

Food allergy: the invisible hoe

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Introduction

The literature on food allergy lacks a clear consensus on the prevalence or uniformity for criteria for making a diagnosis and management. Even food allergy (FA) has no universally accepted definition.

Hence, the aim of this review article is to focus on FA, its economic burden, the main risk factors, possible mechanisms, and the most effective diagnostic and management approaches that can be taken into consideration when facing relevant clinical symptoms.

Food allergy has significant deleterious effects on family economics, social interactions, school and work attendance, and health-related quality of life. Children with multiple Food allergy face many nutritional problems as a consequence of an unsupervised elimination diet; failure to thrive and protein-losing enteropathy are the most severe chronic problems. The condition leads to extra stress for their families in terms of care at school, risk of death, and the need for emergency medication [1]. In adults, allergic disorders lead to impaired quality of life, increased absenteeism from work, and reduced productivity when they are at work, and lead to a huge financial burden [2].

Anaphylaxis is the most dangerous effect that may be fatal for both children and adults. It is estimated that severe allergic reactions to foods lead to 30 000 emergency room visits, 2000 hospitalizations, and 150 deaths each year in the USA [1], and the cost of treating FA reactions is estimated to be about half-billion dollars annually [3].

Access to accurate allergy and immunology testing is required to recognize avoidable allergens, to identify targets for specific immunotherapy, and (at times) to exclude allergy as a potential contributor toward symptoms [4].

The awareness of Food allergy has to be improved among the general population and also among medical personnel. We cannot control FA if we do not suspect it!!

Epidemiology

FA is an abnormal response to a food protein triggered by the body's immune system. Any food can induce allergic

reactions, even foods that have been tolerated for years. However, eight types of food account for over 90% of allergic reactions in susceptible individuals, namely, cow's milk, eggs, soya, wheat, fish, shellfish, peanuts, and tree nuts [5,6].

The more frequent types of Food allergy in adults differ from those in children. The most common Food allergy in adults is toward shellfish, peanuts, tree nuts, fish, and egg. The most common Food allergy in children is toward milk, eggs, peanuts, and tree nuts.

Allergic reactions have been also reported to corn, gelatin, meat (beef, chicken, mutton, and pork), seeds (sesame, sunflower, and poppy being the most common), and spices such as coriander, garlic, caraway and mustard, and pepper (black, white, and green).

Allergic reactions to fresh fruits and vegetables such as apple, carrot, peach, plum, tomato, and banana are often diagnosed as oral allergy syndromes and can be overcome, in most allergic individuals, by eating cooked fruits or vegetables [7].

Allergens change because of differences in the genetic profiles and different dietary habits from one country to another. Canada, for example, recognizes all the common allergens and also recognizes sesame seeds and mustard [8]. The European Union additionally recognizes celery as a common allergen. Fish allergy is present at a higher prevalence in fish-eating countries. Other regionally significant or novel food allergens may include pineapple (Ghana), okra (Nigeria), and mopane worm (Botswana) [9].

Allergy to animal products is more severe in winter and plant product allergy is more severe in summer. The reason for the relationship with season is still unclear, apart from the fact that plants flourish in the summer season, which is also characterized by more pollens and molds in the atmosphere (<http://www.allergy-diaasoliman-egypt.net>).

Several national health surveys indicate that the prevalence of FA and the associated clinical and social burdens have increased in recent years [9–11]. However, increased awareness and reporting in developed countries

could be responsible for this increase in the prevalence of FA.

The prevalence of FA depends on genetic factors, age, dietary habits, geography, and diagnostic procedures. Although the incidence of Food allergy is hard to document, it has been estimated that FA affects 6–8% of children younger than 4 years of age and 2–4% of adults [12].

Wide-scale multicenter population-based studies are required to assess the prevalence of allergy and its clinical correlates in many countries including Egypt [13]. Children living in urban centers have a much higher prevalence of Food allergy than those living in rural areas [14].

