

Clinico-Epidemiological and Allergens Profiles of Dogs with Canine Atopic Dermatitis from Haryana, India

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ABSTRACT

The present investigation was conducted to study the clinico-epidemiology and allergens profile of canine atopic dermatitis (CAD) in dogs in and around Hisar, Haryana (India). A total of 46 dogs with pruritic dermatological conditions presented at Veterinary Clinical Complex of the College from April to October, 2022 were screened as per the Favrot's criteria of diagnosis of CAD and ruling out other dermatological conditions. Allergens profile of CAD in dogs was established using intradermal testing with a panel of allergens. Clinico-epidemiological investigation revealed CAD (45.65%) to be the most common pruritic skin diseases diagnosed, followed by bacterial dermatitis (13.04%) and pyodermatitis (13.04%) in pruritic dogs. Labrador retriever was the most common breed of dog affected with CAD, followed by Pitbull with age predisposition between 6 months to 3 years. Axillae, forepaws and hind paws were the most common body sites affected with lesions of atopic dermatitis. All the affected dogs qualified ≥ 6 clinical features of Favrot's criteria of CAD with affection of front feet and ear pinnae, sparing the dorso-lumbar area and ear margins. Allergens profile of CAD in affected dogs revealed both indoor (house dust mites, molds, house dust) and outdoor allergens (plant pollens, allergens of cockroach and mosquitoes) to be the frequent causes of CAD in dogs in study area. Accordingly, the living environment of the dogs can be adjusted to avoid the allergen exposure in affected dogs.

Key words: Allergens profile, Canine atopic dermatitis, Clinico-epidemiology, Dogs, Haryana

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INTRODUCTION

The skin is the largest organ of body, constituting 12 to 24% of dog's body weight depending on the species and age (Moriello, 2022). The functions of skin include sensation, protection, heat regulation, excretion, secretion, Vitamin D synthesis (Garland, 2013). Apart from these, skin is a sensitive part of dog's body which has aesthetic virtues to pet owners. Hill *et al.* (2006) in UK recorded 21.4% of the caseload with dermatological problems and the pruritus was the most common presenting sign, accounting for 30 to 40% of the canine dermatological consultations. Likewise, Khurana *et al.* (2016) in an epidemiological study on dermatological disorders in dogs presented at VCC, LUVAS revealed a prevalence of 21.34% with sarcoptic mange as the most common, followed by pruritus, pyoderma and allergic eczema, in decreasing order. Important differential diagnoses for pruritic skin diseases in dogs include ectoparasitic skin diseases, microbial skin infections, allergic skin diseases and neoplastic disease (Hensel *et al.*, 2015).

Among these, canine atopic dermatitis (CAD) is one of the most common pruritic skin diseases of dogs, with a prevalence of 3-15% in the general dog population and representing 3-58% of dogs with skin disease presented to veterinarians (Saridomichelakis and Olivry, 2016). It is a genetically predisposed inflammatory and pruritic allergic skin disease with characteristic clinical features, associated most commonly with IgE antibodies to environmental allergens (Halliwell, 2006). It has heritability of 0.47 in Labrador

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and Golden retrievers suggesting that approximately 50% of the variability in pathogenesis of CAD is determined by inherited genetics and 50% determined by environmental factors (Shaw *et al.*, 2004). The age of onset is between 6 months to 6 years but more than 70% of the dogs develop clinical signs between 1 to 3 years (Santoro, 2019).

In CAD, IgE antibodies are directed against environmental allergens. The most common allergens of atopic dermatitis in dogs were found to be mold (67.3%), followed by house dust (54.5%) and house dust mites (49.1%) with low distribution of dogs allergic to outdoor allergens (Kim *et al.*, 2011). The

most often affected areas are ear pinnae, axillae, abdomen, front and hind feet, lips and perineal area (Favrot, 2009). Pruritus must be present and its absence rules out the diagnosis of CAD. Some dogs with atopic dermatitis have no visible primary lesions but when present it primarily consists of erythema. Secondary lesions include self-induced alopecia, excoriations, dry lustreless hair, hyperpigmentation, scaling and lichenification (Favrot *et al.*, 2010). Although a vast literature is available on epidemiology, diagnosis and allergens profile on CAD in different parts of the world especially the developed countries, however, a paucity of literature is there in Indian conditions with respect to its epidemiology and allergy testing etc. Therefore, a systematic investigation was planned to study the clinico-epidemiology and identification of relevant environmental allergens of atopic dermatitis in dogs in our conditions.

