PEER REVIEWED

Food Allergy: Diagnostics & Therapeutic Food Options

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Food allergy and intolerance have been recognized in humans and animals for many years.[1] These disorders can be categorized as:

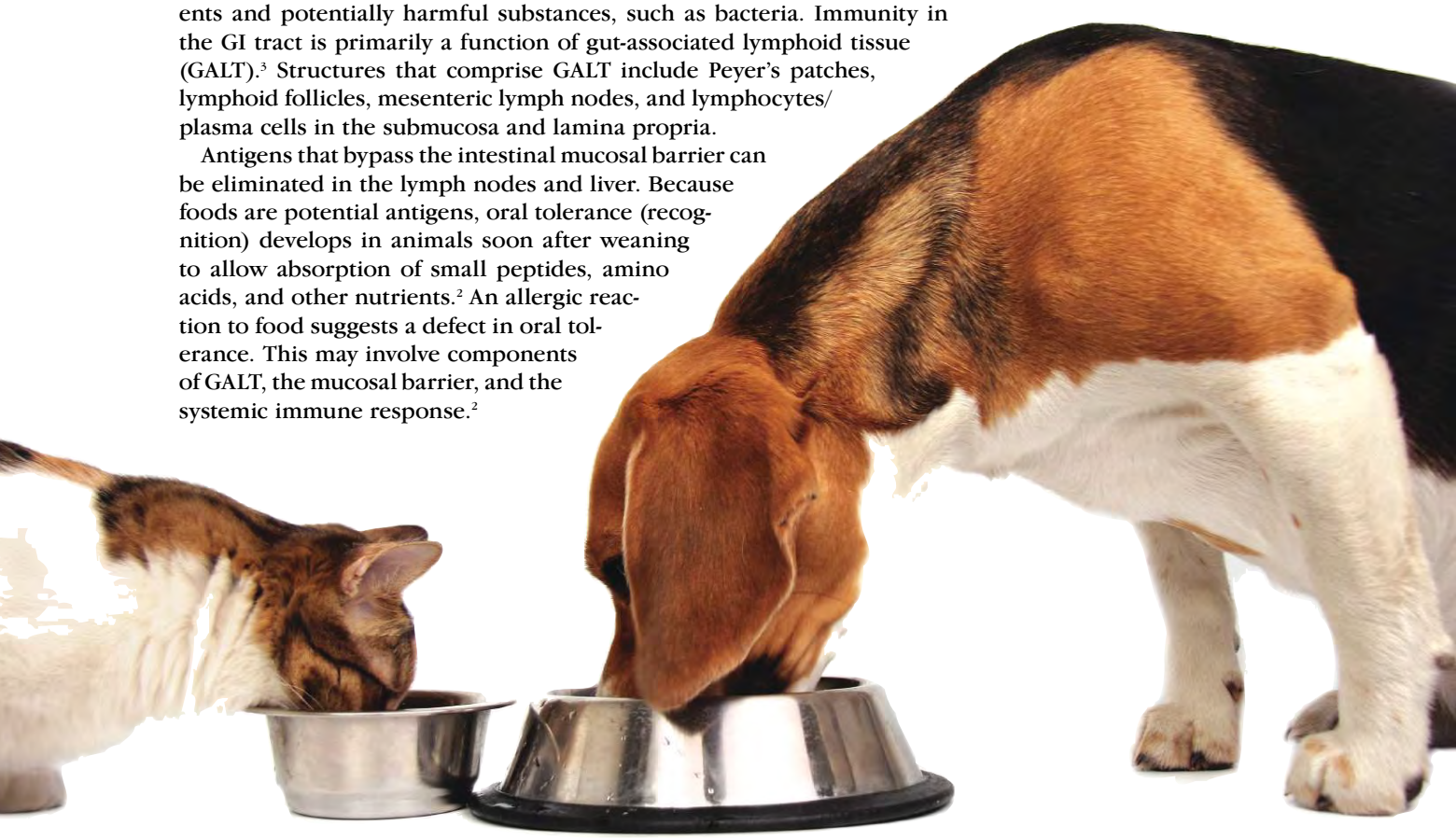
- Immunologic
- Nonimmunologic
- Toxic.[2]

Immunologic food allergy may be further characterized as *immediate* (anaphylaxis, type I hypersensitivity) or *delayed* (type III or IV hypersensitivity), although exact mechanisms have not been well described in dogs and cats (**Table 1**).[3] Nonimmunologic disorders (food intolerance) include metabolic and pharmacologic reactions to food, as well as reactions to bacterial, fungal, or chemical toxins.[1,2]

PATHOGENESIS

In normal animals, the gastrointestinal (GI) tract differentiates between nutrients and potentially harmful substances, such as bacteria. Immunity in the GI tract is primarily a function of gut-associated lymphoid tissue (GALT).[3] Structures that comprise GALT include Peyer's patches, lymphoid follicles, mesenteric lymph nodes, and lymphocytes/plasma cells in the submucosa and lamina propria.