A family history of atopy, especially of FA, is a good screening test to identify individuals at risk of FA and the rate of allergy in a sibling of an allergic individual is known to be higher than the rate in the general population [13]. Individuals with other allergies have a higher incidence of Food allergy than their nonallergic peers. Children with Food allergy are two to four times more likely to also have asthma, eczema, and allergic rhinitis (hay fever) [15].

About 50% of children with allergies to milk, egg, soy, and wheat will outgrow their allergy by the age of 3–6 years. Those who are still allergic by the age of 12, especially to nuts, legumes, fish, and shellfish, tend to have allergies throughout their lifetimes [16].

It is well known that about one in five individuals reporting an adverse reaction to food have a true FA; of these, the majority will have non-IgE-mediated allergies [17].

Mechanism of food allergy

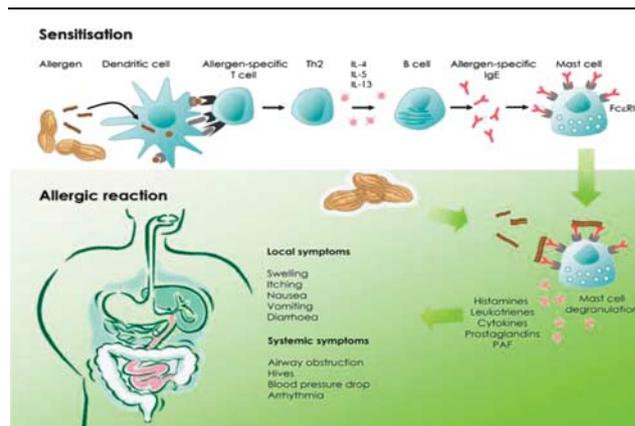
Allergy is an altered immune reaction that is now recognized to be either immediate, late, or delayed (<http://www.allergy-diaasoliman-egypt.net>).

The mechanisms by which an individual develops an allergy to specific foods are largely unknown [18]. Food is one of the allergens that induce allergic symptoms. Other allergens, according to Harvard Medical School, include medication, insect venom, and environmental (e.g. to pollen, dust, mold, or animal dander) [19].

Many Food allergy are caused by hypersensitivities to particular proteins in different foods. Hypersensitivities are categorized according to the parts of the immune system that are attacked and the amount of time it takes for the response to occur. There are four types of hypersensitivity reactions: type 1, immediate IgE-mediated; type 2, cytotoxic; type 3, immune complex mediated; and type 4, delayed cell mediated [20]. Food-allergic disorders can be broadly divided into IgE-mediated or non-IgE-mediated reactions.

In IgE-mediated FA, sensitivity to glycoproteins in food is caused by a series of interactions among T cells, B cells,

Figure 1



Sensitization and allergic reaction [22].

antigen-presenting cells, and mast cells [11,21]. Food allergens bind with food-specific IgE antibodies residing on mast cells and basophils to activate the cells (Fig. 1) [22]. Activated cells release histamine and other inflammatory chemical mediators (cytokines, interleukins, leukotrienes, and prostaglandins). These mediators cause several systemic effects such as mucous secretion, nerve stimulation, smooth muscle contraction, and vasodilatation. These effects result in symptoms of FA such as, rhinorrhea, itching, dyspnea, and anaphylaxis. These allergic reactions have an acute and rapid onset (from seconds to an hour).

In non-IgE-mediated FA, which is much more common, activation and recruitment of lymphocytes and eosinophils are cardinal features of the diseases and symptoms are typically of late onset and nonacute (<http://www.allergy-diaasoliman-egypt.net>) [11].

In most cases, foods cause reactions in allergy-prone individuals if they are swallowed. In certain individuals, food may cause reactions such as asthma if inhaled. Flour can cause asthma in bakers who are allergic to this substance. Inhalation of aerosolized food particles such as fish and shellfish during cooking may cause respiratory symptoms in selected food-allergic individuals [23].

Young children with severe liver dysfunction appear to have a high prevalence of food sensitization. Hepatic mechanisms may therefore be important for establishing immune tolerance to dietary antigens in humans [24].

