Profile of the canine population with atopic dermatitis at the dermatology service of the Veterinary Hospital from Federal University of Minas Gerais

Perfil da população canina com dermatite atópica no serviço de dermatologia do Hospital Veterinário da Universidade Federal de Minas Gerais

Perfil de la población canina con dermatitis atópica en el servicio de dermatología del Hospital Veterinario de la Universidad Federal de Minas Gerais

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Abstract
Canine atopic dermatitis (AD) is an IgE-mediated type I hypersensitivity reaction to sensitization to environmental allergens. Pathogenesis is quite complex, involving genetic and environmental factors, food allergens, skin barrier defects and immune dysfunction. Data on its prevalence and epidemiological aspects in Europe and North America are easily found in the literature. However, when searching for specific national locations, studies are still scarce. Thus, the objective of this study was to determine the prevalence and characteristics of canine AD at the dermatology service of the Veterinary Hospital from Federal University of Minas Gerais (UFMG). For this purpose, 761 medical records of dogs attended at the service from January 2015 to December 2020 were analyzed. The results revealed that of all dermatological diagnoses in the species, 28,12% (214/761) of the cases were of dogs with AD. 34,51% (291/761) of the dermatological cases were from allergic etiology, and of these, AD corresponded to 73,56% (214/291), representing the most prevalent allergic disease in dogs at the Veterinary Hospital from UFMG. Females were more affected than males, as well as dogs of defined breeds in comparison to mixed breed dogs, with shih tzu being the most prevalent pure breed, followed by mixed breed dogs. Because it is a highly pruritic disease that affects the quality of life of dogs and their owners, this study contributes to a better understanding and diagnostic approach to the disease in the local canine population.
Keywords: Allergy; Atopy; Dogs; Dermatitis; Prevalence.

Resumo
A dermatite atópica (DA) canina é uma reação de hipersensibilidade tipo I, mediada por IgE frente à sensibilização aos alérgenos ambientais. Sua patogênese é bastante complexa, envolvendo fatores genéticos, ambientais, alimentares, defeitos de barreira cutânea e disfunção imunológica. Os dados sobre sua prevalência e aspectos epidemiológicos em países europeus e norte-americanos são encontrados facilmente na literatura. Entretanto, quando se busca por localidades nacionais específicas, os trabalhos ainda são escassos. Desta forma, objetivou-se determinar a prevalência e as características da DA canina no serviço de dermatologia do Hospital Veterinário da Universidade Federal de Minas Gerais (UFMG). Para tanto, foram analisados 761 prontuários de cães atendidos no serviço no período de janeiro de 2015 a dezembro de 2020. Os resultados revelaram que de todos os diagnósticos dermatológicos na espécie, 28,12% (214/761) dos casos foram de cães com DA. 34,51% (291/761) da casuística dermatológica eram de etiologia alérgica, e destes, a DA correspondeu a 73,56% (214/291), representando a alergopatia mais prevalente da espécie no Hospital Veterinário da UFMG. As fêmeas foram mais acometidas do que os machos, assim como cães de raças definidas em relação aos sem raça definida, sendo shih tzu a raça pura mais prevalente, seguida dos cães sem raça definida. Por se tratar de uma doença altamente pruriginosa, que afeta a qualidade de vida dos cães e de seus tutores, tal estudo contribui para melhor compreensão e abordagem diagnóstica da doença na população canina local.
Palavras-chave: Alergia; Atopia; Cães; Dermatite; Prevalência.

