

Investigating consumer knowledge and behaviour in the context of functional foods

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Abstract. The future of functional foods will depend on the extent to which they are accepted by consumers. Results are presented from a questionnaire that investigated consumers' self-reported knowledge, behavioural intentions and purchasing behaviour regarding functional foods. Findings are that two thirds of UK respondents, just less than half of Danish respondents, almost two thirds of Spanish respondents, and 88% of Polish respondents say they buy one or two functional food items per week. Between 30-55% of respondents say they understand functional foods reasonably well (UK 55%; Denmark 30%; Spain 43%; Poland 49%). A number of factors were related to respondents' stated intention to purchase probiotics. If someone in the household had suffered food poisoning in the previous 12 months or had children living at home, respondents were more likely to consider buying functional foods to help reduce the risk of food poisoning. Respondents who have never had any formal food safety training were more likely to consider buying functional foods. Further, knowledge of the correct food sources for a number of food-borne pathogens also affected the likelihood of respondents considering buying probiotic functional foods. The findings provide up-to-date information about consumers and the developing functional foods market.

Key words: Consumers, knowledge, behaviour, functional foods

1. Introduction

"The driver of the market is ultimately the consumer and the greater part of the incentive to develop food functionality must come from consumer demand"⁽¹⁾.

The concept of functional foods is derived from the knowledge that some parts of the diet have the ability to contribute benefits that go beyond nutrition. Since the 1980s, the concept of functional foods has developed, and so too has interest in such products amongst the food industry, consumers and the regulatory authorities. The future of functional foods will depend on the extent to which consumers understand and accept them⁽¹⁾.

1.1 Definitions and types of functional foods

"A functional food may be defined as a food having health promoting benefits and/or disease preventing properties over and above its usual nutritional value"⁽²⁾.

"Functional foods are generally defined as food products to be taken as part of a diet that provides health benefits beyond traditional nutritional effects"⁽³⁾.

Food products described as functional foods include a range of products, from those that have a particular functional ingredient, to staple foods fortified with a nutrient that would not normally be present to any great extent. For example, functional foods include food items that contain specific minerals, vitamins, fatty acids or dietary fibre, foods with added biologically active substances such as phytochemicals or other antioxidants, and probiotics that have had live beneficial cultures added⁽⁴⁾. Specifically, there are margarines that have added plant sterols, eggs enriched with omega-3 fatty acids, and bread or breakfast cereals fortified with folic acid.

Probiotic functional foods are one type of functional food receiving increasing attention from both supply and demand sides of the food supply chain. Probiotics can be defined as foods that have had beneficial live cultures such as *Lactobacillus* sp. or *Bifidobacteria* sp. added (for example through fermentation) in order to improve intestinal microbial balance.

1.2 Regulation

In December 2006 the European Commission published a new regulation on health and nutrition claims – ‘Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on Nutrition and Health Claims made on Foods’⁽⁵⁾. This was in light of scientific advances and technological innovations in the food sector, and the demand from consumers and industry to set a new legislative framework on the use of health claims on foods. Across the EU, the regulation was effective from January 2007⁽¹⁾. The regulation allows for some well-established health claims to be made but other claims must undergo scientific assessment to ensure that consumers are not being misled⁽²⁾. The important point to make about the regulation is that it regulates *claims* not *foods*.

1.3 Market development

Within Europe, the market for functional foods has developed at different rates in different countries. For example, Castellini *et al*⁽⁶⁾ report data from 1998 suggesting that France, the UK and Germany had 67% of the total market value of functional foods in nine member states where data were available at that time. Also, there are certain types of functional food products for which the market has developed more rapidly. EU data from 1998 suggested that dairy products accounted for 65% of the functional foods market, with margarines and spreads accounting for a further 23%⁽⁶⁾. As an example of the size of the market, the UK market for functional food and drink products was forecast to have a value of £1720million in 2007, according to figures from the IGD⁽²⁾ (figure 1).

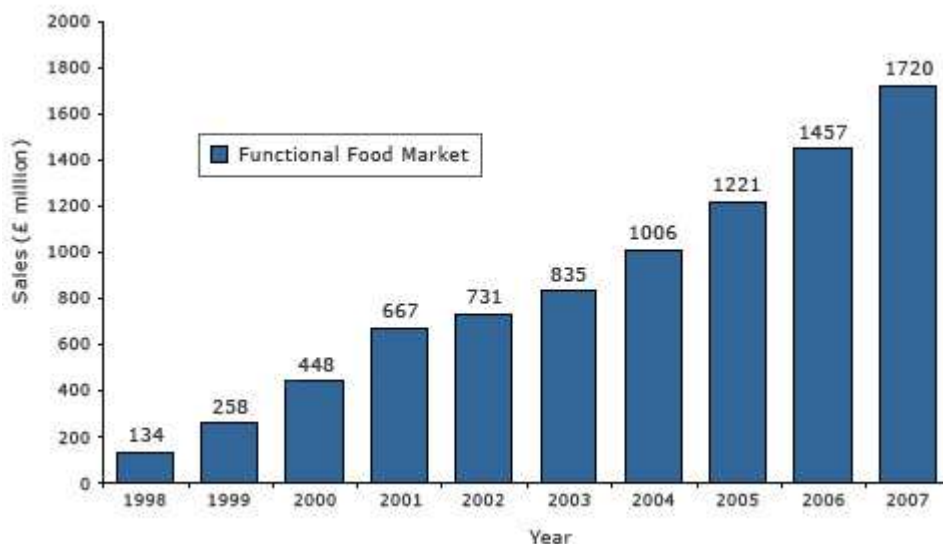


Figure 1. Estimated and forecasted market for UK functional food and drink products 1998 to 2007

