



Emphasizing the Role of Pet Animal Allergy, Prevalence, Therapeutic Measures and Molecular Diagnostics

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ABSTRACT

Pet allergies, especially caused by cats and dogs, are a serious problem for society since millions of people are affected. Those allergic reactions are caused mostly by Immunoglobulin E (IgE), in which the immune system reacts excessively to the proteins encountered in the pet dander, saliva, urine, and fur. The most common are respiratory symptoms, which manifest as sneezing, congestion of the nose, asthma, skin allergies such as dermatitis and hives, and eye allergies. These allergens are lightweight and easy to become airborne and stick to clothing and other household surfaces, which are difficult to get rid of totally. Cats, in particular, should be regarded as a very powerful allergen source, with Fel d 1 (secretoglobulin protein complex) causing allergy in the first place, whereas dogs have similar allergens, Can f 1 and Can f 5. Depending on genetics, personal exposure, and the amount of contact, reactions start and become worse. Emotional attachments to pets usually do not allow people to get rid of the animals despite the risks they pose. Hence, the control plans need to be used so as to minimize the health impact. These are environmental control interventions that include HEPA filters, regular cleaning, grooming activities, and the establishment of pet-free zones. Symptomatic relief is provided by the use of medical interventions, such as antihistamines, leukotriene inhibitors, and immunotherapy. Furthermore, allergies to home-related triggers can be minimized by home renovation and assistive treatments such as the use of nasal irrigation and diet changes. Understanding the nature and source of pet allergens, as well as implementing targeted interventions, allows people living with allergy to maintain a healthy lifestyle while continuing to enjoy the companionship of pets.

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INTRODUCTION

Allergic reactions, also known as hypersensitivity, occur when the body's immune system faces foreign particles, leading to an exaggerated immune response created by immunoglobulin E (IgE) (Tedner et al. 2022). Typical clinical signs consist of urticaria, eczema, asthma, rhinitis, vomiting, diarrhea, and possibly life-threatening anaphylactic shock (Pullerits et al. 2021). This widespread worldwide issue consists of common allergens that attach to IgE antibodies and provoke the previously mentioned responses in everyday life, including pollen, food, dust

mites, microbes, pet dander, and insect stings (Shamji et al. 2021). The relationship between humans and their companions is deeply emotional, especially with cats and dogs (Weber-Guskar 2021). These animals provide them with emotional support, security, and companionship. But these animals can also harm them through some allergic reactions.

The pets we keep at our homes as companions can cause multiple types of allergies (Zednik and Pali-Schöll 2022). Pet allergies are a common type of allergic reaction caused by exposure to protein found in pet dander (dead skin flakes), saliva, urine, or fur (Halliwell et al. 2021). The

most common form of indoor allergies is from domesticated animals (Ojwang et al. 2020). The proteins found in their dander, saliva, urine, or fur can trigger a wide range of symptoms, including nasal congestion, sneezing, itchy skin, watery eyes, asthma, and eczema (Sparkes 2022a). Pet allergies are also common in developed nations where the practice of keeping pets is common and the living conditions come in confinement. An individual with having family history of allergies or asthma will have higher chances of getting allergic reactions from pets (Kalayci et al. 2022). Depending on both genetics and the environment, children exposed to pets at an early age demonstrate either desensitization or, counter intuitively, an allergic over reaction. Allergic reactions may occur in different intensities.

In certain cases, a little exposure to an animal can lead to severe symptoms, whereas other people will develop delayed or faint symptoms over the course of time (Beck et al. 2020). The allergens can easily be airborne and can be attached to clothes, carpets, furniture, and walls, and it is not easy to avoid them (Strzelczyk et al. 2020). Pets are usually considered members of the family, and the idea of relocating them out of the home may be emotionally stressful. Thus, the management strategies are critical in making people feel comfortable with their pets with minimal allergic reactions. These methods involve complete cleaning procedures, adoption of HEPA air purifiers, limitation on pets in some areas, and symptomatic medication (Lowther et al. 2023). In the following chapter, the information laid down is the attempt to comprehend the origins of dog and cat allergens, the nature of the allergy that they cause, and the evidence-based management and therapy practices. Proper knowledge and equipment will help those with allergies to continue enjoying keeping pets and not kill their health in the process (Sparkes 2022b).

Sources of Allergies

Dogs and cats as allergens are directly related to specific proteins found in their excretions and skin cells (Virtanen and Rytönen-Nissinen 2020). These proteins are potential triggers of immune responses even in sensitive individuals and are mainly spread indoors (Deets and Vance 2021). There are about eight allergens identified for each animal (Costa et al. 2022). The cat allergens, Fel d 1, Fel d 7, and Fel d 4, have a greater ability to provoke an immune response than Fel d 6 and Fel d 8. The dog allergens, Can f 1, account for roughly 70% of pet allergies, while Can f 5 and Can f 6 make up over 30%. Knowing the sources of these allergens is crucial for managing exposure effectively (Arbes Jr et al. 2004).