Cross-reactivity

Cross-reactivity is the ability of the immune system to recognize similarities between different allergens such that allergic antibodies produced against one allergen will also react against another similar allergen [25]. Cross-reactivity is detected among legumes, tree nuts, fish, shellfish, cereal grains, mammalian and avian food products, and a variety of other plant-derived foods that may share proteins with pollens, latex, and each other [25,26]. Individuals with allergies to hen's eggs

may cross-react to other types of eggs and poultry, especially chicken (<http://www.allergy-diaasoliman-egypt.net>).

Heating reduces the allergenicity of beef, and therefore, well-cooked beef is less likely to cause a problem with those with cow's milk allergy [27].

Numerous latex allergens cross-react with food and pollen proteins, sometimes causing severe anaphylactic reactions. Foods commonly reported to cross-react with latex include banana, avocado, kiwi, chestnuts, potato, and papaya [28,29].

The risk of cross-reaction increases with increasing concentration of serum food-specific IgE antibody [30] and antibody affinity is also likely to be influential [31].

Risk factors for food allergy

No one knows exactly why some individuals are allergic to certain food substance. Similar to any disease, FA could be caused by one or more of the following reasons: genetic susceptibility, environmental, or nutritional factors.

The development of FA is influenced by heredity, gastrointestinal permeability, immune response, and exposure to food. The immature state of the mucosal barrier and the immune system might play a role in the increased prevalence of gastrointestinal infections and FA in the first few years of life.

Children appear to inherit tendencies toward allergic reactions, not specific allergies. For example, a parent may have allergic rhinitis and his/her child may have a milk allergy. If one parent has atopy, the baby has 50% possibility of having allergy, whereas if both parents are atopic the baby is more than 70% prone to allergy.

Children born by cesarean section (with a family history of allergy) have a greater risk of having milk allergies than those born by normal vaginal delivery [32]. It is believed that babies that are not breast fed are more prone to develop allergies. Conclusive breast feeding, combined with the avoidance of solid foods and cow's milk for the first 4–6 months, as recommended by the American Academy of Pediatrics (AAP) and the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), may help reduce allergies [18,19] as very early introduction of solid foods before week 17 of age [33] was found to increase the risk of allergy.

Medical conditions that make it easier for allergen to pass through the walls of the stomach and intestines and enter the bloodstream increase susceptibility to FA. These conditions include gastrointestinal disease, digestive tract infections (by bacteria, yeast, parasites, or viruses), malnutrition, prematurity, and diseases that impair the immune system, such as eosinophilic esophagitis (EoE) [34].

Emotional state may play a role in the problem, for example stress, premenstrual tension, and anger, especially if the immune system is not functioning properly.

When FA and asthma occur together, the symptoms of both are more likely to be severe [35].

Clinical findings

FA is associated with a broad range of signs and symptoms that may involve many systems usually in the digestive system, the skin, and occasionally in the nose and lungs, and the cardiovascular system; however, these reactions may occur anywhere in the body (Fig. 2).

Gastrointestinal symptoms may begin in the area first exposed, with burning, itching, and swelling of the mouth, gums, lips, tongue, and pharynx. Manifestations may end here or extend to other parts of the system or may aggravate to anaphylaxis [35].

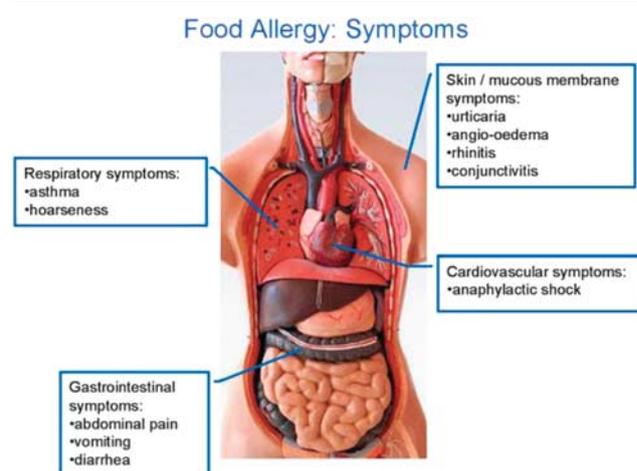
Symptoms of allergies and the amount of food required to trigger a reaction vary from individual to individual [20]. Some allergic reactions occur as soon as an individual starts chewing; others may take several hours to develop.

