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Review Article

Understanding Food Allergens and Intolerance: Assessment, Management and Consumer Safety

Jaya Upraity

Govind Ballabh Pant University of Agriculture and Technology.

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ABSTRACT

Food allergens are increasingly recognized as significant health concerns affecting individuals worldwide. This review article provides an overview of the current understanding of food allergens and intolerances, their prevalence, underlying mechanisms, and implications for health and dietary management..Food allergies involve an immune response to specific proteins in food, leading to adverse reactions that can range from mild to life-threatening. Common allergens include peanuts, tree nuts, shellfish, eggs, milk, soy, wheat, and fish. Anaphylaxis, the most severe allergic reaction, necessitates immediate treatment with epinephrine and careful avoidance of allergens. In contrast, food intolerances result from the body's inability to digest certain foods, often due to enzyme deficiencies or sensitivities. Lactose intolerance, gluten intolerance (celiac disease), and fructose intolerance are among the most prevalent forms of food intolerance. Managing food allergies requires vigilance in reading labels, avoiding cross-contamination, and communicating dietary needs to ensure safety. For individuals with allergies, strict avoidance of allergens is paramount, while those with intolerances may benefit from dietary modifications and alternative food choices. However, navigating social situations and maintaining balanced nutrition can present challenges for affected individuals. This abstract underscores the importance of education, awareness, and support from healthcare professionals in effectively managing food allergens and intolerances. By understanding the underlying mechanisms, implementing appropriate dietary strategies, and fostering a supportive environment, individuals can mitigate risks, improve quality of life, and promote overall well-being in the face of these dietary challenges.

INTRODUCTION

Food allergies have become a growing concern globally, impacting individuals health and food safety. This research aims to comprehensively explore the landscape of food allergens and intolerances, focusing on their identification, management, and implications for consumer safety. A food allergy occurs when the immune

***Corresponding Author:** Jaya Upraity
Address: *Govind Ballabh Pant University of Agriculture and Technology*
Email : jayaupraity64561@gmail.com

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system reacts to a food which is usually harmless. Food intolerance occurs when the body has a chemical reaction to eating a particular food or drink. The symptoms for mild to moderate food allergy or intolerance may sometimes be similar, but food intolerance does not involve the immune system and does not cause severe allergic reactions (anaphylaxis). Food allergy and food intolerance are commonly confused, as symptoms of food intolerance occasionally resemble those of food allergy. However, food intolerance does not involve the immune system and does not cause severe allergic reactions (known as anaphylaxis). Food intolerance also does not show on allergy testing, and the Australiasian Society of Clinical Immunology and Allergy (ASCIA) advises against non evidence-based allergy tests. Food intolerance can be a difficult concept to understand. Sometimes, substances within foods can increase the frequency and severity of migraine headaches, rashes (such as hives) or the stomach upset of irritable bowel. Peanuts, tree nuts, eggs, cow's milk, wheat, sesame, fish, shellfish and soy cause the majority of food allergic reactions. Peanut allergy is one of the most common allergies in older children as only approximately one in 4 children will outgrow peanut allergy. When symptoms appear within a few minutes of eating the particular food, it makes pinpointing the allergen an easy task. However, if the cause is unknown, diagnostic tests may be needed.

STATEMENT OF THE PROBLEM

Understanding Food Allergens And Intolerance: Assessment, Management, And Consumer Safety

EMERGENCE AND JUSTIFICATION OF THE PROBLEM

Emergence of the problem

More than millions of people develop food allergies and probably one of our relatives has food allergy and it is common in babies and children and appears at any age.The body's immune system keeps the body healthy by fighting off infections and other dangers to good health. A food allergy reaction occurs when the immune system overreacts to a food or a substance in a food, identifying it as a danger and triggering a protective response. Many people have no knowledge how harmful it can be and they do not know about the protective measures to be done. The study will be conducted to know the best possible cure and to learn about the different allergies occurring to people in India.

Justification of the problem

Food allergens are very harmful and hazardous to health. Most people have no knowledge about allergens and their pros and cons. There will be a survey conducted at village level to raise awareness and teach people about food allergens and intolerance.

OBJECTIVES

1. To identify common food allergens and intolerances prevalent in different populations.
2. To assess current methods and technologies for detecting and quantifying food allergens in various food products.
3. To evaluate strategies for managing and mitigating the risks associated with food allergens in the food supply chain.
4. To propose guidelines and recommendations for ensuring consumer safety regarding food allergies and intolerances.