Dander (Dead Skin Flakes)

The most common cause of cat and dog allergies is dander, tiny and constantly replenished skin flakes (van Hage, Käck, Asarnej, & Konradsen, 2023). These microscopic particles can enter the air, settle on surfaces, and be inhaled by humans, triggering allergies. Dander is lightweight and sticky, which allows it to stay in the air for long periods and even settle on clothes, furniture, and walls (Ling & Long). In cats, the allergenic protein Fel d 1, secretoglobulin, is a feline allergen; it is a primary factor responsible for human allergies and is produced by salivary and sebaceous glands,

then spread in fur (Grönlund, Saarne, Gafvelin, & Van Hage, 2010). When a person sensitive to these proteins contacts dander, their immune system overreacts, causing symptoms like congestion, watery eyes, nasal congestion, sneezing, and in severe cases, asthma attacks or rashes. Removing dander completely is difficult; even homes without pets can have dander carried on clothes and in the air. Managing dander requires a combination of reducing exposure, using air filters, medication, and immunotherapy when needed (Reisacher, 2011).

Saliva

Saliva is defined as a thick and viscous secretion produced by salivary glands located in the body (Carpenter 2013). It provides lubrication and helps in chewing food. There are seven salivary glands present in our body (Silvers and Som 1998). Many allergenic proteins are contained in saliva, especially in cats (Polovic et al. 2013). Animals also move saliva to their fur when grooming themselves, and it dries up and flakes up to become airborne. The main cat allergen, Fel d 1, is highly proficient and is synthesized abundantly in the salivary glands. Can f 1 and Can f 2 are like allergens that can be found in the dog saliva, although in low amounts, in contrast to cats (Wintersand et al. 2019).

Urine

Pet urine can be a cause of different allergies (Curin and Hilger 2017). When the urine particles become dried, they can be airborne and spread in the air, and can cause respiratory issues, particularly the urine of the unneutered male cat, which contains allergenic proteins. Examples of such allergens are capable of contaminating litter boxes, floors, and other places where pets urinate. Other than allergies, the pet urine also has some health risks as it breaks down into ammonia, which can irritate the eyes, skin, and respiratory issues (Brodie et al. 2002). Old urine stains may also have harmful bacteria like E. coli or, in rare cases, transmit diseases such as leptospirosis from dogs. For cat owners, there's minimal risk of toxoplasmosis transmission through urine, though the parasite is primarily spread through feces (Pinto-Ferreira et al. 2019).

Fur and hair

Although pet hair is not allergenic, pets carry saliva, dander, and other allergens (Morris, 2010). These allergens can be transferred to surfaces, beds, and clothing. Longer and thicker hairs are more likely to contain allergenic particles. The hairs transfer proteins from dander and saliva, which can trigger allergic reactions. Cats and dogs shed their hair into the environment uncontrollably, and we inhale these particles unintentionally (Van Duijkeren et al. 2011).

Types of allergies

Dog and cat allergies cause a range of body systems, which are diagnosed by a variety of symptoms (Chan and Leung 2018). It is an immune reaction against certain proteins of the pet, and the severity of the allergic reaction is related to environmental or genetic factors, among others, as well as the sensitivity of the person and the degree of exposure (Cao et al. 2019).

Respiratory Allergies

The most common category of pet allergies is respiratory allergies (Ownby and Johnson 2016). In case of inhalation of pet allergens by susceptible individuals, their immune system responds exaggeratedly to form Immunoglobulin E (IgE) antibodies. This causes the release of histamines and other related chemicals, leading to inflammatory conditions (White 1990). The allergens of cats tend to be smaller and airborne than the allergens of dogs; they have increased chances of remaining in suspension and becoming deposited on objects, including curtains, furniture, and beddings. Fel d 1 is the most potent cat allergen that is produced by the saliva and sebaceous glands. The allergens of dogs, particularly Can f 1 or Can f 5, differ according to breeds and tend not to be suspended in the air, yet remain prevalent. Sensitization to feline and canine epidermal flakes or saliva particles inhaled may cause allergic rhinitis (Hay Fever) (Bousquet et al. 2020). This is characterized by sneezing, nasal congestion, and itchy eyes. Symptoms mimic the common cold and tend to persist with continued exposure to pets. In some cases, pet allergies can trigger asthma and lead to wheezing, coughing, and chest tightness, which, if left untreated, can be serious and chronic (Gautier and Charpin 2017).

