

# Identifying what influences the shopping habits of food hypersensitive consumers; an island of Ireland study



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Summary document

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# 1 Background

Food hypersensitivity is an increasingly important public health issue globally. It covers a broad range of adverse reactions to food, many involving an immune response. For the purposes of this study, “food hypersensitivity” can be narrowed down to food allergy, food intolerance and coeliac disease. (Coeliac disease is an autoimmune condition in which the small intestine is hypersensitive to gluten. Gluten is a type of protein that is found in wheat and related grains.)

Robust estimates are available for the prevalence or extent of food allergy and coeliac disease on the island of Ireland (IOI). Recent research has shown that food allergy rates, at least in the Republic of Ireland (ROI), reflect those in the United Kingdom (UK): 1 to 2% of adults and 5 to 8% of children are affected (Bock, 1987; Jansen et al., 1994; Young et al., 1994; O’Donovan et al., 2015). The prevalence of coeliac disease is generally given as 1% of the population. Prevalence estimates are available for some food intolerances in the general population, such as lactose intolerance at 5% (Fielding et al., 1981). However, many other food intolerances remain undefined and, as such, accurate estimates of their prevalence are not possible. Some authorities put the overall prevalence of food hypersensitivity at up to 35 or 40%.

A certain amount of research has been carried out to determine the impact of food hypersensitivity on health and quality of life. The key impacts of living with food hypersensitivity are summarised here.

- Risk perception is unique to the individual and differs between parents, children, adolescents and adults. Adults are more cautious in their everyday lives, especially when they become parents, and teens generally the least cautious.
- Many consumers with food hypersensitivity, and particularly food allergy, take deliberate risks, especially teenagers.
- Subjective or personal perception of risk, often driven by word of mouth (and often online), can also influence food choices.
- Some of the strongest and most adverse impacts on health-related quality of life relate to social and dietary restrictions. These impacts include fear of new foods, new people and new places, as well as concerns around labelling.
- Many individuals and parents avoid enjoyable activities such as dining out, travelling and shopping.
- Anger, embarrassment, feelings of frustration and anxiety are some of the psychological outcomes of living with food hypersensitivity.

- Many consumers with food hypersensitivity feel different from others because of their condition, annoyed at having to follow a strict diet and embarrassed at having to bring their own food to social occasions.

Some research has also been carried out to understand how food hypersensitive consumers make buying choices. This is summarised here.

- The primary risk management strategy for the prevention of a food hypersensitivity reaction in a person is an “avoidance diet”. Therefore, communication of potential risk through product labelling is essential. Food hypersensitive consumers (and their parents or guardians) are avid readers of the ingredients label.
- Food hypersensitive consumers trust well-known and reputable brand names more than less well known brands. This is because the well-known brands are perceived to be associated with stricter safety standards during the manufacturing process.
- Large companies such as chain supermarkets are more trusted because they are perceived to be strongly motivated to protect their reputations. People assume large companies have enough resources to carefully check their products for allergenic ingredients.
- There are also extra costs in adhering to an avoidance diet. For example, gluten-free products are more expensive than their wheat-based equivalents.

Regulation (EC) 1169/2011 obliges food producers and providers to make information about key food allergen ingredients available to their customers. This is to happen both at the point of decision making (e.g. on product labelling or on the menu) and when the food is delivered (e.g. by a catering company or takeaway food outlet). However, the Regulation does not fully address the issue of allergen cross contamination. This information is provided by food businesses voluntarily through the application of “precautionary allergen labelling” (PAL), which contains a warning statement to the consumer.

The lack of any agreement on the wording of such statements is confusing for food hypersensitive consumers. They must work out what message is being conveyed as best they can. This limits their food choices and can lead to increased risk taking (FSAI, 2011). The impact of PAL is summarised here.

- Many food producers use PAL (e.g. labels that say, “May contain X”) to alert consumers to the possible unintended or accidental presence of allergens. The use of PAL is voluntary and is not covered specifically by existing legislation, although it has been argued that general food safety law applies.
- PAL has been devalued through perceived overuse and inconsistent application. It is therefore limited as a risk communication tool.
- Overuse of PAL could further limit an already restricted diet. More seriously, it could lead consumers to ignore the advisory notice altogether and take more risks when choosing food products. It may also lead to consumers avoiding food products that are safe for them to eat.
- Ignoring PAL advice can lead to unintended risky behaviour when consumers continue to freely consume the product. Confusion can also arise when food manufacturers suddenly introduce PAL on a

product. Some consumers may consider the change has been made purely for legal liability reasons to protect the food manufacturer, and so ignore the warning.