Antigens that bypass the intestinal mucosal barrier can be eliminated in the lymph nodes and liver. Because foods are potential antigens, oral tolerance (recognition) develops in animals soon after weaning to allow absorption of small peptides, amino acids, and other nutrients.[2] An allergic reaction to food suggests a defect in oral tolerance. This may involve components of GALT, the mucosal barrier, and the systemic immune response.[2]



PREVALENCE

Food allergy is uncommon, affecting 1% of all dogs and cats.[2]

- Only 5% to 15% of dogs and 1% to 10% of cats with skin or ear disorders are likely to be food allergic.
- There are no recognized age, sex, or breed predilections except a possible higher prevalence in Siamese and Birman cats.
- The reported age of onset is 4 months to 14 years of age in dogs (mean, 2–6 years) and 3 months to 11 years of age (mean, 4–5 years) in cats.

FOOD ALLERGENS

In humans, food allergens are reported to be glycoproteins with a molecular weight of < 70 kilodaltons.[4] Allergy can occur whether foods are processed, raw, or cooked, although Maillard reactant products (which result from cooking a protein with a carbohydrate) can increase the allergic potential.[2]

Many foods have been associated with allergy (**Table 2,** page 26).[2,3] However, establishing the exact food or foods in an individual patient is difficult without systematic challenge testing. In many cases, the diagnosis of food allergy relates to the previous diet but not a specific food. Additives, such as preservatives, flavors, and dyes, are often implicated; however, to date, have not been reported to be associated with allergy in dogs (2 possible cases have occurred in cats).[2]

DIAGNOSIS

Clinical Signs

Pruritus

The cardinal sign of food allergy in both dogs and cats is pruritus.[2] The pruritus is nonseasonal and continuously present. Owners typically report that their pet scratches, bites, and/or licks the skin.

- **Dogs**: Pruritus is often generalized but in some cases limited to the face, ears, legs, feet, axillary and inguinal regions, and/or the perineum.
- **Cats**: In cats, the head, neck, ears, periorbital and preaural regions are commonly affected, with the chin, legs and feet, axillary and inguinal regions, thorax, dorsum, and tail base less common.

Other Dermatologic Signs

Otitis externa is often present and may be the only clinical sign in cats and dogs.[2,3]

- **Dogs**: Primary and secondary skin lesions include papules, erythema, excoriations, pustules, epidermal collarettes, hyperpigmentation, and seborrhea. Recurrent pyoderma can occur.
- **Cats**: Miliary dermatitis is a common reaction pattern along with erythema, papules, excoriations, erosions, ulcerations, alopecia (self-induced), eosinophilic plaques and ulcers, and exudative or scaling dermatitis.

Gastrointestinal Signs

GI disorders occur in some animals with immunologic food allergy, and the signs tend to be nonspecific and intermittent or chronic.[3] Acute GI signs are more likely associated with nonimmunologic food intolerance (diet-responsive enteropathies). Approximately 30% to 50% of animals with cutaneous signs of food allergy also have signs of vomiting, diarrhea, increased frequency of defecation, and abdominal pain.[3,5]

Table 3 (page 26) provides a list of clinical signs by type and species.

Differential Diagnosis

Pruritic dogs and cats with or without skin lesions should be evaluated for ectoparasites (eg, fleas, mites, lice), infection (eg, bacterial pyoderma, *Malassezia* dermatitis, dermatophytosis), and other immunologic disorders (eg, atopic dermatitis, flea allergy, contact allergy, eosinophilic granuloma complex) (**Table 4**, page 27).[3] Animals may have combined allergies (eg, both atopy and food allergy).

Table 1. Types of Hypersensitivity Reactions

	Antigen	Effector	Examples
Type I Reactant: IgE	Soluble	Mast cells	Anaphylaxis Atopy Food allergy
Type II Reactant: IgG	Cell- or matrix-associated	Phagocytes, natural killer cells	Immune-mediated hemolytic anemia
Type III Reactant: IgG	Soluble	Phagocytes, complement	Blue eye (corneal edema) Food allergy Glomerulonephritis
Type IV Reactant: T-cells	Soluble, cell-associated	Macrophages, eosinophils, cytotoxic T-cells	Contact dermatitis Flea allergy Food allergy

Table 2. Foods Reported to Cause Allergies in Dogs & Cats

	Common Foods	Uncommon Foods
Dogs	• Beef • Chicken • Corn • Dairy • Egg • Soy • Wheat	• Fish • Lamb • Pork • Rabbit
Cats	• Beef • Dairy • Fish	• Barley • Egg • Lamb • Pork • Poultry • Rabbit • Wheat

Diagnostic Testing

Dermatologic Diagnostics

A standard approach to pruritic animals typically includes:

1. A thorough history and physical examination, with close evaluation of the skin, haircoat, and ears.
2. Common tests include:
   - Superficial and deep skin scrapings
   - Impression smears for microscopic examination
   - Wood's lamp examination and fungal culture (for suspected cases of dermatophytosis)
   - Otoscopic examination and swabs (see **Diagnostic Approach to Otitis in Dogs**, September/October 2011, available at todaysveterinarypractice.com).
3. Flea control and treatment for ectoparasites even if no fleas or mites are seen.
4. If pruritus completely resolves with glucocorticoids, antihistamines, antimicrobials, or other systemic or topical therapies, then food allergy is less likely.

