

Spotlight

Fall 2009

on nutrition issues

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Acknowledgement

Our special thanks to Dr. Janice Joneja, who provided an expert review of this issue of *Spotlight*. Dr. Joneja is one of the few experts on food hypersensitivity in North America. She is an adjunct professor in the School of Family and Nutritional Sciences at the University of British Columbia and runs a successful private practice in food allergy management. She is also a Registered Dietitian with many years of experience in scientific, clinical and research areas.

Food Hypersensitivity: Do We Know Enough?

Synopsis

In recent years, food hypersensitivity has attracted tremendous interest from consumers, health professionals and scientific researchers. The incidence of food hypersensitivity (food allergies and intolerances) in industrialized countries has increased dramatically over the past few years; however, the overall prevalence in the North American population is only about 4%. There has been a significant increase in knowledge of the pathophysiology of food hypersensitivity, leading researchers to develop more sophisticated diagnostic tests and new treatments for food hypersensitivity. The best advice for preventing an allergic reaction to food remains avoiding the allergenic food. However, a new approach to food allergy management, specific oral tolerance induction, is emerging. This approach, which involves careful exposure to (rather than avoidance of) an allergenic food, has been studied in children with milk, peanut and egg allergies; tolerance to these foods has been achieved in some study participants. Another area of interest for researchers is oral allergy syndrome (pollen-food-related syndrome), which is caused by cross-reactivity between food allergens (proteins) and similarly structured allergens in airborne pollens. The CHILD Study in Canada and the PASTURE Project in the European Union are two of many large studies being carried out to observe the effect of environmental factors on the prevalence of allergic disease. Recently, Health Canada proposed mandatory allergen labelling regulations for packaged foods to improve food safety for Canadians living with food hypersensitivity.

Introduction

Food hypersensitivity – an adverse reaction to food – can occur as a result of food allergy (allergic food hypersensitivity), food intolerance (non-allergic food hypersensitivity) or chemical sensitivity.^{1,2} There has been a dramatic rise in the incidence of food hypersensitivity in many industrialized countries over the past 10 to 15 years.³ Food-induced anaphylaxis remains a leading cause for emergency medical

treatment and has become a major health concern in many countries.²

Diagnosis and management of food hypersensitivity is complex and very challenging for a health practitioner. Understanding of the pathophysiology of food hypersensitivity has increased over the past decade, however, resulting in new directions for diagnosis and new treatments for managing food hypersensitivity.^{2,3}

Developed by the team of Registered Dietitians at Dairy Farmers of Canada



As health professionals, we often see clients who are unable to differentiate between food allergy and food intolerance. A typical example of this confusion is lactose intolerance, which is commonly mistaken for milk allergy. This issue of *Spotlight* discusses the prevalence of, and current management strategies and new directions for, food hypersensitivity and provides general practice guidelines for food hypersensitivity management for health professionals.

In brief

Types of Food Hypersensitivity

Food allergy is an adverse reaction to a protein (allergen) in food. The reaction is caused by an immune-mediated mechanism. During an allergic reaction, symptoms ranging from mild to severe can occur within minutes or hours of ingestion of even a very small amount of an allergen.^{1,2,4}

Food intolerance is a reaction caused by a non-immune mechanism. Intolerance results in impaired digestion or absorption of a food component. Unlike a food allergy, food intolerance requires a larger portion of an offending food and a longer time (hours or days) to elicit an adverse reaction.^{1,2,4}

Chemical sensitivity is an adverse reaction to a chemical that either occurs naturally in or is added to a food. Such chemicals include caffeine in tea, coffee and chocolate; tyramine in aged cheese; and monosodium glutamate (MSG), sulphites and other additives in processed foods.^{1,4}