Resumen

La dermatitis atópica canina (DA) es una reacción de hipersensibilidad de tipo I mediada por IgE a la sensibilización a alérgenos ambientales. Su patogenia es bastante compleja, involucrando defectos genéticos, ambientales, alimentarios, de la barrera cutánea y disfunción inmunológica. Los datos sobre su prevalencia y aspectos epidemiológicos en países europeos y norteamericanos se encuentran fácilmente en la literatura. Sin embargo, cuando se buscan ubicaciones nacionales específicas, los trabajos siguen siendo escasos. Así, el propósito de este estudio fue determinar la prevalencia y características de la DA canina en el servicio de dermatología del Hospital Veterinario de la Universidad Federal de Minas Gerais (UFMG). Para eso, se analizaron 761 historias clínicas de perros atendidos en el servicio entre enero de 2015 y diciembre de 2020. Los resultados revelaron que del total de diagnósticos dermatológicos en la especie, 28,12% (214/761) de los casos fueron de perros com AD. En 34,51% (291/761) de los casos dermatológicos la etiología fue alérgica, y de estos, la DA correspondío al 73,56% (214/291), representando la enfermedad alérgica de la especie más prevalente en el Hospital Veterinario de la UFMG. Las hembras se vieron más afectadas que los machos, así como los perros de razas definidas en relación con las razas mixtas, siendo el shih tzu la raza pura más prevalente, seguida de los perros de razas mixtas. Por ser una enfermedad altamente pruriginosa que afecta la calidad de vida de los perros y sus guardianes, este estudio contribuye a una mejor comprensión y enfoque diagnóstico de la enfermedad en la población canina local.

Palabras clave: Alergia; Atopia; Perros; Dermatitis; Prevalencia.

1. Introduction

Canine AD is one of the most frequent chronic dermatopathy in dogs, affecting 20 to 30% of the canine population (Marsella & De Benedetto, 2017). It is defined as a genetically predisposed, pruritic, and inflammatory skin disease with clinical signs associated with IgE production against environmental allergens (Olivry et al., 2001; Halliwell, 2006).

Its etiology is multifactorial and not fully elucidated yet. However, it is known that genetic and environmental factors affect both the immune response and the skin barrier function, which can be a primary and secondary factor (Marsella, Sousa, Gonzales & Fadok, 2012). Pruritus is the most characteristic clinical sign, especially in the acute phase of the disease, and it may not be lesional. Clinical presentation is erythema and papules, followed by excoriations and other self-induced lesions. As the disease progresses, tissue remodeling lesions, in response to chronic inflammation, appear, such as lichenification, hyperpigmentation, and hyperkeratosis (Larsson & Lucas, 2020).

Diagnosis of canine AD is clinical and based on excluding similar dermatoses, such as other allergic, parasitic, and infectious dermatitis (DeBoer & Hillier, 2001; Wilhem, Kovalik & Favrot, 2011; Saridomichelakis & Olivry, 2016), following the algorithm proposed by Hillier (2002). In addition, Favrot's criteria support the interpretation of clinical findings related to AD and in clinical studies (Favrot, Steffan, Seewald & Picco, 2010). How it is know that genes with altered expression included those relevant to skin barrier formation and immune function in canine AD, as it is in humans, gene expression in the skin of dogs with AD using quantitative real time PCR (qPCR) may be considered suitable target for future genetic and protein function studies (Wood *et al.*, 2009).

Treatment is multifaceted and mainly focused on four factors: time (acute or chronic lesions), presence of pruritus, inflammation, and secondary infections (Santoro, 2019). Therapeutic approaches have been described by the International Committee on Allergic Diseases of Animals (Olivry et al., 2015). Because canine AD corresponds to a large part of the cases in small animals, the study of this dermatopathy becomes increasingly essential. Although the literature is vast, little information is available on its occurrence according to different national geographic regions. Furthermore, the few epidemiological studies that exist are primarily international (Hill et al., 2006).

Given the increased prevalence of this allergopathy and the divergences in the characteristics of the patients according to intrinsic and extrinsic factors, including geographical aspects, it is necessary to recognize the local canine population with AD, for a better diagnostic and therapeutic approach, which should always be individualized. Therefore, the objective of this study was to determine the prevalence and characterize the canine population with AD attended at the dermatology service of the Veterinary Hospital from UFMG, in Belo Horizonte, Minas Gerais, Brazil, from 2015 to 2020, through a retrospective study.

