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Epidemiological study of pyoderma in dogs of Thrissur district[#]

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Abstract

Pyoderma, refers to any clinical picture that results in the accumulation of neutrophilic exudates of varying degrees in conjunction with a bacterial infection. A longitudinal study was conducted among 178 dogs brought to the small animal dermatology unit of Teaching Veterinary Clinical Complex, Mannuthy and University Veterinary Hospital, Kokkalai, Thrissur, Kerala to document the age, breed and sex predispositions and to identify any environmental influence or managemental practice that predisposes to pyoderma. The overall prevalence of pyoderma was 7.5 per cent. Statistical analyses using Chi square test revealed that there was significant difference in the proportion of animals affected with pyoderma among different categories of age, breed, housing system, bathing practices, kennel hygiene, access to oral coat conditioners and feed supplements. The distribution of animals affected with pyoderma was statistically significant between different seasons also. The condition was commonest in dogs between one to three years of age (46.07 per cent). The Labrador retrievers were more predisposed to developing pyoderma. More females (53.37 per cent) were infected when compared to males (46.63 per cent). Majority of the cases (52.25 per cent) were housed outdoors in a separate kennel and were bathed (68.54 per cent) regularly and groomed (36.52 per cent) at least once a month. The analyses of the epidemiological profile of dogs affected with pyoderma revealed that apart from the host factors, the environmental and managemental aspects also plays an important role in the occurrence of pyoderma.

Keywords: *Dogs, epidemiology, prevalence, pyoderma*

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For millennia, dogs have had a special place in the heart of humans. They have been viewed as the 'man's best companion' or 'speechless therapists.' Amidst the lockdowns and subsequent periods of isolation ushered in by the COVID- 19 pandemic, there was a significant surge in the number of pet parents. In India, the dog population has doubled in the last couple of years and is forecasted to reach over thirty-one million by the end of the year 2023 (Fowler, 2023). As the public interest in pet ownership sparked, there has been a shift in the perception of dogs from being used as guards or for hunting to being a beloved family member who holds a special place in the hearts of family members.

Dermatological issues may have a substantial impact on the beauty of the animal as well as in its quality of life. Several clinical studies have shown that dermatological problems account for a significant proportion of companion animal patients. It was estimated that between 20 to 75 per cent of cases encountered in a typical small animal practice have cutaneous issues as the primary or concomitant owner complaint (Scott *et al*., 1990; Scott *et al*., 2001; Khoshnegah *et al*., 2013). Hence, cutaneous infections in dogs are of utmost importance.

Among the multitude of causes for dermatitis in dogs, pyoderma, also known as cutaneous bacterial dermatitis is one of the most prevalent conditions met by companion animal dermatologists. The occurrence of pyoderma is the result of an interplay between the host, agent, environmental and managerial factors that ultimately results in incompetence against the invasion of bacteria. Successful treatment and resolution of pyoderma demand the identification of underlying risk factors and management practices that may predispose to infection. In this scenario, the current study sought to assess the epidemiological parameters and management aspects associated with pyoderma in dogs.

Materials and methods

A longitudinal study was conducted at the Small Animal Dermatology unit of Teaching Veterinary Clinical Complex, Mannuthy and the University Veterinary Hospital, Kokkalai, Thrissur, Kerala during the period from July, 2021 to February, 2023. Dogs were included if they had a clinical diagnosis of pyoderma based upon the presence of compatible clinical signs such as alopecia, pruritus or moist cutaneous inflammatory lesions and the identification of typical bacteria cells *via* direct microscopic examination by Field's staining of either the impression smear or bacterial culture.

Collection of clinical data

All the dogs meeting the inclusion criteria were thoroughly examined and had the following information obtained with the help of a predesigned proforma: signalment, details regarding management practices such as diet, housing, environment, vaccination and deworming, bathing and grooming practices, method of kennel disinfection and presence of ectoparasites.

Statistical analyses

Analyses were performed to evaluate the potential age, breed and sex as well as the environmental and managerial predispositions for pyoderma (Snedecor and Cochran, 1994). Chi square test was done to determine whether the proportion of animals affected with pyoderma was equal in different categories of various epidemiological parameters and managemental factors.