LITERATURE REVIEW

S. No.	Title	Author	Year	Results
1	Food Allergy: Review, Classification and Diagnosis	Cianferoni *et al*	2009	This article shows at that time there is no cure for food allergies rather

				than to live with them.
2	Food Intolerances, Food Allergies, and Restaurants	Borchgrevink *et al*	2010	This study concluded that the restaurants may be unable to adequately meet the needs of such customers.
3	Food Allergy and Intolerance	Petrulalova *et a*l	2015	Allergy is caused by different food allergens (milk proteins, cereals, nuts, fruits and vegetables), while there is frequent cross-allergy among them.
4	The diagnosis and management of food allergy and food intolerances	Turnbull *et al*	2015	Food allergies are more common in children, can be life-threatening and are distinct from food intolerances.
5	Food allergy knowledge, attitudes and their determinants among restaurant staff: A cross-sectional study	Loerbroks et al	2019	In this study it was concluded that the knowledge of food allergy was suboptimal among restaurant staff and attitudes towards customers were rather poor.
6	Food Allergies and Intolerances: A Clinical Approach to the Diagnosis and Management of Adverse Reactions to Food	Onyimba *et al*	2021	It can be concluded that people can avoid food allergies by following a healthy diet and avoiding allergy causing foods.
7	Trends in Food Allergy Research, Regulations and Patient Care	Saab *et al*	2022	Staying current on advances in food allergy research will allow healthcare and nutrition practitioners to provide evidence-based guidance to individuals they serve.
8	Food allergens in oral care products	Coimbra *et al*	2023	As food allergies may occur because of erroneous information or a lack of labelling on the allergen list, manufacturers should be more rigorous in declaring allergens on product labelling regarding the safety of consumers.

METHODOLOGY

Allergen Identification

Reviewing epidemiological data, clinical studies, and dietary surveys to identify common food allergens and intolerances prevalent in different regions and demographics.

On April 18, 2022, the FDA issued a draft guidance for FDA staff and other stakeholders titled Evaluating the Public Health Importance of Food Allergens Other Than the Major Food Allergens Listed in the Federal Food, Drug, and Cosmetic Act.

Symptoms of allergic reactions can include:

- Hives
- Flushed skin or rash
- Tingling or itchy sensation in the mouth
- Face, tongue, or lip swelling
- Vomiting and/or diarrhoea
- Abdominal cramps
- Coughing or wheezing
- Dizziness and/or lightheadedness
- Swelling of the throat and vocal cords
- Difficulty breathing
- Loss of consciousness

Detection and Quantification

Analysing various methods for detecting and quantifying allergens in food products, including ELISA, PCR, mass spectrometry and emerging technologies. Conducting comparative studies to assess their accuracy, sensitivity, and applicability. Analytical methods for detection of Allergens in food.

Methodology	References	Comments	Best suited for
ELISA	(9,10,11,12,13,14,15,16,17,18,19,20,21,22)	• Generally singleplex detection • Detection of IgE and/or IgG- binding allergens	• Detection of preselected allergens for which specific antibodies / commercial kits are available
Mass spectrometry-based methods	(23,24,25,26,27, 28,29,30,31)	• Needs high and specific expertise • Multiplex detection • Do not detect allergens missing in the searched protein database	• Detection of many proteins in the absence of preselection • Detection of proteins independently of their ability to be recognized by specific IgE
Biosensors	(32,33,34,35,36, 37,38,39,40)	• Generally singleplex detection	• Detection of preselected individual allergens for for which specific testes and commercial kits are available
Multiplex allergen technology	(41,42,43,44,45,46,47,48,49, 50,51,52,53)	• Multiplex detection with a single test • Detection of IgE binding allergens • Detection of still unknown IgE binding proteins	• Detection of many selected / unselected allergens with single test

Risk management

Evaluating existing strategies employed by the food industry to manage allergens throughout the production process, including segregation, labelling, and cleaning procedures.

As per the guide of retail food establishments by Minnesota Department of Agriculture, U.S.

Steps to control an allergen risk:

1. Identify which allergens are handled in the retail food establishment.
2. Determine which food products contain each allergen.
3. Evaluate all aspects of the operation to control each allergen.

Ingredient Purchasing and Storage

- Obtain a fully disclosed ingredient list from the supplier including details on sub-ingredients
- Protect raw ingredients in storage to prevent contamination

- Label raw material to indicate allergen content
- Be mindful when substituting raw materials
- Check ingredient list annually to verify there have not been changes from the supplier

Production / Preparation

- Production scheduling: make products with allergenic products with allergenic ingredients all at one time or at the end of a production run, then perform a complete clean-up before running other products
- Do not allow reuse of single service articles such as tray liners, gloves, or aprons
- Dedicate separate utensils or equipment to allergenic products whenever possible
- Protect work-in-process from cross-contact with allergenic products/ingredients in use at other work areas
- Discourage rework or carry-over product; if necessary only use like into like product
- Use standardised recipes so that ingredients are the same from one batch or serving to the next. Dedicate production systems, use separate lines, equipment, rooms, or even facilities where necessary
- Develop an allergen matrix or changeover grid to identify what practices or production changes need to be made between flavours or products (spray down or full clean up)
- Provide lockouts on equipment that uses or supplies allergenic ingredients
- When sampling the product in process, be certain that the sampling device is sanitised appropriately between products
- Allow adequate clean up time between production

