrust information from Government sources more than older subjects (Frewer *et al*., 1998). This may explain why in our study the older subjects expressed the view that the Government had more responsibility to protect them from risks associated with Salmonella, whereas the younger subjects felt that it was more their own responsibility. Risk perceptions have been shown to increase with age to a point and then to decrease with age, possibly due to other health concerns of ageing (Grobe *et al*., 1999). In fact, Salmonella is more common in children and young adults than in the elderly (Forsythe, 1993). Food hygiene and food safety education relating to food poisoning may be more important for the younger age groups.

The item which elicited the most extreme responses to all the potential risks was that man was mostly to blame for any risks to health. For risks from technology to be acceptable to the public there must be an apparent benefit to the hazard exposure (Grobe *et al*., 1999). Benefits from a technology should apply to people exposed to the risks or to the environment and not simply to the industry alone (Frewer, 2000; Siegrist *et al*., 2000). A pan-European study on perceptions of biotechnology and genetic engineering showed that people felt that biotech/genetic engineering research on farm animals and food was not particularly worthwhile or to be encouraged compared to similar research in the areas of medicines and vaccines (INRA, 1993). The item which showed an extreme response in the other direction was that ‘you can never tell if the food you are about to eat contains the potential risk factor’. Labelling of food is an important issue here. Saturated fats showed a less extreme response to this item, probably because many foods are now labelled with information about the fat content of the food.

The PCA elicited two main components identified as dread and knowledge, which support the previous work of Fife-Schaw and Rowe (1996; 2000) and Sparks and Shepherd (1994). Dread is associated with assessments of whether the hazard can be controlled; involves involuntary exposure; has a globally catastrophic effect; will affect future generations; has biased consequences; or has an increasing chance of occurring. Knowledge relates to whether the hazard is new; observable; known by scientists; or has delayed effects (Breakwell, 2000). The fact that people dreaded saturated fats least and felt most was known about them is reflected in other work. A study of 25 potential hazards related to food found that a high-fat diet was perceived by subjects to be the most controllable risk. A high fat diet also showed optimistic bias, with 56% indicating that they perceived themselves to be at a lower risk than other people (Sparks & Shepherd, 1994). Optimistic biases are important since they may lead to ineffective efforts to communicate about risks to reduce risky behaviours (Breakwell, 2000). Despite public policy aims to reduce the amount of fat and in particular saturated fat in the diet there has been only limited success in achieving a reduction in intake over recent years (Ministry of Agriculture, 1999). If it were possible to increase certain aspects of dread relating to saturated fat intake this could motivate people to reduce their fat intake. However, there are ethical issues related to the acceptability of this approach. It is also not clear whether the higher levels of knowledge around saturated fats would outweigh the effects of increasing dread and mitigate against dietary change.

The use of a shortened version of the PFRI enabled the technique to be administered over the telephone without seeming to affect its validity when compared with the postal sample contacted in this study. However, limitations to the use of the psychometric approach have been identified that may influence its applicability in routine surveillance (Fife-Schaw and Rowe, 2000). These include problems with its use with small groups due to individual-level variability and possible order effects that may preclude comparison of data from different studies. Thus, although our data identified the same two components as previous research, further analysis is required to determine whether this shortened version of the PFRI is as effective as the original version.

BSE and salmonella were the risks that were dreaded most. Food poisoning has been associated with the provision of accurate factual information on the hazard (Frewer *et al*., 1997). Although dread was high for Salmonella there was a positive knowledge component on the PCA. BSE on the other hand was equally dreaded but less well known. Social trust has been found to correlate strongly with judged risks for hazards about which people did not possess much knowledge (Siegrist *et al*., 2000). BSE is a much newer hazard than Salmonella. It is an unfamiliar risk being new, unobservable, unknown to those exposed and

delayed in manifestations of harm (Lanska, 1998). In trying to communicate about BSE there has been a perception gap between the authorities and the public leading to distrust of those authorities by the public. An adverse effect occurring with a risk which is unknown and unfamiliar, such as BSE, will have a much greater societal impact than a risk which is known such as Salmonella (Lanska, 1998). This has been manifested by a 40% decrease in beef consumption in the week following the beginning of the media interest (Public Health News., 1996).

