Managing allergies in food service

V V Jankovic1, J Popov Raljic2, R R Mitrovic1, B M Velebit1, B Z Lakicevic1 and L Z Milojevic1

1 Institute of Meat Hygiene and Technology, Kacanskog 13, Belgrade, Serbia
2 Singidunum University, 32 Danijelova St., Belgrade, Serbia

E-mail: vesna.jankovic@inmes.rs

Abstract. Food allergens have appeared in the last two decades as a concealed form of threat which significantly endangers public health, and so allergen labelling on food products, drinks and non pre-packed gastronomic products is clearly defined by legal regulations. Appropriately managing food allergies has become an issue for the foodservice industry because of the rising number of individuals with food allergies. Establishing proper communication between and among customers and foodservice employees could be one of the most important steps in preventing food allergy reactions in restaurants. Proper risk communication often initiates increased attention among restaurant staff to ensure customer safety. Current initiatives to support consumers at risk include a recognised standard for manufacturers seeking to eliminate an allergen from their production, and the integration of food allergy into training for caterers and food standards enforcement professionals.

1. Introduction

Food allergy is defined as an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food [1] or as an adverse reaction to food in which immunologic mechanisms have been demonstrated [2]. Food allergy is a relatively recent newcomer to the ranks of food safety issues, only being effectively recognised as such in the last 25 to 30 years. This recognition, allied with the near impossibility of avoiding the unintended presence of small, yet potentially dangerous residues of allergenic constituents, brought with it the need to assess and manage the resulting risk. Food allergy is recognised as an important public health issue, requiring collaboration between multiple stakeholders, including the food industry, to be effectively addressed. Food allergens affect the health and life of people with hypersensitivity caused by some food components, and such allergens are identified as severe food safety hazards, so their management is one of the fundamental areas of food safety management systems [3,4,5]. Management of allergens in food production aims to assure the safety of allergic consumers, but has proved particularly challenging because of the unique attributes of food allergy and food allergens. Accurate allergen labelling, minimising unintended allergen presence, and circumspect use of meaningful precautionary labelling where required form the cornerstones of effective allergen management. Allergen control plans are the practical description of the essential measures needed to assure implementation of suitable controls. Food allergen risk management must also be integrated into general food safety management and allergen risks be considered at all stages of the food manufacturing process.

Advantages of providing correct food and beverage service to consumers with food allergies include increasing sales, respect and loyalty of consumers [6]. According to [7], research worldwide
indicates a lack of knowledge by hospitality employees about the risks of allergenic food ingredients. The worldwide research also indicates the fact that approximately 70% of hospitality employees have not had an opportunity to be trained and educated about food allergens, allergenic food ingredients or allergen management [8,9].

According to the Serbian Rulebook on Labeling, Marking and Advertising of Food [10], in food service, during the presentation of the food offered to the final consumer and before eating, hospitality employees should highlight all necessary information about the presence of ingredients that can cause allergies and/or intolerances determined in accordance with these regulations.

2. The 14 allergens

The 14 allergens as listed according to [11] are:

1. Cereals containing gluten, specifically wheat (including spelt and Khorasan wheat), rye, barley, oats and their hybridised strains and products thereof, except:
   a) wheat based glucose syrups including dextrose
   b) wheat-based maltodextrins
   c) glucose syrups based on barley
   d) cereals used for making alcoholic distillates including ethyl alcohol of agricultural origin;

2. Crustaceans and products thereof (for example prawns, lobster, crabs and crayfish);

3. Egg and products thereof;

4. Fish and products thereof, except:
   a) fish gelatine used as carrier for vitamin or carotenoid preparations
   b) fish gelatine or isinglass used as a fining agent in beer and wine;

5. Peanuts and products thereof;

6. Soybeans and products thereof, except:
   a) fully refined soybean oil and fat
   b) natural mixed tocopherols (E306), natural D-alpha tocopherol acetate and natural D-alpha tocopherol succinate from soybean sources
   c) vegetable oils derived phytosterols and phytosterol esters from soybean sources
   d) plant stanol esters produced from vegetable oil sterols from soybean sources;

7. Milk and products thereof (including lactose), except:
   a) whey used for making alcoholic distillates including ethyl alcohol of agricultural origin
   b) lactitol;

