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Can Food Allergies Alter Oral Health?

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ABSTRACT

It's been a question of time that, "how much food allergies can harm our oral health?" and so far studies were able to prove significant relation. All though after impressive research work, it's been proven that the oral cavity is the "display" of all our systemic problems and vice-versa. In recent years, most prevailing but an ignorant aspect of allergy has fallen in the row of most required attention. In this article, we tried to highlight the outcomes and impact of food allergies causing oral diseases.

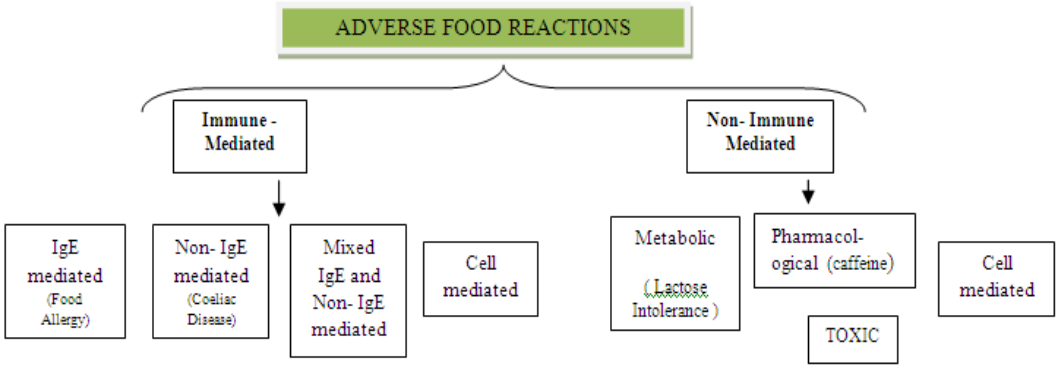
INTRODUCTION

The phenomenon of allergy was discovered by a Pediatrician named Clemens Von Pirquet in 1906.[1] The word allergy comes from Greek words Allos - other and Ergos - work. In accordance, it was defined as "Inappropriate, genetically determined response initiated by exposure to certain substances (allergens or antigens)". A study by Velenta R (2002) showed that more than 25% of the population in industrialized countries suffers from allergies. Report by the European Food Safety Authority stated that the prevalence of food allergies in the general population has been roughly estimated to be around 1-3% in adults and 4-6% in children.[2]

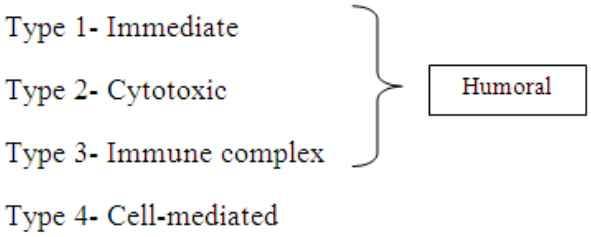
Allergic reactions to certain antigens may manifest distinctly and unpredictably such as – anxiety, skin rashes, dyspnea, dizziness, rhinitis, itchy skin, paleness, hypertension, laryngitis, hypoxia, tachycardia, diarrhea, nausea, urticaria, vomiting, anaphylactic shock, and even fatal sometimes.[3] Sings and symptoms due to allergic reactions are visible in the oral cavity too.

The mechanism behind precipitation of allergic reactions

Von Pirquet proposed the first design of 'allergy' to explain that, "when the individual contacts with an antigen (germs, pollens, foods, etc.), a change in reactivity occurs". This change ('allergy') can induce a protective or harmful response. The first response is known as 'immunity' and the second as 'hypersensitivity'.[1] Adverse food reactions can be categorized as:



The response of the host to the presence of foreign substances can trigger four types of hypersensitivity reactions:



- **Immediate Hypersensitivity (Anaphylactic Reaction)**

The reaction is the result of an antigen induces cross-linking of IgE antibody bound to mast cell or basophils with the release of vasoactive mediators. This type of reaction manifests systemic anaphylaxis and localized anaphylaxis such as hay fever, asthma, hives, food allergies, eczema.[4,5]

- **Cytotoxic Reaction (Antibody-dependent)**

It is IgG or IgM mediated reaction. An antibody directed against cell surface, antigens meditated cell destruction via complement activation. In this case, complication includes blood transfusion reactions. Few examples of cytotoxic reaction are the Rh incompatibility of a newborn, blood transfusion reactions, and autoimmune diseases.[4, 5]

- **Immune Complex Reaction**

IgG and IgM bind antigen, forming antigen-antibody (immune) complexes. Antigen-Antibody complexes deposited in various tissues induced complement activation and an ensuing inflammatory response mediated by massive infiltration of neutrophils. PMNs then release tissue-damaging enzymes. Tissue damage present in autoimmune diseases such as - systemic lupus erythematosus and chronic infectious diseases (e.g., leprosy).[4,5]