Meat, in particular beef, is the main food that may contain the prion that causes BSE. Some of the negative views around foods containing the BSE prion may be affected by a general decline in the popularity of meat which was already occurring before the BSE crisis (Holm & Mohl, 2000). Further work is needed to explore the relationship between perceptions of food risks and consumption of foods to provide information on the impact of potential food risks on the population's diet.

Knowledge of the five potential risks increased slightly over the year, in particular for growth hormone. It may be that by repeating the questionnaire three times over the year subjects felt that they knew more about the topic simply because the terms had become more familiar to them. The increase in knowledge may have been a real one due to improving risk communication and heightened awareness through the media. As risks become more familiar the potential for adverse social effects is ameliorated (Lanska, 1998).

This study has raised a number of important issues for health policy makers and risk communicators. In particular, people perceived saturated fats to be least dreaded perhaps because they are most known. There is a substantial body of evidence concerning the detrimental effects on health of large amounts of fat in the diet (Department of Health, 1994; Weisburger, 1997). Nevertheless, it will be difficult to achieve a reduction in fat intake at a population level since people are not worried about its impact. BSE and salmonella were the risks which were dreaded most, however, since salmonella was more known any adverse public effects relating to salmonella may be less.

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Reference List

Breakwell,G.M. (2000). Risk communication: factors affecting impact. *British Medical Bulletin,* **56**, 110-120.

Cade, J., Calvert, C., & Barrett, J. (1998). How could the BSE crisis affect nutrient intake? Comparison of beef and non-beef eating meat eaters from the UK Women's Cohort Study. *European Journal of Clinical Nutrition,* **52**, 151-152.

Department of Health. Nutritional Aspects of Cardiovascular Disease. 1994. London, HMSO. Report on health and Social Subjects. 46.

Department for Education and Skills (2000) Labour Force Survey. Available from http://www.statistics.gov.uk/statbase/xsdataset.asp?vlnk=2798 (accessed 20 July 2000)

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

Fife-Schaw,C., & Rowe,G. (2000) Extending the application of the psychometric approach for assessing public perceptions of food risk some methodological considerations. *Journal of Risk Research*, 3(2), 167-179.

Forsythe,R.H. (1993). Risk: Reality Versus Perception. *Poultry Science,* **72**, 1152-1156.

Frewer,L. (2000). Risk perception and risk communication about food safety issues. *Nutrition Bulletin,* **25**, 31-33.

Frewer,L.J., Howard,C., Hedderley,D., and Shepherd,R. (1997). The elaboration likelihood model and communication about food risks. *Risk Analysis,* **17**, 759-770.

Frewer,L.J., Howard,C., Hedderley,D., & Shepherd,R. (1998). Methodological approaches to assessing risk perceptions associated with food-related hazards. *Risk Analysis,* **18**, 95-102.

Grobe,D., Douthitt,R., & Zepeda,L. (1999). A model of consumers' risk perceptions toward recombinant bovine growth hormone (rbGH): the impact of risk characteristics. *Risk Analysis,* **19**, 661-673.

Holm, L. & Mohl, M. (2000). The role of meat in everyday food culture: an analysis of an interview study in Copenhagen. *Appetite,* **34**, 277-283.

INRA. Biotechnology and genetic engineering:what Europeans think about it in 1993. 1993. The European Commission. Eurobarometer 39.1.

Lanska,D.J. (1998). The mad cow problem in the UK: risk perceptions, risk management, and health policy development. *Journal of Public Health Policy,* **19**, 160-183.

Manly,B.F.J. (1994). Multivariate statistical methods: a primer. London: Chapman and Hall.