8. Nuts (specifically:
   a) almonds (Amygdalus communis), hazelnuts (Corylus avellana), walnuts (Juglans regia), cashews (Anacardium occidentale), pecan nuts (Carya illinoinensis (Wangenh.) K. Koch),
   b) Brazil nuts (Bertholletia excelsa), pistachio nuts (Pistacia vera), macadamia or Queensland nuts (Macadamia ternifolia), and products thereof, except for nuts used for making alcoholic distillates including ethyl alcohol of agricultural origin;

9. Celery and products thereof;

10. Mustard and products thereof;

11. Sesame seeds and products thereof;

12. Sulphur dioxide and/or sulphites at concentrations of more than 10 mg/kg or 10 mg/L in terms of the total SO₂ which are to be calculated for products as proposed ready for consumption or as reconstituted according to the instructions of the manufacturers;

13. Lupin and products thereof, and;

14. Molluscs and products thereof (for example mussels, clams, oysters, scallops, snails and squid).

3. Food allergens and sensitivities

Food allergies and sensitivities are illnesses that affect individuals in the population when eating foods or food ingredients that most consumers can tolerate with no problem [12]. These illnesses are sometimes called individualistic adverse reactions to foods because they affect only certain individuals in the population. Another catch-all term for these individualistic illnesses is food sensitivities.

Food sensitivities are distinguished from other types of foodborne disease by the fact that they affect only certain individuals in the population. With food sensitivities, affected individuals experience adverse reactions from eating typical amounts (or sometimes even far less) of a food or food ingredient that most consumers can ingest with impunity.
Many different illnesses occur that fall under the broad definition of food sensitivities. Many consumers and some physicians and other health professionals refer to all of these illnesses as food allergy but, no matter what term is used, it is important to recognise that many different types of illnesses occur as a result of ingesting foods and/or food ingredients on an individualistic basis. These different illnesses can require different diagnostic strategies. In all cases, the most common form of treatment is implementation of an avoidance diet – simply avoiding the food or food ingredient that elicits the adverse reaction. However, the degree of care needed to implement a successful avoidance diet can depend upon the nature of the illness, so it is important for physicians to perform a differential diagnosis and for consumers to know which type of illness that they have.

For the food and related industries, the most important message is that some consumers will not know which type of food sensitivity they experience. These consumers are likely to refer to various food sensitivities as food allergy. To provide the best dietary advice to these consumers, it is important to determine which type of food sensitivity is occurring. It is especially important to recognise when a true food allergy is involved, because avoidance can be difficult due to the very low thresholds that some of these consumers have for the offending food.

Food allergies are abnormal immunological responses to a particular food or food component, usually a naturally occurring protein. Two types of abnormal immunological responses can occur – immediate hypersensitivity reactions and delayed hypersensitivity reactions; both are well documented as occurring in affected individuals upon ingestion of specific foods. Immediate hypersensitivity reactions are IgE-mediated reactions with symptoms ensuing within minutes of the ingestion of the offending food. Delayed hypersensitivity reactions are cell-mediated reactions with symptoms developing 48-72 h after ingestion of the offending food. The role of cell-mediated reactions in food allergies is far less well established; IgE-mediated food allergies, by contrast, are quite well understood.

Food intolerances do not involve abnormal responses of the immune system. Three distinct forms of food intolerances are recognised: anaphylactoid reactions, metabolic food disorders, and idiosyncratic reactions. With a few very noteworthy exceptions (e.g. lactose intolerance), the food intolerances are not well understood. Although these illnesses do not truly fall into the category of food sensitivities, it is important to mention allergy-like intoxications at this juncture. Allergy-like intoxications are often confused with true food allergies because the symptoms are often quite similar. Histamine poisoning is the primary example of an allergy-like intoxication. All consumers are susceptible to histamine poisoning if they ingest sufficient amounts of histamine in their diet. Histamine poisoning most typically occurs on ingestion of foods, especially some fish species (tuna, mackerel, mahi-mahi), that have been subjected to improper, elevated storage temperatures and allowed to spoil.

4. Allergen control in the food industry

When a food safety issue due to mishandling of allergenic ingredients occurs, everyone in the food processing industry suffers. Consumers depend on food companies to provide safe products. Consumers who must be mindful of the foods they eat because of potential allergic reactions are especially dependent on the industry’s ability to identify, process and market foods which are labelled correctly. Food-allergic consumers must avoid the foods that trigger their allergic reactions. Thus, they rely heavily upon the ingredient statements of packaged food products to identify the products which contain their allergen(s).