- 40% of respondents with food allergy rated labelling characteristics as a “serious” or a “very serious” problem. They express particular concerns relating to different terms or technical words for ingredients, changes in ingredients, the source of ingredients, and spices and flavours not specifying allergenic ingredients.
- Consumers respond to uncertainty around labelling by being very selective in their food purchases. This gives rise to extra costs, anxiety and impaired quality of life.
- Consumers believe that variations in PAL statements reflect a hierarchy, or different levels, of risk of reaction. For example, people believe that a label saying “May contain X” indicates a higher risk than a label saying “May contain traces of X”.
- Food hypersensitive consumers favour a user friendly and clear label information format.
- Improving the effectiveness of food labelling will not be achieved by simply increasing knowledge about the labels. It will be achieved by changing consumers’ attitudes through highlighting the consequences of risk-taking behaviours.
- Aligning PAL statements with the actual level of risk would greatly enhance patients’ management of food allergy by allowing them to make informed decisions
- PAL should only be used after a thorough assessment of the risk of allergen cross contact. PAL should *not* be used as a substitute for good manufacturing practice or as a generic disclaimer against legal liability.

This investigation sets out to identify the factors that underpin the food purchasing choices of food hypersensitive consumers on the IOI. These include the obstacles such consumers face in this regard and the level of trust they have in food suppliers. Their food hypersensitivity undoubtedly impacts significantly on their quality of life in terms of social, dietary and psychological factors. Research that links together all the stakeholders involved on the IOI will benefit food hypersensitive consumers and improve food supplier best practice.

## 2 Methods used

- The databases explored for the published literature review were PubMed, Science Direct, Embase and Google Scholar. The search terms were “food allergy”, “food intolerance”, “coeliac disease” and “food hypersensitivity”.
- **Survey 1** was a consumer focussed online questionnaire about the efficiency of food labelling, which was distributed by several universities on the IOI through email and social media (administered by SmartSurvey™). The minimum number of respondents necessary for valid analysis was determined to be 138. The online survey of attitudes to food labelling returned 623 valid responses, the majority (84%) of which were female. Respondents were aged between 15 and 73, with an average age of 37. 19% had a food allergy and 44% had a food intolerance, while 13% had coeliac disease. A quarter of respondents were parents of children with either food allergy (54%) or intolerance (46%). 65% of respondents had a previous reaction to an allergen and around half had been medically diagnosed as allergic.
- To gather the experiences and knowledge of patient support groups in other countries, their websites were accessed. **Survey 2**, a questionnaire, was sent to European patient support organisations in Belgium, Denmark, France, Germany, Greece, Italy, Norway, Spain, Sweden and the UK. It was also sent to the European Federation of Allergy and Airway Diseases Patients’ Associations. This was accomplished through the European Academy of Allergy and Clinical Immunology Patients’ Organisation Committee.
- “*Free from*” foods are products that do not contain particular allergens. For example, bread made using flour that contains no gluten may be called “free from gluten”. To investigate *free from* foods produced on the IOI, government, trade and trade support organisation databases, as well as business reports, were reviewed. This review was supported by a questionnaire, **Survey 3**, which was targeted at food manufactures in the ROI, NI and the UK (administered by SmartSurvey™).
- An investigation into PAL was conducted online and supported by a questionnaire, **Survey 4**, which was sent to food companies on the IOI and in the UK (administered SmartSurvey™). The research was also supported by a number of short interviews with key executives of some businesses and organisations.
- **Survey 5**, a questionnaire on the availability of food allergen tests, kits and services provided to the IOI, was sent to international companies and research organisations. 30 organisations were contacted, seven replies were received and three of these agreed to be interviewed by telephone.
- A questionnaire, **Survey 6**, was developed to gather the opinions and experiences of analysts with regard to allergen analysis (administered by SurveyMonkey®).

# 3 Investigation findings

## **Behaviour, practices and barriers of food hypersensitive consumers when procuring food: Survey 1, the efficiency of food labelling**

- Food hypersensitive consumers prefer to shop in the larger supermarkets. They rarely use local convenience shops or food stalls and most do not shop online.
- Both food allergic and food intolerant consumers rely on labelling when deciding to buy a food product, even though generally unsatisfied with the reliability and adequacy of labelling. This is particularly true if someone has been medically diagnosed, as they are more concerned about the safety and healthiness of the food they eat.
- When choosing to buy a food product, the quality of labelling, particularly the clarity, is the most important consideration for consumers. This is followed by previous experience with that product, and, to a lesser extent, brand trust and freshness.
- The preferred PAL statement is, “Not suitable for someone with X allergy”. The second preference was for “May contain traces of X”, followed by “May contain X” and “Packaged in a facility that also processes X”.
- The older the age of the respondent, the greater the emphasis on the safety and wholesomeness of food, particularly if they are parents.