Ministry of Agriculture, Fisheries and Food. (1999) National Food Survey 1998. London: The Stationery Office.

Pidgeon,N. & Beattie,G. (1997). *The psychology of risk and uncertainty*. In Handbook of Environmental Risk Assessment and Management.Calow Peal, ed. Oxford: Oxford University Press.

Public Health News. July/August 7, supplement 7/8. 1996.

Siegrist,M., Cvetkovich,G., & Roth ,C. (2000). Salient Value Similarity, Social Trust, and Risk/Benefit Perception. *Risk Analysis,* **20**, 353-362.

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

Traavik,T. (1999). Gene modified foods, con: absence of evidence is not evidence of absence! *Scandinavian Journal of Nutrition,* **43**, 17S.

Weisburger, J.H. (1997). Dietary fat and risk of chronic disease: mechanistic insights from experimental studies. *Journal of the American Dietetic Association,* **97**, S16-S23.

Table 1 Baseline scores for items from the PFRI - mean scores (standard deviation)

Item	Growth hormone residues	BSE	GM foods	Salmonella	Saturated fats
1.Likely harm (1= not likely, 5= extremely likely)	3.13 (1.26)	2.96 (1.30)	3.06 (1.20)	3.51 (1.22)	3.21 (1.09)
2. How worried (1=not worried,5=extremely worried)	2.81 (1.32)	2.98 (1.45)	2.90 (1.31)	3.25 (1.34)	2.58 (1.16)
3. Scientists know (1=nothing,5=everything)	2.76 (0.94)	3.02 (1.00)	2.66 (1.05)	3.62 (0.94)	3.59 (0.88)
4. Easy tell (1=never tell,5=always tell)	1.30 (0.73)	1.26 (0.79)	1.60 (0.96)	1.43 (0.88)	3.09 (1.27)
5. Whose responsibility (1=totally mine,5=totally Government)	3.96 (1.02)	4.07 (1.07)	4.00 (1.06)	3.32 (1.17)	2.54 (1.16)
6. How common (1=extremely rare,5=extremely common)	3.20 (1.12)	2.57 (1.21)	3.18 (1.06)	3.32 (1.03)	4.15 (0.86)
7. Quantity (1= harmful in very small amounts,5=not harmful)	2.75 (1.21)	2.15 (1.33)	2.87 (1.33)	1.70 (0.97)	3.11 (0.97)
8. Control (1=no control,5=total control)	1.85 (1.09)	2.33 (1.34)	2.04 (1.13)	2.23 (1.19)	3.36 (1.14)
9. Fault of mankind (1=natural risk,5=man to blame)	4.32 (1.02)	4.29 (1.04)	4.52 (0.88)	3.30 (1.30)	3.09 (1.37)
10. How serious (1=not at all,5=extremely)	3.17 (1.14)	4.00 (1.23)	3.20 (1.21)	3.86 (1.08)	3.14 (0.96)