MATERIALS AND METHODS

Selection of Animals

The present study was conducted on client owned dogs presented to Small Animal Medicine Section, Veterinary Clinical Complex, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar (India) with the history of pruritus, erythema, self-induced alopecia, excoriations, dry lustreless hair, hyperpigmentation, scaling and lichenification. A total of 46 dogs with pruritic dermatological conditions during the period of April to September, 2022 were screened for the canine atopic dermatitis (CAD). Pet owner consent was taken before proceeding to intradermal allergen testing.

A detailed anamnesis of suspected dogs including breed, age, sex, body weight, type of diet given, housing environment, duration of illness, pattern of illness, clinical signs, any previous treatment, response to treatment etc. were collected from the pet owners and were recorded.

Clinico-Diagnosis of CAD as per Favrot's Criteria

The dogs with pruritic dermatological conditions were evaluated on the basis of Favrot's criteria for clinico-diagnosis of CAD which include onset of signs under 3 years of age, dog living mostly indoors, glucocorticoid-responsive pruritus, chronic or recurrent yeast infections, affected front feet and ear pinnae with non-affected ear margins and dorso-lumbar area (Favrot *et al.*, 2010). The affected dogs satisfying at least 5 features of Favrot's criteria were diagnosed with CAD (Hensel *et al.*, 2015).

Skin Scrapping and Flea Combing

Both superficial and deep skin scrapping examination was done to rule out ectoparasitic infestation in affected dogs as per the recommended procedure (Miller *et al.*, 2013).

With the help of curry comb, the animal's body was brushed vigorously from cranial to caudal to collect scale and debris including adult fleas, flea excreta, ticks, lice or Cheyletiella mites on a brown paper. The suspected flea excreta were tested on a moistened piece of tissue paper or gauze; dissolution into a reddish-brown colour indicated flea excreta (Miller *et al.*, 2013).

Intradermal Allergen Testing

The affected cases satisfying the Favrot's criteria, with exclusion of other diseases with a similar clinical presentation were considered for intradermal allergen testing for confirmation of CAD following the protocol recommended by Hensel *et al.* (2015). A list of common allergens of CAD in dogs was prepared, the allergen solutions were procured from Alcit (India) Pvt. Ltd., New Delhi. This panel included house dust, house dust mites, grasses/weeds pollens, fungi/molds, insects and food items as depicted in Table 4. Histamine acid phosphate was used as a positive control and buffered saline



Fig. 1: Injection sites in a grid layout on left lateral side of thorax in a dog with canine atopic dermatitis



Fig. 2: Intradermal testing results using panel of allergens in a grid layout on left lateral thorax in a dog with canine atopic dermatitis

was used as a negative control (also supplied by Alcit (India) Pvt. Ltd., New Delhi).

A rectangular area on the left lateral side of the thorax was gently shaved and thirty boxes were drawn in a grid layout with injection sites minimum 2 cm apart as shown in Figure 1. Then, exactly 0.1 mL of each test allergen was injected intradermally using tuberculin syringe and the reactions were evaluated after 20 min and read subjectively (assessment of intensity and/or size of erythema, turgidity and/or wheal) and objectively (measurement of diameter or area of erythema or wheal) and were graded in the score of 1+ to 4+ for wheals 25%, 50%, 75% larger than negative control and wheal of the same size or larger than positive control, respectively (Fig. 2). Any reaction with score \geq 2+ was considered clinically and significantly positive reaction for confirmation of specific allergen of CAD (Hubbard and White, 2011).

RESULTS AND DISCUSSION

Clinico-Epidemiology of Canine Atopic Dermatitis

A total of 46 pruritic dogs were screened for CAD and were characterized on the basis of typical diagnostic findings for particular pruritic skin disease conditions. The most common pruritic skin disease condition diagnosed in affected dogs was CAD (45.65%, 21/46), followed by bacterial dermatitis (13.04%, 6/43) and pyodermatitis (13.04%, 6/43). Less common pruritic skin diseases were flea allergy dermatitis and fungal dermatitis (8.70%, 4/46 each), sarcoptic mange and acariasis (4.5%, 2/46 each) and otitis externa (2.17%, 1/46) in decreasing order of frequency. A large survey on the prevalence of dermatological conditions in small animals in United Kingdom revealed pruritis as the most common presenting sign, accounting for 30 to 40% of the dermatological consultations (Hill *et al.*, 2006). Amongst all pruritic skin diseases of dogs, canine atopic dermatitis is one of the most common conditions, with a prevalence of 3-15% in the general dog population (Saridomichelakis and Olivry, 2016) and highly prevalent (36.1%) in dermopathic dog population. In contrast, earlier epidemiological study on dermatological conditions in dogs from 2010 to 2015 at our hospital diagnosed sarcoptic mange as the most common dermatological condition, followed by pruritis, pyoderma and allergic eczema, in decreasing order (Khurana *et al.*, 2016). Jyothi *et al.* (2013) also reported CAD to be the second most prevalent dermatological disorder (21.5%) after mange in dermatotic dogs in Hyderabad. Similar high hospital prevalence (27.9%) of atopic dermatitis in dermopathic dogs in Ludhiana, Punjab has been reported by Brar *et al.* (2017). On the other hand, Singh *et al.* (2022) revealed a low incidence (3.27%) of canine atopic dermatitis in Mizoram.