Gastrointestinal Diagnostics

Animals with GI signs may be evaluated with laboratory analysis (ie, complete blood count, serum biochemical profile, urinalysis, complete fecal analysis) and imaging (ie, abdominal radiography, ultrasound).

Food Trials

A diagnosis of food allergy requires a food trial, which is a 2-step process. First, the animal is introduced to an elimination diet. If the clinical signs (pruritus, GI upset) resolve, then the second step is to feed the original diet or individual foods to see if signs recur.[3,5] A more detailed description follows (see **Food Trials**).

Serum & Intradermal Testing

Commercial laboratories may offer serum testing. Typically, IgE or IgG antibodies directed against foods are measured. Both false-positive and false-negative results are common. Likewise, intradermal testing is unreliable.[5]

Practitioners using serum testing for environmental allergens (atopy) should avoid ordering food allergy panels because clients become convinced that their pets cannot tolerate foods listed as "allergens." This will limit food options (false positives) or lead to inappropriate choices for a food trial (false negatives). Salivary testing for allergy has not been validated.

Table 3. Clinical Signs of Food Allergy in Dogs & Cats

	Dermatologic	Gastrointestinal
Dogs	• Epidermal collarettes • Erythema • Excoriations • Hyperpigmentation • Otitis externa • Papules • Pruritus • Pustules • Recurrent pyoderma • Seborrhea	• Abdominal pain • Diarrhea • Increased frequency of defecation • Vomiting
Cats	• Alopecia (self-induced) • Eosinophlic plaques & ulcers • Erosions • Erythema • Excoriations • Exudative or scaling dermatitis • Miliary dermatitis • Otitis externa • Papules • Pruritus • Ulcerations	• Abdominal pain • Diarrhea • Increased frequency of defecation • Vomiting

FOOD TRIALS

The main challenge of performing a food trial is client compliance. Practitioners or technicians should plan to spend a lot of time explaining to clients what it means to have their pets on a food trial.[3]

No matter which foods are chosen, the trial will fail if owners feed treats, snacks, rawhides, pig ears, human foods, and flavored supplements or if pets have

access to scraps, garbage, outdoor feeding, etc. The medical records should be reviewed to make sure flavored medications have not been dispensed. For the duration of the trial, flavored heartworm preventives and flea products are avoided (topical medications may be used instead).

The 3 trial options are a veterinary therapeutic food, over-the-counter (OTC) food, or formulated home-prepared recipe. There are advantages and disadvantages to each approach.

Veterinary Diets

A number of pet foods can only be distributed by veterinarians who dispense the food in the context of a veterinarian–client–patient relationship. These foods can be novel protein or hydrolyzed. Several clinical studies have demonstrated good results in food-allergic dogs and cats using either novel protein or hydrolyzed therapeutic diets.

Novel Protein Diets

Novel protein diets include ingredients, such as rabbit, venison, fish, duck, or kangaroo, on the theory that other commercial pet foods rarely use these ingredients, so previous exposure in patients is not likely. Unfortunately, more and more OTC retail products are becoming available with these ingredients. Therefore, before proceeding with a novel protein diet, it is important to question the owners about every pet and human food the animal has eaten in the past.

Most novel protein veterinary diets are formulated for adult maintenance, not growth or reproduction. Vegetarian diets are available for situations in which allergy to animal protein (meat) is suspected.

Advantages of veterinary novel protein diets include:

- Complete and balanced formulas
- Palatability
- Useful for diagnosis
- Appropriate for long-term feeding
- Moderate cost.

Disadvantages include:

- The fact that the animal may have already been exposed to the novel protein
- May not be appropriate for puppies and kittens
- Certain diets have increased fatty acids or other ingredients that help with pruritus; therefore, a positive response may not be solely attributed to reduction in clinical signs of food allergy.

Hydrolyzed Diets

Hydrolyzed diets are not designed to be novel. Instead, they are formulated to provide small peptides instead of intact proteins and large polypeptides. Hydrolyzed protein sources include soy, chicken, and chicken liver; these sources are added to carbohydrates, such as rice, potato, or starch from corn or potatoes. Vegetable oils, along with supplemental vitamins, minerals, and other nutrients, such as fiber, are also added to create a food that is complete, balanced, and suitable for long-term feeding.