Proposed Explanations for Food Hypersensitivity

In 1989, Dr. David Strachan proposed the hygiene hypothesis of food hypersensitivity; the theory has gained some support among health professionals. Strachan hypothesized that exposure to bacteria and viruses in infancy seemed to have a protective effect for allergic disease; he believed that cross-infection between older siblings and the infant reduced the incidence of asthma and other allergies in the infant. Several other studies tend to support this explanation.^{5,6}

Symptoms of an allergic reaction are triggered by chemicals (called inflammatory mediators) released by special cells (mast cells) when a foreign protein enters the body through the mouth, nose, skin or urogenital tract. The immune response that leads to this event is controlled by lymphocytes (white blood cells) known as T-helper (Th) cells.⁴

Our immune system protects us from foreign substances that enter our bodies. When a foreign material enters the body, the immune response follows one of two pathways: the Th1 pathway fights disease-causing bacteria and viruses and the Th2 pathway responds to foreign proteins that cause allergic reactions.^{4,5}

The hygiene hypothesis suggests that our sanitized living environment has made the Th2 pathway dominant over the Th1 pathway because there is a decreased need to fight microorganisms in the natural environment. This switch has increased the prevalence of allergies in industrialized countries.⁴ It has been suggested that if babies and children were exposed to a wider range of microorganisms, the Th1 pathway would dominate, thereby decreasing the prevalence of all types of allergies in these countries.⁴

The hygiene hypothesis has prompted the European Union to fund a large project called PASTURE (Protection against Allergy – Study in Rural Environments) to study the effect of an indoor environment (that is, living in farm versus non-farm communities) on the prevalence of allergies in children.^{5,6} PASTURE is an ongoing project but the authors of the study have so far observed that children

who grow up in the proximity of animals and in a non-sanitized farming environment have a decreased incidence of asthma and other allergies. This is known as the “farming effect.” Studies carried out in the United States have reported similar findings. There are some studies, however, that do not agree with the hygiene hypothesis.⁶

Other hypotheses being considered to explain the increased prevalence of food hypersensitivity include the following³:

- Increased consumption of omega-6 fatty acids
- Decreased consumption of omega-3 fatty acids
- Reduced dietary intake of antioxidants
- Excess or deficiency of Vitamin D

Allergic Food Hypersensitivity (Food Allergy)

Up to 25% of adults in North America believe that they or their children suffer from food allergies. In reality, food allergies affect only 4% of North Americans – 6% to 8% of children and 1% to 2% of adults.^{2-4,7,8} Canadian rates are similar to those in the United States.^{1,5}

Most food allergies are acquired within the first three years of life; the incidence decreases progressively until the end of the first decade. Clinical tolerance develops over time for most food allergens, except peanuts, tree nuts, fish and shellfish.^{2,3,7,8} In Canada, the following foods or additives are considered priority food allergens with respect to labelling¹: peanuts, tree nuts, sesame seeds, milk, eggs, fish (including shellfish and crustaceans), soy, wheat gluten and sulphites.

Food allergies usually occur in people who are genetically predisposed to allergy, although reports indicate that as many as 15% of children with food allergy have no family history of allergies.⁴ According to many scientific studies, and as noted above, environmental factors seem to play a significant role in the increased incidence of allergic disease in Western countries.^{2,3,5}

Food allergies occur through either immunoglobulin E (IgE)–mediated or non-IgE-mediated immune mechanisms.^{2-4,7,8}

IgE-Mediated Food Allergy

Immunoglobulin E is released by T-helper cells in all allergic reactions. IgE is allergen-specific, which means that for every type of allergen (food or environmental), the body produces a specific IgE. A skin-prick test or a blood test can indicate the presence of allergen-specific IgE, but these tests often produce false-positive results. Therefore, these results have to be viewed in the context of clinical symptoms before a food allergy can be clearly established. In North America, 3.5% to 4% of the population suffers from IgE-mediated food allergies.^{1-4,7,8}

Symptoms of IgE-mediated food allergies include urticaria (hives), an itchy skin rash, angioedema (tissue swelling), oral allergy syndrome, rhinitis (nasal inflammation), asthma and anaphylaxis. Gastrointestinal symptoms include nausea, abdominal cramps, vomiting and diarrhea.²⁻⁴

In IgE-mediated food reactions, the response is immediate, producing mild to life-threatening (anaphylaxis) symptoms. In non-IgE-mediated food reactions, the response tends to be delayed and is not life-threatening. As well, non-IgE-mediated reactions require prolonged exposure to a food allergen to manifest.^{2,3,8}

Did you know?