Breed, Age and Sex-wise Occurrence of CAD

Breed-wise occurrence of CAD in dogs revealed that Labrador Retriever (33.33%, 7/21) was the most common breed of

dogs affected with CAD, followed by Pitbull (14.29%, 3/21), Indian Mastiff, German Shephard, Bully mix (9.52%, 2/21 each). Less common breeds of affected dogs were Dogo argentino, Golden retriever, Pug, Boxer and Beagle (4.76%, 1 each). Our findings are in accordance with pioneer worker Favrot, (2009) who reported Labrador retrievers or Golden retrievers and German shepherd dogs, to be predisposed for CAD. Jaeger *et al.* (2010) conducted a multicentre study to analyse breed predisposition of dogs with CAD from five different dermatologic referral centres in three continents and revealed golden retrievers and German shepherd dogs to be predisposed to CAD in three of five locations. The definition of CAD itself suggests strong breed and/or familial predispositions as the heritability of CAD has been estimated to be 0.47 mainly in Labrador and Golden retrievers (Shaw *et al.*, 2004). Even among Labrador retrievers, the dogs with chocolate coloured coats are 1.94 times more likely to have CAD than black or yellow coloured dogs (Harvey *et al.*, 2019). Mazrier *et al.* (2016) recognized five dog breeds (Boxer, Bulldog, Labrador retriever, Pug, and West Highland white terrier) predisposed to CAD worldwide. Brar *et al.* (2017) in their hospital based study on dogs with atopic dermatitis in Ludhiana (Punjab) also revealed a high affection in Labrador retriever, toy breeds and German shepherd dogs.

Age-wise occurrence of CAD in dogs is depicted in Table 1. Overall, the CAD was recorded more in 6 months to 3 years of age group dogs (71.43%), the age group most predisposed to the conditions (Griffen and Deboer, 2001). This was followed by more than 3 years' age group dogs (28.57%). Similarly, Tarpataki *et al.* (2006) reported the age of onset of atopic dermatitis between 4 months and 3 years in 66.6% of affected dogs. Likewise, Favrot *et al.* (2010) in prospective study on chronic canine atopic dermatitis revealed 68% of affected dogs experiencing the first signs before 3 years of age. Brar *et al.* (2017) also reported a higher affection in 1-3 years' age group dogs in Ludhiana. Similarly, an incidence study on CAD in Mizoram revealed 6 months to 3 years' age group dogs to be most commonly affected (Singh *et al.*, 2022).

The present investigation revealed male dogs (66.66%) to be affected more than female dogs (33.33%) which might be due to preference of dogs' owner for keeping male dogs over female in the study area. The reports of sex predisposition of CAD in dogs are inconsistent (Favrot, 2009; Favrot *et al.*, 2010; Bizikova *et al.*, 2015; Mazrier *et al.*, 2016), suggesting no sex predilection in whole dog population, irrespective of breed. However, breed-wise sex predisposition has been detected in Golden or Labrador retrievers (more in female), Boxer (more in male) (Favrot *et al.*, 2010) and Pug (more in male) (Mazrier *et al.*, 2016). Brar *et al.* (2017) also revealed no sex predisposition of atopic dermatitis in dermopathic dogs in Ludhiana. In contrast, Singh *et al.* (2022) revealed higher incidence of CAD in female dogs in Mizoram.