Source: <http://www.igd.com/index.asp?id=1&fid=1&sid=4&tid=46&cid=118>

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1.4 Consumer purchasing behaviour

This is a range of components that together contribute to models of consumer purchasing behaviour, models that aim to explain consumers' buying decisions⁽⁷⁾. Components of the decision-making process are both ‘affective’ and ‘cognitive’, both of which may be influenced by several factors, such as the socio-demographic characteristics of the individual consumer or the marketing activities of producers and retailers. As a result of the combination of components the consumer’s reaction may be observed through the purchase of a specific product. In addition to socio-demographic attributes, psychological and life-style attributes are thought to be useful determinants of purchasing behaviour. Personal motivation may also be an important factor driving the purchase of certain types of products, such as healthy food. Further, the level of consumer knowledge about functional food ingredients and consumer understanding

of the relationship between nutrition and health are likely to be important to that consumer's attitude towards functional foods. Additionally, preferences are regarded as an important factor for the decision-making process of consumers. For consumers to prefer one product over another, it has to offer some benefit that is not offered by the competing product. In this sense, consumer preferences reveal the benefits that the consumer perceives certain products to possess. Consumers try to maximise their benefit when purchasing a product, while operating within financial restrictions. Sparke and Menrad⁽⁷⁾ argue that combining consumers' affective and cognitive components, the factors that influence those components, including their psychological and lifestyle attributes, and their knowledge of, understanding of, and preferences towards newly developed food products, results in a consumer behaviour model that can be used to understand how consumers might behave towards certain products. So, at the level of individual consumer, the stimuli behind purchasing behaviour relating to functional foods are likely to include her/his socio-demographic background, and her/his knowledge and previous experience of functional foods. These stimuli are considered and processed by the consumer, and as a reaction, the preferences are revealed through purchase decisions.

1.5 What influences responses to functional foods?

Drawing on the consumer behaviour models as described in section 1.4, a number of studies have investigated some of these components. Thus in the discussion that follows, consideration is given to how components are related to attitudes towards, knowledge of, and purchase decisions relating to, functional foods.

Socio-demographics

Age has been shown to be related to the purchase of different types of functional foods⁽⁶⁾⁽⁸⁾⁽⁹⁾ and to differences in consumer views of functional foods⁽¹⁰⁾. For example, younger respondents may be willing to pay more for a product such as tomato juice containing soy⁽¹¹⁾ and be more interested in for example, conjugated linoleic acid (CLA) flavoured milk⁽¹²⁾. However, the youngest consumers have also been found to have a fairly negative attitude towards functional food products⁽¹³⁾ so findings are not conclusive. Nevertheless, the age of the consumer may have an influence on their response to functional foods.

Consumers living in households with teenagers may be more interested in products such as CLA-flavoured milk⁽¹²⁾, and the presence of children in the home may increase the purchasing frequency of, for example, omega-3 yogurt and omega-3 margarine⁽⁹⁾. People with a higher level of education and higher income levels have been shown to be more interested in certain products, such as tomato juice containing soy⁽¹¹⁾. Differences in consumer views of functional foods have been linked to levels of education⁽¹⁰⁾. It has also been found that women are willing to pay a higher premium for products with health benefits⁽¹¹⁾. Thus, it is likely that a range of socio-demographic variables can be related to consumer responses to functional food products.

Cultural differences

In addition to individual socio-demographic characteristics, broader, cultural differences may be important in explaining differences in responses to functional foods. For example, certain countries where certain health issues are more prevalent have a higher demand for specific types of functional foods that claim to tackle those particular issues⁽⁶⁾. Also, data collected from students in Canada, United States, and France in 2004 revealed cross-cultural differences in the influence that knowledge, credibility of information, and food attitudes had on the acceptance of functional foods⁽¹⁴⁾. These findings about differences between countries are interesting as the current study has been conducted in four EU countries.

Health and nutrition

Not surprisingly, differences in consumer views of functional foods can be explained by the role of food and health in peoples' lives⁽¹⁰⁾, specifically, the importance that individuals attach to health issues, their knowledge of health issues, and their general interest in health issues. For example, it has been shown that knowledge of health and/or nutrition is a significant explanatory variable, which diminishes the likelihood that an individual will purchase products containing lycopene for reducing the risk of developing prostate cancer⁽⁸⁾. Further, a tendency to read the nutrition information on food products was found to be an important factor affecting the purchase of omega-3 products⁽⁹⁾. Positive attitudes toward the healthiness of

conventional dairy products significantly increased interest in purchasing some CLA-enhanced dairy products⁽¹²⁾. In studies reported by Binns and Howlett⁽¹⁾ consumers were found to respond positively to products that claimed to eliminate food additives, or that made claims about health and well-being criteria. Belief in the health benefits of functional foods was found to be the main positive determinant of acceptance of functional foods⁽¹⁵⁾. In another study⁽¹⁶⁾ logistic regression analysis was used to determine the factors that influenced consumers' purchasing behaviour relating to food products with health and nutrition claims. The respondent's perception of the healthiness of the product, and their perception of the credibility of the health or nutrition claim, were found to positively influence purchasing choice, while the format of the health or nutrition claim were of no importance. Given the relationship between functional foods and health, and the growing awareness of the links between nutrition and health, it is not surprising that consumer responses to functional foods have a somewhat complicated relationship with consumer attitudes to health issues.