Advantages of hydrolyzed diets include:

- Complete and balanced formulas
- Generally good palatability
- Useful for diagnosis
- Appropriate for long-term feeding

Table 4. Common Differential Diagnoses for Adverse Food Reaction

	Dogs	Cats
Allergic	• Atopy • Flea allergy dermatitis	• Atopy • Flea allergy dermatitis
Infectious	• Bacterial pyoderma • *Malassezia* dermatitis	• Dermatophytosis
Parasitic	• *Cheyletiella yasguri* • Intestinal worm hypersensitivity • Lice • *Sarcoptes scabiei*	• *Cheyletiella blakei* • *Demodex gatoi* • *Notoedres cati*
Other	• Drug reaction • Seborrhea	• Eosinophilic granuloma complex • Idiopathic miliary dermatitis

CORRECT TERMINOLOGY

Acceptable current terminology for products used for food trials is:

- ***Novel protein***—a food or ingredient the animal has not eaten previously
- ***Hydrolyzed***—products in which ingredients have been broken down into smaller components.[3]

The term *hypoallergenic* is actually incorrect, as all foods are antigenic in that they are foreign proteins. For example, a lamb and rice product may be novel and nonallergenic to one dog but highly allergenic to a different dog.

- May be formulated for growth as well as maintenance
- Reasonable chance of efficacy even if animals have been exposed to many different foods in the past.

Disadvantages include:

- Higher cost
- Potential hyperosmolar qualities that can lead to diarrhea or GI upset
- Variable palatability.[3]

Over-the-Counter Commercial Foods

Many pet food companies have introduced products that contain unusual or novel ingredients. Specialty pet stores in particular may stock different foods that are marketed to certain consumers looking for alternatives to common grocery-store products.

However, retail foods are not specifically formulated as medical diets to be used in the diagnosis and treatment of disease. The ingredient lists may contain protein sources not advertised on the front of the label, so a careful evaluation is necessary. Limited data suggest that cross-contamination of retail foods can lead to traces of chicken protein even in products advertised to be free of chicken or limited to 1 meat, such as venison.[6] Therefore, OTC foods are not ideal for food-allergic animals, at least in the early stages of diagnosis and treatment.

Home-Prepared Diets

Dogs and cats can be fed ingredients intended for human consumption. A wider variety of foods can be used, and are not limited to those sold by pet food companies. Typically, one protein source (eg, meat, fish, beans, tofu) is combined with one carbohydrate source (eg, rice, potato, oatmeal). A complete, accurate diet history is necessary, just as when feeding novel protein diets.

Advantages include:

- Individualized for specific needs
- Good palatability
- Involves the owner in treatment.

Disadvantages include:

- Expensive, especially for large dogs
- Inconvenient and time-consuming to prepare
- Diets are not complete and balanced unless a trained nutritionist is consulted.

OUTCOMES & CHALLENGE TESTS

Animals with immunologic food allergies and food-responsive enteropathies will usually respond positively to food trials within 4 to 12 weeks. Clinical signs, such as pruritus, GI upset, and otitis, will start to improve in the first month, but up to 3 months may be necessary to document significant improvement.

Certain dermatologic conditions wax and wane over time and concurrent infections or ectoparasites may also have been successfully treated in the first few weeks of a food trial; therefore, not all animals that appear to be improving have immunologic food allergy.

Challenge Test

A challenge test should be performed once the animal is free of significant clinical signs. The 2 methods are:

1. Feed small amounts of the original diet
2. Introduce individual food items, such as chicken, beef, corn, or other suspect ingredients, one at a time.

Most animals will relapse or develop clinical signs

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within 1 to 2 weeks (sometimes just a day or two) when fed small amounts of the allergenic food. Owner compliance is essential for a valid challenge; many clients prefer to stay on the successful food instead of risking a relapse by pursuing a challenge test.

Prognosis

The prognosis is excellent for food-allergic animals, as long as the allergenic foods or ingredients are identified and avoided. New allergies can arise in the future, including allergies to novel proteins, so a food trial followed by a challenge may need to be repeated.

SUMMARY

Food allergy and intolerance in dogs and cats are not common conditions but the successful diagnosis and treatment is rewarding. Dogs and cats with nonseasonal pruritus, GI signs, and chronic or recurrent otitis, especially patients that are nonresponsive to medical therapy should undergo an appropriate food trial.

Veterinary novel protein and hydrolyzed diets are preferable to OTC commercial foods. Home-cooked diets are also useful but need to be formulated and/or evaluated by an experienced veterinary nutritionist to ensure they provide a complete and balanced diet. ■

GALT = gut-associated lymphoid tissue; GI = gastrointestinal; OTC = over the counter

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