

## Food Allergies and Intolerances in Pets

Adverse food reactions are categorised as reactions to dietary ingredients by specific individuals which are harmless to others. This term covers toxic reactions, food allergies and food intolerances. A food allergy is an immune system response to one or more proteins that have been ingested by the pet. These proteins are referred to as antigens because they cause antibody production, and an allergen is an antigen that causes an immune reaction and is therefore allergy-inducing (Cave 2006). In an allergy response, the immune system incorrectly recognises the food protein as an antigen and causes a chain reaction in the body, commonly an immunoglobulin E (IgE) mediated response which leads to allergy symptoms. A food allergy develops in two stages: when the allergen is first consumed, it triggers the production of IgE antibodies which are specific to the protein ingested. This is known as the sensitisation period, and these antibodies bind to basophils and mast cells. If the allergen is consumed again, it binds to its specific IgE antibodies and cross-linking of these antibodies causes release of histamines and leukotrienes, chemical mediators, from basophils and mast cells activated during the cascade of reactions caused by the immune response. Cross-linking of receptors and allergens is needed to activate mast cells and basophils, meaning that two or more IgE antibodies need to bind to one allergen to cause a reaction (Matsuo *et al.* 2015; Waserman and Watson 2011). When a pet develops a food allergy, it is most commonly as a result of long-term exposure to a protein (Raditic *et al.* 2011).

Food intolerance is not an immune-mediated response, but typically a cell-mediated response. Food intolerance is a reaction to the pharmacological effects of food components, or enzyme defects within the body. All foods contain chemicals with the potential to cause pharmacological activity, which may or may not cause a gastrointestinal reaction and related symptoms. The mechanism of action that causes a food intolerance in this manner is not fully known (Lomer 2015). Enzyme defects are characterised, for example, by the pet not having sufficient enzymes in the gastrointestinal tract to digest a particular ingredient that has been consumed. Lactose intolerance is a good example. When cats and dogs are first born, the milk from their mother contains lactose, and they are able to digest it efficiently. However, once weaned they will not typically be exposed to lactose again unless fed dairy-containing products by owners, so the lactase enzyme that ingests lactose is surplus to requirement. Therefore, the body reduces production of this enzyme. In some cases, production of lactase can cease altogether, or reduce to extremely low levels. Therefore, when lactose is consumed the body cannot sufficiently digest it, leading to lactose passing through the gastrointestinal tract into the intestine. This causes an increase in the water content of the intestine, and the microflora present in the intestine can ferment the lactose and produce gas. This leads to the symptoms of flatulence and diarrhoea often seen in pets with lactose intolerance (Deng *et al.* 2015). However, lactose intolerance can be reversible, as the presence of lactose in the diet can cause increased production of the lactase

enzyme once the initial symptoms and inflammation have subsided (Lomer 2015).

Allergy symptoms develop much more rapidly than those of food intolerance. Symptoms of food intolerance are gastrointestinal reactions involving abdominal pain, bloating, vomiting and diarrhoea. This is largely due to food intolerances more commonly affecting the gastrointestinal tract organs such as the bowel, causing symptoms deriving from this area (Guilford *et al.* 2001). Whereas allergy symptoms can manifest in a number of ways because the immune system is affected, including gastrointestinal, respiratory, nervous and skin reactions, which are all caused by the release of histamine. Gastrointestinal reactions are often unpleasant for the owner as they have to clean up what can sometimes be large amounts of vomiting and diarrhoea. Respiratory reactions can involve coughing, wheezing and difficulty breathing, and discharge from the nose and eyes. Allergy symptoms can also manifest in the central nervous system and affect balance and movement or cause nerve pain. Skin reactions, known as pruritis, which is a general term for itching, are only seen in the case of food allergy and not intolerance, typically shown through inflammation which causes the skin to become hot, red, dry and flaky (Gaschen and Merchant 2011). Skin reactions cause the pet to become itchy and they can make symptoms worse by repeatedly scratching or licking the affected area. Skin reactions are the most common symptoms of food allergies, occurring in up to 90% of cases. In cats, it has been suggested that food allergies are the second highest cause of allergy-related dermatitis, seen in up to 11% of cases (Guilford *et al.* 2001). The symptoms shown as a result of allergic reactions are varied and can also be similar to symptoms of other ailments, so are not always the first thought of a vet during examination. A vet will treat the symptoms first, for example using steroids to help improve breathing. With pruritis, the first course of action will be to rule out parasite infestation such as fleas or ticks, and any infections. Treatment will involve soothing the skin to prevent the animal causing further damage through licking and scratching. Once treatment options have been explored for the initial symptoms, if they have not worked then vets would look into the possibility of a food allergy.