Knowledge

Knowledge of products and product attributes is thought to be related to consumer purchase behaviour. The likelihood of functional food acceptance has been found to decrease with a high level of claimed knowledge or awareness of the concept of functional foods⁽¹⁵⁾. However, data collected from students in Canada, United States and France, revealed that a high level of knowledge was one of the the main positive determinants of the acceptance of functional foods⁽¹⁴⁾. Again these varying results suggest a somewhat complicated relationship between knowledge of functional foods and product acceptance.

Information

Beliefs about health and product-related benefits, and a belief in the credibility of information are among the positive determinants of the acceptance of functional foods⁽¹⁴⁾. Conversely, opinions about the trustworthiness of information relating to functional foods have been found to be not very strong⁽¹⁴⁾. Purchasing choice is positively influenced by the extent of effort put into information acquisition⁽¹⁶⁾.

Experience

There is an expectation that previous experience of certain food products will influence future intentions with regard to those products. Thus, consumers who had previously purchased calcium or vitamin-enriched milk or calcium-enriched orange juice, were more likely to be interested in CLA-enriched cheese. However, previous purchase of omega-3 products or soy products was not related to interest in CLA milk products⁽¹²⁾.

Modern technologies, price and family illness

A number of other issues may affect the response of consumers to functional foods. For example, differences in consumer views of functional foods may be explained by the acceptability of modern food technologies⁽¹⁰⁾, by price⁽¹²⁾ and by the presence of a family member who is unwell⁽¹⁵⁾. In the latter case, it has been found that the likelihood of functional food acceptance increases if a member of the respondent's family is unwell.

Overall, there is a range of components that may be socio-demographic or cultural; that relate to knowledge, experience or information; and others, all of which may be related to interest in functional foods. Ultimately, as stressed by Sparke and Menrad⁽⁷⁾ it is likely that there is a complicated interplay between components.

The aim of the work reported here is to establish what functional food items are currently purchased by people in four EU countries, the frequency with which they purchase functional food items, their level of self-reported knowledge of functional foods, and the likelihood that they would purchase probiotics that could help reduce the risk of food poisoning. Further, the work aims to establish whether there are certain factors, for example, food safety education received, likely behavioural response to food safety messages, knowledge of pathogens, and socio-demographic characteristics, that are related to the frequency with which people purchase functional food items, their self-reported understanding of functional foods, and their willingness to consider buying functional food items that may help to reduce the risk of food poisoning (pro-biotics). The method, results, discussion and conclusions are presented below.

2. Method

A questionnaire survey was conducted in the UK, Denmark, Spain and Poland. In the first two countries, the survey was conducted by post, in the latter two countries it was completed by telephone.

2.1 Sample selection

UK

In the UK, a geographically-clustered, multi-stage, random sample was undertaken, based on UK parliamentary constituencies. The first stage of the sampling procedure was a random selection of ten parliamentary constituencies. This was followed by a further random selection of one electoral ward within each constituency. Questionnaires were sent to a random selection of seventy households in each of the ten sampling areas in September 2007. An identical questionnaire was posted to all non-respondents 12 days later.

Denmark

In Denmark, a random sample of 1000 names and addresses was purchased from a company supplying distribution lists drawn from telephone directories. The sampling frame aimed to achieve a geographical distribution based on the relative size of the population in particular regions. In addition, the list included mobile-phone-only households, again relative to the percentage then found in Denmark - about 17%. In this way there was an adjustment for the fact that younger people tend to be less likely to have a landline connection and more likely to have only a mobile phone.

Spain and Poland

In Spain and Poland, telephone numbers were randomly selected from across the countries. Once successfully connected to a householder, interviewers asked respondents two screening questions. First, they were asked if they were the person responsible for the majority of cooking in the household, and second they were asked to confirm that they do sometimes cook red meat and poultry. Once both of these criteria were confirmed, and with the respondents' agreement, the survey proceeded. As with the questionnaires conducted in the other countries, no demographic quotas were applied. Telephone surveys were conducted using the CATI (Computer Assisted Telephone Interviewing) service.

2.2 Design of the questionnaire

In addition to the questions specific to functional foods, respondents were asked about a range of food safety-related issues, including their knowledge of pathogens in food, their household experiences of food poisoning, whether they had received any food safety training, and others. A range of socio-demographic questions were also asked.

In relation to functional foods, respondents were asked:

- On average, how often do you buy functional foods?
- How well do you feel you understand the role of functional foods in contributing to health and wellbeing?
- Would you consider buying functional foods which contain probiotic bacteria (live cultures) to help reduce the risk of food poisoning?

The definition of functional foods given in the survey was as follows:

“Functional foods (and drinks) are foods with added health benefits. Examples include: yogurt drinks fortified with probiotic bacteria; cereals with extra dietary fibre; sports and energy drinks; gluten-free pasta; low cholesterol spreads; dairy products enriched with calcium; and soft drinks with added vitamins or minerals”.