Packaging and Labelling

- Verify level accuracy; update to reflect current formula
- Ensure compliance with labelling regulations which generally requires declaration of all ingredients; exception to this includes spices, some colours, flavours and processing aids and incidental additives at insignificant levels or that have no technical function or effect. Allergenic ingredients are never exceptions, they MUST be declared at any level - there is no "insignificant level"
- Check labels on incoming ingredients; supplier may have sent the wrong product or may have used the wrong label
- Limit use of precautionary labelling (such as "may contain") in lieu of good manufacturing practices. Do not list ingredients that are not in the formula
- Consider cross-contact potential on packaging / portioning utensils

Sanitation

- Have standardised procedures for sanitation operations (SSOP's) and ensure they are followed
- Use appropriate cleaning methods (detergents/cleaning chemicals, water, and sanitizer)
- Ensure proper storage of clean items
- Specify employee practices - hand washing at appropriate times (for example, after handling a product that contains allergens, such as peanuts); proper hand washing procedures; use of clean clothing/aprons / gloves and when to change

Display / Service

- For bulk food displays, use dedicated trays or display areas, post notification of allergen hazards with signs at point of display, and place foods with allergens towards the bottom
- If foods with allergenic ingredients can not be adequately separated, offer only as packaged food
- For in-store demonstrations, prominently display the ingredient list and do not provide product to unaccompanied children
- Consider a sign or menu statement that individuals with food allergies, intolerance or

sensitivities may request information about the ingredients of anything served or sold (all employees should be trained and have access to this information)

Staff Training / Education

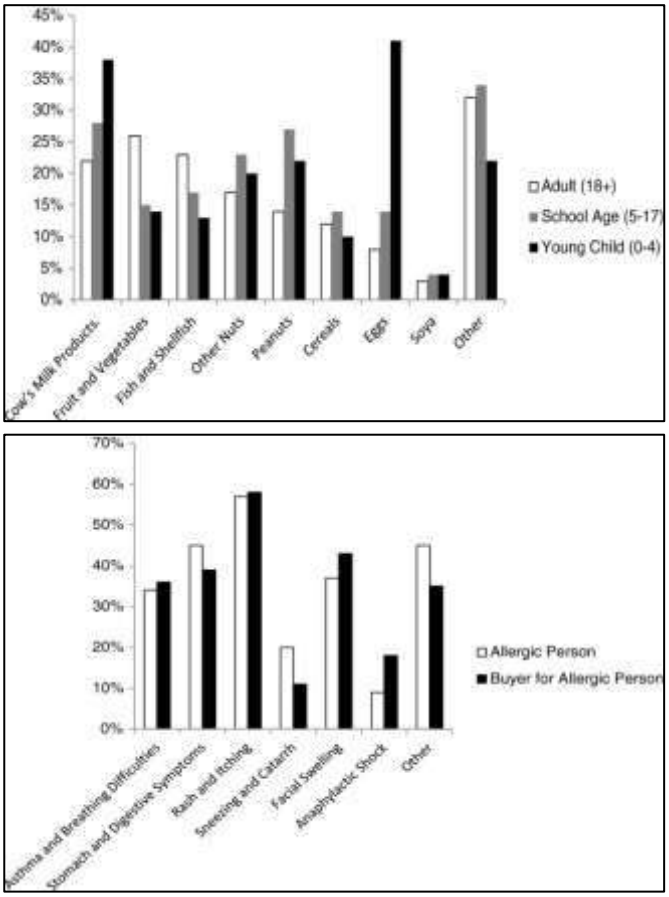
- Ensure all employees have an understanding of allergens, the hazards of undeclared allergens on labels, and the ability to identify common allergens in all foods sold
- Train employee groups on specific allergen concerns; kitchen employees need to understand about cross-contact potentials, service staff need to have ingredient lists available when customers inquire. It is better for them to say they don't know if an ingredient is included than to risk a customer's health
- Points to include in a training program:
  - ✓ define allergens
  - ✓ consequences to sensitive people
  - ✓ importance of allergen control
  - ✓ most common areas where problems occur
  - ✓ accurate labelling
  - ✓ control measures

