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## Prevalence and epidemiological profile of canine pyoderma in and around Rewa, Madhya Pradesh

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**Abstract**

This study was aimed to determine the prevalence, clinical manifestations, cytological characteristics, and therapeutic responses of pyoderma in dogs presented to the Small Animal Medicine OPD of Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, Rewa, Madhya Pradesh, India, Divisional Veterinary Hospital, Bichhiya, Rewa and some private clinics in Rewa. Out of a total of 1010 dogs screened, 180 dogs exhibited dermatological affections, with 47 cases (26.11%) diagnosed as pyoderma based on clinical examination, cytological evaluation of impression smears and skin scrapings to rule out parasites. Diagnosis was confirmed by characteristic lesions and microscopic findings of degenerated neutrophils with cocci and rod bacteria in the impression smears. Detailed assessments included body temperature, pulse, respiration, pruritus score, lesion presence and distribution score, coat condition score, gross dermatological score, and cytological score. Common clinical lesions comprised of pruritus, erythematous papules, furuncles with edema, hot spots with moist erosive surfaces, ruptured pustular moist lesions, generalized alopecia, exfoliative superficial pyoderma, pyo-traumatic lesions, pustules, interdigital furunculosis, excoriations, erosions, and ulcers. Pyoderma prevalence was recorded to be highest in the 1-3 years age group (63.83%), with non-descript (38.29%) most susceptible, and males (70.21%) more affected than females (29.78%). Skin cytology proved a rapid, reliable diagnostic tool, revealing increased neutrophils and bacteria. All clinical scores (pruritus, lesion distribution, coat condition, gross dermatological, cytological) were significantly elevated in affected dogs compared to controls.

**Keywords:** Age, breed, dermatological score, dog, prevalence, pyoderma

**Introduction**

Companion animal practice has expanded rapidly in recent decades, particularly in urban areas where increased awareness of animal welfare has led to greater demand for advanced veterinary care. Among dermatological disorders of dogs, pyoderma is one of the most common and persistent conditions encountered in clinical practice worldwide. It represents a substantial proportion of canine dermatology cases and continues to pose diagnostic and therapeutic challenges. Pyoderma is defined as a bacterial infection of the skin characterized by suppuration and inflammatory tissue response (Angus, 2009) <sup>[1]</sup>. The high occurrence of pyoderma in dogs is attributed to species-specific anatomical and physiological characteristics of canine skin, including a relatively thin stratum corneum, reduced lipid barrier protection, and exposed hair follicles that facilitate microbial invasion and colonization (Mason and Lloyd, 1989) <sup>[19]</sup>. Epidemiological studies have shown that pyoderma is more commonly observed in young adult dogs, particularly between one and three years of age, and certain breeds such as Labrador Retrievers appear to be more predisposed, indicating possible genetic susceptibility. In addition to host factors such as breed, age, and immune status, environmental and management factors including hygiene, housing, nutrition, and ectoparasite infestation play an important role in disease occurrence and recurrence. Clinically, pyoderma is classified based on the depth of infection into surface, superficial, and deep pyoderma. The condition is characterized by a variety of lesions including papules, pustules, crusts, epidermal collarettes, alopecia, erythema, scaling, pruritus, hyperpigmentation, and lichenification (Mahto and Biswas, 2013; Kshama and Yathiraj, 2014) <sup>[18, 15]</sup>.

Diagnosis is primarily based on clinical examination and cytological evaluation, which is a rapid, minimally invasive, and reliable diagnostic tool for confirming bacterial infection and guiding therapy (Hillier *et al.*, 2014) <sup>[11]</sup>. Therefore, cytology plays a crucial role in the diagnosis and management of canine pyoderma.

### Materials and Methods

This prospective study spanned six months (July-December 2025) at the Department of Veterinary Medicine, College of Veterinary Science and Animal Husbandry, Rewa, Madhya Pradesh, India. A total of 1010 dogs presenting to the Small Animal Medicine OPD, Divisional Veterinary Hospital (Bichhiya), and private clinics in Rewa underwent screening for dermatitis, with pyoderma confirmation in 47 cases (4.65%).