Foods that are highly allergenic are easy to identify; a delayed reaction is harder to detect. An allergic reaction to multiple foods is difficult to discover. When a child is allergic to a number of foods, the clinical picture can be serious and avoidance of the offending allergens leads to major dietary restrictions and, in turn, nutritional deficits.

Children with FA are two to four times more likely to experience other allergic conditions and asthma than those without FA. This is of great importance as FA could be an under-recognized risk factor for problematic asthma [36]. Also, children with coexisting FA and asthma may be more likely to experience anaphylactic reactions to foods and be at a higher risk of death [35–37].

The possibility of FA should be considered in children and young individuals who do not show a satisfactory response to treatment for atopic eczema, gastroesophageal reflux disease (GERD), and chronic constipation or diarrhea.

Figure 2



Food allergy: symptoms [22].

Some individuals believe that Food allergy is linked to childhood hyperactivity and to arthritis; however, there is no evidence to support this [38]. The most serious reaction to food is anaphylaxis.

Anaphylaxis

Most allergic reactions to food are relatively mild but in some individuals, a FA can trigger a severe allergic reaction called anaphylaxis that may be life threatening. Anaphylaxis typically occurs through an IgE-dependent immunologic mechanism, most commonly triggered by foods, stinging insect venoms, or medications, affecting the respiratory tract and blood circulation, causing the following symptoms, according to Mayo clinic [38]:

- (1) Constriction and tightening of the airways.
- (2) A swollen throat or the sensation of a lump in the throat that makes it difficult to breathe.
- (3) Shock, with a marked decrease in blood pressure.
- (4) Rapid pulse.
- (5) Dizziness, lightheadedness, or loss of consciousness.

Emergency treatment is critical for anaphylaxis. Untreated, anaphylaxis can cause a coma or death. It requires an immediate injection of epinephrine, together with life saving resuscitation measures. Antihistaminics are injected to treat cutaneous manifestations of anaphylaxis, especially pruritus. There is lack of evidence for the use of steroids, although they may be valuable in preventing a biphasic reaction.

The World Allergy Organization (WAO) [39] recommends that epinephrine should be injected intramuscularly into the mid-anterolateral thigh, and the patient should be placed on the back (or in a position of comfort if there is respiratory distress and/or vomiting), with the lower extremities elevated. Simultaneous calls for ICU or medical help is mandatory, and the patient may need another dose of epinephrine.

The WAO has established patient information links to various allergist-recommended educational resources categorized by language and geographical region available at: http://www.worldallergy.org/links/patient_links.php.

Eosinophilic esophagitis

EoE is characterized by swelling of the esophagus caused by an allergic white blood cell, the eosinophil. Symptoms appear to be age-related, with younger children having more symptoms of weight loss, abdominal pain, chest pain or heartburn, coughing, and vomiting, and older children and adults having food impaction, dysphagia, and heartburn.

It is not exactly clear what causes EoE, although this disease may be related to other allergic diseases, particularly asthma. Recently, there have been studies showing an association between food and environmental allergies and EoE. The most common food triggers for EoE are milk, egg, wheat, rye, and beef [40].

Table 1 Symptoms associated with eosinophilic esophagitis and coping mechanisms

Symptoms	Coping mechanism
Dysphagia and feeding dysfunction	Avoiding highly textured foods such as meat Avoiding bulky foods, such as bagels Cutting food into small pieces Lubricating foods before eating with liquid or butter Extensive chewing of foods Prolongation of meal times
Food impaction	Drinking liquid to wash food down Raising the hand above the head Jumping up and down Waiting for food to dissolve or to pass into the stomach
Chest pain	Avoid foods that exacerbate pain Avoid acidic drinks

wikispaces.com/Eosinophilic + Esophagitis.AInotes-ainotes.