Types of functional foods covered by the survey question that aimed at identifying what functional food items were bought by respondents were:

- Foods which are low in cholesterol or low in fat
- Foods which are high in dietary fibre
- Foods which are fortified with vitamins and minerals (eg calcium or iron)
- Foods with added probiotic bacteria (e.g. 'live' or 'active' yogurts/yogurt drinks)
- Gluten-free products
- Sports and energy foods or drinks
- Functional drinks (e.g. drinks with added herbs, vitamins, minerals, anti-oxidants)

However, the question “Would you consider buying functional foods which contain probiotic bacteria (live cultures) to help reduce the risk of food poisoning?” was preceded by the statement “*Some probiotics (live micro-organisms such as those found in 'active' or 'live' yogurts) have been shown to help prevent the growth of poisonous bacteria*”. In this part of the study the definition of functional foods was therefore narrowed to probiotic functional foods.

2.3 Statistical analysis

Data were analysed using SPSS (Statistical Package for the Social Sciences) Version 15. There were two stages to the statistical analysis, descriptive statistical analysis and analysis of variance.

The variables tested in the second stage were:

- Whether or not the respondent has had any formal food safety education or training;
- Whether a member of the respondent's household has suffered food poisoning in the previous 12 months;
- The respondent's knowledge of the food source of 11 micro-organisms / pathogens;
- The frequency with which the respondent cooks from scratch;
- Whether the respondent agrees with the statement “I am likely to act upon food safety information”; and
- A number of socio-demographic variables, as follows:
 - Sex of the respondent;
 - Age of the respondent;
 - Whether the respondent lives alone or with others;
 - Whether or not the respondent has any children;
 - Whether or not the respondent has any children under the age of 16;
 - Whether or not the respondent has any children living at home;
 - The occupational status of the respondent;
 - The occupation of the respondent (UK, Spain and Poland); and
 - The level of education of the respondent (Denmark only).

3. Results

3.1 Responses

In the UK, 190 usable surveys were returned, representing a return rate of 27%. In Denmark, 281 usable questionnaires were returned, representing a return rate of 28%. In Spain 204 telephone surveys were successfully completed, representing a 'response rate' of 22%. After excluding dialled numbers that were business or fax numbers, answer machines or engaged numbers; numbers that had a 'number not recognised' message and other unsuccessful calls, 939 numbers were successfully dialled and answered by a householder. Of those, 204 persons agreed to respond. Thus, there were 735 refusals or surveys not completed. In Poland, 200 telephone surveys were successfully completed, representing a 'response rate' of 23%. After excluding dialled numbers that were not home numbers or where there was no answer, 880 numbers were successfully dialled and answered by the appropriate householder. In order to obtain responses from 200 people it was necessary to dial these 880 numbers as there were 680 refusals.

3.2 Respondents

The survey asked for the person who is responsible for the majority of cooking in the household to complete the questionnaire. Thus, unsurprisingly, the majority of respondents in all countries were female (UK-74%; Denmark-68%; Spain and Poland-90%) (table one).

In terms of age, only 14% were under 35 in the UK, 9% in Denmark, and 12% in Spain and Poland. However, in the UK, Denmark and Poland, from age 35 upwards, the age distribution was fairly even, with approximately 20-25% in each of the age groups 35-44 years, 45-54 years, 55-64 years, and 65 years and over. However, in Spain, only 12% of respondents were in the 55-64 years age category. The highest representation was in the 35-44 years age group (29%) and the 45-54 years age group (27%). A further 21% were over 65 years old.

In the UK 83% of people said they live with other people (Denmark-72%; Spain-89%; Poland-79%); 15% (UK), 28% (Denmark), 11% (Spain) and 21% (Poland) live on their own; and 54% (UK), 41% (Denmark), 71% (Spain), and 66% (Poland) of respondents have children living at home.

In terms of employment status, 58% (UK), 64% (Denmark), 46% (Spain), and 40% (Poland) are in full- or part-time work, and 27% (UK), 29% (Denmark), 10% (Spain) and 39% (Poland) are retired.

In Denmark, while 12% of respondents have only the basic level of compulsory education, 44% have some pre-degree level education beyond compulsory school education, 33% have a university degree (first degree) and 12% have a higher degree.

In Spain, 36% described themselves as a housewife/husband, much higher than in the other countries (9% in the UK; 4% in Denmark; 10% in Poland).

Of those in Spain in work, the largest group are those in managerial and technical jobs (32%), with a further 24% in non-manual skilled work, and 19% in unskilled jobs.

In Poland, of those in work, the largest group are those in administration/ service sector jobs (38%), with a further 19% in a non-manual skilled position, and 18% in skilled or unskilled manual jobs.

In the UK, of those in work, the largest group are those in managerial and technical jobs (43%) with a further 25% in non-manual skilled work, and 14% in professional jobs.