Diagnosing a food allergy in a pet can be a difficult process, as there is no one test that can be carried out. Skin and blood tests can be used to ascertain that there is an allergy present due to detecting immune markers, but these tests cannot identify the source of the allergy, and are generally unreliable and not recommended in practice (Hill, 1999). The most common and effective method used by veterinarians to diagnose food allergies is the use of elimination diets, which is a longer process but helps to pinpoint the ingredient(s) that the pet is sensitive to (Wills and Harvey 1994). An elimination diet is feeding alternative sources of proteins and carbohydrates that the pet has not been fed in the past. These diets are often very simple and use one protein and carbohydrate source. Ingredients that can be used in elimination diets include rabbit, venison, pork and fish, with carbohydrates such as sweet potato, white potato, and pea. The elimination diet is fed for a period of up to 12 weeks to allow clinical symptoms of the allergy to dissipate. If the symptoms of the allergy are alleviated, it



indicates that an ingredient in the previous diet is the cause of the allergy symptoms. This theory can then be tested by re-introducing the diet, and if clinical signs return within two weeks then it confirms the diagnosis of food allergy to a particular ingredient (Wills and Harvey 1994). The elimination diet diagnoses the presence of a food allergy, but does not necessarily indicate the ingredient that the pet is sensitive to. This can be done by introducing new protein sources one at a time. Once the base elimination diet has been established and fed without causing any symptoms, a new protein can be introduced to the diet. For example, if the base diet is salmon, then some chicken can be introduced. If no symptoms reappear during the first four days of including chicken in the diet, then it indicates that the pet is not allergic to chicken, but if they do then it points to a chicken allergy. This can be tried one protein source at a time including meats, fish and vegetables, and will allow owners to create a database of ingredients that their pet can and cannot consume. This is a long process to carry out, but will identify what products the pet is sensitive to, allowing the owner to

have a more informed choice and potentially opening up a greater choice when looking for varieties of products to feed their pet. Feeding an elimination diet to outdoor cats may prove more difficult compared to indoor cats and dogs, as cats have the freedom to pick up and eat alternative food sources when outside. With outdoor cats, it could also be the case that it is not an ingredient in the commercial diet fed by the owner that is causing the allergic reaction, but something they are eating when they are roaming, either that they are catching or picking up from food that other people are leaving within their reach. The diagnosis of food intolerance also follows the dietary exclusion method, but in some cases a reduction in the consumption of an ingredient can be enough to improve symptoms. This is because there can be a threshold for reactions to intolerances such as lactose that can be dependent on the amount consumed at any one time and the amount of lactase that is produced by the body (Lomer 2015). For example, if small amounts of lactose are consumed at several periods throughout the day, this may not cause an intolerance reaction in a pet that

has low-level lactase production, but consuming a larger amount of lactose-containing foods in one sitting may cause an intolerance reaction, as it may be more than the body can digest at one time.

