

A Review on Current Food Allergy

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ABSTRACT

An allergy, also a food allergy, occurs when your body's natural defence overreacts to exposure or consumption to a particular substance, treating it as an attacking substance and sending out chemicals to defend against it. Symptoms of a food allergy usually range from mild to severe. The most severe allergic reaction is Anaphylaxis-a life threatening whole body allergic reaction that can impair your breathing, causing in your blood pressure and affect your heart rate. New research is being developed on the pathogenesis of IgE and non-IgE mediated disease. Recently, management of food allergies consists of educating the patient to avoid consuming the responsible allergic food and initiating therapy if consumption occurs. However, novel strategies are being studied thoroughly including sublingual/oral immunotherapy and vice versa with a standing hope for future prevention and cure to food allergy and its related consequences in reference to future strategies.

Keywords: *Allergens specific IgE, Lactose intolerance, non-IgE, Peanut hypersensitivity, Food allergy, Food safety, Symptoms, Diagnosis*

INTRODUCTION:

Food allergy is defined as an adverse immunologic response to food. Food related reactions are associated with a broad range of causes and symptoms that may involve any body system, including the skin, gastrointestinal and respiratory tracts, and cardiovascular system. Immunoglobulin E (IgE)-mediated food allergy is a leading cause of anaphylaxis, and, therefore, referral to an allergist for timely and appropriate diagnosis is mandatory. (Sicherer, 2002; Sicherer and Sampson, 2006; Sicherer and Sampson, 2010; Macdougall and Etuwewe, 2005; Madsen, 1997; Halken, 1997; Crevel et al., 2007).

The production of fermented foods is one of the oldest food processing technologies known till date. Lactic acid bacteria are used in food fermentation for longer preservation and improving textures, flavours and tastes. Moreover, proteolysis during fermentation can result in reduction of immunoreactivity of food proteins. Hence, it could be expected that fermentative transformations with suitable lactic acid bacteria could produce hypoallergenic products (El-Ghaish et al., 2011).

Diagnosis depicts a careful history and diagnostic tests, such as skin prick test, serum-specific IgE and, if indicated, an oral food challenge. 90% of food allergies are caused by :- Eggs, milk and dairy products, peanuts, fish, wheat, soy, sesame, shellfish. Once the prognosis of food allergy is confirmed, strict elimination of the allergic food item from the diet is utmost necessary. Anaphylactic reactions to egg and fish have been described as earlier as the 16th and 17th century. This article provides an overview of the epidemiology, pathophysiology, and diagnosis of food allergy. Most food related symptoms occur within two hours of ingestion; often they start within minutes. Delayed symptoms are most typically seen in children who develop "eczema". (Sicherer and Sampson, 2010; Savage et al., 2007; Skripak et al., 2007).

The risk of developing allergies is significantly influenced by genetic disposition. The changes in lifestyle and environmental factors result in increases of adverse food reactions. Complex factors include socio-economic impacts, impacts of external and internal environment, exposure to new allergens, stress, use of antibiotics, infectious diseases, climate change, and others (Rimárová, 2008; Samartín et al., 2001).

CLASSIFICATION

IgE-mediated food allergy is the leading cause of anaphylaxis, a severe, potentially fatal allergic reaction. Unfortunately, food reaction is a broad term representing any abnormal clinical response related to consumption of a food and they are further classified as food intolerance (lactose intolerance) or active food allergy (peanut hypersensitivity) based on the pathophysiological mechanisms of the reaction as such in one way. (Sampson 1997; Carolyn et al., 2008). Based on the immunological mechanism that are involved, food allergy may be further classified as a) IgE-mediated, which are mediated by antibodies which belongs to the Immunoglobulin E (IgE) and are the top distinguished food allergy reaction; b) cell-mediated when the cell component of the immune system is responsible for the food allergy and most of the times affect the gastrointestinal tract; c) mixed IgE cell mediated when both IgE and immune cells are equally involved in the reaction. It is important to

distinguish food allergy from other non-immune mediated adverse reactions to food, particularly since more than 20% of adults and children alter their diet due to perceived food allergy. (Kimber and Dearman, 2002).