- **Cell-Mediated (Delayed Hypersensitivity)**

Cell-mediated reactions are initiated by sensitized helper t cells (Th1 cells). These cells release cytokines that activate macrophages or cytotoxic T cells (T_c cells) that mediate direct cellular damage. The Cell-mediated reaction takes 48-72 hours, or longer, after contact with the antigen. Many chronic infectious diseases, including tuberculosis and fungal infections, exhibit delayed hypersensitivity.[4,5]

The above classification explains the action of immunity in response to the allergens. Apart from the response it ensures enrollment of all body systems. To understand the response of oral mucosa, we have to probe into the structural configuration and cellular entities of the oral tissues.

In - Oral mucosa

Our mouth is subjected to a wide spectrum of antigenic agents including- metal of utensils, foodstuff, drugs, pollens, toothpaste, dental materials including restorative material, denture material, and microorganisms. Anatomically, the oral mucosa is formed by three layers - epithelium, lamina propria, and submucosa. The cells present in the oral mucosa, which are directly related to the immunologic properties, are dendritic cells, T lymphocytes, and B lymphocytes.[6,7]

As the cell-associated IgE comes in contact with an allergen, the IgE molecules become “cross-linked” to that allergen”. This activates the mast cells. Mast cells produce soluble mediators such as Histamines and prostaglandins that influence the dendritic cell function by stimulating maturation and antigen processing. This activates the T cells.

Dendritic cells in oral mucosa including the external epithelial layer show the features of the Langerhans cells observed in various areas of the body with the function of antigen presenting cells (APCs).[6,7,8]

Regarding lymphocytes in the oral mucosa, the T cells are mainly located in perivascular spaces in the epithelial layer, and about 40 times more represented in the oral mucosa than in the skin. The B cells are virtually absent in the epithelium and the papillar layer of the mucosa.[6,7]

FOOD CAUSING ALLERGIES

All of us eat to survive. Apart from the fact, even food can be harmful sometimes. Almost 1 in 20 young children under the age of 5 years and almost 1 in 25 adults are allergic to at least one food.[9]

Food allergies generally develop early in life but can develop at any age. People who develop allergies as adults usually have their allergies for life.[9]

- ✓ In infants and children, the most common foods that cause allergic reactions are: Egg, Milk, Peanut, Tree nuts, Raw -vegetables and fruits, walnuts, Soya, Spices, flavor enhancing additive herbs, candies, chewing gums and Wheat.

- ✓ While in adults, the most common foods that cause allergic reactions are: Peanut, Walnuts, Tree nuts, Fish, Fruits, Shellfish (shrimp, crayfish, lobster, and crab)

- ✓ In general - walnuts, cashew nuts, almonds, hazelnuts, fruits (Apple, Pomegranate, papaya) and vegetables (banana, avocado, kiwi, mango, tomato, potato), milk, eggs, spices, cinnamon, soybeans, fish (cod, tuna, salmon) and shellfish (snails, mussels, oysters, lobster, crabs, shrimps), chewing-gums and candies are the most common food allergens worldwide.[9,10]

On the other hand most of you must be familiar with the term "Food Intolerance" it is a bit different from "Food Allergy". The difference between food intolerance and food allergy is - In the case of food allergies symptoms are unpredictable, may involve the skin, mucus membranes, respiratory system, oral mucosa, cardiovascular, gastrointestinal symptoms, and anaphylaxis.[10,11] But symptoms of food intolerance are confined to the gastrointestinal tract. Examples of Food intolerance are:

- *Lactose intolerance* (Lactose is a sugar found in milk and most milk products.)
- *Food additives* (Certain products such as *MSG (Monosodium Glutamate)* and Sulfites which are added to enhance taste, add color)
- *Fructose intolerance* (Present in fruits)
- *Gluten intolerance* (Gluten is a part of wheat, barley, and rye)

ORAL - ALLERGIC DISEASES

Conditions can be categorized as:

Soft tissue -

- *Oral Allergy Syndrome*
- *Allergic Contact Stomatitis*
- *Plasma Cell Gingivitis*
- *Latex Fruit Syndrome*
- *Erythema Multiforme*
- *Lichenoid Reaction*
- *Angioedema*
- *Head and neck cancer (HNC)*

Hard tissue -

- *Tooth Ache*

Oral Allergy Syndrome - Oral allergy syndrome (OAS) is caused by cross reactivity between proteins found in fresh fruits, vegetables and nuts with pollens. It's described by various names as "pollen-food allergy syndrome," "pollen-food syndrome," and "pollen-associated food allergy syndrome".[12]This syndrome occurs in a large number (up to 70 percent) of people with pollen allergy.

