



Food Allergy: Symptoms, Diagnosis and Treatment

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Abstract

Sometimes, body of a person over reacts to a substance present around and which is a normal substance for others is called allergen and the phenomena is called allergy. The allergen is considered to be a foreign substance by the body and its defense system overreacts releasing chemicals to defend against that substance. Many humans are prone to food allergy (when allergen is present in a food). A few foods viz. milk, cereals, soybean, nuts, eggs, fish, shell fish have been marked as foods with more probability of acting as food allergens. Symptoms of allergy may be visible on skin as rashes, difficulty in respiratory tract, gastro-intestinal tract, cardiovascular system etc. These symptoms may range from low risk to life threatening. The food allergy may be hereditary also. One has to be very cautious if allergic. The only medicine under life threatening condition called as anaphylaxis is epinephrine injection. The patient is advised to keep epinephrine auto-injector with him/her all the time. It is recommended not to eat or even expose to a known food allergen. It is found that allergic persons especially children have imbalanced gut microbiome. There is decline of good bacteria. Bacterial therapy may be useful for suppressing food allergy.

Keywords: Food allergy; Allergen; Gastrointestinal tract; Skin rashes; Respiratory tract; Cardiovascular system; Gut microbiome; Enterocolitis

Introduction

Normally, immune system in the body has a defence role and tries to keep the person healthy by nullifying the effect of an infection or a danger to normal health. However, it is very common that a person's body overreacts to a substance present around which is a normal substance for other persons. A substance which causes allergy is called as 'allergen'. Technically, an allergy is called when body's natural defences overreact to exposure to a particular substance considering it as an invader and there is release of chemicals to defend to that particular substance [1,2]. There is a genetic tendency to develop allergic diseases. When body comes in contact of an allergen, there may be an immune response leading to allergic inflammation. Mostly persons either inhale allergens or take as a part of food. There may be different types of allergens which are found in the form of dust, pollen,

insects, moulds, pets and food [3,4]. In this article, emphasis has been given to food allergens which develop allergy called as food allergy.

Food allergy is more in children compared to adults. It has been estimated that 4 to 6% children and around 4% adults have food allergy. Visible symptoms of food allergy are most often found in babies and children. It has also been found that sometimes, a food which is being eaten by an individual since years without any problem, may exhibit allergic symptoms [2].

Whether allergy is hereditary?

Although, it has been considered that allergy may be hereditary, it can't be predicted whether a progeny will be in heredity food allergy from the parent. Similarly, it is not necessary that all siblings will suffer from the same allergic condition. However, it

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has been observed that if a child is allergic to a food like peanut, his/her younger siblings will also have allergy to that food [2,5,6]. It has been observed that symptoms of a food allergy may vary from mild to much severe. It is also seen that the same food has caused mild allergy symptoms at one time, may exhibit much severe symptoms some other time. A severe allergic condition is anaphylaxis when there is obstruction in breathing and condition may be life threatening. There may be sudden decrease in blood pressure which may affect the functioning of the heart. Sometimes, person develops these severe symptoms within few minutes of eating the food and situation may be harsh even leading to death. If medical care is available timely, mostly doctors give an injection of epinephrine [2,5-7].

Common Allergic Foods

Although there is no hard and fast rule, any food may be allergic to an individual. The following foods have been found to act as allergens in most of the cases [2,6]:

- Milk
- Peanuts
- Eggs
- Fish
- Shellfish
- Soybean
- Wheat
- Tree nuts

Besides, certain ingredients used in condiments like mustard and sesame seeds have also been found to be allergens. Sometimes, certain vegetable oils, Bengal gram flour have also been found to act as strong allergens [2,8].

Symptoms of Allergy

The common symptoms of allergy are visible on skin in the form of rashes which may be converted into eczema or urticaria (hives). Sometimes, symptoms are visualized as pale or blue coloring on the skin. In some persons, allergy symptoms are visualized by difficulty in breathing which affects lungs and in longer term, it may develop asthma. In some people, symptoms develop in the form of watery nose and/ or eyes which may develop in the form of either hay fever (allergic rhinitis) or conjunctivitis. In some cases, allergens affect the gastro-intestinal tract which may be visualized as pain (cramps) in stomach and/or vomiting, tight hoarse throat, difficulty in swallowing, swelling on tongue etc. In some rare cases, allergen may affect cardiovascular system which results in poor pulse rate, dizziness, feeling faintness etc [2,6].