More than 200 proteinaceous allergens have been identified and characterised, and over 100 different foods or food components may cause adverse reactions (Hayakawa et al., 1999; Astwood and Fuchs, 1996). The eating habits and socio-cultural background are responsible for differences in foods most commonly involved in allergy. Variations of occurrence are between age groups as well as countries (Madsen, 1997; Ring et al., 2001). The main allergens, which according to recommendation of European Union subject to mandatory marking on the food are:

- cereals containing gluten (i.e. wheat, rye, barley,
- oats, spelt, kamut or their hybridised strains) and products thereof,
- crustaceans and products thereof,
- eggs and products thereof,
- fish and products thereof,
- peanuts and products thereof,
- soybeans and products thereof,
- milk and products thereof (including lactose),
- nuts i. e. Almond (*Amygdalus communis* L.),
- Hazelnut (*Corylus avellana*),
- Walnut (*Juglans regia*),
- Cashew (*Anacardium occidentale*),
- Pecan nut (*Carya illinoensis* (Wangenh.) K. Koch),
- Brazil nut (*Bertholletia excelsa*),
- Pistachio nut (*Pistacia vera*),
- Macadamia nut and Queensland nut (*Macadamia ternifolia*) and products thereof,
- celery and products thereof,
- mustard and products thereof,
- sesame seeds and products thereof,
- sulphur dioxide and sulphites at concentrations of more than 10 mg/kg or 10 mg/litre expressed as SO₂ (DIRECTIVE 2003/89/EC).

Allergies from milk

Milk allergy is caused when the immune system reacts against one or more of the proteins found in milk. This happens due to the lack of the immune system to learn to recognize milk proteins as being harmless. Milk allergy is often muddled with Lactose Intolerance. Lemke and Taylor (1994), described lactose intolerance that happens when people deficient in intestinal lactase enzyme, which is needed to break down the milk sugar to lactose. When milk or other dairy products that the person is allergic to are consumed, these individuals develop nausea, gas and diarrhoea. Blades, (1996) mentioned lactose intolerance is the most common genetic disorder affecting more than half of the world population drastically. It is an important source of energy during the first year of a human's life, providing almost half the total energy requirement of infants. Similarly, hard cheeses, which are low in lactose, and fermented milk products such as yoghurt are usually well tolerated.

Allergies from nuts

Peanuts are one of the most frequent causes of food allergy, and it seems to be less common. Nut allergy is an important condition because it starts at an early age, is life long and can be fatal. In its mildest form, that allergy condition can be limited to a rash, sickness and headache to swelling of the tongue and lips, whereas both tree nuts and peanuts allergy in its extreme form can cause anaphylactic shock.

EPIDEMIOLOGY

Many studies in the past few decades have shown that although 40% to 60% of parents believed that there child's allergic symptoms are related to food consumption, only 4% to 8% of children have allergic symptoms reproduced by oral food challenges or consumption the prevalence of food allergy is highest in infants and toddlers (6% to 8%) and decreases with slightly with age, affecting almost 4% of the adults. (eczema). Children with moderate to severe atopic dermatitis have a higher prevalence of IgE-mediated food allergy, estimated at about 10% to 30% depending on the severity of atopic dermatitis.

The most common food allergens in the paediatric population include cow's milk, eggs, peanuts, tree nuts, soy, wheat, fish and shellfish, whereas peanuts, tree nuts, fish, and shellfish are predominant in adults.

There has been a significant increase in the incidence of food allergies including a rise of allergy emergency department visits for food allergic reactions. The reasons for the increase in food allergy prevalence are not known, but, the short period of time over which the increase occurred, suggest that the environmental factors are more likely to be relevant than genetic factors as a part of the hygiene hypothesis. It is likely that additional factors play an important role such as methods of food preparation, increased use of antacid, and exposure to medicinal creams containing food allergens. The introduction of food later in the infant diet has been postulated to play a role in the increase of food allergy.

PATHOPHYSIOLOGY

Food allergy is an immunological reaction against the food allergens and is typically IgE-mediated, non-IgE mediated (i.e. cell mediated) or mixed IgE and non-IgE mediated. IgE-mediated food allergic reactions are those that are immediate, reproducible, and that are easily and also readily diagnosed by detection of food-specific IgE antigen. (Bousquet et al., 1998). The allergenic segments or the "epitopes" of the proteins are observed to be small (10 to 70 kD in size), with water soluble glycoprotein that are generally resistant to denaturation by heat or acid and, thus, can remain intact even after processing, storage, cooking and digestion processes. Examples of these glycoproteins include caseins in milk, vicillins in peanuts, and ovomucoid in eggs. In general, allergies to additives and preservatives occur to be uncertain and rare. The non-IgE mediated food allergies represent the minority of the immunologic reactions to food and occur in the absence of demonstrable food-specific IgE antibodies in the skin or serum. They are less well characterised, but typically are due to an acute or chronic inflammation in the gastrointestinal tract, where eosinophils and T cells seem to play a major role. (FAO, 1995; Lamabadusuriya, 2004).