The diagnosis of adult EoE according to Mayo Clinic includes the following:

- (1) Presence of esophageal symptoms.
- (2) Presence of 15 or more eosinophils/high-power field on esophageal biopsy.
- (3) Exclusion of GERD, as it has been associated with eosinophilic infiltrate in the esophagus.

Treatment of EoE:

- (1) Symptomatic treatment (Table 1).
- (2) Medications: fluticasone propionate and proton pump inhibitors.
- (3) Esophageal dilation for strictures.

Exercise-induced food allergy

Some individuals have an allergic reaction to a food triggered by exercise. Neither food intake nor physical activity by itself produces anaphylaxis [41].

Eating certain foods may cause itching and lightheadedness soon after starting exercise. In serious cases, an exercise-induced FA can cause anaphylaxis that necessitates emergency interference [42]. Crustacean shellfish, tomatoes, cheese, and celery are common causes of exercise-induced FA.

Not eating for a couple of hours before exercising and avoiding certain foods may help prevent this problem.

Differential diagnosis of food allergy

According to Mayo clinic, there are common conditions that can cause symptoms mistaken for a FA including the following:

- (1) Food intolerance: discussed later.
- (2) Food poisoning, metabolic reactions to food, and reactions to drug-like chemicals in foods (e.g. caffeine and amines) and adverse reactions because of chemicals added to food, for example, sulfites,

monosodium glutamate, artificial sweeteners, and food colorings. Pharmacologically active food components cause the release of histamine, which leads to nervousness. Tyramine in aged cheeses triggers migraine.

- (3) Chronic stress or psychological factors.
- (4) Food aversion: symptoms are often nonspecific and unconfirmed by blinded food challenges.
- (5) Celiac disease: although celiac disease is sometimes referred to as a gluten allergy, it is not an actual FA. Like a FA, it does involve an immune system response, but it is a unique immune system reaction that is more complex than a simple FA. This chronic digestive condition is triggered by eating gluten, a protein found in foods containing wheat, barley, or rye [43,44].

Food intolerance versus food allergy

Food intolerance is more common than FA. An individual with food intolerance is unable to digest and process a food correctly, usually because of a lack of a certain enzyme or enzymes, and it does not involve the immune system, although the symptoms may resemble those of a FA (Table 2).

One of the most common intolerances to food is lactose intolerance, which may be the result of the body's inability to digest sugars in food because of a deficiency of lactase enzyme. Lactose intolerance can cause symptoms very similar to those of irritable bowel syndrome (IBS) [45]. However, abnormal immune reactions mediated by IgG antibodies coexist in patients with IBS. It is very important to treat IBS by eliminating the allergic foods according to the serum level of food-specific IgG antibodies.

Yeast intolerance can cause stomach bloating, halitosis (bad odor of the mouth), mouth ulcers, white discoloration of the tongue, mood swings, heartburn, nasal congestion, sugar cravings, and fatigue. Avoidance of foods containing yeast such as bread, peanuts, soy sauce, and cheese alleviates these symptoms.

Food intolerance, like FA, can cause nausea, vomiting, stomach pain, and diarrhea. Other symptoms of food intolerance include gas cramps, or bloating, heartburn, headaches, and irritability.

Underchewing and eating the same food too much and frequently makes an individual prone to developing food intolerance. Repeated use of antibiotics and anti-inflammatory drugs may cause food intolerance. Psychological reactions may aggravate clinical symptoms.

Food intolerance is more chronic, less acute, less obvious in its clinical presentation, and often more difficult to diagnose than allergy, as skin tests and standard immunological studies are not helpful [46]. Food intolerance can lead to allergic reactions, however, if particles of undigested food enter the bloodstream.