The Peanut Allergy Conundrum

Per capita peanut consumption in China and the United States is similar and yet there is virtually no peanut allergy in China. It is believed that Chinese eat mostly boiled or fried peanuts while Americans eat mostly dry-roasted peanuts; the process of dry roasting can increase the allergenicity of peanut proteins. The incidence of peanut allergy in North American children doubled between 2002 and 2007; the reported prevalence is about 1%.^{2-4,8}

Celiac Disease

Celiac disease is caused by hypersensitivity to gluten (found in wheat, rye and barley), mediated by a non-IgE-mechanism.^{2-4,7,8} The incidence of celiac disease has been increasing in recent years and according to recent statistics, 1% of the North American population suffers from this disease.^{1,9}

Cow's Milk Allergy

Cow's milk allergy is less prevalent than is believed and commonly reported in the mainstream media. Apart from proteins in breast milk, cow's milk protein is often the first protein an infant consumes (derived from infant formula). The prevalence of cow's milk allergy is 2% to 3% in infants less than one year old; it resolves by age five in 80% to 90% of children.^{2,4,7,10} Cow's milk allergy can persist into school age, however, and even into adolescence for a small minority of children.^{10,11} In adults, the prevalence of milk allergy is reported to be only 0.1% to 0.5%.⁴

Cow's milk allergy can be IgE mediated or non-IgE mediated. Children with non-IgE-mediated milk allergy tend to outgrow it earlier than those with IgE-mediated allergy.^{10,11} Milk contains more than 25 different proteins – 80% casein proteins and 20% whey proteins.¹² The milk proteins that most commonly trigger an allergic reaction are beta-lactoglobulin (in whey); alpha-, beta- and kappa-casein; and bovine serum albumin (in whey).⁴

Very few studies have been done of milk allergy in adults. Whey and casein proteins are both implicated in adults and the reaction to these proteins can be severe.¹³ Some of the gastrointestinal symptoms of cow's milk allergy (nausea, abdominal pain, bloating, flatulence and diarrhea) make it difficult to distinguish milk allergy from lactose intolerance.⁴

Did you know?

Cooked Milk May Offer Benefits

Some individuals who are allergic to whey proteins are able to consume boiled milk or cooked milk in prepared foods. Most whey proteins are readily degraded by heat while casein proteins are more heat stable and may not be degraded by heat.⁴

Non-Allergic Hypersensitivity (Food Intolerance)

Lactose Intolerance

Lactose intolerance is a typical example of food intolerance. Lactose is the principle sugar in milk. A digestive enzyme called lactase is required to break lactose down into simple sugars (glucose and galactose), which can be readily absorbed by the body. In the average North American diet, 10 grams of lactose are consumed daily from milk products.⁴ Symptoms of lactose intolerance include nausea, abdominal pain, bloating, flatulence and diarrhea.

The lactase enzyme is produced in the lining of the small intestine. A temporary lactase deficiency caused by an injury or illness (such as a severe bout of diarrhea, radiation in the pelvic area or celiac disease) or a permanent reduction of this enzyme (as is the case in 80% of the adult population in the world) prevents complete digestion of lactose.