Diagnosis integrated detailed history, clinical examination of skin (ears, paws, coat, follicles), and lesions (erythema, alopecia, pruritus, pustules, papules). Skin scrapings examination was done as described by Brar *et al.* (2000) <sup>[3]</sup> to rule out parasitic etiology. Vital parameters (temperature, pulse, respiration, body condition) were recorded for each case. Cytology used impression smears stained as per the method of Mendelsohn *et al.* (2006) <sup>[20]</sup> and Mueller (2009) <sup>[22]</sup>. All dogs were subjected to clinico-dermatological scoring as per modified method described by Loeffler *et al.* (2011) <sup>[17]</sup> for which owners were asked to score their dog pruritus in terms of behaviour i.e. scratching, rubbing, chewing or licking on a scale of 1 to 5. Assessment of the presence and distribution of skin lesion was scored on a scale of 1 to 5. Similarly, coat condition was subjectively

assessed on a scale of 1 to 5. On the basis of sum of pruritus score, presence/distribution of lesion score and coat condition score, an overall gross dermatological score was assessed on a scale 1 to 15 as per the method of Nema (2021) <sup>[33]</sup>. Cytological evaluation was accomplished using the Direct impression and Indirect impression smears method described by Mendelsohn *et al.* (2006) <sup>[20]</sup>. Modified Wright-Giemsa staining was used to stain cytology samples to reliably identify inflammatory cells and bacteria (Beco *et al.*, 2013) <sup>[2]</sup>. For cytological scoring, slides were examined using 100X oil immersion and a minimum of 10 fields assessed. A semiquantitative scale given by Fadok and Irwin (2019) <sup>[7]</sup> was be used to score the slides on the basis of bacterial burden. Confirmation of pyoderma cases were done by clinical signs and cytological examination. The prevalence of pyoderma was calculated as a percentage of positive dogs with pyoderma out of total number of dogs screened during the study.

### Results and Discussion

#### Prevalence of pyoderma in dogs

During this study, a total number of 1010 dogs were screened for skin affections in general and pyoderma in particular, out of which 180 dogs (17.82%) were reported for plethora of skin problems like pyoderma, mange, contact allergic dermatitis, flea allergic dermatitis, canine atopic dermatitis etc. Among these 180 cases, 47 dogs (26.11%) were finally diagnosed with pyoderma based on cutaneous lesions and cytological findings of impression smears. The prevalence of pyoderma has been presented in Table 01.

**Table 1:** Prevalence of pyoderma in dogs

| Total number of animals screened | No. of Animals having skin lesions | Percentage of animals having skin lesions | No. of Animals having pyoderma among skin lesions | Percentage of animals having pyoderma amongst skin lesions | Overall prevalence of pyoderma (%) |
|----------------------------------|------------------------------------|-------------------------------------------|---------------------------------------------------|------------------------------------------------------------|------------------------------------|
| 1010                             | 180                                | 17.82                                     | 47                                                | 26.11                                                      | 4.65                               |

The result of the present work regarding prevalence of skin affection in dogs are in close agreement with the observation of Nema (2021) <sup>[33]</sup> and Verma (2023) <sup>[35]</sup> who reported 20.05% and 21.90% prevalence of dermal disorder in dogs respectively. However, low prevalence has been previously reported by Veeranki (2015) <sup>[34]</sup>, Gopal *et al.* (2023) <sup>[8]</sup> and Kale (2024) <sup>[31]</sup> who reported 10.08%, 6.98% and 11.04% respectively. On the contrary, higher prevalence of skin affections has been recorded by Chaudhary *et al.* (2019) <sup>[4]</sup> and Haritha *et al.* (2022) <sup>[9]</sup> who reported 42.55% and 33.4% prevalence respectively. Higher occurrence of dermatological problems could be attributed to season, climatic factors and to managerial practice adopted in particular area (Sharma *et al.*, 2008) <sup>[28]</sup>. The variations in pyoderma prevalence across studies likely stemmed from differences in canine population demographics, environmental and climatic conditions, and owner preferences for housing and management practices. Higher rates in tropical regions like India probably results from elevated humidity and temperature that promotes bacterial proliferation, alongside seasonal fluctuations and population characteristics (Hillier *et al.*, 2014) <sup>[11]</sup>. Comorbid endocrine disorders such as hypothyroidism and hyperadrenocorticism compromise skin barrier function, elevating susceptibility (Santoro *et al.*, 2015) <sup>[27]</sup>. Urban-rural disparities, variable allergen/infection exposure, nutritional deficiencies (e.g.,

omega-3 fatty acids), referral bias toward complex cases in specialty clinics, and regional antimicrobial usage patterns further might have contributed to these discrepancies.