Table 1: Age wise occurrence of canine atopic dermatitis in dogs (n=21)

Sr. No.	Age	No. of affected dogs (n=21)	Percent
1	6 months- 3 years	15	71.43
	6 months – 1 year	5	23.81
	1-2 years	5	23.81
	2-3 years	5	23.81
2	> 3 years	6	28.57

Clinical Profile of Dogs with Canine Atopic Dermatitis

Favrot *et al.* (2010) proposed and confirmed two sets of criteria to characterize the clinical features and signs in a large population of dogs with CAD. The first set which included eight criteria, out of which five positive criteria has been confirmed highly sensitive to use as screening test of CAD in general practice. If six criteria are fulfilled, the diagnosis of CAD is considered highly specific. In the present investigation, all the affected dogs qualified six or more than six clinical features of the Favrot’s criteria of CAD. Sixteen dogs (76.19%) qualified seven or more than seven clinical features, while ten dogs (47.62%) qualified all the clinical features of the Favrot’s criteria of CAD. Therefore, the Favrot’s criteria of CAD was found to be highly sensitive and specific in clinico-diagnosis of canine atopic dermatitis in affected dogs and is recommended to be utilized as screening test of clinico-diagnosis of CAD in clinical settings.

Relative frequency of clinical features of Favrot’s criteria in dogs with CAD is depicted in Table 2. The most common clinical features of Favrot’s criteria were pruritic lesions affecting the front feet (100%) and sparing the dorso lumbar area (100%), followed by non-affected ear margins (95.24%) and history of chronic and recurrent yeast infections (95.24%) and affection of ear pinnae (90.48%). As five positive Favrot’s criteria must be fulfilled for screening of CAD in the general practice (Favrot *et al.*, 2010), so these five clinical features of Favrot’s criteria might be utilized for sensitive clinico-diagnosis of CAD in clinical settings. This was followed by dog living mostly indoors, onset of signs under 3 years of age, glucocorticoid responsive pruritus in decreasing order of frequency.

Table 2: Relative frequency of clinical features of Favrot’s criteria in dogs with canine atopic dermatitis (n=21)

Sr. No.	Clinical feature of Favrot’s Criteria	No. (21)	Percent
1	Onset of signs under 3 years of age	17	80.95
2	Dog living mostly indoors	18	85.71
3	Glucocorticoid responsive pruritus	16	76.19
4	Chronic or recurrent yeast infections	20	95.24
5	Affected front feet	21	100.00
6	Affected ear pinnae	19	90.48
7	Non affected ear margins	20	95.24
8	Non affected dorso lumbar area	21	100.00

Body sites predisposition as per Canine Atopic Dermatitis Extent and Severity Index (CADESI)-4 scale, comprised of 20 body sites typically affected in atopic dogs with CAD, adopted as per Olivry *et al.* (2014), is depicted in Table 3. Out of typical 20 body sites, the most common body sites affected with lesions of CAD in affected dogs were axillae (100%), fore paws (100%) and hind paws (100%), followed by inner side of thighs, ear pinnae, inguinal region face and shoulder front in decreasing order of frequency. Less common sites were base of tail, front pastern, and abdominal skin at stifle joint and perineal region, respectively. Brar *et al.* (2017) in their clinico-pathological investigation on dogs with atopic dermatitis in Ludhiana revealed the lesions mainly at groin, abdomen, neck, periocular region, axillae, muzzle and paws, ear pinnae, limbs and tail in decreasing order of frequency. Singh *et al.* (2022) in Mizoram studied the distribution of lesions of CAD on different body sites as per CADESI scale in affected dogs which revealed the erythematous lesions mostly present in ear pinnae, followed by front paws, right and left axillae, groin and peri-labial area that is in accordance with the present investigation.

Table 3: Body sites predisposition as per CADESI-4 scale in dogs with canine atopic dermatitis (n=21)

Sr. No.	Body sites	No. (21)	Percent
1	Muzzle/face (1)	13	61.90
2	Ear pinnae (2)	17	80.95
3	Axillae (2)	21	100.00
4	Fore-paws (2)	21	100.00
5	Hind paws (2)	21	100.00
6	Shoulder front (2)	13	61.90
7	Fore pastern (2)	8	38.10
8	Abdominal skin at stifle point (2)	8	38.10
9	Inner thighs (2)	19	90.48
10	Inguinal (1)	16	76.19
11	Perineal (1)	7	33.33
12	Base of tail (1)	9	42.86

Intradermal Allergen Testing in Atopic Dogs

Various environmental allergens have been incriminated in the pathogenesis of canine atopic dermatitis which include dust and storage mite antigens, house dust, pollens from grasses, trees and weeds, mold spores, epidermal antigens, insect antigens (Hill and Deboer, 2001). Relative frequency of allergens causing CAD in affected dogs is depicted in Table 4. Out of 26 allergens tested, the pollens of *Ricinus communis* (n=15) was found to be the most common allergen for canine atopic dermatitis in dogs followed by dust mite (*Dermatophagoides pteronyssinus*, n=14). The other dust mite *Dermanyssus farinae* was also found allergic in affected dogs with almost similar frequency (n=13). Likewise, pollens of *Parthenium hysterophorus* and *Argemone mexicana* were