Table 2 Mean displacement values by age and sex for each potential risk

		Dread component		Knowledge component	
		Mean	**95% Confidence Interval for Mean**	**Mean**	**95% Confidence Interval for Mean**
BSE	male	.24*	-.03, .52	-.71	-.85, -.56
	female	.57	.38, .77	-.71	-.81, -.61
	18-39yrs	.15	-.14, .45	-.77	-.91, -.62
	40-64yrs	.58	.37, .80	-.69	-.80, -.57
	65+yrs	.44	-.03, .89	-.72	-.93, -.52
Growth hormones	male	-.09*	-.30, .13	-.81	-.95, -.68
	female	.47	.30, .65	-.79	-.88, -.70
	18-39yrs	-.01*	-.26, .24	-.84	-.96, -.72
	40-64yrs	.46	.28, .65	-.77	-.88, -.66
	65+yrs	.14	-.19, .47	-.82	-1.01, -.63
GM food	male	-.09*	-.36, .19	-.69	-.83, -.55
	female	.58	.38, .78	-.53	-.63, -.43
	18-39yrs	.12	-.20, .43	-.45*	-.60, -.30
	40-64yrs	.41	.18, .63	-.61	-.72, -.49
	65+yrs	.52	.12, .91	-.76	-.96, -.57
Salmonella	male	.19	-.02, .39	.11	-.04, .27
	female	.41	.26, .56	.25	.15, .34
	18-39yrs	.06*	-.12, .24	.32*	.18, .46
	40-64yrs	.47	.30, .65	.21	.10, .32
	65+yrs	.42	.09, .74	-.001	-.21, .21
Saturated fat	male	-1.14*	-1.32, -.96	1.71*	1.52, 1.89
	female	-.84	-.99, -.69	1.96	1.82, 2.10
	18-39yrs	-1.00	-1.19, -.80	2.34*	2.16, 2.52
	40-64yrs	-.93	-1.09, -.76	1.86	1.71, 2.01
	65+yrs	-.99	-1.28, -.70	1.30	1.03, 1.57

* analysis of variance by sex or age group within each component P<0.05

Table 3. First two principal components
(unrotated principal components analysis from baseline responses)

	Component 1 "dread"	Component 2 "knowledge"
Level of worry	0.47	0.17
Likelihood of harm	0.44	0.17
Scientists' knowledge	0.01	0.34
How easy it is to tell	-0.10	0.56
Government's responsibility	0.30	-0.31
How common it is	0.29	0.27
What quantity is dangerous	-0.32	0.06
Control over eating it or not	-0.23	0.54
Fault of mankind	0.30	-0.07
Seriousness of any harm	0.40	0.20