Table 1. Respondents

Characteristic		UK	Denmark	Spain	Poland
Sex					
	Male	26	32	10	10
	Female	74	68	90	90
Residential status					
	Live alone	16	28	11	20
	Live with others	84	72	89	80
Any children?					
	Yes	80	82	82	88
	No	20	18	18	12
Any children under 16					
	Yes	37	34	46	35
	No	63	66	54	65
Any children at home					
	Yes	54	41	71	66
	No	46	59	29	34
Age					
	15-24	5	1	1	4
	25-34	9	8	11	9
	35-44	21	20	29	25

	45-54	23	24	27	21
	55-64	20	24	12	24
	65 and over	22	23	21	19
Occupational status					
	Working full-time	39	54	36	36
	Working part-time	20	10	10	4
	Student/ training	3	2	1	3
	Retired	28	29	10	39
	Not currently working	0.5	2	7	4
	Housewife/ husband	9	4	36	10
	Other	-	-	-	5
Occupational class					
	Professional	14	-	11	6
	Managerial and technical	43	-	32	11
	Non-manual skilled	25	-	24	19
	Administration/ service sector	-	-	-	38
	Manual skilled	7	-	7	12
	Partly/ Unskilled manual	8	-	27	6
	No occupational classification	2	-	0	10
Education level					
	Basic education	-	12	-	-
	Further education - vocational	-	26	-	-
	Further education - academic	-	7	-	-
	HND equivalent	-	22	-	-
	First degree (bachelors)	-	32	-	-
	Second degree (masters/ PhD)	-	12	-	-

All figures are 'valid percent' figures

3.3 Descriptive statistics: Behaviour and experience

Respondents were asked to indicate their level of agreement or disagreement with the statement "I am likely to act upon food safety-related information". Results in table two show that 80% of respondents in the UK, 85% of respondents in Denmark, 64% of respondents in Spain and 61% of respondents in Poland agreed with this statement.

Forty eight percent of respondents in the UK, 45% in Denmark, 35% in Spain and 16% in Poland, indicated that they had had some formal food safety training or education.

When asked "how often do you cook from scratch?" 74% of UK respondents, 86% of Danish respondents, 88% of Spanish respondents and 83% of Polish respondents, indicated that they do so at least three times per week.

Finally, respondents were asked whether anyone in their household had suffered from food poisoning in the last 12 months. In the UK only seven percent said yes, six percent in Denmark, three percent in Spain and four percent in Poland.

Table 2. Descriptive statistics: Behaviour and experience

Question	UK	Denmark	Spain	Poland	
I am likely to act upon food safety-related information					
	Agree	80	85	64	61
	Neutral	13	13	18	17
	Disagree	4	1	11	23
	Don't know	3	0	6	0

Had any formal food safety training or education?	Yes	48	45	35	15
	No	52	55	65	85
How often do you cook from scratch?	Never	3	1	1	1
	Less than once a week	-	-	-	2
	1 or 2 times per week	23	13	12	16
	3 or 4 times per week	28	24	14	29
	More than 4 times per week	46	62	74	54
Has anyone in the household suffered from food poisoning in the last 12 months?	Yes	7	6	3	4
	No	93	90	96	96
	Don't know	0	4	1	0

All figures are 'valid percent' figures

3.4 Pathogen knowledge

Respondents were asked about their knowledge of food sources associated with 11 micro-organisms. Table three shows that in the UK there are three key pathogens for which people can identify a correct source. These are salmonella, ecoli 0157 and listeria monocytogenes. Respondents had very little knowledge of the other eight pathogens.

In Denmark there is only one key pathogen for which respondents can identify a correct source. This is salmonella. Reasonable levels of knowledge of an additional four pathogens (campylobacter, listeria monocytogenes, clostridium botulinum and ecoli 0157) were demonstrated by the respondents, with between 12% and 23% of respondents correctly identifying the source of the four pathogens. Respondents had very little knowledge of the other six pathogens.

In Spain there is also one key pathogen that the majority of respondents have heard of, and for which they can identify a correct source. Again, this is salmonella (91% knew a correct food source of this pathogen). The only other pathogen for which more than 10% of respondents correctly identified a food source, was clostridium botulinum (14%). The remaining nine items were evidently unfamiliar to most respondents, with only between 1-6% of respondents correctly identifying a source.

In Poland there is again one key pathogen that the majority of respondents have heard of, and for which they can identify a correct source and again this is salmonella (87% knew a correct food source of this pathogen). The only other pathogen for which more than 10% of respondents correctly identified a food source, was ecoli 0157 (14%). The remaining nine items were evidently unfamiliar to most respondents, with less than 10% of respondents correctly identifying a source.

Table 3. Knowledge of micro-organisms

Micro-organism	Identified correct food source of micro-organism (%)			
	UK	Denmark	Spain	Poland
Salmonella	72	85	91	87
Ecoli 0157	43	13	4	14
Listeria monocytogenes	28	18	4	4
Campylobacter	6	24	3	3
Clostridium botulinum	6	16	14	5
Staphylococcus aureas	6	5	3	3
Food-borne viruses	5	5	6	9
Clostridium perfringens	3	1	3	0
Shigella	3	1	2	6

Bacillus cereus	3	4	1	2
Yersinia enterocolitica	1	2	1	1

3.5 Functional foods

Descriptive statistics reveal that 62% of UK respondents buy functional foods one or two times a week. This can be interpreted as buying one or two functional food *items* per week. Nineteen percent never buy them. In Denmark 44% of respondents buy functional foods one or two times a week and forty six percent never buy them. In Spain 59% of respondents buy functional foods one or two times a week and 20% never buy them. In Poland 39% of respondents buy functional foods one or two times a week and only 5% never buy them (table four).