Skin Reactions

A skin reaction is a change to the appearance, texture, or feeling of the skin that is not normal for exposure to allergens, skin irritants, infections, or internal health diseases (Cula et al. 2005). It is the skin's way of responding to something it perceives as harmful or foreign. Some individuals are allergic to simple skin contact with dogs and cats (Gedon and Mueller 2018). Skin allergies may range from Contact Dermatitis – an inflammation marked by red, itchy, and blistered lesions at the site of contact that occurs in sensitive individuals or those with eczema, and Hives (Urticaria). Urticaria occurs as raised and itchy welts which form on the skin almost immediately after exposure to allergens from pets, frequently during the licking or touching of the pet (Jafilan and James 2015).

Allergic conjunctivitis (Eye Allergies)

Eye allergies are also known as allergic conjunctivitis. They occur when the eyes react to the allergens. Allergies around the eye occur when the allergens interact with mast cells, which are located at the conjunctiva, the thin layer that covers the eye and the inner part of the eyelid. On coming into contact with the body, histamine and other chemicals are released, causing the occurrence of allergy symptoms. Pets and other allergens can provoke the eyes to become red, itchy, watery, and puffy (Patel et al. 2017). This can dramatically affect one's focus and activities, especially in enclosed spaces. The symptoms are red, itchy eyes, watery eyes, a burning sensation, swollen eyelids, and sensitivity to light. The diagnosis of eye allergies is based on medical history, symptom pattern, and allergy test in some cases.

Systemic Reactions

A systemic allergic reaction, also known as anaphylaxis, is a severe, potentially life-threatening allergic reaction that affects multiple organ systems in the body (Moneret-Vautrin et al. 2005). It occurs when the body's immune system overreacts to an allergen, releasing chemicals that

can cause a cascade of symptoms throughout the body. Some individuals may have more severe or widespread reactions, such as anaphylaxis, though this is uncommon with pet allergens. It is more likely to happen in highly allergic individuals, especially with exposure to allergens through broken skin or mucous membranes. Anaphylaxis symptoms include difficulty breathing, low blood pressure, fainting spells, and other symptoms that require urgent care (Pflipsen and Colon 2020).

Modern allergic diseases

Chronic Sinusitis, the condition is also characterized by persistent inflammation of the nasal sinuses (Rudmik and Soler 2015). It can result from constant exposure to pet allergens and may lead to headaches, facial pressure, and nasal discharge. Atopic Dermatitis (Eczema) Allergens may not always trigger eczema flares, but the condition can be aggravated by exposure to pets for sensitive individuals (Berke et al. 2012).

Allergic reactions: Delayed

Delayed reactions refer to immune responses that manifest hours or even days after the initial exposure to an antigen or drug (Uhr 1966). This contrasts with immediate reactions, which occur within minutes. Delayed reactions are often characterized by inflammatory responses mediated by T cells and other immune cells, rather than antibodies. Some allergic reactions occur immediately, and others show symptoms a few hours later (Becker 1995). This slow response may pose many difficulties as it would be less easy to diagnose since the cause-and-effect relationship between exposure and symptoms is not clear. It is important to diagnose the nature of the allergic reaction to be able to treat it (Sastre 2010). Not all reactions require removal of the pet; when the diagnosis and treatment of the allergies are made properly, most individuals can stay conveniently with their pets.

Remedies/methods to cure or overcome

Pet allergies affect many people worldwide, typically triggered by proteins found in animal dander, saliva, fur, and urine (Ownby and Johnson 2016). Some remedies can overcome these allergies, and the sufferer can live with their pets. Here are some brief guidelines and strategies to overcome these allergies.

Control Measures on the Environment

Decreasing exposure to allergens at home is the most effective method of reducing pet allergies (D'Amato et al. 2020), including bedrooms and soft furnishings. This allows your body to recover after exposure to the allergens, providing an environment with minimal amounts of the allergens. Pet placement is of top priority, especially since pets should not be in bedrooms, as they can induce symptoms due to constant exposure over time during sleep. Use HEPA air purifiers to trap microscopic allergens, such as pet dander and particles of dried saliva that circulate in the air are trapped using high-efficiency particulate air (HEPA) filters. Position purifiers in the most occupied rooms, such as living rooms, bedrooms, etc., to considerably reduce airborne irritants. Proper cleaning of the frequency cleaning is essential in maintaining a low level of allergens (Jackson et al. 2008). Use the vacuum

that is equipped with a HEPA filter to vacuum carpets, rugs, and furniture at least twice weekly. They should clean wood or tile floors with a damp cloth so that allergens are not spread in the air. Wash pet beddings, blankets, and soft toys once a week using hot water to remove any accumulated dander and saliva (Jackson et al. 2008).