Food-induced allergic disorders are broadly categorised into those mediated by immunoglobulin E (IgE) antibodies or by non-IgE-mediated mechanisms. IgE mediated allergic responses are the most widely recognised form of food allergy and are detected by the instant arrival of symptoms after consumption. Oral tolerance depends upon an intact and immunologically active gastrointestinal barrier. This barrier includes the epithelial cells joined by tight junctions and a thick mucus layer, as well as luminal and brush border enzymes, bile salts, and extremes of pH, which contributes to make antigens less immunogenic. In addition, innate (natural killer cells, polymorphonuclear leukocytes, macrophages, epithelial cells, and toll-like receptors) and adaptive immunity (intraepithelial and lamina propria lymphocytes, Peyer's patches, IgA, and cytokines) provides an active barrier for the foreign antigens barricading their way. (Scott et al., 2010).

Disorders such as atopic dermatitis (AD), eosinophilic gastroenteritis, and eosinophilic esophagitis (EoE) can possibly be associated with a mixed IgE-/cell-mediated mechanism of reaction to food. In these medical disorders, the association with food may not be depicted in all the allergic cases. It is mandatory to note that food allergy is not a cause of other different medical conditions such as migraines, behavioural or developmental disorders, arthritis, seizures or inflammatory bowel disease, etc. (Sampson, 1992).

In contrast, early exposure to foods might prevent the development of food allergy under some conditions. Alternatively sensitization is accommodated, if the gastrointestinal barrier is contacted by presentation of proteins via various routes, such as the respiratory tract or skin. In oral allergy syndrome, also known as pollen-food-related syndrome, oral tolerance is bypassed because sensitization occurs through the respiratory tract, due to cross reactivity between the pollen allergen and allergen contained in the fruit. Finally food allergy is at least in part genetically determined. Peanut allergy, for instance, is about ten times more likely to be prevalent in a child with a sibling who is peanut allergic compared to the general population risk: however, specific genes have not been identified. Similarly, in non-IgE-mediated food allergies, there is a large domestic and racial difference. reaction (Novembre et al., 1988).

DIAGNOSIS

The patient's medical history is a powerful weapon against treating the allergies, especially if the patient and family are objective historians. Food allergy is clearly suspected more often than it is found by accurate diagnostic procedures and is confirmed by challenges in less than 20% of the time. (Bollinger et al., 2006). In general, the history can be more helpful in IgE-mediated disorders, because these reactions occur so soon after food ingestion and because multiple target organs are affected.

Food Avoidance

Once a certain food allergy is diagnosed, strict eradication of the offending food allergen from the patient's diet is necessary. A well managed, proper balanced diet will keep the patient free from symptoms and while on the other hand maintaining nutritional status. When the balanced diet (excluding the allergen) is used as treatment,

the relevant food should only be reminisced once the evidence exists that the food allergy issue has been totally resolved and eradicated.(Smith and Munoz-Furlong, 2000).

Oral immunotherapy

In oral immunotherapy (OIT), the food is slowly introduced under medical supervision, and the other dose of food increases every 2 weeks until a predefined maintenance dose is reached. Most patients experience mild unfavourable events (e.g., oropharyngeal pruritus, GI symptoms) that gets resolved without any treatment or with oral antihistamines. However, adverse reactions that require epinephrine may occur during OIT. Thus a methodical analysis of the patient's diet holds extremely useful as an initial step. Important historical considerations include the following: 1. Is the reaction propagated? Does it occur each time the food intake occurs? If not, it is unlikely to be triggered. 2. What is the time fraction for the reaction? Immediate hypersensitivity reactions gradually occur instantly, often within minutes and nearly always within 2.5 hours respectively. Additional clinical history of the patients can be helpful as well. Occasionally, the history can be complicated as per the fact that trivial amounts of foods may occur in certain products.

Food desensitisation

At present there is no cure for food allergy beyond avoidance of the food that is allergic to a specific person and transfer of epinephrine, however, current research is focused on food desensitisation (anaesthetise). In desensitisation, patients do not react to the food allergen but are continuing to perceive treatment with the food on a regular basis. With tolerance (also known as sustained detachment), patients have discontinued treatment and continue not to react to the food allergen affecting them. (Bock, 2000; Scott et al., 2010).

Prognosis

The prognosis of food allergy is complex and totally dependent on the particular food type. Children should get checked frequently by their allergist at regular intervals to determine whether clinical endurance has been developed or not. In most cases, allergy to peanuts, tree nuts, fish, and shellfish is lifelong and in some cases can't be cured at ease.