Table 4. Functional foods

Question	UK	Denmark	Spain	Poland
How often do you buy functional food items?				
3 or more times per week	19	11	20	50
1 or 2 times per week	62	44	59	39
Less than once a week	-	-	-	8
Never	19	46	20	5

All figures are 'valid percent' figures

Table five shows which types of functional food items are bought by those respondents who do buy functional foods. This shows that in three countries (the UK, Denmark and Spain) it is the low fat/ low cholesterol foods that are bought by the highest percentage of respondents. However, in Poland it is the probiotic yogurt or yogurt drinks that are bought by the highest percentage of respondents. It is noticeable that in Denmark a much smaller percentage of respondents (6%) buy probiotic products than in any of the other three countries. Similarly, Danish respondents are far less likely to buy foods fortified with vitamins or minerals.

Table 5. Purchase of different types of functional foods: of those who do buy functional foods percentage who buy:

Functional food type	UK	Denmark	Spain	Poland
Low fat or low cholesterol foods	67	52	73	59
High fibre foods	48	46	58	60
Probiotic yogurt or yogurt drinks	48	6	47	83
Foods fortified with vitamins or minerals	31	8	57	52
Functional drinks	17	5	8	39
Sports/energy foods/drinks	15	3	25	15
Gluten free	7	4	11	17

In terms of knowledge of functional foods, 55% of respondents in the UK, 30% in Denmark, 43% in Spain and 49% in Poland say they understand functional foods reasonably well (table six). Thirty two percent of UK respondents, 56% of Danish respondents, 31% of Spanish respondents and 3% of Polish respondents say they understand functional foods only a little. In the UK 5% of respondents, in Denmark 10% of respondents, in Spain 7% of respondents, and in Poland only 3% of respondents say they don't understand functional foods at all. Only 8% in the UK, 5% in Denmark, 15% in Spain and 46% in Poland say they understand functional foods very well. It is important to note that self-reported knowledge is not necessarily the same as actual knowledge – which was not tested.

Respondents were asked if they would consider buying probiotics to help avoid the risk of food poisoning (table six). In response, 23% of UK respondents, only 6% of Danish respondents, 18% of Spanish

respondents and 31% of Polish respondents said they would definitely consider buying probiotics to help avoid the risk of food poisoning.

In the UK 62%, in Denmark 74%, in Spain 51% and in Poland 60% say they would 'probably' or 'maybe' consider buying probiotics to help avoid the risk of food poisoning.

Only 14% in the UK, 20% in Denmark, 22% in Spain and only 9% in Poland say 'no' they would not consider buying probiotics to help avoid the risk of food poisoning.

Table 6. Understanding of functional foods and intention to purchase probiotics

Question	UK	Denmark	Spain	Poland
How well do you understand functional foods?				
Very well	8	5	15	46
Reasonably well	55	30	43	49
A little	32	56	31	3
Not at all	5	10	7	3
Would you consider buying probiotic functional foods to help reduce the risk of food poisoning?				
Definitely	24	5	18	31
Probably	21	20	23	43
Maybe	41	54	28	17
No	14	20	22	9
Don't know	-	-	8	-

All figures are 'valid percent' figures

3.6 Analysis

Next, analysis was conducted in order to investigate whether there are variables that are related to the frequency of purchase of functional foods, level of self-reported knowledge of functional foods, and potential interest in purchasing probiotic functional foods to help reduce the risk of food poisoning. All the findings reported below are those relationships that were shown to be statistically significant.

Regularity of functional food purchase

In the UK, those who never cook from scratch, purchase functional foods most frequently. However, this finding should be treated with caution because of the small number of respondents who never cook from scratch (only 3%).

In Denmark, those respondents living in a household where someone has suffered from food poisoning in the last 12 months, respondents who do not live alone, or respondents who do not know a correct food source of clostridium botulinum, are likely to purchase functional food items more frequently. Those Danish respondents with the highest level of education (i.e. second degree – masters or PhD equivalent) are likely to buy functional foods least frequently.

In Spain, those respondents who live with other people are likely to buy functional food items more frequently. In Spain, respondents who know a correct food source of clostridium perfringens are likely to buy functional foods most frequently. However, these results should be treated with caution because there are very few people in the 'correct' category (only 3%).

In Poland those respondents who know a correct food source for listeria monocytogenes are likely to buy functional food items most frequently. However, these results should be treated with caution because of the small number of correct responses (only 4%). Those Polish respondents who know a correct food source for shigella (6% of responses) are likely to buy functional food items most frequently.

Understanding of functional foods

In the UK, if the respondent knows a correct food source of salmonella, listeria monocytogenes, ecoli 0157, bacillus cereus (3% of responses), or clostridium botulinum (6% of responses) then they are more likely to have a higher level of self-reported understanding of functional foods. In the UK if the respondent has had some formal food safety education or training, is female or is aged 45-64 years, then they are more likely to have a higher level of self-reported understanding of functional foods. In the UK if the respondent is under 25 years or over 65 years they have the lowest level of self-reported understanding of functional foods. Those UK respondents whose occupation is classed as non-manual professional or non-manual managerial and technical have the highest level of self-reported understanding of functional foods.

Those Danish respondents who do not know a correct food source for salmonella express the highest level of self-reported knowledge of functional foods. In Denmark, those respondents who have had some formal food safety training or education are likely to express a higher level of self reported knowledge of functional foods.