Results and discussion

There were 2366 dogs that were presented with dermatological problems during the period from July, 2021 to February, 2023. Of those dogs, 178 had a diagnosis of pyoderma during the study period. The pyoderma cases accounted for approximately 7.5 per cent of the companion animal dermatological consultations. This figure is comparatively lower compared with the results of an earlier study conducted at the same geographical location, in which the prevalence was reported as being 12.5 per cent (Udayasree and Usha, 2005). According to Boruta *et al.* (2016), people who are strongly connected with their pets provides a higher level of veterinary care and more often follows the recommendations of the

veterinarian, regardless of the costs. Hence, the considerably low prevalence of pyoderma in the present study could be attributed to the evolution of the bond between man and dog over the past few decades wherein, at present dogs enjoy the position of a family member and receive more attention and care. Apart from this, considerable advances in companion animal dermatology and better awareness among pet parents might have also contributed to the comparatively reduced occurrence of pyoderma.

Host factors

Statistical analysis using chi square test revealed that there was significant difference between the numbers of animals affected with pyoderma in different age groups. Out of the 178 pyoderma cases diagnosed, 82 dogs (46.07 per cent) were between one to three years of age, 59 dogs (33.15 per cent) were between three to six years, 28 (15.73 per cent) were less than one years and nine dogs (5.06 per cent) were above six years of age. The study identified that pyoderma was most common in dogs between one to three years (46.07 per cent) of age as described in table 1. The findings of this study were in total agreement with the previous studies on bacterial dermatitis among dogs in Wayanad district (Nair *et al*., 2022), Thrissur (Shyma and Vijayakumar, 2012) and Rajasthan (Khinchi *et al*., 2019). Gonclaves *et al*. (2022) explained that the increased incidence of diseases in adult animals could be because of their increased access to the outdoors, socialising nature with other animals and lack of specific immunity acquired after first exposure. However, Udayasree and Usha (2005) reported a higher predisposition in dogs below one year of age (48.08 per cent). Singh *et al*. (2012) pointed out that the poor development of epithelium, high body temperature, high nutritive demand and

Table 1. Epidemiological profile of dogs affected with pyoderma using chi square test

Sl. No	Signalment		Number of dogs (n = 178)	Per cent	Chi square value (p value)
1.	Age	Less than 1 year	28	15.73	70.764 (0.00)*
		1 to 3 years	82	46.07	
		3 to 6 years	59	33.15	
		Above 6 years	9	5.06	
2.	Gender	Male	83	46.63	0.809 (0.368)^{ns}
		Female	95	53.37	
3.	Breeds	American Bully	9	5.06	98.393 (0.00)*
		Beagle	14	7.87	
		Boxer	3	1.69	
		Chippiparai	5	2.81	
		Dachshund	8	4.49	
		Doberman	10	5.61	
		German Shepherd	19	10.67	
		Golden Retriever	8	4.49	
		Great Dane	4	2.25	
		Labrador retriever	32	17.98	
		Mudhol Hound	2	1.12	
		Non-Descript	2	1.12	
		Pitbull	14	7.87	
		Pomeranian	13	7.30	
		Pug	22	12.36	
		Shit Tzu	9	5.06	
		Siberian Husky	4	2.25	

Values in the parenthesis indicates p value. * Significant at 0.05 level ($p < 0.05$); ns non-significant ($p > 0.05$)

overcrowding could be the possible reasons for infection in young dogs. In the present study, the upper and lower age limits of occurrence could not be accurately arrived at owing to the comparatively low number of young and geriatric animals presented to the hospitals during the period of study. However, the median age at the onset of clinical signs was 18 months with a range from 30 days to 12 years.

Regarding the gender-wise occurrence of pyoderma, the observations of the present study suggests that there was no statistically significant difference between the proportion of male and female animals affected with pyoderma. However, it was reported that the total number of female dogs (53.37 per cent) were higher compared to male (46.63 per cent). The findings of the present study were in concurrence with those of Shyma and Vijayakumar (2012) and Singh *et al*. (2012). On the contrary, the earlier reports (Janardhan *et al*., 2022; Khinchi *et al*., 2019; Sarma *et al*., 2013) indicated that male dogs were at higher chances of being affected with pyoderma. The results of the present study also suggested that 16 (16.84 per cent) out of the 95 female dogs were spayed and 24 (28.92 per cent) out of the 83 male dogs were castrated. Based on these observations, it could be inferred that in female animals, the stress associated with endocrine alterations such as oestrus, pregnancy, whelping or nursing might lower the immune status of animals making them more prone to cutaneous infections (Udayasree and Usha, 2005).