Food reactions causing oral allergy syndrome are almonds, apples, apricots, avocados, bananas, carrots, celery, cherries, chicory, coriander, fennel, fig, hazelnuts, kiwifruit, nectarines, parsley, parsnips, peaches, pears, peppers, plums, potatoes, prunes, soy, strawberries, wheat, potential peanuts. Reactions may begin with one type of food and with reactions to others developing later.[13]

Signs and symptoms include tingling, irritation, burning, and/or swelling of the oropharynx, lips, tongue, and palate where the fresh fruit or vegetable touched. A sensation of tightness in the throat may be observed.[13]

Allergic Contact Stomatitis (ACS) - ACS is caused by an antigen specific T cell mediated hypersensitivity immune reaction to allergens that are in direct contact with the oral mucosa. Food causing allergic contact stomatitis are - spices (particularly cinnamon), Dodecyl Gallate (food additive), candies, and chewing gum.[14,15] Typical signs are intense erythma, vesicles, erosions, ulcers, and shaggy hyperkeratosis which may may involve any part of the mouth including the tongue, roof of the mouth, cheeks, and lips (cheilitis). Symptoms resolve once the cause is removed.[14,16]

Affected individuals may complain of a burning sensation and mouth sensitivity to cold, hot, and spicy foods.

Plasma Cell Gingivitis - Plasma cell gingivitis is a rare benign condition of the gingival. It is characterized by sharply demarcated erythematous and edematous gingivitis.[17]

Plasma cell gingivitis is considered a hypersensitive reaction to some antigen present in chillies, cinnamon, mint, candies, khat leaves, colocasia leaves and chewing gum.[17,18,19]

Plasma cell gingivitis affects the labial and palatal/lingual marginal gingiva and interdental papilla. Common sings are edematous and erythematous. These characteristics appear due to the gathering of specific white blood cells, called plasma cells, in the gums.[18] The labial/buccal attached gingiva appears to be red in color, with loss of stippling and granular surface, extends up to the mucogingival junction. Ulceration and vesicles are absent.[20] Other areas that may be involved include the tongue or lips. This reversible condition is different than gum disease, and symptoms resolve once the cause is removed.[19]

Latex Fruit Syndrome - A large number of individuals who are allergic to latex products show hypersensitivity to some foods especially fresh fruits. This association of latex allergy with fruit allergy is called "Latex-Fruit Syndrome".[21]
Fruits such as avocado, banana, passion fruit, kiwi, papaya, mango, peach, fig, melon, and pineapple, are all associated with this syndrome.
Symptoms manifested by Latex Fruit Syndrome are redness and swelling of lips, tongue, and buccal mucosa.[21]

Erythema Multiforme - In erythema multiforme both the skin and the mouth are affected. Mouth lesions begin as swelling and redness of the oral mucosa, followed by the formation of blisters which break and leave areas of ulceration. Food causing erythma multiforme includes salmon berries and margarine.[22]

The lips may become swollen and develop bloody crusts. The typical skin lesion is the "target" or "iris lesion" which consists of concentric rings of red skin surrounded by areas of normal colored skin (see Right).[22]

Lichenoid Reaction - These lesions resemble lichen planus. Lichenoid reaction shows pattern such as white striations, erythma, erosions,white papules or plaques. Sometimes ulcers are located within the lesion and surrounded by the whitish lines.[23,24,25]

Lichenoid reaction is associated with the habit of chewing gum or eating candies and cinnamon.
These lesions are found most commonly on the buccal mucosa but may occur throughout the mouth.[25]

Angioedema - Angioedema is a soft, painless, non-itchy swelling that usually involves the lips, tongue or cheeks. .Allergic angioedema is the most common type and includes reactions to foods such as peanuts, tree nuts, fish, shellfish, cow milk, soy, and egg.[26] It typically develops rapidly and can become a serious event requiring emergency treatment, if the swelling spreads to the larynx and results in severe breathing difficulty.[27]

Head and neck cancer (HNC) - HNC includes cancers of the oral cavity, oropharynx and larynx. Out of many potential risk factors for HNC include low fruit and vegetable intake.

Immune reactions manifested in the form of allergies have been extensively studied for their relationship with cancer risk.[28]

Tooth ache - According to the University of Kentucky School of Dentistry, the reason for this is the close proximity between the maxillary sinuses and the mouth. Maxillary sinus becomes inflamed during an allergic reaction. When this happens, pressure can build up inside the sinuses and push against the upper molars, causing pain while chewing, and sensitivity to extreme temperatures in the mouth and, sometimes, a throbbing sensation.[29]

SPECIFIC DIAGNOSTIC TESTS

The following tests are commonly used for the diagnosis of food allergies.