Figure 1. Principal components plot for potential food hazards

Figure 2. Mean dread score by potential food risk – changes over time

BSE, growth hormones, GM food,
Salmonella, saturated fat

Figure 3. Mean knowledge score by potential food risk – changes over time

BSE, growth hormones, GM food,
Salmonella, saturated fat

Figure 1. Principal components plot for potential food hazards

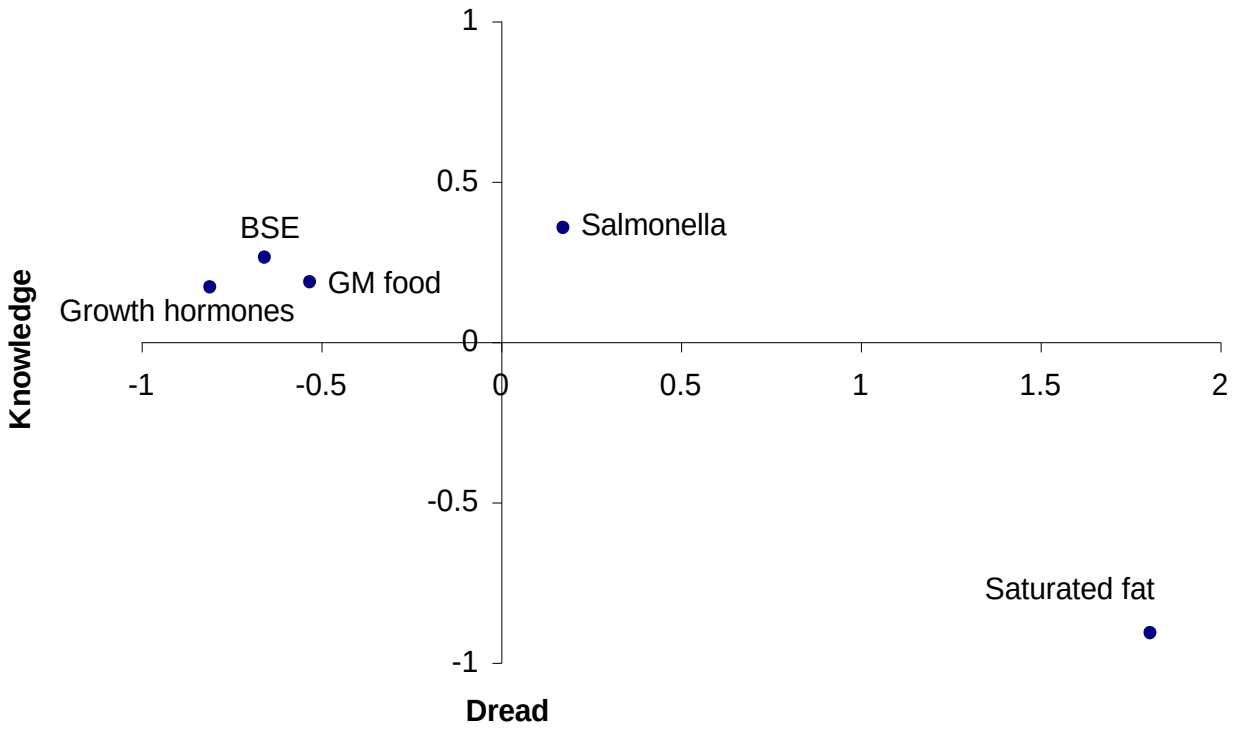

Figure 2. Mean dread score by potential food risk – changes over time

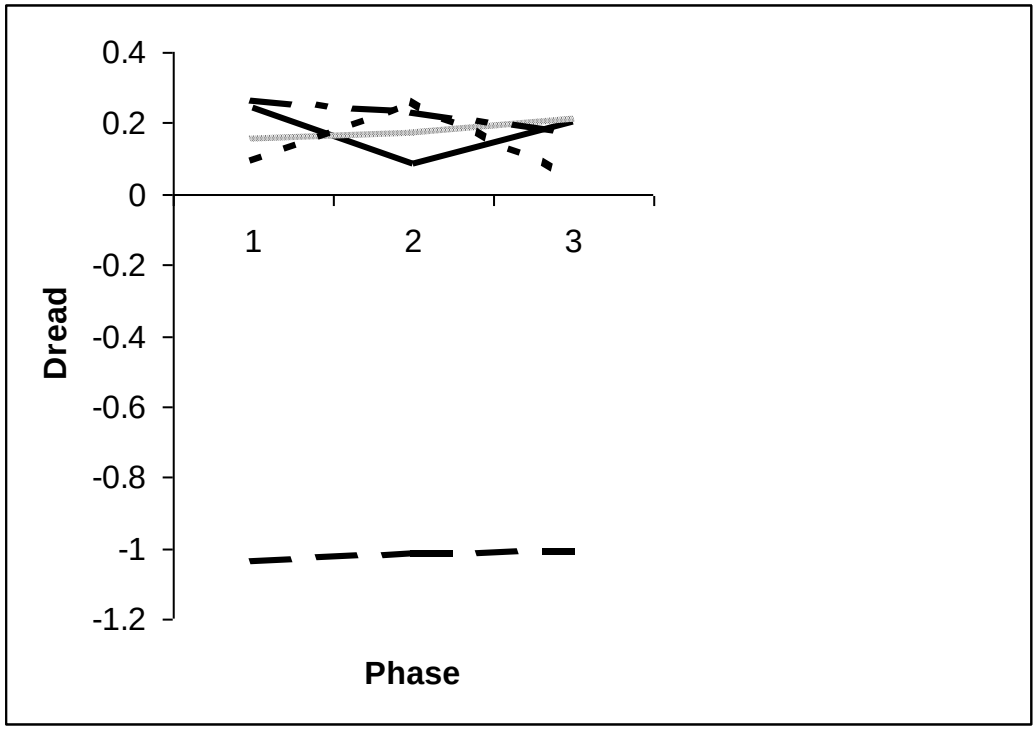

Figure 3. Mean knowledge score by potential food risk – changes over time