In the present study, statistical analysis using chi square test revealed that there was significant difference between the distributions of animals affected with pyoderma in different breeds. Labrador retriever breed of dogs (17.98 per cent) were more predisposed followed by Pug (12.36 per cent), German Shepherd (10. 67 per cent), Pitbull, Beagle (7.87 per cent each) and Pomeranian (7.37 per cent) as described in table 1. Similar findings were made by Janardhan *et al*. (2022) from Hyderabad and Khinchi *et al*. (2019) from Rajasthan wherein both of them reported a higher prevalence in Labrador retrievers. Whereas the study by O'Neilll *et al*. (2022) on the epidemiology of skin fold dermatitis in dogs of the United Kingdom revealed that certain breeds like English Bulldogs (15.50 per cent) and English Cocker Spaniels (13.04 per cent) were particularly more susceptible to pyoderma. Hobi *et al*. (2023) suggested that the anatomical peculiarities associated with brachycephalic breeds such as pugs cause foreshortening of the forehead that leads to excessive folding of the skin around the muzzle, eyes, and ears. Reduced air circulation, increased warmth, humidity, and debris within skin folds, combined with intermittent friction and trauma result in overgrowth of commensals and toxin generation that may predispose to pyoderma. However, on perusal of the literature, it was found that it is difficult to reach a conclusion regarding breed-wise occurrence of pyoderma as the popularity and preference of breeds varied at different periods and at different geographical locations, which contributed to variations in the reports. Since the present study was conducted over a short period and with a limited available sample size, an actual breed predisposition to the condition could not be established.

Environmental and managerial factors

The present study also investigated different environmental and managerial risk factors associated with pyoderma (Table 2).

Even though seasonal factors are not the sole determinants of pyoderma, they can play a role in the occurrence of pyoderma. Seasons or certain environmental conditions may contribute to an increased risk of pyoderma (Singh *et al*. 2012; Khurana *et al*. 2016). Although there was an year-round occurrence of bacterial skin infections, month-wise occurrence of pyoderma revealed maximum cases during May and October (8.99 per cent) followed by September (7.86 per cent) and March (6.74 per cent). The least number of cases were reported during November (3.37 per cent). Contrary to the observations of the present study, Singh *et al*. (2012) reported the highest prevalence in July (25 per cent). Whereas, Khurana *et al*. (2016) reported maximum cases of pyoderma during the rainy season and suggested that there is a correlation between the occurrence of pyoderma and monthly ambient temperature.

Table 2. Animals affected with pyoderma with respect to different environmental and managerial factors

Sl. No	Epidemiological Data		Number of dogs (n = 178)	Per cent	Chi square value (p value)
1.	Housing	Indoor	37	20.78	29.674 (0.00)*
		Outdoor	93	52.25	
		Indoor and outdoor	48	26.97	
2.	Kennel Cleaning	Regular	124	69.66	103.894 (0.00)*
		Not Regular	54	30.34	
		Using chemicals/ Disinfectants	68	54.84	
		Plain water	32	25.81	
		Dog Shampoo	24	19.35	
3.	Bathing	Regularly a. At home b. At grooming center	122 103 19	68.54 84.42 15.58	24.472 (0.00)*
		Occasionally	56	31.46	
4.	Grooming	Regularly	65	36.52	1.022 (0.600) ns
		Occasionally	59	33.15	
		No grooming	54	30.33	
5.	Diet	Household	63	35.39	4.798 (0.091) ns
		Commercial	46	25.84	
		Both	69	38.7	
6.	Deworming	Regular	96	53.93	1.101 (0.294) ns
		Not regular	82	46.07	
7.	Vaccination	Regular	144	80.9	67.978 (0.00)*
		Not regular	34	19.1	
8.	Supplements	Regular	50	28.09	34.180 (0.00)*
		Not regular	128	71.91	

Values in the parenthesis indicates p value. * Significant at 0.05 level ($p < 0.05$);
ns non-significant ($p > 0.05$)

Under the Koppen climate classification, Thrissur features a tropical humid climate with an oppressive hot season and abundant seasonal rainfall. According to this system, summer, which lasts from March through May, is the hottest season of the year. This is followed by south-west monsoon (June to September), post-monsoon (October and November) and winter (December to February). Statistical analysis using chi square test revealed significant difference between the numbers of animals in different seasons as indicated by the p value of 0.006 which was less than 0.05. Maximum cases of pyoderma were reported during the south west monsoon and post monsoon seasons followed by winter and summer (Fig.1). This could be due to the warm wet weather which favours an environment conducive to bacterial proliferation (Roth and James, 1989). They also suggested that frequent exposure to moisture in the form of activities such as swimming or regular bathing can contribute to the occurrence of pyoderma. Contrary to this Orvis (2021) suggested that just as in humans, the cold and dry weather during the winter months could cause the dog's skin to become dry, flaky, and pruritic, providing an ideal portal of entry for bacteria. Furthermore, spending more time indoors with central heating might cause humidity levels to drop, potentially resulting in dry skin conditions which enhance the likelihood of pyoderma. Hensel *et al*. (2015) proposed that certain factors like seasonal variations in exposure to allergens such as pollen, dust, grass and mould may cause pruritus and skin irritation, that in turn contribute to the development of secondary pyoderma.