Table 2 Food intolerance vs. food allergy

Food intolerance	Food allergy
Etiology	
Exposure to certain food	Exposure to certain food
Does not involve immune response	Involves immune response (IgE or non-IgE)
Lack of certain enzyme(s)	Genetic susceptibility
Dose related	Dose related
Psychological stress	Stress + low immunity
Fade	
Not life threatening	May be life threatening
Examples	
Lactose intolerance	Milk allergy
Yeast intolerance	Egg allergy
Onset	
Starts at any age	Usually begins in childhood
Symptoms	
Usually of delayed onset	Usually begin within minutes to an hour of eating
Prevention	
Diminish the amount of causative food(s)	Elimination of the offending food(s)
Probiotic	Desensitization

Diagnosis of food allergy

The diagnosis of FA should be made as follows:

- (1) Assessment of the history (symptoms and their timing): to suspect foods and amounts required to produce a reaction.
- (2) Clinical examination:
 - (a) Symptoms and signs.
 - (b) Anthropometric measurement (especially in children).
- (3) Food and symptom diary: A file record of foods eaten, medications taken, and timing of symptoms is kept for 2 weeks. Foods suspected of causing allergy can be confirmed by immunological tests.
- (4) Immunological tests [30,47,48]: There are many types of allergy tests: skin prick test, blood test, fecal eosinophil-derived neurotoxin (EDN), and food challenge test.

Skin prick tests

- (1) Are used to detect IgE antibodies only.
- (2) They can confirm an allergy to a particular food according to a patient's history.



- (3) Non-IgE-mediated allergies cannot be detected using this method.

Fecal

EDN in a single spot sample performs similar to a skin prick test (for IgE and IgG) to examine for intestinal permeability in toddlers with cow's milk allergy [49].

Blood test

Radioallergosorbent test (RAST):

- (1) Used to detect IgE antibodies only.
- (2) A CAP-RAST test is a specific type of RAST test as it can show the amount of IgE present to each allergen [50].

Food challenges

- (1) Double-blind placebo-controlled food challenges (DBPCFC) are the gold standard for the diagnosis of Food allergy, including most non-IgE-mediated reactions.
- (2) Blind food challenges involve packaging the suspected allergen into a capsule, administering it to the patient, and observing the patient for signs or symptoms of an allergic reaction.
- (3) Because of the risk of anaphylaxis, food challenges should be administered under a controlled environment in a hospital.
- (4) Although considered the most accurate and reliable method to detect the prevalence of FA, DBPCFC is not always practical in epidemiological studies of FA and it appears that skin prick testing and in-vitro-specific serum IgE are better predictors [51].

Prevention and management of food allergy

Currently licensed treatments target only the symptoms of reactions and anaphylaxis, not the allergies themselves. The public generally overestimates the number of individuals with FA. As a result, many individuals avoid certain foods unnecessarily. It is important to use reliable methods to diagnose FA to avoid unnecessary dietary restrictions and to determine how big the problem of FA is [52].

Food elimination diet

The only way to prevent an allergic reaction in sensitive individuals is to eliminate the food or the food component from the diet. The patient begins with a simple elimination diet, omitting only foods that are suspicious [53]. The food suspected of causing the allergic reaction is withdrawn from the diet for 2–6 weeks. The food is then reintroduced into the diet. If the symptoms disappear when the food is withdrawn and then returns once the food is introduced, this normally confirms a FA [54].

Ideally, the approach toward etiological management of allergy should include an attempt to reverse the pattern of immune response against the desired antigen from reaction to tolerance. As the patient is already intolerant to that antigen, attempts at high-dose tolerance are undesirable and may be dangerous, and low-dose tolerance is the only option available. The aim is logically to: (a) clear the body from the antigen, (b) remove the inflammatory stimulus from the desired antigen, (c) to reintroduce it in low doses orally to achieve a low-dose tolerance state, and then (d) to shift to high-dose exposure to produce high-dose tolerance; this management should be combined with other therapies (<http://www.allergy-diaasoliman-egypt.net>).