## **Experiences and lessons to be learned from other countries: Survey 2**

In investigating the websites of European and worldwide patient support and non-governmental organisations for food hypersensitive consumers, these points were noted.

- The websites of patient support organisations, for the most part, concentrate on medical and safety issues, including diagnosis, treatment and nutrition.
- An Anaphylaxis Australia member survey in 2003 identified problems in understanding allergen labelling.
- The majority of Anaphylaxis Australia members contact food manufacturers for more information on their products.
- 96% of Anaphylaxis Australia members surveyed avoid food products that are labelled as containing a specific allergen. 80% of respondents avoid food products that “may contain” a specific allergen.
- Anaphylaxis Australia members wanted a standardisation of PAL statements.

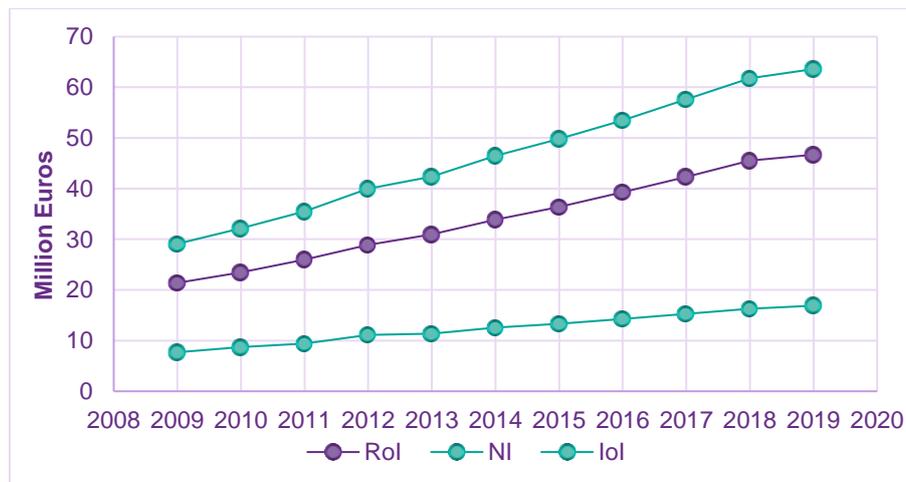
- An Italian patient support organisation identifies PAL as being problematic.
- A response to the survey was received from the Anaphylaxis Campaign (UK). Their main concerns were
  - A lack of knowledge and understanding that exists in catering outlets, resulting in incorrect and dangerous information being given.
  - A lack of knowledge and understanding amongst some members of the general public.
  - Inconsistencies in the application of PAL. The Anaphylaxis Campaign recommends using PAL only after carrying out a thorough risk assessment.

## Market and industry analysis of “free from” foods on the island of Ireland: Survey 3

### Sales value of “free from” food on the island of Ireland

- Sales of *free from* products increased by 37.5% between 2009 and 2014 in IOI, with the ROI accounting for 73% of the market. Projections show that sales will double by 2019, reaching €63.6 million (Mintel, 2013; Mintel, 2014). (See Figure 1.)

Figure 1: Sales value and projected sales of *free from* foods between 2009 and 2020



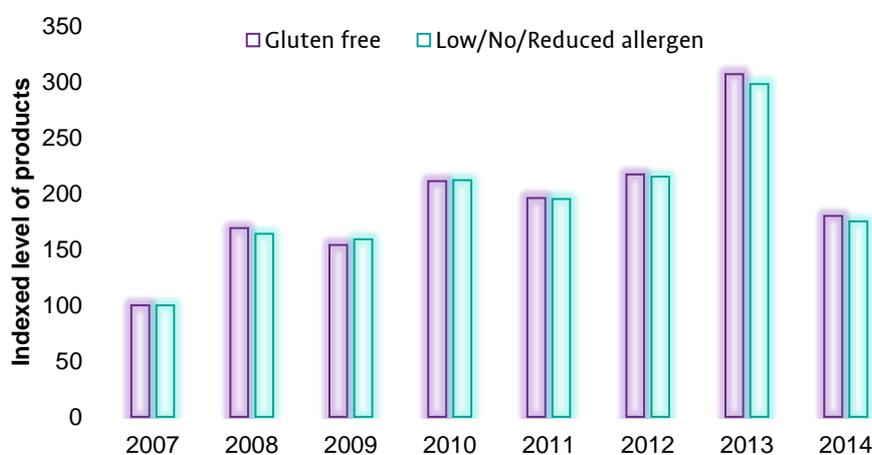
- Market share of *free from* products increased in the same period by 60%, although still accounting for only 0.5% of overall grocery sales. Market values in NI showed a 53% increase, reaching €12.6 million, compared with €33.9 million for the ROI, which showed growth of 58% (see Table 1).