Generally, it has been observed that allergy symptoms are visible within few hours of consuming the food. However, in children, sometimes allergic reaction in the form of eczema is visible after

a day or so [2,9]. In some cases, when infants are given external milk (milk powder, milk formula etc) or other solid foods having soybean and/or cereal grains for the first time, they develop a severe stomach problem like frequent vomiting, diarrhea with blood in the stool resulting in dehydration. This type of allergic reaction is called as food protein induced enterocolitis syndrome (FPIES). Although FPIES is considered to be a medical emergency, such symptoms being similar to viral or bacterial infection, doctors get confused resulting delay in the treatment of FPIES [10].

Sometimes, people develop itchy throat and buccal cavity after eating uncooked vegetables or fruits, it may not be allergy from these vegetables or fruits, but due to the presence of pollen on the vegetable or fruit and not due to vegetable or fruit itself. These symptoms are called oral allergy syndrome. In fact, immune system recognizes the pollen and/ or a protein present in the uncooked food (vegetable/ fruit/ other uncooked food) which acts as an allergen. The allergen may be destroyed by proper cooking and thereafter, it is expected to face no allergic problem [2,11].

Mode of action of allergens

When an allergen enters in the body either by inhalation, invading or with food, there is an immune response resulting in production of antibodies. The antibody binds to mast cells and then there is release of a hormone, histamine leading to allergic inflammation (mostly there is redness and/ or swelling on the skin), ultimate results in irritation and person feels much uncomfortable. When a chemical/ food additive acts as allergen, it may not cause an immune response, then these symptoms are called adverse reactions and not allergy [2,6,12].

Diagnosis and Treatment

Once, allergic reaction has been diagnosed, it is always advised not to eat that allergen containing food. It has been observed that a person allergic to a particular food, has much fair chances to be allergic to other related foods. Many times, a person allergic to peanuts, has fair chances to have allergy from related foods like peacans, almonds, cashews, walnuts. Sometimes, it is very difficult to determine the food to which person is allergic. There may be many food items which have never been tried by the person. It is believed that negative tests with specific food items are much fruitful in ruling out allergy [1,2,6,13].

If a food item is allergic to two different persons, it is not necessary that both will have same type of symptoms. Not only this, it has been found that if same person eats an allergic food, he/she may experience different symptoms every time and severity may also differ. As has been mentioned above, allergic reactions may affect respiratory tract, skin, cardiovascular system, gastrointestinal tract. As has been mentioned above, sometimes,

person may develop anaphylaxis which is much risky condition and if patient is not given proper treatment, there may be even death [2,6,14].

Although allergy to a particular food item may be at any age, most likely it occurs in early childhood stage. If so, doctor (allergy specialist) must be consulted who will like to know about the family medical history for allergic foods. It is most likely that doctor may ask about the time for visible allergic symptoms, on which body part these symptoms are experienced, on eating how much food quantity, person developed allergic reaction etc. Thereafter, doctor may like to conduct the following allergic tests [2]:

Skin prick test: A small amount of the suspected allergic food is dissolved in water (or any other liquid in which suspected allergic food gets dissolved) and this sample is put on the skin (generally either on back or forearm). Thereafter, skin is pricked with a sterile scalpel or some other pointed object so that liquid seeps under the skin. If wheal like bump forms at the site where liquid having suspected allergen is placed within 15 to 30 minutes, then test of allergy is considered to be positive. It is preferred to conduct a control test simultaneously where liquid (used for dissolving suspected allergic food) without suspected allergic food is placed in a nearby area of the skin and this area must not develop wheal.

Blood test: Here, amount of Immunoglobulin E antibody present in the blood is determined. In this test, one may require more time (several days) in getting the results.