also found allergic with similar frequency. Among fungal allergens, *Penicillium* spp. and *Aspergillus flavus* were found to be the most common allergens, followed by *Aspergillus fumigatus* and *Trichoderma* spp. Among insects, the allergens of cockroach (M) and mosquitoes were found to be the most common, followed by housefly and ant allergens, respectively. Among food items, the most common food allergen found was soybean (n=12), followed by egg white (n=11), rice, milk, wheat, chicken and mutton in decreasing order of frequency. House dust was also found to be a common allergen in 11 cases. Likewise, chicken feather was also found allergic in 9 atopic dogs. Similar findings have been documented by various Indian workers in atopic dogs.

Jyothi *et al.* (2013) confirmed the diagnosis of canine atopic dermatitis in dogs in Hyderabad by intradermal allergic

skin test (IDAST) and revealed highly positive reactions towards cockroach, parthenium weed and common dust allergens. Bhagya *et al.* (2021) conducted intradermal testing in dogs of Pug breed to identify the common aeroallergens associated with atopic dermatitis in Karnataka and revealed highly positive reactions to house dust mites, *Dermatophagoides farinae* (61.11%) and *Dermatophagoides pteronyssinus* (55.56%), followed by human dander (55.56%), cockroach (*Periplanata americana*) (41.67%), house dust (27.78%) and *Amaranthus spinosus* (19.44%). Similarly, Singh *et al.* (2022) conducted intradermal testing with environmental allergens on atopic dogs in Mizoram and revealed positive reactions to house dust, house dust mites and some pollens. In contrast, Kim *et al.* (2011) reported mold (67.3%) to be the most common allergens, followed by house dust (54.5%),

Table 4: Intradermal testing - relative frequency of allergens causing canine atopic dermatitis in dogs (n=21)

Allergen Category	Allergen	Concentration	No.	%
Dust mites	<i>Dermatophagoides pteronyssinus</i>	1:5000	14	66.66
	<i>Dermanyssus farinae</i>	1:5000	13	61.90
Pollens	<i>Ricinus communis</i>	1:500	15	71.43
	<i>Parthenium hysterophorus</i>	1:500	13	61.90
	<i>Argemone mexicana</i>	1:500	13	61.90
	<i>Eucalyptus</i>	1:500	11	52.38
	<i>Cynodondactylon</i>	1:500	9	42.86
Fungi/ Mould	<i>Penicillium</i>	1:500	13	61.90
	<i>Aspergillus flavus</i>	1:500	13	61.90
	<i>Aspergillus fumigatus</i>	1:500	11	52.38
	<i>Trichoderma</i> spp.	1:500	10	47.62
	<i>Candida albicans</i>	1:500	8	38.10
	<i>Rhizopus nigricans</i>	1:500	6	28.57
Insects	Mosquito	1:500	13	61.90
	Cockroach (M)	1:500	13	61.90
	Housefly	1:500	12	57.14
	Ant	1:1000	11	52.38
Food	Soybean	1:500	12	57.14
	Egg white	1:1000	11	52.38
	Rice	1:500	10	47.62
	Milk	1:500	9	42.86
	Wheat	1:500	8	38.10
	Chicken	1:1000	7	33.33
	Mutton	1:1000	4	19.00
Dust	House Dust	1:500	11	52.38
Miscellaneous	<i>Parthenium</i> leaves	1:500	11	52.38
Feathers	Chicken feather	1:500	9	42.86

inhalants (52.7%), house dust mites (49.1%) and insects (48.3%) with a low distribution of dogs allergic to outdoor allergens in Korea. Overall, in the present investigation, both the indoor and outdoor allergens were implicated as the causes of atopic dermatitis in dogs in study area. Accordingly, the living environment of the dogs can be adjusted to avoid the allergen exposure in affected dogs.

CONCLUSION

From the present study, it is concluded that canine atopic dermatitis is the most common pruritic skin disease condition in pruritic dogs in the study area with predisposition in Labrador retriever breed between 6 months to 3 years' age group. The Favrot's criteria of CAD was found to be highly sensitive and specific in clinico-diagnosis of canine atopic dermatitis in affected dogs and is recommended to be utilized as screening test for CAD in clinical settings. The allergen profile established of dogs with CAD revealed both indoor (house dust mites, molds, house dust) and outdoor allergens (plant pollens, allergens of cockroach and mosquitoes) to be the frequent causes of CAD in dogs in study area. Accordingly, the living environment of the dogs can be adjusted to avoid the allergen exposure in affected dogs.

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