ORAL FOOD CHALLENGES

Often an elimination diet provides diagnostic information as well as symptomatic relief. If not, it is possible that not all the responsible food has been eliminated. If the elimination diet is successful, food challenges are indicated to confirm the diagnosis and clarify the individual food triggers. For gastrointestinal disorders, biopsy after elimination (normalisation) and then after reintroduction (inflammatory response) can help identify responsible food triggers. Oral food challenges are the key to establishing and identification of specific food triggers. Most rigorous method is the double grinded and placebo-controlled method (DPBC), but single blind (patient) and open challenges can be performed. The least time diligent procedure is the open challenge. If the end points are specifically defined and documented, this procedure is satisfactory for diagnostic purposes. DPBC challenges are indicated when the end points are subjective complaints (bias is possible) or there are specific research objectives. (Bock et al., 1984).

FOOD ALLERGY THERAPY

The only proven therapy is food elimination. However, many families find it difficult to read labels. Many foods have multiple ways to call an ingredient (for example, casein, whey, and lactalbumin for milk). FDA (FOOD DRUG ADMINISTRATION) enforces FALCPA (FOOD ALLERGEN LABELLING AND CONSUMER PROTECTION ACT) in the food allergen labelling, the agency also regulate, which include all foods except poultry, mostly meats, certain egg products and most alcoholic beverages as such. Food labels clearly identify the food source name of any ingredient that is allergic to a particular person or patient respectively. Proper labelling of food helps allergic customers to identify food or ingredients that they should avoid or consume as such. All the patients at a risk for anaphylaxis must be trained to identify early symptoms and be prepared to treat the condition appropriately.

FUTURE THERAPIES

One alternative approach to prevent food allergy was to delay the introduction, promote breastfeeding or remove the allergens from the mother's diet during pregnancy. Overall , these therapeutic options have not been successful. The only dietary measure which has been shown to be important in well conducted longitudinal studies is introduction of formulas and solid foods into an infant's diet before 4-6 months of age. New studies of alternate routes of allergen administration are in progress. About 50% of the patients in the active group reached maximum doses (20 g), while only 9% in the placebo group reached the maximum doses. Using a standardised

oral immunotherapy (OIT) protocol for treatment of various food allergies, Patri arca et al. reported that 83% of food-allergic subjects completing the protocol could probably tolerate the food to which they were previously allergic. The most common food allergy in their division was milk, followed by egg and fish. In addition to age-related food allergic reactions, subjects receiving OIT demonstrated a significant decrease in a food specific IgE and an increase in specific IgG4.(Majamaa et al., 1999). Component resolved diagnostic testing (CRD) is a comparatively new method (blood test) to determine the risk or severity of the allergic reactions to certain foods (e.g., peanuts, hazelnuts, CM, eggs,etc.) CRD can also identify cross-reactive specific components to other similar allergens from different pollen species or foods. Other strategies that can help in the assistance in the food allergy diagnosis are elimination of diets and food/symptom calculation. The elimination diet can be used for both the diagnosis and treatment of food allergy and requires a complete avoidance of suspected foods or multiple foods for a given period of time (usually 1-2 weeks) while monitoring for an associated decrease in symptoms. Therefore, an elimination diet should only be accepted under the supervision of an experienced medical professional.

CONCLUSION

Food allergies are continuing to rise similar to other food allergies, but the exact cause for the rise is unknown. IgE-mediated food allergy is an important clinical problem of increasing generality. Evaluation by an allergist is essential for the proper diagnosis and treatments. The mainstay of the treatment is the avoidance of responsible food and timely administration of epinephrine for allergic reaction. Once the food allergy is diagnosed, the only proven therapy is to avoid the allergic food. A diet or eating plan to eliminate the allergy must be developed carefully. A registered dietitian can provide valuable assistance in meal planning and in suggesting alternative foods or ingredients. The industry must provide these consumers with the information important for them to follow such avoidance effectively. Ingredient labelling statements are the key to implementation of safe and effective avoidance diets. Manufacturers must also be made aware that certain processing practices such as the use of shared equipment and the use of re-work can result in undeclared residues of allergenic foods existing in other products. And also manufacturers need to be conveyed through the use of Good Manufacturing Practices (GMP) including the implementation of Hazard Analysis and Critical Control Point (HACCP) systems, which involve intimate cooperation with suppliers of the raw materials and at other points in the food supply chain. Current research on treatment is focused on food desensitisation. Further insights into the pathophysiology of the food allergy and anaphylaxis will lead to the development of improved methods for prevention, diagnosis, and management. These advances create the opportunities for novel therapies for food allergies. And we conclude with the point, at the current time, the only cure is ; avoidance.

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