Therapy

- (1) *Antihistamines*: For a minor allergic reaction, prescribed antihistamines may help reduce symptoms. H1-antihistamines are the mainstay medications in many allergic diseases. Second-generation H1-antihistamines are preferred and more widely used owing to their better safety profile and efficacy than first-generation antihistamines [55].
- (2) *Epinephrine*: For a severe allergic reaction, the patient may need an emergency injection of epinephrine and a visit to the emergency room [38].
- (3) *Steroids*: Steroids are used to calm down the immune system cells that are attacked by the chemicals released during an allergic reaction. Steroids can be administered locally, orally, or through an injection. A long period of time is usually required for these to take effect [50].
- (4) *Traditional Chinese medicine*: The Chinese herbal medicine formula FAHF-2 completely blocks anaphylactic reactions in a murine model of peanut allergy. This formula is based on a long-used Traditional Chinese Medicine formula for parasite infection [56–58].
- (5) *Oral immunotherapy (OIT)*: Researchers have been studying the use of OIT as a treatment for FA. Small doses of the allergy-inducing food are swallowed or placed sublingually. The dose of the food is gradually increased. Initial results seem to be promising [38,58,59]. However, the WAO does not currently recommend OIT or other immunomodulatory approaches to prevent anaphylaxis triggered by food [39].

Conclusion

FA, which is an abnormal response to a food protein triggered by the body's immune system, affects as many as 6–8% of young children and 3–4% of adults, with an increasing prevalence in westernized countries, but lacking definite figures in many countries including Egypt. It has significant deleterious effects on family economics, social interactions, school and work performance, and health-related quality of life, and may cause anaphylaxis that carries the risk of death and the need for emergency medication.

Any food can induce allergic reactions, even foods that may have been tolerated for years. However, eight types

of food account for over 90% of allergic reactions in susceptible individuals, namely, cow's milk, eggs, soya, wheat, fish, shellfish, peanuts, and tree nuts.

The mechanisms by which an individual develops an allergy to specific foods are largely unknown. However, food-allergic disorders can be broadly divided into IgE-mediated or non-IgE-mediated reactions.

The diagnosis of FA depends mainly on the history, food and symptom diary, and clinical examination for differentiation from other adverse reaction to foods, for example food intolerance, celiac disease, and eosinophilic esophagitis and enteritis. FA usually affects the digestive system, the skin, and occasionally the respiratory tracts, and cardiovascular system. Symptoms start within minutes up to several hours from ingestion of food. The diagnosis can be confirmed by immunological tests (food challenges, skin prick test, and serum food-specific IgE).

FA may underlie severe asthma, atopic eczema, GERD, chronic constipation or diarrhea, or anaphylaxis. Some individuals have an allergic reaction to a food triggered by exercise (exercise-induced FA); others may develop allergy following severe gastroenteritis or after prolonged use of antibiotics. Severe malnutrition could result from strict unnecessary avoidance of many important allergenic foods, especially in children.

Cross-reactivity is detected among legumes, tree nuts, fish, shellfish, cereal grains, mammalian, and avian food products, and a variety of other plant-derived foods that may share proteins with pollens, latex, and each other.

The management of FA should be aimed at educating the patient on how to avoid ingesting the causative allergen, especially when eating outdoors, and initiating therapy if ingestion occurs. A patient with severe allergy or a history of anaphylaxis should carry an epinephrine injection, and learn how to use it; it is life saving. Promising studies on the management of FA include sublingual/OIT, injection of anti-IgE antibodies, cytokine/anticytokine therapies, Chinese herbal therapies, and novel immunotherapies utilizing engineered proteins and strategic immunomodulators. Elimination of the offending food is still the clue in the management of FA.

Recommendations for allergic and high-risk individuals to increase awareness about FA should be implemented carefully.