Table 1: Sales of *free from* food as a percentage of the grocery market between 2009 and 2014

Year	<i>Free from</i> food		Overall grocery market	
	€m	€m	Percentage of total grocery sales	
2009	29.1	14,811	0.19	
2010	32.2	14,698	0.21	
2011	35.5	14,158	0.25	
2012	40.0	13,575	0.29	
2013	42.4	13,716	0.31	
2014 (est.)	46.5	13,828	0.34	

- These figures probably reflect the increase in the general consumption of *free from*, particularly gluten-free, products.
- Future growth is expected to be less pronounced, as the higher cost of some *free from* foods will dissuade more non-hypersensitive consumers from buying these products (Mintel, 2014).
- Between 2007 and 2014, new *free from* products were launched in the UK and the ROI, and not just for the gluten-free market. The highest number of product launches was in 2013, at 605 (Figure 2).

Figure 2: Number of *free from* and reduced allergen products launched between 2007 and 2014



- The “snack” and “bakery” categories have consistently dominated the *free from* product launches between 2007 and 2014. Other important categories were “dairy” and “sauces and seasonings”. Baby food experienced a significant reduction during this period of around 56% (see Table 2).

**Table 2: New *free from* products by food category as a percentage of products launched in 2007, 2013 and 2014**

<i>Free from</i> food category	Percentage of new products launched		
	2007	2013	2014
Snacks	15	11	14
Bakery	15	14	14
Dairy	5	11	11
Sauces and seasonings	14	13	10
Processed fish, meat and egg products	1	7	9
Baby food	16	9	7
Desserts and ice cream	5	4	5
Meals and meal centres	4	3	4
Side dishes	4	5	4
Chocolate and confectionery	4	5	3
Other	17	18	19

- Companies are responding not only to interest from consumers who do not wish to eat meat, for example, or those who may be hypersensitive to it. Businesses are also increasingly launching products that are suitable for consumers with gluten or wheat intolerance.
- In all, almost 5,000 *free from* food products were launched in the UK and the ROI between 2009 and 2014 (Table 3).

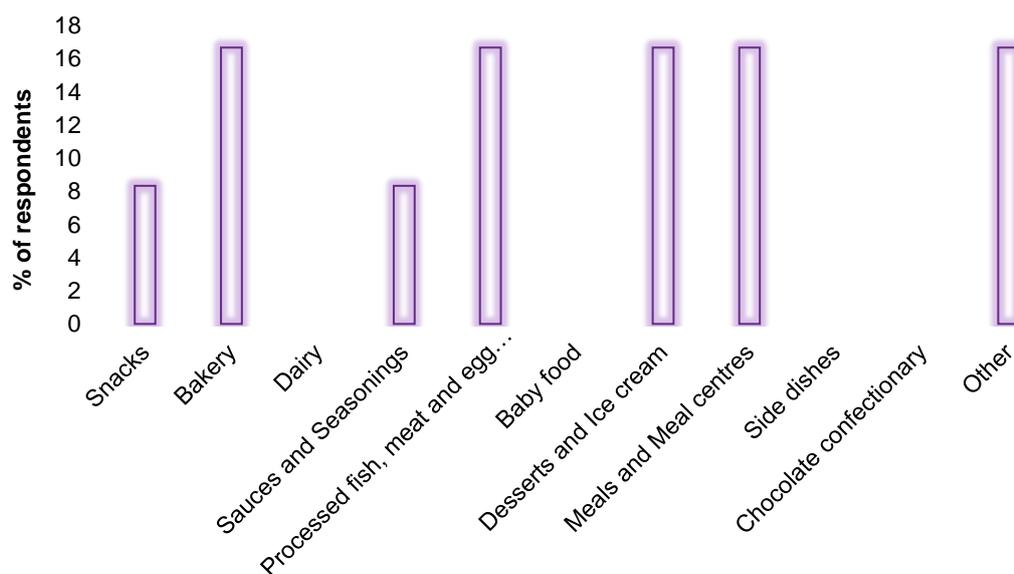
**Table 3: Number of new *free from* food products launched between 2009 and 2014 by company type**

Type of company	Code	New free from products launched						Total
		2009	2010	2011	2012	2013	2014	
Low cost large retailer	R1	46	112	36	8	20	3	225
Premium product large retailer	R2	5	15	23	27	75	52	197
Average cost large retailer	R3	8	26	48	48	15	5	150
Multinational company specialising in soups, dressings and snacks	P1	14	22	14	22	25	11	108