#### Age-wise prevalence of pyoderma

**Table 2:** Age-wise prevalence of pyoderma in dogs

| S. No. | Age groups (years) | Number of animals (n-47) | Percentage (%) |
|--------|--------------------|--------------------------|----------------|
| 1      | <1 year            | 05                       | 10.63          |
| 2      | 1-3 years          | 30                       | 63.83          |
| 3      | 3-5 years          | 07                       | 14.89          |
| 4      | 5-7 years          | 03                       | 6.38           |
| 5      | >7 years           | 02                       | 4.25           |

Age-wise prevalence of pyoderma in dogs of various age groups of dogs is depicted in Table 02. Highest incidence was found in 1-3 years age group (63.83%), followed by 3-5 years (14.89%), < 1 year (10.63), 5-7 years (6.38%) and >7 years age group (4.25%) in decreasing order. Highest prevalence rate for pyoderma in 1-3-year age group has also been previously reported by Markandey (2021) <sup>[32]</sup>, and Verma (2023) <sup>[35]</sup> as to be 45.16% and 27.86% respectively. Similarly, Naveena *et al.* (2023) <sup>[23]</sup> and Kale (2024) <sup>[31]</sup> reported 45.25% and 33.33% among 1-2 years age group respectively. In contrast, Curtseit *et al.* (2009) <sup>[6]</sup> recorded

higher prevalence of pyoderma in dogs aged between 9-14 years, while Khurana *et al.* (2016) [13] and Thapa and sarkar (2018) [30] documented higher prevalence of dermatological disorders in dogs up to one year age. Nonetheless, Koshnegah *et al.* (2013) [14] opined that there were no age predilections for dermatological diseases in dogs. The highest prevalence found in 1-3 years age group in this study, might be due to greater number of cases presented at Medicine OPD of the Veterinary Clinical Complex at Veterinary College, Rewa, during the study period. Secondly, young dogs may have immature or challenged immune systems, increasing susceptibility for bacterial skin infections. Higher activity levels in young juvenile dogs could also lead to more skin trauma and exposure to environmental pathogens.

### Breed-wise prevalence of pyoderma

The breed-wise prevalence of canine pyoderma has been expressed in Table 03 Maximum cases of pyoderma were reported in non-descript (38.29%) followed by Labrador (23.40%), German shepherd (17.02%), Spitz (6.38%), Pug (4.25%), Dachshund (2.12), Dobermann (2.12%), Cross-breed (2.12%), Shih Tzu (2.12%) and Saint Bernard (2.12%) in a decreasing manner.

**Table 3:** Breed-wise prevalence of pyoderma in dogs

| S. No. | Breed           | Animals affected | Percentage (%) |
|--------|-----------------|------------------|----------------|
| 1      | Non-descript    | 18               | 38.29          |
| 2      | Labrador        | 11               | 23.40          |
| 3      | German Shepherd | 08               | 17.02          |
| 4      | Spitz           | 03               | 6.38           |
| 5      | Pug             | 02               | 4.25           |
| 6      | Dachshund       | 01               | 2.12           |
| 7      | Dobermann       | 01               | 2.12           |
| 8      | Cross-breed     | 01               | 2.12           |
| 9      | Shih Tzu        | 01               | 2.12           |
| 10     | Saint Bernard   | 01               | 2.12           |

Markandey (2021) [32] also reported higher prevalence of pyoderma in non-descript dog as 35.48% respectively followed by Labrador 25.80% in lines with the findings of this study. In contrast Khinchi *et al.* (2019) [12], Nema (2021) [33], Haritha *et al.* (2022) [9], Verma (2023) [35] and Kale (2024) [31] reported higher prevalence of pyoderma in Labrador as 33.33%, 28.12%, 30.8%, 34.42% and 36.77% respectively followed by German shepherd as 21.87% by Khinchi *et al.* (2019) [12], 21.21% by Nema (2021) [33] and 26.22% by Verma (2023) [35]. The breed predilection to dermatological problems varies with the breed composition of canine population in a particular region and popularity of individual breeds (Pocta and Svoboda, 2007) [25].

Higher prevalence of pyoderma in Non-descript and Labrador followed by German Shepherd in the present study might be due to preference of people towards these breeds as a companion animal. In addition, there might be sampling bias which might have over-represented the afore said breeds in the findings. Non-descript dogs showed higher pyoderma susceptibility due to active lifestyles, increasing trauma and moisture exposure, compounded by poor hygiene, malnutrition, and management deficiencies (Hillier and Griffin, 2001) [10]. Labradors exhibit predisposition from genetic atopy disrupting skin barriers, secondary infections, and dense coats trapping moisture/bacteria to foster

folliculitis and secondary pyoderma (Olivry *et al.*, 2015; Miller *et al.*, 2013) [24, 21].