Food labelling for the presence of allergenic foods/ingredients must identify all foods that intentionally contain the particular food or ingredients derived from that food. However, voluntary labelling for the possible presence of an allergen (e.g. “May contain”) should be reserved for situations that potentially represent genuine hazards. In recent years, there has been a proliferation of the use of precautionary allergen statements, which range in wording from “May contain” and “Processed in a facility”, to “Made on shared equipment”. This increase has limited consumer food choices. Alarmingly, food-allergic consumers, especially teens, are beginning to ignore precautionary
statements, and taking risks regarding the food they choose to eat. This can lead to trouble for both the consumer and the industry.

An allergen control plan is a critical component in product safety initiatives. For food industries [13] looking to establish a food allergen control plan, there are three key steps:

a) Risk Assessment: Risk assessment involves a hazard analysis by a multifunctional team that includes members from such departments as manufacturing, quality, food safety, sanitation, research and development, and regulatory compliance. Risk assessment helps identify potential sources of food allergens and maps their path through each step of the manufacturing process. Once the path is identified, controls can be put in place in target areas such as reception and storage, scheduling of production runs, variations in production, equipment design and supply and cleaning materials. It is important to periodically review and reassess risk assessments, as new products, formulation changes or vendor changes can change production conditions.

b) Risk Management: The key to successful risk management is developing work instructions and standard operating procedures that control the possibility of unintentional allergen contamination. These procedures and instructions include quality requirements for vendors’ ingredients, segregation, production controls, manufacturing scheduling, equipment and plant design, as well as cleaning and sanitation procedures. It is important to validate that these procedures and practices are effective using a science-based approach. In addition, these activities should be routinely reviewed and evaluated for effectiveness. A successful allergen control plan relies on continuous training, clear explanation of procedures and documentation of the existence and effectiveness of the plan.

c) Risk Communication: The next step after assessment and management is communication. If an allergenic food in a plant could be unintentionally found in the finished food product, it is essential this information appears on the food label. Risk assessment can help define the nature of the potential allergen. Is the final product manufactured from ingredients that contain allergens, or is it manufactured on equipment that is in direct contact with allergenic ingredients? This analysis can ensure proper labelling, either in the food ingredients or as a precautionary allergen label. Ultimately, it is important to remember that food allergen control plans require management commitment to succeed.

Continual communication and training increase the safety of manufactured products. Allergen control is but one of the many efforts to prevent and minimize foodborne illness in humans, but the development of and adherence to an effective allergen control plan will go far in protecting allergic consumers and reducing the food manufacturer’s risk to reputational and recall costs.

Establishing proper communication between and among customers and food service employees can be one of the first and most important steps in preventing food allergy reactions in restaurants [14,15]. Proper communication among stakeholders should initiate increased attention by food preparation and service staff when serving customers with food allergies. Although there are other food allergy-related publications available, no research has been published regarding food allergy risk communication.

Researchers found that restaurant staff lacked knowledge regarding food allergens in the menu, ways to prevent cross contact and the severity of food allergy reactions [16]. One study from the UK revealed that about 21% of the peanut-free meals that were prepared immediately after peanut-containing meals were contaminated with peanut or peanut protein. Researchers also found that restaurant employees’ confidence levels were high even though their knowledge about serving customers with food allergies was not adequate. Specifically, 70% of the respondents in this study felt they could guarantee a safe meal, while 35% thought fryer heat could destroy allergens and 25% thought it was safe to remove allergens from a finished meal [17].

Strict avoidance of food allergens and early recognition and response to allergic reactions are extremely important for individuals with food allergies to prevent fatal food allergy reactions [18]. To prevent potential food allergy reactions, customers with food allergies have used various strategies prior to and while dining out. For example, customers chose restaurants with which they were familiar and where they were known by the staff; avoided establishments and cuisines that are considered high-
risk such as buffets or ethnic restaurants; and checked online menus, ingredients, and allergen information before dining out [19].