Average cost large retailer	R4	31	34	21	4	6	9	105
Average cost large retailer	R5	8	15	18	11	16	20	88
Average cost large retailer	R6	2	17	24	3	23	5	74
Large private company with alternatives to milk, yogurt, cream, meat and margarine	P2	1	14	10	17	14	7	63
Large company specialising in baby food products	P2	12	7	17	12	6	1	55
Large private company gluten-free food supplier	P3	6	12	11	1	0	0	30
Other companies		527	609	588	742	1,040	617	4,123
<b>Total</b>		<b>614</b>	<b>771</b>	<b>774</b>	<b>887</b>	<b>1,220</b>	<b>727</b>	<b>4,993</b>

A survey of food manufacturers in the ROI, NI and the UK showed they produce a wide range of *free from* food products (Figure 3).

**Figure 3: Number of *free from* products manufactured in the ROI, NI and the UK by food category between January and August 2014.**

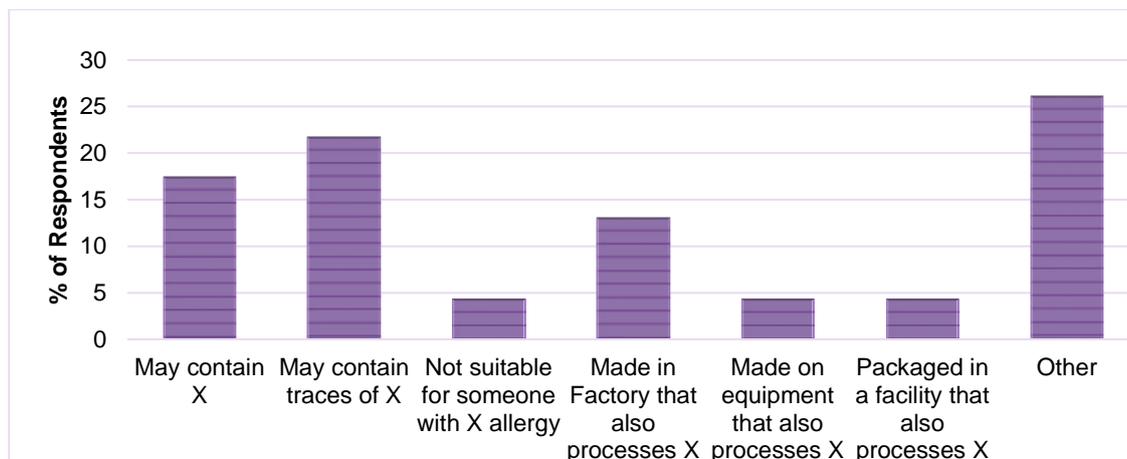


- 83% of food manufacturers in the ROI and the UK said they have no plans to export their *free from* products, indicating limited export potential of these products from the IOI.
- Information on the volume of *free from* products produced and the export markets was considered commercially sensitive and so food businesses were not willing to share this information.

#### **Food manufacturers and precautionary allergen labelling (PAL): Survey 4**

- In most countries, PAL is voluntary and not required by legislation (except Switzerland, Japan, Argentina and South Africa). However, the use of PAL is increasing year-on-year.
- Food manufacturers in Ireland and the UK were surveyed as to why they use PAL. The main reasons given were;
  - uncertainty of allergen thresholds (35% of respondents)
  - lack of clarity over standards in applying PAL (18%)
  - fear of litigation (18%)
  - lack of information from suppliers (18%)
  - loss of reputation (12%)
  - flexibility in supply chains (6%) and
  - flexibility in production (6%).
- Several factors lead to the use of PAL, the most important being the uncertainty of allergen thresholds – how much could trigger an adverse reaction in a food hypersensitive consumer.
- In a survey of food manufacturers, cereals containing gluten were used by approximately 80% of respondents. Milk and wheat were the second most used ingredients by around 65% of respondents. Sulphites, soybeans and eggs were also used by around 53%, 57% and 46%, respectively. Other allergenic ingredients were also used but to a much lesser extent, including peanuts, tree nuts, celery, fish, shellfish and sesame.
- 50% of food manufacturers use PAL for milk, 44% for soybeans and 39% for cereals containing gluten and wheat.
- Most food manufacturers (68%) did not go to regulators to get advice on using PAL.
- 83% of food manufacturers said that the PAL wording they used complied with a standard (e.g. the British Retail Consortium).
- Food manufacturers gave their preferred precautionary allergen statements, “May contain X” and “May contain traces of X”, at 21.8% and 17.4%, respectively (see Figure 4). The Food Standard Agency’s best practice guidance recommends using either “May contain X” or “Not suitable for someone with X allergy” (Food Standards Agency, 2011). However, these two categories represented just 22% of the total responses.