### Sex-wise prevalence of pyoderma

**Table 4:** Sex-wise prevalence of pyoderma in dogs

| S. No. | Gender | Animals affected | Percentage (%) |
|--------|--------|------------------|----------------|
| 1      | Male   | 33               | 70.21          |
| 2      | Female | 14               | 29.78          |

Sex-wise prevalence of pyoderma has been recorded in Table 04 whereby higher rate of incidence was recorded in male (70.21%) as compared to female (29.78%) dogs.

Higher prevalence in male dogs was recorded with close resemblance with earlier findings of Markandey (2021) [32], Haritha *et al.* (2022) [9], Naveena *et al.* (2023) [23], Verma (2023) [35] and Kale (2024) [31] who reported 64.45%, 58.3%, 56.2%, 52.45% and 53.36% respectively. In contrast higher prevalence in female dogs has been also reported by several workers like Shyma and Vijaykumar (2011) [29] and Lodha and Das (2014) [16] who reported it to be 57.50% and 57.35% respectively. There is no evidence of a substantial gender predisposition for the development of pyoderma and no study has established sex predisposition in the prevalence of skin diseases.

Higher incidence in male dogs could be observed due to the fact regarding people's preference for male over female because of their masculine look, better vigour and no issue of breeding nuisances or unwanted pregnancies. In addition, male dogs might engage more in roaming, Fighting, and mounting, leading to superficial skin traumas like abrasions and wounds that serve as entry points for invasion by bacteria like *Staphylococcus pseudintermedius* leading to pyoderma. Unneutered males have greater roaming tendencies and poor hygiene from urine marking or inter-dog contact, leading to impaired skin barrier integrity which further promotes bacterial overgrowth. Apart from this there may be hormonal influence of androgens like testosterone which may increase sebaceous gland activity, alter skin pH and promote bacterial growth (Millier *et al.*, 2013) [21].

### Skin lesions in pyoderma

Common clinical skin lesions in pyoderma were recorded as, erythematous papules (Plate 01: A), ruptured pustular moist lesion (Plate 01: B), furuncles with edema over the neck (Plate 01: C) inter digital lesions (Plate 01: D), severe erythema (Plate 01: E), generalized alopecia with widespread scabby lesion (Plate 01: F), moth-eaten alopecia over the dorsal areas (Plate 01: G), interdigital furunculosis (Plate 01s: H), the bacterial invasion (e.g. *Staphylococcus pseudintermedius*) triggers neutrophilic inflammations leading to pustule formation which rupture and form crusts. Bacterial toxins and cytokines (IL-1 and TNF- $\alpha$ ) causes vasodilatation leading to redness (erythema) and warmth (Hillier and Griffin, 2001) [10]. Folliculitis damages hair follicles causing alopecia (Santoro *et al.*, 2015) [27] and is exacerbated by pruritus and self-trauma. Pustules rupture oozing serum and WBCs along with bacteria forming dried crusts and further perpetuating the infection (Beco *et al.*, 2013) [2]. Healing pustules leave circular scaling as epidermis regenerates causing formation of epidermal collarettes (Millier *et al.*, 2013) [21]. Deep bacterial invasion may lead to tissue necrosis and further ulcer formation. In

chronic inflammations, it may stimulate melanocytes causing post inflammatory hyper-pigmentation.