Pet Care Strategies

Grooming your animal and maintaining good hygiene can reduce the production of allergens by your pet (Chapman and Wood 2001). Take pets to the bath once a week (Weber 2005). Washing your pet once every week using hypoallergenic pet shampoo will also assist in eliminating dander and saliva in the fur. Cats, in spite of being stubborn when it comes to baths, can be cleaned using pet-safe cleansing wipes. Frequent brushing does not allow loose fur and dander to fall around the house. Always brush your pet outside, and wear a mask on your face in case you are sensitive. You can invite a non-allergic person within the family to do the grooming work. Cat urine is highly allergenic, and when dry, it can rise off the ground (Anderson et al. 1985). Change the litter with low-dust and unscented litter, and dry clean the litter box on a daily basis. Locate the litter box in an area that has good air flow, and use gloves and a mask when cleaning the litter box.

Medical Intervention of Allergy Relief

In cases where environmental control measures are inadequate, drugs and treatments may be used to suppress symptoms (Tovey and Marks 1999). Histamine-releasing inhibitors (e.g., Cetirizine, Loratadine) prevent the release of histamine and lessen sneezing, itching, and a runny nose (Kawakami et al. 2019). Short-term relief is congestion (e.g., pseudoephedrine), which is not to be used over long periods (Jakubowski et al. 2018). In the cases when allergies are serious, physicians can prescribe Leukotriene inhibitors (e.g., montelukast) as suppressants to asthmatic-like symptoms (Rayner et al. 2024). Allergy injections (immunotherapy), whereby the immune system is gradually desensitized to pet allergens over time. An alternative to shots is the sublingual immunotherapy (SLIT), which is the painless dissolving of allergen tablets under the tongue. People who are susceptible to anaphylaxis (this is extremely uncommon with pet allergies) need to have an epinephrine auto-injector (EpiPen) and need to obtain medical attention as soon as possible in case they are experiencing symptoms of difficulty breathing, swelling, among others (Ventura et al. 2022).

Home Modifications for Allergen Reduction

Modifying certain aspects of your home can significantly improve the levels of allergens present. Carpets trap pet dander and are difficult to clean thoroughly, which can lead to escalating persistent allergens. Use washable curtains and cover your mattresses with allergen-proof casings (Roy and Platts-Mills 2024). Replace upholstered furniture with leather or vinyl furniture, as they contain fewer allergens. Regularly open windows to allow the circulation of fresh air, and use exhaust fans in kitchens and bathrooms to reduce humidity, which can exacerbate the persistence of allergens. Taking care of some small aspects of your home will lessen the risk of allergies.

Alternative and Supportive Therapies

Supportive care includes physical, psychological, social, and spiritual support for patients and their families. There are many types of supportive care. Examples include pain management, nutritional support, counseling, exercise, music therapy, meditation, and palliative care. While individuals may find relief through various methods, this does not absolve one from seeking medical attention. Congestion can be alleviated with saline treatments of the nasal passages, such as neti pots. A neti pot is a small container, resembling a teapot, used for nasal irrigation. It's typically used to flush out nasal passages with a saline solution, helping to relieve congestion caused by allergies, colds, or sinus problems. The practice, known as nasal or sinus rinsing, helps to remove mucus and debris, making breathing easier and cleansing allergens (Boorsma et al. 2020). It has also been proposed that a healthy stomach micro biome can boost defenses against allergens, so that one could add more pro-biotic foods (yogurt and kefir) along with anti-inflammatory foods rich in omega-3 or leafy greens (McKenzie et al. 2017).

Conclusion

Cat and dog allergies are common and cause health problems, especially in people with a genetic tendency or breathing issues. The proteins found in pet dander, saliva, and urine can trigger a variety of allergic reactions, from mild symptoms like sneezing and itching to more serious conditions such as asthma or, rarely, anaphylaxis. These allergens persist in indoor environments and stick to fabrics, bedding, and surfaces, making complete removal nearly impossible, particularly in homes where pets are considered family members. Despite this, living with pets is still achievable through careful management, awareness, prevention, and treatment. Environmental controls, such as using HEPA filters, cleaning regularly, and restricting pet access to certain areas, can significantly reduce exposure. Additionally, allergen levels can be lowered by grooming pets frequently and cleaning them. Medical treatments like antihistamines, immunotherapy, and decongestants offer reliable relief for sufferers. For more severe or long-term issues, options like sublingual immunotherapy or injectable desensitization, administered by health care professionals, can be considered. Complementary practices such as supporting gut health with pro-biotics or maintaining low humidity levels—also help manage allergies. Ultimately, with the right combination of strategies, individuals allergic to animals can live comfortably with pets without compromising their health or emotional bonds. Continuous education and personalized treatment plans are crucial for long-term allergy control, allowing pet lovers to enjoy their animals without constant allergic reactions.

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