It is important to distinguish between true milk allergy and lactose intolerance because management of the two conditions differs. The level of lactose intolerance varies in individuals and therefore personal tolerance for lactose should be determined. Most lactose-intolerant individuals can enjoy one glass of milk per day without experiencing symptoms; more recently it has been suggested that colonic adaptation to lactose may improve tolerance.^{4,14}

Cross-Reactivity of Food Allergens:

Oral Allergy Syndrome

Oral allergy syndrome is also known as pollen-food-related syndrome; it is the most common food hypersensitivity disorder in adults.¹⁵ It is caused by food proteins in fresh fruits and vegetables, which have structures similar to those of airborne pollens.

For example, if an individual is allergic to birch trees, he or she can develop allergic symptoms after eating raw potatoes, carrots, apples, pears, hazelnuts or kiwi fruit. Similarly, ragweed allergy symptoms can be associated with melons, bananas and kiwi fruit, and grass pollen allergy with raw tomatoes and celery. These foods (except nuts) are better tolerated when cooked because allergens are degraded in fruits and vegetables during cooking. In recent years, the list of foods causing oral allergy syndrome has increased significantly.^{2-4,7,8,15}

Symptoms of oral allergy syndrome include itching and irritation of the oral cavity, swelling of the lips or tongue and throat tightness within minutes of ingesting an offending food.^{2-4,7,8,15}

The Challenges of Food Allergies

If diagnosing a food allergy is complex, living with one can be worse. For a parent of an allergic child, there are numerous day-to-day worries; lunches have to be packed and school outings, birthday parties and eating out can be very stressful. Travelling by air with food allergies can be quite hazardous: children and adults with allergies can develop severe allergic reactions to airborne powder in the aircraft cabin from a package of tree nuts, or to peanuts or hidden allergens in the food served to passengers.^{2,16} Air Canada has removed peanuts and shellfish from its menu while WestJet does not serve tree nuts, peanuts, fish, shellfish or sesame seeds to its passengers.¹⁶

Future Directions for Food Allergy Management

Specific Oral Tolerance Induction

In recent years, a new approach has emerged for managing food allergies. The specific oral tolerance induction approach involves administration of an allergenic food in very small doses, gradually increasing the amount every day to eventually provide a regular portion. In theory, this process trains the body's immune system to accept the allergenic food protein and establish tolerance. Once tolerance to an allergenic food is established, that food should then be consumed regularly.^{2-4,17}

A number of studies of specific oral tolerance induction have been carried out recently for milk, peanut and egg allergies. In one of the studies of milk allergy, the majority of children were able to tolerate daily consumption of 200 to 250 mL of milk for a year.¹⁸ In another study, gradual introduction of thoroughly heated cow's milk to children also seemed to induce some tolerance.¹⁹ For peanut allergy, a recent study was able to show tolerance for a small amount of peanut in a group of severely allergic children.²⁰ For egg allergy, a small number of participants have also been observed to tolerate eggs.¹⁷

Specific oral tolerance induction seems very promising but the procedure is in the experimental stage and carries significant risks for children with severe food allergies. It requires close monitoring and should be carried out only under the supervision of a physician.²⁰ Some researchers, however, question whether this approach will bring permanent tolerance of a food allergen and suggest that more studies should be carried out to test its long-term efficacy.^{17,21,22}

What's new

Food Labelling

In July 2008, Health Canada proposed new food labelling requirements for food allergens (tree nuts, peanuts, sesame seeds, wheat, eggs, milk, soy, fish including crustaceans and shellfish), sulphites and gluten in packaged foods. The requirements are in response to the growing demand by health professionals and consumers for clearer allergen disclosure on food labels. These regulations should come into effect in the near future.²³

In the meantime, Health Canada has partially funded a large Canada-wide project, called Canadian Healthy Infant Longitudinal Development

(CHILD), intended to identify whether environmental factors are responsible for the increased prevalence of allergic disease in children up to age five.⁵



Diagnosing Food Allergy

Diagnosing a food allergy is often a complex and time-consuming process. The gold standard for diagnosis is the double-blind, placebo-controlled oral food challenge (DBPCFC). In recent years, however, many sophisticated tests have been developed that may help identify a food allergy before resorting to DBPCFC.^{2,3,7} Below are some methods allergy practitioners commonly use to identify allergens.^{2-4,7,8}