Treatment options will focus on alleviating or calming the symptoms; for example, with skin lesions this can lead to secondary infections if bacteria invade any open wounds. The only treatment for the food allergies themselves is to avoid feeding the allergen in any format. This can be challenging for owners when looking into the ingredient label of a product. Some brands prefer to label their products in a category format, meaning that each ingredient in the food is not specified on the packaging. This is not illegal in any way and there are clear descriptions of what type of ingredient goes into which category, but it is not helpful to those owners who have pets with allergies, as they cannot tell by looking at the packaging whether their pet can consume the treat or complete food. Therefore, in order to find the information, the customer needs to contact the company to ask if the ingredient is included, which can put some customers off from buying the product as the information is not readily available. An increase in the occurrence of food allergies and intolerances to common pet food ingredients has led to the introduction of novel ingredients, and hypoallergenic or hydrolysed protein dog and cat foods. Novel ingredients include *those* animal protein sources that are typically more expensive and have not been used as commonly in pet foods, such as pork, venison, duck and fish in pet diets. There are no guidelines set out by FEDIAF that control the use of the term 'hypoallergenic' and what types of foods it can be associated with. The Oxford Dictionary term for hypoallergenic is "*relatively unlikely to cause an allergic reaction*". Therefore, as there is nothing restricting the use of the term, it can be used to describe foods that do not contain the ingredients that have been determined as common allergens for that species. However, the literature is unclear as to what the common allergens for pets are, with sources identifying a range of proteins as 'common' allergens, but there are some overlaps between what have been identified. It is thought that common allergens in dogs are beef, chicken, dairy products, soybean, egg and wheat (Raditic *et al.* 2011; Mueller *et al.* 2016). In cats, common allergens have been identified as beef, fish, wheat, maize and dairy products (Mueller *et al.* 2016; Wills and Harvey, 1994). All of the ingredients listed are very common ingredients in pet food diets and have been for a long time period. This is because historically, diets have been made up of lower-cost materials such as chicken meal, meat and bone meal (containing beef) and cereals including wheat, which could have caused over-exposure to these proteins and led to allergies. It is only the emergence of different price points with development of premium and super-premium foods that has introduced new and varied protein sources into the market, mostly driven by the pet-owning population wanting to introduce variety to their pets' diet, as well as continuous nutritional research. Diets that claim to be hypoallergenic should not include any of the ingredients that are described as common allergens, and should be able to reduce the allergy symptoms. Some hypoallergenic diets, mostly those that are a veterinary-based diet, use hydrolysed proteins. Hydrolysed proteins are proteins which have undergone a process to disturb the structure of the protein. This changes its shape, preventing the body from being able to recognise it. This means that pets that are allergic to, for example, chicken, should be able to consume foods that contain hydrolysed chicken protein without suffering allergy symptoms. These types of foods can also be fed as part of an elimination diet to identify the protein that is causing the allergy symptoms. They can also be fed as a full-time diet by owners who want to

alleviate their pets' symptoms and potentially do not want to reintroduce proteins that may cause an issue to find out the true cause of the allergic reaction, or if a pet has a number of allergies and the owner cannot find a suitable food that does not contain any of the allergens.

Food allergies in pets can cause discomfort, both physically for the pet, and emotionally for the owner. Symptoms are generalised, so an allergy is not always the first thought of a veterinary professional upon initial examination, and the only way to identify presence of a food allergy and the exact ingredient is through dietary elimination trials. These can be time-consuming and potentially costly to the owner through buying several foods containing different ingredients. However, once the ingredients have been identified, it will give the owner more freedom to provide variety in their pet's diet if they wish, and prevents the continued discomfort of the pet through alleviation of allergy symptoms.

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## Jennifer Dean

Jennifer Dean graduated from the University of Nottingham with a Bachelor of science with Honours Degree in Animal Science and a Master's Degree in Animal Nutrition. She joined Pets Choice in 2016 in the role of NPD Technologist. Jennifer is involved in all areas of new product development including complete foods and treats for cats and dogs, as well as improving current products and answering customer's nutritional enquiries.