2. Methodology

A retrospective study with medical records of patients attended at the dermatology service of the Veterinary Hospital from UFMG was carried out, analyzing the following characteristics of the dogs: sex, breed, age, clinical signs, pruritus, occurrence of secondary bacterial and fungal infections, frequency of otitis and concomitant allergies. Comorbidities, dermatological or not, that patients had during follow-up at the dermatology service were also included. Data analysis was descriptive.

To select medical records of dogs with AD, a report was generated through the Veterinary Hospital system, with all records of dermatological appointments realized between January 2015 and December 2020. From this report, dogs that during consultations and follow-up visits had a final diagnosis of canine AD were selected. Dogs that were clinically suspected but had no definitive clinical diagnosis were excluded from the atopic group of the study.

The diagnosis of canine AD was established by the history, clinical signs and exclusion of other pruritic and inflammatory skin diseases through routine complementary examinations, in addition to having completed the allergic trial with the treatment of secondary infections, elimination of ectoparasites and a restrictive hypoallergenic diet, with commercial hydrolyzed protein or homemade with an unprecedented source of protein, for at least eight weeks.

3. Results and Discussion

The period studied ranged from January 2015 to December 2020 and a total of 761 medical records of canine patients with a diagnosed dermatopathy were computed at the dermatology service of the Veterinary Hospital from UFMG. Of these, 214 dogs were clinically diagnosed with canine AD, corresponding to a prevalence of 28,12% of all dermatological appointments of the species in the period corresponding to five years. Among the most prevalent dermatopathies in the service, the following stand out: 1) allergopathies, with 34,51% of the cases; 2) infectious dermatitis, with 25,86%, including bacterial and fungal causes; and 3) parasitic dermatitis, with 10,79% of the cases. Of all allergopathies, canine AD corresponded 73,53% of the cases, being the most prevalent allergy.

The study of Santos and Santos (2016) characterized the profile of canine AD in Salvador, Bahia, and allergies also corresponded to the majority of dermatopathies in dogs. However, the authors found AD as the second most frequent allergic disease, with flea allergy dermatitis (FAD) as the most prevalent allergy in the region. This finding corroborates to the found for Cardoso *et al*. (2011), in northern Paraná, where FAD was the most prevalent allergopathy. However, the study of Souza *et al*. (2009), carried out in Santa Maria, Rio Grande do Sul, diverges from these findings, since AD was the most prevalent hypersensitivity, corroborating what was observed in this present study, despite the important geographic difference.

Branquinho and Castro (2016), in Distrito Federal, also found AD as the most prevalent allergopathy, corresponding to 80% of cases, followed by FAD (14%) and food allergy (6%). In the study of Gasparetto *et al*. (2013), allergies ranked second among all dermatopathies in the state of Mato Grosso, with parasitic dermatitis being the most prevalent of the cases. Although less frequent than in the studies mentioned above, canine AD was also the most diagnosed allergic dermatitis among all allergopathies.

The prevalence of AD in our study (28,12%) was lower than what was found by Amarante, Ramadinha and Pereira (2015), who detected AD in 36,1% of the dogs attended at the dermatology service of the Universidade Federal Rural do Rio de Janeiro. The higher percentage of cases is probably due to the fact that the number of medical records was significantly higher, with 1.462 dogs studied in the equivalent of the same period (five years).

For sex, females were affected in 58% of cases, while males, 42%, data that corroborates with other national epidemiological studies (Amarante *et al*., 2016; Ribeiro *et al*., 2020; Couceiro *et al*., 2021). Although it is described in the

literature that there is no sexual predisposition (Miller, Griffin & Campbell, 2013), it can be concluded from these studies that females have a higher diagnosis of AD than males.