### Skin cytology of impression smears

Impression smears from the lesions of superficial pyoderma affected dogs were stained with Giemsa stain and EMB (Eosin methylene blue) and observed under oil immersion (100x) which revealed the presence of cocci and rod bacteria in most of the cases along with degenerated neutrophils. Various observations like impression smear from moist lesion of skin showing eosinophil and neutrophil (100X) (Plate 02: A), impression smear revealing large no. of rods (bacilli) among degenerate neutrophil (100X) (Plate 02: B), severe rod (bacilli) infiltration from impression smear of dog with pyoderma lesions (100X) were recorded during microscopic examination of stained impression smears. Similar observations as in the present study have been previously recorded by Veeranki (2015) [34]. In our study, the observation of impression smear examination proved to be a rapid, cost effective, non-invasive diagnostic tool for confirmation of pyoderma. Craig (2003) [5] also considered this approach cost-effective, quick to perform, and highly specific while Rod (2010) [26] opined that cytological examination was invaluable in supporting clinical suspicion of pyoderma. Impression smear cytology offers rapid microscopic assessment for instant diagnostic insights in acute pyoderma, facilitating prompt treatment choices. This minimally invasive method, merely pressing a slide to lesions, inflicts negligible discomfort, supports frequent sampling, and relies on inexpensive tools like microscopes, slides, and stains, outperforming costlier options such as histopathology or cultures. It enables direct observation of bacterial shapes (e.g., cocci or rods) for preliminary identification of staphylococcal or similar pathogens, while highlighting inflammatory cells (neutrophils, macrophages) to distinguish pyoderma from conditions like allergic dermatitis. Ultimately, these findings steer targeted empirical antimicrobial therapy, enhancing outcomes and curbing overuse of broad-spectrum agents.

### Dermatological scores in dogs with pyoderma

On the day of presentation, mean $\pm$ SE pruritus score was significantly higher ( $p\leq 0.05$ ) in pyoderma-affected dogs ( $4.17\pm 0.31$ ) as compared to healthy dogs ( $1.00\pm 0.00$ ). Pyoderma causing *Staphylococcus spp.* may release exotoxins that activate itch receptors causing pruritus. In addition, histamines, cytokines (IL-31) and prostaglandins from skin inflammations stimulate nerve endings. Besides, compromised skin allows penetration of allergens and irritants, triggering itch. The pruritus score of the control group remained unchanged and statistically comparable throughout the study period. Similarly, presence and distribution of lesion scores were significantly higher ( $p\leq 0.05$ ) in pyoderma-affected dogs ( $3.50\pm 0.43$ ) as compared to the healthy dogs ( $1.00\pm 0.00$ ). In a similar fashion, coat condition scores were significantly higher ( $p\leq 0.05$ ) in pyoderma-affected dogs ( $3.67\pm 0.42$ ) as compared to the healthy dogs. Bacterial infection of skin damages hair follicles causing poor hair growth, dullness and/or alopecia (Millier *et al.*, 2013) [21]. In addition, excessive scratching or licking may also cause hair loss, broken hairs and coat damage. Pus, serum and crusts mat the coat making it greasy or rough (Beco *et al.*, 2013) [2]. The gross dermatological scores were significantly higher

( $p\leq 0.05$ ) in pyoderma-affected dogs ( $11.33\pm 1.05$ ) as compared to the healthy dogs ( $3.00\pm 0.00$ ), reflecting severe cutaneous involvement. Similarly, the cytological score were significantly higher ( $p\leq 0.05$ ) in pyoderma-affected dogs ( $3.67\pm 0.21$ ) as compared to the healthy dogs ( $0.00\pm 0.00$ ) indicating marked cytological involvement.



**Plate 1:** (A) Erythematous papules (B) Ruptured pustular moist lesion (C) Furuncles with edema over the neck (D) Inter digital lesions in dog with pyoderma (E) Severe erythema (F) Generalized alopecia with widespread scabby lesion (G) Moth-eaten alopecia over the dorsal areas (H) Interdigital Furunculosis

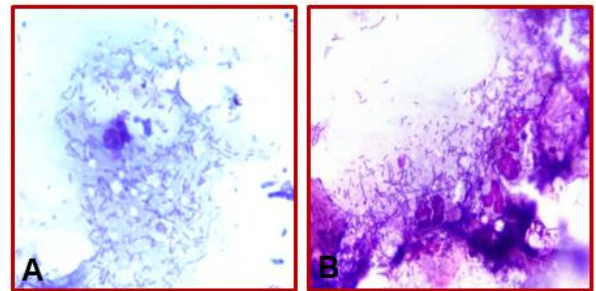


**Plate 2:** (A) Impression smear revealing large no. of rods (bacilli) among degenerate neutrophil (100x) (B) severe rod (bacilli) infiltration from impression smear of dog with pyoderma lesions (100x)

### Summary and Conclusion

This study reveals pyoderma's 4.65% overall prevalence in screened dogs at Rewa clinics, peaking in young (1-3 years) male non-descript and Labrador breeds, underscoring cytology's role in rapid diagnosis. These insights guide companion animal dermatological practice by promoting early screening and breed-specific hygiene protocols, enhance pet health, and reduce antimicrobial resistance in India's expanding companion dog population.

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