**Figure 4: Manufacturers' preferred precautionary allergen statements**



- 63% of food manufacturers claim they perform a risk assessment before using PAL. This may be due to the high cost of carrying out thorough allergen risk assessments.
- There is no standardisation across food sectors with regard to PAL use.
- The production process will influence how likely a company will resort to PAL. For example, it is harder to clean a “dry” production process such as bakery or dried powder system compared with a “wet” production process such as milk or soups.
- The FSAI carried out a survey of PAL in 2011. This showed that 11% of food products that did not have PAL contained detectable levels of food allergens, while a staggering 93.5% of food products with PAL did not contain that allergen. Therefore, there seems to be little correlation between the wording of the PAL and the risk of cross contamination with allergens.

## Testing for food allergens on the island of Ireland

### Testing companies survey: Survey 5

- A questionnaire to international companies who provide analytical kits and services on the IOI was returned by a total of seven companies. All of them will sell kits to the IOI or accept samples for analysis from the IOI. They are
  - Indoor Biotechnologies
  - Exova
  - Morinaga Institute of Biological Science
  - R-Biopharm AG
  - BioCheck
  - Romer Labs
  - Public Analyst's Laboratory.

- These companies provide the following services.
- Five companies test food samples.
- Five companies sell kits for testing food samples.
- Three companies test food samples and sell kits.
- One company provides other services.
- The companies use these methods for allergen analysis.
- All companies use ELISAs (enzyme-linked immunosorbent assays) to detect and quantify allergens.
- Four companies use an LFD (lateral flow device).
- Two companies use DNA/PCR (polymerase chain reaction) methods.
- Four companies use other methods in addition to the above (Luminex xMAP, enzymatic methods, the Tanner method for sulphites and ion chromatography for lactose).
- Five companies use ELISAs based on monoclonal primary antibodies, while four companies use ELISAs based on monoclonal secondary, polyclonal primary and polyclonal secondary antibodies.
- In most cases the antibodies are raised in animals on a diet that is *free from* allergens.
- Six companies indicated their ELISA methods identify purified allergen protein, while five companies provide ELISAs that detect crude allergen extracts.

The allergen tests offered by these companies are set out in Table 4.

**Table 4: Number of companies offering certain allergen tests on the IOI**

Allergens	Number of companies offering tests	
Crustacean (e.g. crab, lobster, shrimp), unspecified	6	
Shrimp or prawn	1	
Crab	1	
Lobster	1	
Crayfish	1	
Eggs	3	
Molluscs (e.g. shellfish, octopus, snails)	1	
Wheat	4	
Rye	3	Test
Barley	3	
Fish, unspecified	3	
Gluten (a protein found in wheat and related grains)	4	
Lactose (a sugar found in milk)	2	
Galactose (a type of sugar)	1	
Casein (a protein found in milk)	1	
Peanut	1	
Soya	1	
Hazelnut	1	
Sulphur Dioxide (SO <sub>2</sub> )	1	

methods are readily available for 71% (22 out of 31) of the common allergenic foods that are subject to EU legislation (see Table 5). No pricing information on tests was given by the respondents to this survey.

**Table 5: Availability of allergen tests on the IOI**

Annex II entry	Allergen	Method or test available?
Cereals containing gluten and products of these cereals	Wheat	✓
	Rye	✓
	Barley	✓
	Oats	✓
Crustaceans and products containing these crustaceans	Shrimp or prawn	✓
	Crab	✓
	Lobster	✓
	Crayfish	✓
Eggs and products containing egg	Egg	✓
Fish and products containing fish	Fish	✓
Peanuts and products containing them	Peanuts	✓
Soybeans and products containing them	Soybeans	✓
Milk and products containing milk	Skimmed milk powder	✓
	Cheese	✓
Nuts and products containing these nuts	Almond	✓ Note 1
	Hazelnut	✓
	Walnut	§
	Cashew	§
	Pecan	✓
	Brazil	§
	Pistachio	§
	Macadamia	§
Celery and products containing celery		§
Mustard and products containing mustard		§
Sesame seeds and products containing them		§
Sulphur dioxide (SO <sub>2</sub> ) or sulphites		✓
Lupin and products containing lupin		§
Molluscs and products containing these molluscs	Mussels	✓
	Scallops	(✓)
	Cockles	(✓)
	Oyster	(✓)
	Clam	(✓)
<b>Total</b>	<b>31</b>	<b>22 ✓ or (✓)</b>

Key

✓ Test available on the IOI

(✓) Test available for mollusc is presumed to react to the listed species

§ Test advertised but not claimed to be available (unprompted) by respondents

Note 1 Almond tests are available but known to cross react with other Prunus species (e.g. plums, cherries, nectarines, apricots and peaches).