1. Skin prick test

In cases of suspected IgE-mediated immunological reactions to food a skin prick test may be performed. The diagnostic accuracy of a skin prick test in suspected food allergies varies.

A needle prick is done to place a tiny amount of food extract just below the surface of the skin on lower arm or back. If allergic, there will be swelling or redness at the test site. This is a positive result. It means that there are IgE molecules on the skin's mast cells that are specific to the food being tested. Negative reactions have a 95% accuracy of there not being an IgE reaction; however, positive tests have only a 50-60% predictive accuracy.[2,30]

2. Measurement of specific serum IgE antibody levels

The radioallergosorbent test (RAST) and derived immunochemical tests are used in determination of food-specific serum IgE antibodies. These tests correlate variably with the diagnosis since their clinical sensitivity and specificity vary according to the conditions used.[30,31]

3. Food challenge

This can be done on an open basis or by single-blind challenge when the offending food is given to the subjects who are kept unaware of what they are being given. Open challenge is less convincing than a single-blind challenge.[30,31]

4. Atopy patch test

The atopy patch test identifies allergens which may be involved in causing atopic dermatitis. It involves application of an allergen under an occlusive dressing for 48 hours onto non- affected part of the patients' skin. The test area is then examined for reddening and consistent.[30,31]

5. Tests of respiratory function

Tests of respiratory function will be useful where respiratory signs and symptoms are present in immunologically-mediated adverse reactions to food. Such tests may include those for assessing narrowing of the airways and/or inflammation (bronchopulmonary provocation).[30,31]

MANAGEMENT & TREATMENT OF FOOD ALLERGIES

1. Read food product ingredient labels carefully.
2. Avoid food products that don't list their ingredients or food products that contain an ingredient you don't recognize.

3. When eating in a restaurant, tell server about your food allergy, and ask specific questions about the food being served.
4. If an allergist prescribes an epinephrine/adrenaline auto-injector, learn how to use it and carry it all the time.
5. Wear a Medic Alert identifier (Bracelet) so that, in case of an accident, others know about your allergies and reactions.

MEDICATIONS

Allergy medications are available as pills, liquids, inhalers, nasal sprays, eye drops, skin creams and shots (injections).[32]

Corticosteroids

Corticosteroids help prevent the release of symptom-causing chemicals during an allergic reaction. Most corticosteroid medications require a prescription.[32]

Oral antihistamines (pills and liquids)

Oral antihistamines ease symptoms such as swelling, runny nose, itchy or watery eyes, and hives (urticaria). Over-the-counter oral antihistamines include loratadine (Claritin) and cetirizine (Zyrtec), and levocetirizine (Xyzal) are available by prescription. Fexofenadine (Allegra) is available both over-the-counter and by prescription.[32]

Decongestants

Decongestants are used for quick, temporary relief of nasal and sinus congestion**.**

Oral decongestants (pills and liquids)

These relieve nasal and sinus congestion caused by hay fever.

A few other medications work by blocking symptom-causing chemicals released during an allergic reaction. Montelukast and Cromolyn (Nasalcrom).

TREATMENTS UNDER DEVELOPMENT

DNA vaccines

DNA vaccines can be used to reduce allergic reactions. DNA vaccines can be developed by one of three approaches: (i) using the naked DNA of allergens (ii) using hypoallergenic derivatives of allergen DNAs by modification of nucleotides; or (iii) fragmenting allergen DNA and fusing with ubiquitin, as fragmenting the antigen destroys its native structure.[32]

Anti-IgE antibodies

Binding of IgE antibodies to specific high affinity receptors (called Fc epsilon receptors, or FcεRI) on basophils and mast cells triggers the release of histamine and other mediators that result in allergy symptoms. Thus developing anti-IgE antibodies against IgE could be a potential therapeutic option for allergy treatment.[32]

Modification of the epitopes

Modification of IgE binding sites, i.e. epitopes of allergens, could be another approach to attenuate hypersensitivity reactions. Epitopes of allergens can be created by modifying allergens and their hypoallergic derivatives.[32]

Target mast cells and basophil cells expressing FcεRI

Another possible option to reduce IgE related hypersensitivity reaction is to directly kill the mast cells and basophils expressing high affinity receptors (FcεRI) for IgE.[32]

Immunotherapy

Immunotherapy (biologic therapy) is indicated for people who are extremely allergic to specific allergens. Immunotherapy is done by gradually exposing the patient to lower doses of allergens to reduce the sensitization.[32]

CONCLUSION

Fresh research work is required. Indulgence of medical and dental professionals is required to invest more efforts in deriving the severity related to food allergies causing other oral problems.

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