- A thorough medical and dietary history to identify food hypersensitivity
- Prick/puncture skin test
- A blood test such as the radioallergosorbent test (RAST) or a more specific IgE-sensitive test such as Immuno CAP RAST
- Elimination diet and oral food challenge once a food allergen is identified
- DBPCFC if needed

Prevention of Food Allergies

It is very important to prevent, reduce or relieve food allergy early in childhood because food allergy plays a significant contributory role in other allergic diseases such as eczema, asthma and allergic rhinitis.⁴ In their 2008 report, Health Canada and the American Academy of Pediatrics make the following suggestions for infants:^{2,4,25,26}

- High-risk infants (those with a parent or sibling who has a food allergy) should be exclusively breastfed for at least six months.
- If supplementation is needed with breastfeeding for a high-risk infant, use an extensively hydrolyzed casein formula.
- No special diet is recommended during pregnancy and lactation unless the mother is allergic to a certain food or the baby develops allergic symptoms.
- Introduction of solid foods should be delayed until six months of age. Foods should be introduced one at a time.

General Practice Guidelines

Identifying food hypersensitivity is very complex. Our role, therefore, is to help and guide our clients until they can be seen by an allergy specialist. The following steps can be helpful.^{2-4,7,8}

1. Check whether there is a family history of food hypersensitivity.
2. Take a detailed dietary history and have the client keep a five-day food record.
3. Try to identify the onset of adverse reactions and symptoms (immediate versus delayed).
4. Suggest avoidance of the offending food (if identified) until a food allergy or intolerance is definitively established.
5. Encourage the client to keep a food and symptoms diary.
6. Encourage the client to read ingredient lists on packaged foods while shopping.
7. Refer the client to a Registered Dietitian once the food allergen has been identified.

In brief

What Is Anaphylaxis?

Anaphylaxis is an acute life-threatening reaction caused by an IgE-mediated allergy. It occurs in all ages but is most common in teenagers and young adults. Anaphylaxis Canada recently created a new Web site (www.whyriskit.ca) that provides strategies for preventing food-induced anaphylaxis.²⁴

Symptoms of anaphylaxis are seen in all organs of the body and include generalized itching, hives, irritation of the mouth and throat, nausea, vomiting, abdominal pain, tightness of the throat and chest, loss of consciousness and in rare extreme cases, cardio-vascular collapse and death from anaphylactic shock.^{3,4,7,8,24}

Did you know?

Exercise-Induced Hypersensitivity

In some cases, exercise can bring on an anaphylactic reaction to an allergenic food within two to four hours of ingestion. Without exercise, the ingested food would not normally cause a reaction. This condition is known as food-associated exercise-induced anaphylaxis (FAEIA) and it occurs in people who have a positive allergy skin test to a food that normally does not induce allergic reaction. FAEIA is most common in women between ages 15 and 35.^{2-4,7}

Conclusion

Over the past decade, there has been extensive research in the diagnosis and management of food hypersensitivity (food allergy and intolerance). Diagnosing a food allergy remains very challenging, however, and it should be done by an allergy specialist, who will use scientific methods for diagnosis. Once a food allergen is identified, it is important to refer the client to a Registered Dietitian, who can tailor a special diet to meet the client's daily nutritional requirements. This step will eliminate unnecessary avoidance of foods and reduce the stress caused by a food allergy.

The best advice for preventing a food-related allergic reaction is still avoidance of the allergenic food. There is, however, a new direction in food allergy management: early, gradually increasing exposure to the food allergen (rather than total avoidance) may help develop clinical tolerance. This is the theory behind specific oral tolerance induction, which is still in the experimental stage. We hope that future studies in this area will allow children and adults to develop permanent tolerance to food allergens. In the meantime, our role as health professionals is to provide guidance and adequate education to clients who live with food hypersensitivity.

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