### Analytical considerations: Survey 6

- Five companies said all their allergen detection and analysis methods were validated, while two companies confirmed that some of their methods were validated. Four companies had published their validations.
- Two companies employ DNA-based methods. Both investigate matrix PCR inhibition and optimise the extraction for recovery of allergenic protein or DNA. One company indicated that the size of the detected genome is known.
- None of the companies used LC-MS (liquid chromatography–mass spectrometry) methods for allergen analysis. (Eurofins, which did not take part in the survey, deploys an LC–MS based assay for some allergens.)
- 86.8% of respondents mentioned that allergen analysis was “very important”, with 13.2% indicating it was “somewhat important”.
- 10.5% of respondents indicated the trend in food allergen analysis was “increasing a lot”, 65.8% “increasing”, and 23.7% replied “neutral”.
- Concerning carrying out food allergen analysis to quality criteria, 2.6% found this extremely difficult. 42.1% found this difficult, 52.7% were neutral and 2.6% of respondents found this very easy.
- 45.9% of respondents said that reference or quality control materials for food allergen analysis are “available but with reservations as to usefulness or credibility”. Only 5.4% replied that such materials are “readily available, useful and credible”.
- Regarding the confirmation of the presence of a food allergen by using a different technique, 73% of respondents replied that this is “very difficult” or “slightly difficult”. Only 2.7% of respondents replied that this is “easy”.
- For most methods (83%), applicability, selectivity, sensitivity, limit of quantification and reproducibility were addressed. Only 67% of respondents displayed an awareness of “measurement uncertainty”. The “ruggedness of a method” – how well it stands up to examination – was not really addressed.

### Analysts’ opinions and experiences

- Three respondents were interviewed from 1) an international general analytical service provider with a food division, 2) an international ELISA manufacturing company and 3) an ROI Public Analyst laboratory.

- In general, a mixture of both proteins and groups of proteins are detected depending on the matrix (the system used to grow or develop the food test) and the allergen or analyte (the substance to be detected). Examples given were: the various prolamins (proteins found in cereals); Ara h1 (another seed storage protein); ovalbumin and ovomucoid (types of protein found in eggs);  $\beta$ -lactoglobulin (whey protein found in cow and sheep's milk), and  $\alpha$ -,  $\beta$ - and  $\kappa$ -Caseins (milk proteins).
- The commercial ELISAs used typically target one of those proteins through a monoclonal antibody; the result is then scaled up to try to represent the allergenic food. The outcome depends on how the ELISA has been calibrated by its vendor. For example a whole egg powder may have been used to calibrate an egg ELISA, so the results, no matter what fraction of egg (e.g. whole, yolk or white, powder) is actually present in the sample, are calculated as "whole egg". This may be misleading as to the quantity of allergen present unless corrected for by a knowledge of the ingredients or the formulations and accepted conversion factors.
- Kits can detect either the allergen or a non-allergenic marker. It is not always clear from the product literature what is actually detected by the kit. It may be necessary to contact the company for more information.
- It may not be clear how to extrapolate readings to the whole food sample – how to scale up the results and gauge their relevance. This is important as contamination by the whole food may not be the issue, for example contamination by defatted peanut flour rather than by whole peanuts.
- DNA-based or PCR methods are not suitable for detecting certain allergens such as milk – for example, if the detection of cow DNA does not necessarily mean that milk protein is present in a sample.
- Gliadin (protein found in gluten) is thermostable – it is not affected by heat – while egg and milk protein allergenicity can be reduced by thermal processing (the application of heat). The allergenicity of raw peanut is lower than that of roasted peanut.
- Kit users are almost never told about the impact of processing on allergenicity in the kit insert. For example, there is no information offered where the ELISA is calibrated with roasted peanut flour but the sample may contain raw peanut. Or where whole egg powder is the calibrant, how test readings relate to raw egg.
- The issue of testing for hydrolysates (proteins that have been partially broken down) applies mainly to milk and beer. It is unknown how hydrolysed and clarified the beer is. The gluten proteins may be all hydrolysed down to amino acids, simpler compounds that are not allergenic but equally may be cleaved into large fractions that remain allergenic. Other examples are breakfast cereals and malt vinegar. Validation is on a case-by-case basis.
- Information on matrix interference information, such as the binding of protein in chocolate by the allergen tannin (ameliorated or partly offset by the addition of fish gelatine), is not readily available from the kit companies, despite being routinely encountered (e.g. fenugreek interference with peanut assay).