Despite these prevention strategies, customers with food allergies have experienced communication challenges when dining out because some restaurant staff did not seem to have knowledge about food allergies, did not understand special requests, and were not aware of the severity of food allergy reactions [6]. There is a lack of legislation or training guidelines focusing on the risk management of food allergies and risk communication-related issues in restaurants. Yet most food handlers perceive the foodservice industry as a low-risk business, which negatively affects their safe food-handling behaviours [7]. Therefore, food allergy risk communication can be used as a tool to reduce the chance of food allergy reactions caused by the mistakes of restaurant staff when serving customers with food allergies [8].

Precisely defined and consistent safety management standards for allergens lead to a consistent and sustainable food safety management in the food industry, but also in the production of gastronomic products. Allergenic foods can be risky in two cases: when they are directly taken into the body alone or as an integral part of a gastronomic product, or by cross-contamination of non-allergenic foods with allergenic ones during the food production process [9].

5. Allergen policy
The allergen control plan must be implemented, audited, enforced and updated continually [20]. Allergen information needs to be regularly updated, especially when new ingredients or different brands of ingredients are introduced to the menu. Staff must be familiar with this procedure to ensure that they can deal with such requests from company. The allergen control plan should address the following activities:

- Supplier monitoring
- Plant traffic flow
- Raw material storage
- Color-coding systems for utensils used with allergens
- Production scheduling
- Cleaning
- Use of rework
- Evaluation of program effectiveness
- Label review policies
- Frequency of plan review
- Documentation and documentation review of activities
- Employee education

6. Predictive modelling of allergenic foods
In the area of risk management of allergenic foods in the food industry, there is an irrational opinion of zero risk tolerance that entails the complete avoidance of any food that is potentially a causative allergen [21]. The risk of cross-contamination by allergens during the food production is present despite the efforts of food producers to comply with all the requirements for applying the principles of good hygiene practice.

Predictive modelling in risk management of allergenic foods is significantly hampered by a poorly defined method food declaration, whereby the zero risk tolerance for allergens induces food producers to use the term “May contain” on food labels [22]. Some stakeholders are not convinced that the new labelling legislation provides sufficient information to allergic consumers [23]. Due to fear of cross-contamination in the absence of accurate precautionary or “May contain” labelling, food allergic consumers are uncertain about product safety, and might not be able to understand or interpret the information on the food labels. For food allergic consumers, unintentional exposure to allergens when
eating outside the home in restaurants and other catering outlets is particularly problematic, as unintentional exposures to problematic allergens can occur.

The need to establish a reliable system of declaring, labelling and marketing of foods has caused a necessary step ahead in science, such as the determination of eliciting doses (ED) of allergenic food ingredients, which vary depending on individual predispositions and geographical determinants. The initial EDs of proteins in allergenic foods were taken as the highest ones found by the research group of Allergen Bureau VITAL scientists in Australia [24]. The VITAL 2.0 program has established reference doses of total allergenic protein intake and defined an action network of risk levels for allergenic foods, calculated by using reference doses and reference quantities of food intaken/portion sizes of gastronomic products (i.e., the ratio of the reference dose and the amount of food intaken or the portion size of the gastronomic product for one meal). By determining the reference doses, an effective basis for communication within the risk management of allergenic foods has been set up, which has enabled detailed identification, characterisation and significantly easier risk management, weighting and selection, i.e. detailed risk analysis for food allergens.

7. Conclusion
An increasing number of people are being diagnosed with food allergies. For some, the repercussions could be fatal. The foodservice industry is going to encounter an increasing demand for special meals to cater for those with allergies. Allergenic foods and gastronomic products that contain them are distinguished by specific characteristics compared to other health and safety risks. In the hospitality industry, there is a general lack of knowledge of food allergies, and staff may not be able to respond adequately to requests for non-allergenic foods. However, allergens can be controlled and minimised using careful risk analysis throughout each segment of food chain. The key basis for security management of allergens is good consumer-to-customer and employee-supplier communication and excellent interpersonal communication within each foodservice facility. However, the risks beyond the control of allergen management are undeclared or wrongly declared allergens and unverified allergies. Allergens in foods that are not properly labelled or are highlighted in a less recognisable way can cause significant failures in the safety management system. Another risk which is almost impossible to avoid is an allergic reaction occurring for the first time. These situations require that there is a person in hospitality facilities who is trained to recognise such symptoms and react correctly and in a timely manner. Understanding the similarities and differences in attitudes, knowledge and training with respect to food allergies between hospitality managerial staff and employees would help food industries plan and implement policies and training that best fit both managerial staff and employees.