Breed is an important aspect, represented in Table 1, since it has already been determined that genetic inheritance is a risk factor for the development of AD and the breed prevalence varies geographically worldwile. It was observed that dogs of specific breed have a greater predisposition than dogs of mixed breed (Amarante *et al.*, 2015; Alves *et al.*, 2018; Ribeiro *et al.*, 2020), as found in this present study, with 88,78% of the dogs having defined breed and 11,22% of them having mixed breed. However, Couceiro *et al.* (2021) found that canine AD was predominant in dogs mixed breed, with 47,9% of the cases.

The most predisposed breeds to canine AD worldwide, involving data from Germany, Australia and the United States, according to a multicenter study realized by Jaeger *et al.* (2010), were bichón frisé, boxer, bull terrier, cavalier king charles spaniel, french bulldog and german shepherd. Other breeds such as english bulldog, lhasa apso, labrador retriever, pug, schnauzer, cocker spaniel, west highland white terrier, yorkshire terrier, fox terrier (Miller *et al.*, 2013), as well as jack russell terrier and Golden retriever (Wilhem *et al.*, 2011), are also described as predisposed in foreign literature and several are compatible with those identified in this study.

In several Brazilian studies, the most prevalent pure breed was poodle (Santos & Santos, 2016; Alves *et al.*, 2018; Ribeiro *et al.*, 2020), differing from the present study, taking fifth place among pure breeds. A significant number of mixed breed atopic dogs was found, in agreement with other authors (Amarante *et al.*, 2015; Santos & Santos, 2016; Alves *et al.*, 2018; Couceiro *et al.*, 2021). The predominant breeds in this study corroborate those found by Branquinho & Castro (2016) in Distrito Federal, who had shih tzu and lhasa apso as the breeds most diagnosed with canine AD. The breed prevalence described here is also similar to the most commonly observed in São Paulo: shih tzu, lhasa apso, poodle, french bulldog, english bulldog and pug (Larsson & Lucas, 2020).

Table 1 – Relative frequency by breed of the canine population with atopic dermatitis at the dermatology service of the Veterinary Hospital from UFMG between 2015-2020:

Breeds	*Relative frequency*
Shih Tzu	23,83%
Mixed breed	11,21%
Lhasa Apso	9,81%
French Bulldog	8,41%
Yorkshire Terrier	6,54%
Poodle	6,07%
Others	34,13%
Total	**100%**

Source: Personal archive.

In the present study was observed that 63,55% of dogs were up to seven years old at the time of diagnosis, corroborating the most common age of AD manifestation in the International literature (Miller *et al.*, 2013) and with other national epidemiological studies (Branquinho & Castro, 2016; Santos & Santos, 2016; Ribeiro *et al.*, 2020). Amarante *et al.* (2015) found that 7,95% of atopic dogs were less than one year old at diagnosis and 21,97% were less than three years old. This last data agrees with the frequency of dogs diagnosed up to three years of age in this study (20,56%) and in the study from Ribeiro *et al.* (2020), who observed even a higher prevalence (38,8%).

The low frequency of dogs diagnosed with less than one year of age can be explained by the probability that the puppies have not had enough exposure to the allergens for sensitization to occur and, therefore, to develop clinical signs. Another

hypothesis is that most owners search the specialty with the recurrence and chronicity of clinical signs, delaying the moment of definitive diagnosis in these patients. The ages of patients at diagnosis are represented in Table 2.

Table 2 – Frequency by age of the canine population with atopic dermatitis at the dermatology service of the Veterinary Hospital from UFMG between 2015-2020.

Age in complete years	Relative frequency
<1 year of age	1,4%
1 years of age	2,8%
2 years of age	4,67%
3 years of age	11,68%
4 years of age	11,21%
5 years of age	10,75%
6 years of age	12,15%
7 years of age	8,88%
8 years of age	8,88%
9 years of age	7,48%
>10-16 years of age	20,09%
Total	**100%**

Source: Personal archive.