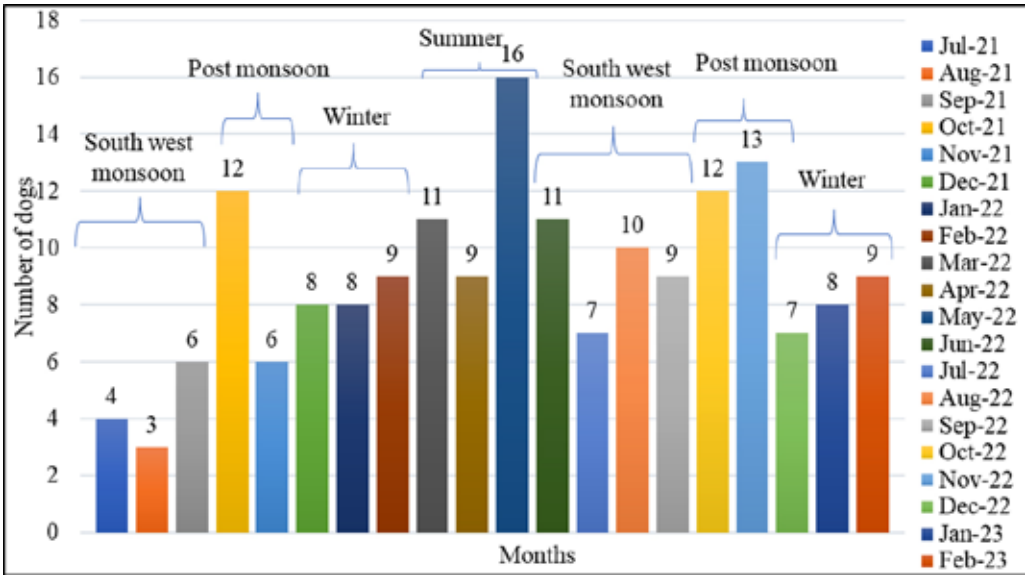

Fig. 1. Season-wise distribution of pyoderma

In the present study, there was no statistically significant difference between the number of animals affected with pyoderma and feeding practices. However, majority of the animals (38.7 per cent) affected with pyoderma were being provided with a combination of home-made and commercial diets. In contrast to this Stercova *et al*. (2022), proposed that dry commercial diets were gaining popularity among pet parents as they were easy to store and supply and were considered balanced. Gonclaves *et al*. (2022) reported that the supply of non-balanced or left-over food of humans may increase the risk of developing metabolic diseases that negatively interfere with the well-being of the animal. Hence, it is recommended to provide a balanced diet to favour performance and well-being.

Ruling out flea bite hypersensitivity must be the initial step in the management of pyoderma in middle-aged dogs (Seckerdieck and Mueller, 2018). In the present study, the presence of ectoparasites such as fleas or ticks was noticed in 36 (20.22 per cent) out of the 178 animals with pyoderma and all these animals were being managed with a topical ecto-parasiticide preparations. Similar findings were reported by Miller *et al*. (2013) wherein they proposed that flea bite hypersensitivity might be one of the major factors that predisposes to pyoderma.

As observed, no statistical significance could be appreciated between the number of animals affected with pyoderma and deworming history. On the other hand, there was statistical significance between the number of animals affected with pyoderma and their vaccination history. A large proportion of the study population was regularly dewormed (53.93 per cent) and vaccinated (80.9 per cent), at least against rabies suggesting that most of the owners were paying special attention to the welfare and care of their pets. However, only a smaller proportion (20.78 per cent) made use of copro-parasitological examination before deworming. In the present study, there was statistically significant difference in the proportion of animals with pyoderma with respect to supplementation of oral coat conditioners and mineral mixtures. Out of the 178 animals affected with pyoderma, majority (71.91 per cent) were not administered any oral coat conditioners, vitamin or mineral supplements whereas 28.09 per cent of dogs were regularly provided with oral coat conditioners, vitamin and mineral supplements.