Recommendations for allergic individuals

- (1) Food allergy at any age require:
 - (a) Strict attention to the food eaten.
 - (b) Careful reading of food labels.
 - (c) Knowledge of food allergen derivatives, for example butter is a milk product and mayonnaise is derived from egg.
 - (d) Learning how to be extremely specific when eating out.
 - (e) Learning how to avoid offending food antigens.
 - (f) Increase awareness of Food allergy.
 - (g) How to expect and manage allergic reactions.
- (2) Even healthy natural foods can have adverse effects if an individual is allergic to them.
- (3) Food allergy can occur de novo even for foods we used to consume.
- (4) The following foods are highly allergenic: dairy products, eggs, bananas, beef products, chocolate, citrus fruits, corn, oats, nuts, processed and refined foods, salmon, strawberries, tomatoes, and wheat, and should be consumed with caution.
- (5) Egg white is more allergenic than egg yolk.
- (6) Avoidance of any food products that contain artificial color or any other food additives.
- (7) Cooking can destroy a number of the allergens in fruits and vegetables; however, the allergens in some vegetables, such as celery, are not affected by cooking.
- (8) Cooked meat is less likely to cause a problem in those with cow's milk allergy.
- (9) Newer processing techniques, such as high-pressure treatment of foods, fermentation, and enzyme treatment, can help reduce the allergenicity of some food proteins.
- (10) Refining can remove allergens from oils.
- (11) An allergic individual with a history of anaphylaxis from peanuts, nuts, fish, or shellfish should eliminate these foods completely from his diet.
- (12) An epinephrine injection should be carried at all times for emergency, and its expiry date should be checked.
- (13) Avoid eating for at least 2 h before exercise.
- (14) It is better to avoid taking aspirin within 3 h of eating in allergic individuals.
- (15) After a fast, an attempt can be made to consume the 'foods to avoid' in very small amounts. If an individual feels bloated or has a slight headache, an upset stomach, gas, diarrhea, a rapid pulse, or heart palpitations after eating certain foods, these should be eliminated from the diet for 60 days, and an attempt should be made to introduce them again in small amounts under medical supervision.
- (16) When foods are removed from the diet, alternative nutrient sources must be provided.
- (17) Infants at high risk should be breast fed exclusively for the first 4–6 months or receive a casein hydrolysed formula or amino acid-based formula.
- (18) Lactating mothers should avoid eating high allergenic foods as the protein content may pass in the breast milk and cause lifelong allergy.
- (19) Specific food aversion in some children may underlie FA.
- (20) Get the child a medical ID bracelet, and keep in touch with his caregivers to identify his allergenic foods.
- (21) A too-clean environment may encourage allergy!!
- (22) Peanuts, nuts, and fish should be excluded from the diet of atopic children for the first 2–3 years.
- (23) The clinician must consider the age of the patient, and dietary and clinical history.
- (24) Avoid stress.
- (25) Management of FA = elimination of the offending food(s).

Suggestions for research

- (1) Egyptian food habits and allergy.
- (2) Salty foods and allergy.
- (3) Genetic engineering to develop hypoallergenic foods.
- (4) Environmental pollution and FA.
- (5) Hygiene and FA.
- (6) Stress and FA.
- (7) Liver diseases and pathogenesis of FA.
- (8) Vaccination and FA.
- (9) Intestinal flora and probiotics, and FA.
- (10) H2 antagonist in FA.
- (11) IBS and FA.
- (12) Ginger in the management of allergy.
- (13) Zinc or vitamin A deficiency and FA.
- (14) Fecal EDN in the diagnosis of non-IgE allergy.

Data sources

Electronic searches of PubMed abstracts, journal text, international agencies (NAID, AAAAI, espai, WAO, WHO and CDC), online practitioner expertise data from known figures of allergy in Egypt, from Ain Shams University (Dr Diaa Soliman, Dr Yehia Algamal, and Dr Elham Hosny), in addition to the author's experience in clinical nutrition at the National Nutrition Institute.

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Conflicts of interest

There are no conflicts of interest.

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