- Cross reactivity such as peanut–walnut or peanut–pea, can be problematic. It requires a different antibody to check for non-specific binding or further dilution of the samples to eliminate the interference.
- Association of Official Analytical Chemists (AOAC)-validated ELISA kits are the testing kits of choice.
- The lack of positive controls and scarcity of reliable reference materials, with the consequent need to produce in-house controls, remain a significant problem.
- Having flexible scope within ISO/IEC 17025 accreditation to analyse for a new allergen or in new matrices based on in-house validation work is very useful.
- The deployment of LC–MS or LC–MS/MS methods was seen as having potential. However, currently the market for allergen analysis does not support deployment of these methods on the IOI.

## 4 Conclusions

The main findings in this study are summarised here.

- Consumers with food hypersensitivity procure pre-packed food in large supermarkets “most of the time”. They “rarely” shop at medium-size supermarkets, local convenience shops, premium shops or food stalls.
- Factors that affect food choice and purchasing behaviours include prior experience, brand trust, product and venue cues and the country of origin. These factors are used to aid informal decision making. Labelling is given the most consideration in determining whether or not a food product is safe to eat.
- Consumers dislike PAL because they are uncertain as to the basis for using it, and it reduces their food choices considerably. Parents in particular perceive adverse effects on their children’s nutrition.
- The strongest and most adverse impacts on health-related quality of life have to do with dietary and social restrictions, including concerns around labelling.
- No significant differences were found between food allergic and food intolerant consumers in their practices and attitudes towards food labelling.
- Consumers who self-diagnose are less likely to be concerned about the safety of the foods they buy and are not as influenced by product labelling, compared with consumers who have been medically diagnosed.
- Parents valued the safety of foods significantly more than adults without children. Parents also use labelling more and are significantly more influenced by labelling.
- Between 2009 and 2014, *free from* product sales experienced a significant increase on the IOI. Currently there is a wide range of *free from* product categories available. That said, *free from* food products sales still accounted for less than 0.5% of overall grocery sales in 2014.
- There was no evidence of any significant export market in *free from* foods by ROI or UK food producers.
- According to market analysis the level of PAL statements has increased in recent years. Unfortunately, the evidence suggests the presence of a PAL is not matched by the presence of the allergen the producer is warning against. This implies that warning labels are being used as a substitute for allergen risk assessment.
- This has led to a lack of consumer confidence in the usefulness of labelling, which can therefore be disregarded – a high risk behaviour for food hypersensitive consumers.

Identifying what influences the shopping habits of food hypersensitive consumers; an island of Ireland study.

- There is reasonable availability of analytical capacity for allergens, gluten and major food intolerance testing on the IOI. However, for 29% of the possible EU-legislated allergens, although tests are advertised they may not be readily available or are only available in non-trusted formats within the IOI.
- Food allergen testing is conducted mainly using ELISA, and, to a lesser extent, DNA-based and other techniques.
- Food allergen analysis is important to food laboratories and demand for allergen testing seems to be increasing.

## 5 Recommendations

1. Food hypersensitive consumers are interested in both the health benefits and safety of foods so labelling that addresses both concerns will be helpful to these consumers. Improved understanding in this area could prove beneficial for both consumers and the food industry.
2. Labelling as a means of communication must address the issues that are important to consumers. The regulatory framework needs to be sufficiently flexible to remain relevant to consumers and to facilitate new research, new ways of communicating risk and new technology.
3. Food businesses should consider if their products could carry the *free from* label advisory. This may require structural changes at production level to reduce the risk of allergen cross contamination even further but would also reduce reliance on PAL. The cost–benefit analysis of doing so is something each food business operator has to consider on a case-by-case basis.
4. Efforts to establish allergen thresholds and eliciting doses (the level at which an allergic reaction may be caused) are ongoing. However, if there is confusion or uncertainty on the part of the food hypersensitive consumer, they may reject the idea without considering the implications in full. These consumers should be kept fully informed of developments in this area.
5. Involving food hypersensitive consumers in the consultation elements of the process for defining food labels would help reduce any uncertainties in meeting their. Such involvement would help food businesses to design trustworthy and effective labelling.
6. In relation to allergen testing, there will soon be a requirement for more robust, reliable and cheaper analytical methods to support allergen thresholds once these have been agreed and codified in the regulations. This entails the availability of reference materials and further investigation. It also calls for manufacturer–user collaboration in dealing with issues surrounding the extraction and recovery of allergens, matrix interferences and cross reactivity of allergens. Greater clarity from ELISA kit manufacturers on such issues is required for all forms of analysis in the allergens testing area.

7. The potential for online shopping forums and marketplaces as a means to communicate allergen content should be investigated. Comparative research between online (including phone and tablet) and other shopping methods in terms of convenience, ease of understanding the label, cost and so-on, would be informative.

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