In Spain, women or those respondents who do not have children living at home are likely to express a higher level of self-reported knowledge of functional foods than are men. Those Spanish respondents whose job classification is either partly skilled or unskilled are likely to express the highest level of self-reported knowledge of functional foods.

In Poland, those respondents who agree with the statement “I am likely to act on food safety information”, those respondents without children living at home, or those respondents who are currently unemployed or who are a housewife or househusband with no paid occupation, are likely to have the highest level of self-reported knowledge of functional foods.

Would respondents consider buying functional foods?

In the UK if someone in the household has suffered food poisoning in the last 12 months, or if there are children living at home, then the respondent is more likely to consider buying functional foods to reduce the risk of food poisoning.

In Denmark, those respondents who have never had any formal food safety training or education, and respondents who do not know a correct food source for bacillus cereus (4% do know) are more likely to consider buying functional foods to help avoid food poisoning.

In Poland, those respondents who know a correct food source for food-borne viruses are least likely to consider buying functional foods to help avoid the risk of food poisoning

4. Discussion

Differences between countries

Response rates in all four countries were above 20% (between 22% and 28%) and were slightly higher in the two countries where the questionnaire was conducted by post and not telephone.

Results show that in Poland and Spain there is a higher percentage of households (90%) where women are responsible for the majority of the cooking. It is lowest in Denmark (68%). This suggests that the traditional gender-based domestic roles remain strongest in Spain and Poland but persist in all countries.

In terms of household structure, in all four countries the majority of people live with other people (over 70%) but again there is some inter-country variation with Denmark being the lowest and Spain the highest. There was quite a large variation in the percentage of households with children, with Spain and Poland having the highest percentages (71% and 66% respectively) and the UK and Denmark having lower percentages (54% and 41% respectively).

The social differences are also demonstrated when considering employment status. Again it is the UK and Denmark that are similar to each other, with 58% and 64% in full- or part-time employment, respectively, but different to Spain and Poland, with 46% and 40% in full- or part-time employment, respectively.

Although it is not the purpose of this study to conduct an analysis of social differences between member states in the EU, these findings suggest that differences exist in household structure and social conditions, which may in turn affect consumer purchasing behaviour in individual countries.

The role of information provision may be important to consumers and the choices they make with regard to food safety and the purchase of food products. The results to this study suggest that more consumers in the UK and Denmark (80% and 85%) are likely to be receptive to some kinds of food-related information and to act on them, than in Spain and Poland (64% and 61%). This may relate to issues such as trust in information sources and regulatory authorities, and the extent and tradition of information provision from governing bodies.

There were considerable differences in the percentage of respondents who had received some formal food safety education or training. This was highest in the UK (48%), and lowest in Poland, where only 16% had received any formal food safety training. This may be due to a longer history of more stringent regulation in the food industry in the UK and is a situation likely to change in Poland now that it is a member of the EU.

Although it was noted earlier that some considerable differences remain in terms of household structure and society, the percentage of people who claimed to cook from scratch at least three times per week, was similar between countries. It was lowest in the UK (74%) and highest in Spain (88%). These figures are unlikely to reflect the general population as it is likely that self-selection bias exists among respondents. That is, people who responded are likely to have a greater interest in food and food related issues.

Experience of food poisoning in the households of respondents was low and consistent across all countries, with between 3% and 7% indicating that someone within their household had suffered from food poisoning in the previous 12 months. However, it is recognised that food poisoning often goes unreported and undiagnosed. It is unlikely that people consistently consider 'an upset stomach' or other temporary illness that could be food-related, to be a case of food poisoning.

Knowledge of the food sources associated with certain pathogens, food-borne viruses and food-related micro-organisms was an area of the results where considerable differences were identified between countries. However, knowledge of pathogen sources was generally low. There is only one pathogen (salmonella) where more than 70% of respondents in all four countries correctly identified an associated food source. This was lowest in the UK (72%) and highest in Spain (91%). There were only four more pathogens where more than 10% of respondents in at least one country correctly identified an associated food source. These were ecoli 0157 in the UK, Denmark and Poland; listeria monocytogenes in the UK and Denmark; campylobacter in Denmark; and clostridium botulinum in Denmark and Spain. The greater familiarity with these pathogens is likely related to food poisoning incidents reported in the media.

The above findings were investigated to see whether and how they related to purchase of functional foods, knowledge of functional foods and intention to purchase functional foods.

Functional foods

The key findings relating to functional foods are presented here. Two thirds of UK respondents, just less than half of Danish respondents, almost two thirds of Spanish respondents, and 88% of Polish respondents say they buy one or two functional food items per week. In terms of self-reported knowledge of functional foods, between 30-55% of respondents say they understand functional foods reasonably well (UK 55%; Denmark 30%; Spain 43%; Poland 49%). Results suggest that in the UK, Spain and Poland there is a range of functional food products that are familiar to, and popular with, a relatively high percentage of consumers. However, results suggest that the Danish market for functional foods is relatively small and restricted to a small number of types of functional foods. For example, 46% of Danish respondents stated that they never buy functional foods. This is much higher than in the other

three countries. There is also a much greater percentage of Danish respondents who stated that they understood functional foods only a little or not at all (66%). The corresponding figure from the Polish results is 6%. These are interesting results that warrant further investigation to uncover the reasons for the differences.