References
[1] Boyce et al. 2010 Guidelines for the diagnosis and management of food allergy in the United States J. Allergy Clin. Immunol. 126 51–8
[2] Muraro et al. 2014 EAACI food allergy and anaphylaxis guidelines: Primary prevention of food allergy Allergy 69 590–601
[3] Crevel R W R and Cochrane S A 2014 Food Safety Assurance Systems: Management of Allergens Food Industry Encyclopedia of Food Safety ed Y Motarjemi (Netherlands: Elsevier) pp 254–61
[4] Stein K 2015 Effective allergen management practices to reduce allergens Handbook of Food Allergy Detection and Control ed S Flanagan (Sawston, Cambridge: Woodhead Publishing UK) pp 103–31
[5] Spirić D, Borović B, Velebit B, Lakicević B, Babić J, Milijasević M and Janković V 2010 Studija o nalazu pšeničnog glutena u različitim životnim namirnicama Tehn. mesa 51 176–94
[6] Abbot M, Byrd-Bredbenner C and Grasso D 2007 Know before you serve: developing a food-allergy fact sheet Cornell Hotel Restaurant Administration 48 274–83
[7] Kwon J, Shanklin C W and Liu P 2013 Dining experiences of customers with food allergies Poster Presented at the Food and Nutrition Conference and Expo (Houston, Texas: FNCE)
[8] Ahuja R and Sicherer H 2007 Food allergy management from the perspective of restaurant and food establishment personnel Ann. Allergy Asthma Immunol. 98 344–8

[9] Sicherer S 2004 Current approach to the diagnosis and management of adverse reactions to foods J. Allergy. Clin. Immunol. 114 1146–50

[10] Regulations on food declarations, labeling, and advertising 2017 RS Official Gazette 19/17 and 16/18

[11] Regulation (EU) 2011 No 1169/2011 of the European Parliament and of the Council OJ L 304

[12] Taylor S L and Hefle S L 2005 Food Allergies and Intolerances Modern Nutrition in Health and Disease ed M E Shils, Shike M, Ross A C, Caballero B and Cousins R J (Philadelphia: Lippincott Williams and Wilkins) p 1512

[13] G Lopez-Velasco 2018 Establishing an Effective Food Allergen Control Plan, foodsafetytech.com

[14] Allen K J Remington, B C Baumert, J L Crevel ,R W R Houben, G F Brooke-Taylor, S Kruizingga A G and Taylor S L 2014 Allergen reference doses for precautionary labeling (VITAL 2.0): clinical implications J. Allergy Clin. Immunol. 133 156–64

[15] V Jankovic B Lakicevic R Petronijevic D Spiric V Djordjevic J Popov-Ralic 2016 Soybean and gluten in meat products – Consumer Protection Strategy Agro FOOD Industry Hi Tech 27 3 30–2

[16] Mills C et al. 2004 Information provision for allergic consumers – where are we going with food allergen labelling Allergy 59 1262–8

[17] Mills C 2007 Improved quality of life to food allergic consumers Mol. Nutr. Food Res. 51 148–9

[18] Leftwich J, Barnett J, Muncer K, Shepherd R, Raats M M, Hazel Gowland M and Lucas J S 2011 The challenges for nut-allergic consumers of eating out Clin. Exp. Allergy 41(2) 243–9

[19] Han W 2012 Risk Communication When Serving Customers with Food Allergies in Restaurants in the USA, PhD thesis (Houston: University of Houston)

[20] V Deibel 2004 Writing and Implementing an Allergen Control Plan www.foodsafetymagazine.com

[21] Hattersley S Ward R Baka A and Crevel R 2014 Advances in the risk management of unintended presence of allergenic foods in manufactured food products – An overview Food Chem. Toxicol. 67 255–61

[22] B Madsen et al. 2009 Approaches to risk assessment in food allergy Food Chem. Toxicol. 47 480–9

[23] A K J Remington B C Baumert J L Crevel R W R Houben G F Brooke-Taylor S Kruizinga A G and Taylor S L 2014 Allergen reference doses for precautionary labeling (VITAL 2.0): clinical implications J. Allergy Clin. Immunol. 133 156–64

[24] B Madsen et al. 2012 Can we define a tolerable level of risk in food allergy Clin. Exp. Allergy 42 30–7