Although it does not exist as a pathognomonic clinical sign, pruritus is the most important sign in dogs with AD, and it should be present, because it's absence excludes the diagnosis of this disease (Favrot *et al.*, 2010). Pruritus was the main clinical sign reported by the owners in 78,50% of the cases, a lower finding compared to the presence of pruritus in study from Ribeiro *et al.* (2020), with 94,6% and Alves *et al.* (2018), with 81,8I%. In 63,10% of the cases the pruritus was alesional at the time of diagnosis. In 36,90%, it was already accompanied by primary skin lesions such as erythema and papules. About the location of pruritus and skin lesions, in 59,90% the interdigital regions were the most affected, with reports of intense interdigital licking and on palmoplantar surfaces; next, the face, with 31,98% of the dogs presenting itching and facial erythema (periocular and perilabial), accompanied by hypotrichosis and alopecia; and perineum, with 8,10% of affected dogs.

It is known that the interdigital areas and palmoplantar surfaces are among the most frequently affected in dogs with AD (Favrot *et al.*, 2010; Wilhem *et al.*, 2011; Larsson & Lucas, 2020). The foot pruritus in this study corroborates with Jaeger *et al.* (2010), who found 62% of this region involvement in the dogs included in the study. The low frequency of perineal pruritus (8,10%) may be due to the fact that it is more frequent in dogs with food allergies than in dogs with AD (Loeffler, Soares-Magalhães, Bond & Lloyd, 2006).

For the approach of pruritus, was used the pruritus visual analog scale (pVAS) with an interval of zero to ten centimeters, proposed by Hill, Lau and Rybníček (2007) and Rybníček, Lau-Gillard, Harvey and Hill (2009). Most dogs with AD had severe and very severe pruritus, as shown in Table 3, with the following scores as empirical classification: 1). Absence of pruritus: 0-1.9; 2). Mild pruritus: 2-4; 3). Moderate pruritus: >4-6; 4). Severe pruritus: >6-8; and 5). Very severe pruritus: >8-10.

Table 3 – Classification of the pruritus degree in the canine population with atopic dermatitis at the dermatology service of the Veterinary Hospital from UFMG between 2015-2020:

Classification of pruritus	Relative frequency
Absent pruritus	0%
Mild pruritus	0,6%
Moderate pruritus	16,67%
Severe pruritus	44,05%%
Very severe pruritus	38,69%%
Total	**100%**

Source: Personal archive.

Secondary bacterial and fungal skin infections are quite frequent in canine patients with AD and, in addition to contributing to the worsening of itching and discomfort to the patient, they also act as perpetuators of the allergic inflammatory cascade and skin barrier dysfunction. It is known that AD is closely related to the development of otitis externa and pruritus in the pinna, and otitis is already considered part of the signs presented by these dogs (Meason-Smith, Olivry, Lawhon & Hoffmann, 2020). Otitis externa may be present in more than 50% of the cases (Larsson & Lucas, 2020). In the study conducted by Ribeiro *et al*. (2020) otitis was the most frequent secondary sign in dogs with AD, affecting 73% of them, followed by pyoderma with 30,4% of cases. Our study found that they were also the two most identified secondary affections in patients, with 42,14% of patients presenting with otitis externa and 45% pyoderma. The prevalence of *Malassezia* overgrowth detected by Ribeiro *et al*. (2020) was much lower (1,21%) than what we found (7,85%). The occurrence of superficial pyoderma observed here corroborates with the literature, which shows that 40 to 60% of atopic dogs have secondary bacterial skin infection (Larsson & Lucas, 2020).

It is suspected that the prevalence of canine AD in the population attended at the dermatology service of the Veterinary Hospital from UFMG is even higher than that detected (28,12%), since, among all the diagnoses of dermatopathies, 20,99% were from superficial pyoderma and 7,71% from otitis externa, in other words, it is very likely that these dogs had these conditions as clinical signs of AD, but at that time they did not have the definitive diagnosis to be included as atopic dogs.

Regarding the comorbidities (Table 4) found in atopic dogs, food hypersensitivity (31%) was the most prevalent in this study, followed by FAD, which also affected a large number of patients, with 25% of cases. Neoplasms had an important position, having cases of mammary tumors (17%) and canine mast cell tumors (9%) diagnosed, probably due to advanced age, breed predisposition and chronic skin inflammation.