If the above test(s) is/are negative, it is easy to rule out the presence of allergen in the suspected food. However, if test(s) is positive, one may not be sure with 100% certainty that allergen is there in the suspected food. In that situation, sometimes doctor conducts another test called as oral food challenge test which is as follows:

The oral food challenge test must be conducted under strict surveillance of a specialist. The person is asked to eat much smaller amount of the suspected food orally repeated over a period of time (at intervals of few hours). Every time, dose of the food is increased gradually and before giving the dose, symptoms, if any are observed carefully. This test is considered to be risky and therefore must be conducted in the presence of a doctor with ready emergency medicines and equipment etc [15,16].

After diagnosis, if it is confirmed that a particular food item is allergic to a person, it is advised not to eat that food or food stuff having that as ingredient. It is also advisable that while purchasing food items, label having ingredients must be read carefully to confirm that allergen specific for that person is not

there. One should also confirm that allergen is not there with any other name.

Some people do not take allergy seriously which may be dangerous. It is difficult to predict whether from a food allergen, allergy will be mild or severe even life-threatening. Even from the same allergen, if earlier person got mild allergic symptoms, it is possible, next time, the same person may experience a condition like sudden decrease in blood pressure (hypotension) leading to life-threatening, medically a condition called as anaphylaxis. The anaphylaxis may be within few minutes or seconds after exposure to allergen. It is due to triggering of many chemicals in the body by the allergen which may bring the body into shock. Under the circumstances, immediate treatment is injection of epinephrine. It is recommended that once there is confirmation for a food allergy, doctor must recommend epinephrine auto-injector and must train the patient for its use. The patient must keep epinephrine auto-injector with at least two doses with him/her since no one can predict whether there may be recurrence of the severe condition after an hour or so injecting the first dose. The patient must also be aware about the expiry date of the epinephrine auto-injector. It is recommended that if person finds symptoms like weak pulse, low blood pressure, difficulty in breathing, continuous cough, hives, tightness in throat with difficulty in swallowing, skin rashes with vomiting, diarrhea, pain in abdomen etc, epinephrine injection must be taken immediately and should call for an ambulance for going to hospital. The patient must also be aware of side effects of epinephrine like dizziness, shakiness, anxiety, restlessness etc. Sometimes, person may get variation in heart rate, hypertension, even heart attack. Persons with cardiovascular disease and/ or diabetes have higher risk. However, still one has to take the risk of side effects since no substitute for epinephrine is available and it is considered to be the only medicine to reverse the life-threatening symptoms of anaphylaxis [2,6,17].

Chong et al. [18] studied reaction phenotypes in IgE-mediated food allergy and anaphylaxis. They observed that food anaphylaxis may be pathophysiologically different than caused by non-food. They also observed that phenotypic symptoms of food allergy may be different in different individuals, and allergen immunotherapy may influence the phenotypic symptoms. They also suggested that researchers must think to study the factors in order to determine who are at most risk of severe food allergic reactions.

McWilliam et al. [19] discussed tree nut allergy prevalence, emerging diagnostics and prognostics which are helpful in managing tree nut allergy. They also discussed the limitations in understanding the tree nut allergy prognosis.

Precautions for Patients Having Food Allergy

In most countries, Governments have formulated laws to declare in clear language the ingredients present in the food stuff. Even it is also mandatory to declare the nature of additive and/ or flavouring agent if any. Although mostly there are no specific laws, some people prefer to put precautions on the labels with indication of 'may contain', 'made in a shared facility' or so to cautious the people for the presence of any potential allergen contamination.

Sometimes, it becomes difficult for the patient to exclude certain stuff from the daily diet (may be apprehension that excluding a certain food item will create deficiency of certain nutrients or so). Under the circumstances, it is advisable to consult a nutritionist or a dietitian. Many times, either the patient or family members are worried whether a particular food item which has become allergic, will remain allergic throughout life. For this, no answer can be given with certainty. It has been observed that in many cases, allergy for certain items like cereals, eggs, milk may disappear with time. However, certain allergies, especially to nuts, fishes etc persist throughout life.