In the present study, there was statistically significant difference between the number of animals with pyoderma and their housing history. Out of the178 animals affected with pyoderma, majority (52.25 per cent) were

housed outdoors in a separate kennel whereas, 26.97 per cent were left free indoors for some time and kept inside the kennel for the rest of the time. Least number of pyoderma cases (20.78 per cent) was reported among animals that were strictly reared indoor along with the owners. This figure is in broad agreement with the study of Prakash *et al*. (2022), in which 53.33 per cent of the animals were kept outdoors. On the contrary, Shyma and Vijayakumar (2012) reported that 85.72 per cent of animals were kept outdoors. Proper housing provides proper control and personal environment, safe and secure holding place and protects the animal from inclement weather conditions (Sreekumar and Ninan, 2016). Devi and Vijayakumar (2013) suggested that to reduce cutaneous infections in animals, proper housing and good ventillation should be given to animals in closed confinement especially during the rainy season and winter months.

Statistically significant difference could be appreciated in the proportion of animals with pyoderma with respect to different kennel hygiene practices followed. As observed, the majority of owners regularly (69.66 per cent) cleaned the kennel. However, 54.84 per cent of them were using chemicals or disinfectants. Shyma and Vijayakumar (2012) stated that these chemicals and disinfectants probably acted as local irritants and led to self-inflicted trauma that later on became extensive areas of pyoderma.

There was statistically significant difference between the number of animals affected with pyoderma and the bathing history. Out of the 178 cases of pyoderma, 122 animals (68.54 per cent) were bathed regularly, at least one or more times a week, while regular bathing was not practised in the remaining 56 cases (31.46 per cent). Among the 122 dogs, that were regularly bathed, 84.42 per cent were bathed at home while 19 (15.58 per cent) were taken to commercial grooming facilities at least once a month. Similar findings were reported by Shyma and Vijayakumar (2012). However, Prakash *et al*. (2022) reported that 76.67 percent of animals were bathed at least once or more times a week.

No statistical significance was recorded between the number of animals and the various grooming practices followed. Out of the 178 animals with pyoderma, 69.66 per cent received proper attention for the health and hygiene of their dog's coat by grooming the animals, of which 36.52 per cent regularly groomed their dogs while 33.15 per cent practised occasional grooming. At-home grooming (84.42 per cent) was the most prevalent form of grooming, followed by taking dogs to a grooming centre. Sreekumar and Ninan, (2016) recommended daily grooming of dogs to remove dead hairs, distribute natural oils of skin, check the matting of hairs and improve cutaneous circulation. Additionally, in long-haired breeds, grooming could aerate the skin and prevents severe hair matting that eventually predisposes to recurrent or chronic cutaneous and ocular infections, anal soiling and obstruction, faecal constipation and impaction, urine scalding and parasitic infestations (McDonald *et al*., 2022). Radhakrishnan *et al*. (2018) suggested that grooming should be a part of daily care and if daily grooming is not possible, brushing and combing at least a week is essential. On the contrary, according to studies by Cain and Mouldin (2015) pyoderma, particularly furunculosis has been proposed to occur as a sequelae to follicular trauma following vigorous grooming of skin and coat as well as due to bathing with contaminated shampoos or conditioners, particularly bulk formulations that are diluted for use in commercial grooming facilities making frequently bathed dogs more susceptible to pyoderma. Hence aggressive bathing, grooming or hair clipping of the pets is discouraged as this causes follicular trauma and increased susceptibility to opportunistic infection following exposure to contaminated grooming products or water sources.

Conclusion

The results of this study provide valuable data on the prevalence, epidemiological profile, environmental factors and managerial practices that predispose dogs to pyoderma. The analysis of the epidemiological profile of dogs affected with pyoderma revealed that the condition was more prevalent in female dogs, between one to three years of age. Labrador

retrievers were more predisposed compared to other breeds. Majority of the cases were housed outdoor in a separate kennel, were bathed regularly and groomed at least once a month.

This study provided additional evidence that pyoderma still constitutes a major part of small animal dermatology consultations. Every dog is distinct and several host, managerial and environmental circumstances might affect the prevalence of pyoderma over the year. Identification of underlying risk factors, environmental influences and managemental practices aids in successful therapeutic management and faster recovery. Hence, this should be included in the critical 'day one' competency for newly qualified veterinary graduates and they must be trained well enough to obtain a detailed epidemiological profile and correlate it with clinical signs that in turn aid in the diagnosis and management of infection.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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