Consumer survey

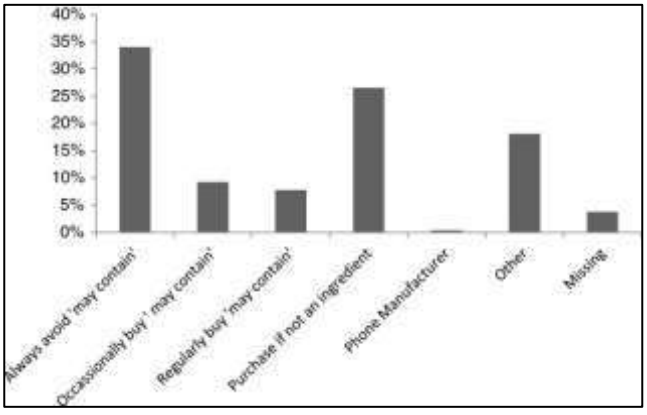
Administering surveys or interviews to assess consumers knowledge, attitudes, and behaviours regarding food allergens and intolerance.

As per the report published by National Institute of Health Sciences, U.K.

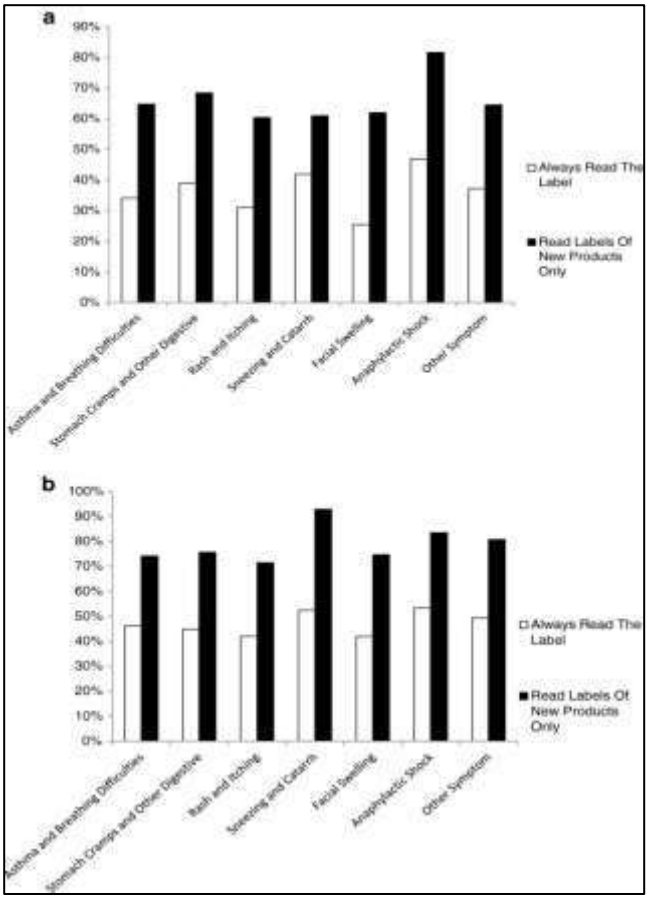
Foods reported as responsible for allergies, grouped by the age of the individual affected (Percentage of all respondents (n = 949)).



Symptoms of food allergy reported by the two main groups of respondents (respondents separated into two mutually exclusive groups: food allergic individuals (n = 537) and food buyers only (n = 412)).



Use of 'May Contain' labels by allergic consumers and those buying foods for such individuals (n = 949).



Comparison of buying behaviours reported by respondents reporting different symptoms of food allergy and presented separately for food allergic individuals (a) and those buying foods for such individuals (b).

EXPECTED OUTCOMES

1. Comprehensive understanding of prevalent food allergens and intolerances in different populations.
2. Assessment of the effectiveness and limitations of current allergen detection methods in the food industry.
3. Recommendations for improving allergen management practices in food production, labelling, and handling to enhance consumer safety.
4. Insights into consumer perceptions and behaviours related to food allergens and intolerances, aiding in educational and awareness campaigns.

CONCLUSION

Food allergens and intolerances represent significant challenges that impact individuals' health, dietary choices, and quality of life. While food allergies involve immune responses to specific proteins, leading to potentially severe reactions, intolerances arise from difficulties in digesting certain foods, often resulting in gastrointestinal discomfort. Both conditions require careful management, including avoidance of trigger foods, dietary modifications, and awareness of potential cross-contamination.

The management of food allergens and intolerances extends beyond individual dietary choices to encompass broader considerations, such as social interactions, food labelling regulations, and access to allergen-free alternatives. Education, awareness, and support from healthcare professionals play crucial roles in empowering individuals to navigate these challenges effectively and safely. Moreover, ongoing research into the underlying mechanisms of food allergies and intolerances, as well as advancements in diagnostic tools and therapeutic interventions, offer hope for improved management and outcomes for affected individuals. By fostering understanding, empathy, and inclusivity, we can create environments that accommodate the diverse dietary needs of individuals with food allergies and intolerances, thereby promoting health, well-being, and inclusivity for all.

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