It is always advised that allergic person must be extra careful while eating outside either in a restaurant, or in a party or a friend/relative's place. It is preferred to enquire thoroughly from the kitchen care taker about the ingredients etc. Sometimes, if person is extra-ordinary sensitive, he/she may develop allergy even on walking in a restaurant or a kitchen having that allergic food. It is always preferred to be extra cautious and must instruct in the restaurant not to use the utensils having contamination of specific allergen [2,20].

Recently, there are reports that good bacteria present in gut microbiome may provide protection against food allergies. It has been reported that after oral administered good bacteria to mice, these became more resistant to food allergy and in some cases became reversal of the allergy. It has been indicated that orally administered bacterial therapy may correct the imbalance in gut microbiome and reset the immune system resulting in suppression of food allergy [21].

It has been reported that oral administration of *Subdoligranulum variabile* or consortium of *Clostridiales* species suppressed food allergy in mice. It has been shown that bacterial oral administration induced transcription factor ROR- γ t by regulatory T cells in a MyD88-dependent manner which was deficient in food allergic mice [21].

It has been predicted that changes in life style, increase in caesarean deliveries of babies, avoidance in breast feeding, increased uptake of antibiotics are main factors for imbalance of gut microbiome resulting depletion of good bacteria in the gut which prepare the immune system to recognize food as harmless.

On analyses of gut microbiome of food allergic children and without having any food allergy, difference in microbial species has been found. Scientists are engaged in determining good bacteria in the gut which help in suppressing the food allergy [22,23].

As indicated from above mentioned facts, food allergy is considered to be much dreaded disease and may be life threatening. People are more worried when food allergy is detected in young babies/ children. According to a report of American Academy of Pediatrics, which suggests that there are more chances of developing food allergy if solid food is fed to very young babies. It has been recommended that babies of less than 17 weeks must not be given solid food. It has also been recommended to do breast feeding for as long as possible. Earlier, it was being recommended that exclusive breast feeding must be up to six months. If family has strong history of food allergy, then it is recommended to feed hypoallergenic formulas [2,24].

It has been found that peanut allergy is more prevalent in children. The National Institute for Allergy and Infectious Disease recommended in 2017 that babies having egg allergy and/ or severe eczema have more chance of developing peanut allergy. It is recommended that infants 4 to 6 months old and have started taking solid food, must be given food having peanut. At this stage, it will be clear whether peanut is safe for the infant. Generally, infants who develop peanut allergy have either low or moderate risk condition. It must be noted that infants must not be given whole peanuts since these may chock the esophagus or pharynx [2,25].

In January, 2020, US Food and Drug Administration (FDA) gave approval for a drug, Palforzia {Peanut (*Arachis hypogaea*) Allergen Powder-dnfp} to suppress allergic reactions, including anaphylaxis against peanut allergy in young children aged between 4 to 17 years [26,27].

A few years back, National Academies of Sciences, Engineering, and Medicine, USA appointed a committee to examine critical issues related to food allergy and to give its recommendations. The committee recommended ways to monitor prevalence, explore risk factors, improve diagnosis, and provide evidence-based health care. It was said that diagnostic tests must be conducted judiciously. Evidence-based prevention strategies were also recommended like a strategy to prevent peanut allergy through early dietary introduction. It was also mentioned that there is need of improved education of stakeholders to recognize, manage and prevent allergic reactions. It was also emphasized that intramuscular epinephrine injection must be given to treat anaphylaxis. It was also advised to improve food allergen labelling and evaluation of the requirement of epinephrine auto-injectors with dose required for infants. Emphasis was also given



to do more effective researches to address key questions about diagnostics, mechanisms, risk determinants, and management. The ultimate aim is to find safe and effective therapies [28].

Conclusion

To conclude, food allergy must not be taken lightly by the patients and their family members. Food allergy may become life threatening to the patient. No medicine is available for the food allergy. It is recommended that one must take precautions for the food which causes allergy to a specific person, must not be eaten or even its exposure must be avoided. The dreaded condition of food allergy is anaphylaxis which may be life threatening. Under the conditions, doctors generally advise to take epinephrine by injection. It is advised that patient, after consulting the doctor, must always keep epinephrine auto-injector with him/her for emergency. More researches are required to address key questions about diagnostics, mechanisms, risk determinants, and management.

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