Table 4 – Relative frequency of comorbidities diagnosed in the canine population with atopic dermatitis at the dermatology service of the Veterinary Hospital of UFMG between 2015-2020.

Comorbidities	*Relative frequency*
Food allergy	31%
Flea allergy dermatitis	25%
Mammary tumors	17%
Mast cell tumors	9%
Leishmaniasis	4%
Hyperadrenocorticism	4%
Hypothyroidism	2%
Diabetes mellitus	2%
Chronic facial cutaneous lupus erythematosus	2%
Lipoma	2%
Alopecia post-grooming	2%
Total	**100%**

Source: Personal archive.

It is currently known that food allergens are the cause of AD flares in dogs with symptoms indistinguishable from those caused by environmental allergens (Olivry, DeBoer & Prélaud, 2007). The response to the elimination diet trial with new or original protein (homemade or hydrolyzed) can be total, if it is the only cause of the clinical signs, or partial, in cases where the food allergen participates in the pathogenesis of AD (Andrade, 2018). *Sensu stricto* atopic dermatitis is defined when the condition is responsive only to environmental allergens, and *sensu lato* atopic dermatitis, when food and environmental allergens are recognized as causing clinical signs (Olivry *et al.*, 2007). It is also important to note that atopic like dermatitis was also recognized and defined as a pruritic and inflammatory dermatopathy with clinical features identical to those seen in dogs with AD, but without an IgE response to environmental allergens (Halliwell, 2006).

It was observed in our study that 31% of dogs with AD had partial improvement with the hypoallergenic diet, whether homemade with novel protein or commercial with hydrolyzed protein, representing the prevalence of dogs with AD induced by environmental and food allergens in the studied population. Griffin and DeBoer (2001) reported that up to 30% of dogs with AD had food hypersensitivity simultaneously. However, Zur, Ihrke, White and Kass (2002) reported that only 7% of dogs with AD were also affected by food hypersensitivity. These data are difficult to compare with each other because they are studies of different designs, variable sizes of the studied groups, geographic location and period in which the studies were carried out.

On the other hand, FAD was concomitantly observed in 25% of dogs with AD, a finding superior to the found by Ribeiro *et al.* (2020), which detected 14,8%. An important and often overlooked fact is that approximately 75% of dogs with AD may have concomitant FAD and food hypersensitivity (Barbosa, 2015). Our study observed that 56% of dogs with AD had another diagnosed allergopathy besides canine AD.

Canine mast cell tumor is the most common malignant skin neoplasm in the species and was observed in 9% (4) of atopic dogs. The retrospective study by Santos (2017) aimed to assess the possible association between chronic skin inflammation and this neoplasm. He found that 55% of dogs diagnosed with mast cell tumors had a history of chronic skin inflammation, with 25% of patients having a previous diagnosis of chronic otitis externa, 17,5% of food allergy and 15% of AD. He also found that dogs diagnosed with mast cell tumors and a history of chronic cutaneous inflammation had a lower mean of age than those who did not have this history. Furthermore, histologically, these patients had a higher degree of mast cell tumor (Santos, 2017).

4. Conclusion

From the above results, it is concluded that canine AD was the most diagnosed allergopathy in the period studied at the Veterinary Hospital from UFMG. The characteristics of the canine population with AD are in accordance with the literature, affecting mainly dogs of specific breeds, as shih tzu, females, young adults and adults up to seven years of age, who present severe to very severe pruritus as the main clinical sign, especially in interdigital regions, with frequently secondary pyoderma and otitis externa. Furthermore, it was possible to detect that a large number of dogs with AD also had food hypersensitivity and FAD, concomitant allergies that aggravate the clinical signs of the disease, which can trigger atopic flares and influence the therapeutic approach. So, the epidemiological and clinical aspects here studied, are important to diagnostic and classification of the dogs with AD.

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