Purchase of functional foods

There is a range of factors found to be related to the regularity of purchase of functional foods (note that these results are not consistent across all four countries – see the results section above for details). Those who never cook from scratch purchase functional foods most frequently. This may be explained by the fact that those who cook from scratch least frequently are likely to buy many more types of processed foods and fewer ‘basic’ and ‘natural’ ingredients.

Respondents from a household where someone has suffered food poisoning within the previous 12 months purchase functional foods most frequently. An assumption could be made individuals from households that have suffered food poisoning are likely to employ actions in order to avoid the same experience. What the results do not demonstrate is whether functional food purchase behaviour changed as a result of the food poisoning incident. This would be an interesting question to investigate.

There appears to be a somewhat complicated relationship between knowledge of pathogen sources and frequency of functional food purchase. In some cases those who lack knowledge of correct food sources for certain pathogens purchase functional foods most frequently. In other cases it is those who do know the correct food sources for certain pathogens who purchase functional foods most frequently. Thus findings are inconclusive about the role of knowledge of pathogens in influencing purchase of functional foods.

Finally, those respondents with the highest level of education purchase functional foods least frequently. It may be that they are more sceptical of new foods and food claims but this point would need further investigation for substantiation.

Self-reported knowledge of functional foods

Those respondents who demonstrate correct knowledge of food sources for a number of pathogens have a higher level of self-reported knowledge. Although self-reported knowledge is not the same thing as actual knowledge this finding suggests that in the majority of cases peoples’ assessment of their own awareness of functional foods may be realistic. However, this relationship was not consistent across all countries and in Denmark those respondents who did not know a correct food source for the pathogen salmonella expressed the highest level of self-reported knowledge of functional foods. If there is a correlation between knowledge of pathogen sources and understanding of functional foods then these respondents may not have the level of understanding to which they lay claim. It may also be dependent on how products are promoted and advertised in different countries.

Respondents who had had some formal food safety education or training expressed a higher level of self-reported knowledge of functional foods. This suggests a greater confidence in personal knowledge that may not be totally unfounded.

Females expressed a higher level of self-reported knowledge of functional foods. This may be because, as results show, in a majority of households women are responsible for the majority of the cooking and thus foods are likely a subject with which they are more familiar.

The age of the respondent was found to be related to levels of self-reported knowledge of functional foods. Specifically, those aged 45-64 had a higher level of self-reported knowledge and those under 25 or over 65 had the lowest level of self reported knowledge. The reasons for this are unclear as age was not found to be related to actual purchase of functional foods, hence there is no suggestion that certain age groups have more experience of functional foods.

Results relating to occupation show a mixed relationship to self-reported knowledge of functional foods. For example, in some countries those working in professional and managerial or technical posts express

the highest level of self-reported knowledge, while in others it is those in partly skilled or unskilled jobs or who are unemployed, a housewife/husband, or in no paid occupation who have the highest level of self-reported knowledge of functional foods. These results suggest that occupation is not a key determining factor of the level of self-reported knowledge of functional foods.

Those respondents who agree with the statement 'I am likely to act on food safety information' express the highest level of self-reported knowledge. It may be that this group of respondents are generally more open to information about food and food products and thus feel well-informed about food-related issues, including functional food products.

Intention to purchase probiotic functional foods

A number of factors were found to be related to respondents' stated intention to purchase probiotic functional foods. If someone in the household had suffered food poisoning in the previous 12 months then the respondent is more likely to consider buying functional foods to help reduce the risk of food poisoning. This finding is perhaps intuitive. A household that has recently experienced food poisoning is more likely to be open to products that may help to avoid similar experiences in future.

If there are children living at home then the respondent is more likely to consider buying functional foods to help reduce the risk of food poisoning. Many previous studies have found that households with children take a greater interest in the health and safety of food products.

Those who have never had any formal food safety training or education are more likely to consider buying functional foods to help reduce the risk of food poisoning. This may be because those who have had some formal food safety training or education are more confident about their own knowledge and practices regarding food safety and thereby feel that they do not need to consider buying products that help avoid the risk of food poisoning.

The findings related to knowledge of pathogen sources seem to suggest that those with least knowledge of pathogens are most likely to consider buying probiotics to help avoid the risk of food poisoning. This again may relate to the fact that those with more knowledge are more confident in their own ability to understand conditions and behaviour likely to lead to food poisoning and therefore are not as likely to feel the need to buy products that could help avoid food poisoning.

5. Conclusions

The findings show that there is a range of factors such as frequency of cooking from scratch, personal experience of food poisoning, knowledge of pathogens in food, and socio-demographic variables that are related to the regularity of functional food purchase.

Likewise, the findings suggest that there is a range of factors such as knowledge of pathogens in food, level of food safety-related education, likely behaviour change in response to food safety messages, and socio-demographic variables that are related to respondents' self-reported level of understanding of functional foods.

Further, the findings suggest that there is a range of factors related to personal experience of food safety issues, food safety-related knowledge, food safety-related education, and socio-demographics that impact on respondents' potential interest in buying probiotic functional food products to help reduce the risk of food poisoning.

Importantly there are significant differences between countries in the majority of cases.

As the literature review revealed, trying to identify consistent components of consumer purchase behaviour models is problematic, as purchase decisions are based on a complicated interplay of

components that are both individual and cultural. Further study with additional populations would be informative to help comprehend the development of this relatively new food market.

Overall, the findings provide up-to-date information about consumers and the developing functional foods market.

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