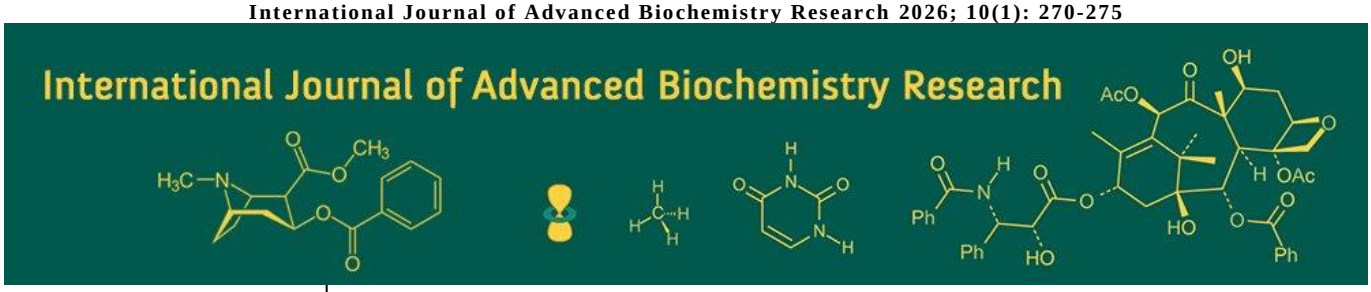

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(1): 270-275
www.biochemjournal.com
Received: 07-10-2025
Accepted: 10-11-2025

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Epidemiological pattern of dermatophytosis in calves from Tarai region of Uttarakhand, India

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DOI: https://www.doi.org/10.33545/26174693.2026.v10.i1d.6921

Abstract
This study aimed to investigate the prevalence and epidemiological pattern of dermatophytosis in calves under one year of age in the Tarai region of Uttarakhand, India. Data were collected from 2007 calves screened across multiple sources, including the Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Pantnagar, nearby areas of Tarai region, Uttarakhand including gaushalas, dairy farms, villages and through hospital records. Clinical examination focused on characteristic dermatological lesions such as alopecia, scaling, and crust formation. Out of 2007 calves screened, 589 were clinically positive for dermatophytosis, yielding an overall prevalence of 29.34%. Age-wise analysis showed the highest prevalence in calves aged 4-6 months (39.71%), while the lowest was observed in 10-12 months old calves (19.07%). Female calves (31.76%) were more affected than males (25.51%). Breed-wise prevalence was highest in HF crossbreds (42.67%), followed by Jersey crossbreds (31.84%), whereas indigenous breeds like Sahiwal and Badri exhibited lower prevalence (28.12% and 18.91%, respectively). Season-wise analysis revealed the highest occurrence during winter (50.96%), followed by rainy (18.72%) and summer (12.57%) seasons, highlighting the influence of climatic and management factors. These findings indicate that dermatophytosis prevalence in calves is influenced by age, sex, breed, season, and rearing environment. Effective control strategies should focus on improving hygiene, housing, and management practices, especially during high-risk seasons and among susceptible age and breed groups.

Keywords: Dermatophytosis, calves, prevalence, epidemiology, Uttarakhand

Introduction
Dairy farming is an important sector providing a significant source of food and income worldwide. However, infectious disease poses a major threat to the health and productivity of dairy calves (Grout *et al.*, 2020) [5]. Dermatophytosis is a fungal skin infection caused by keratinophilic fungi that affects the skin, hair, and hooves of animals. The infection appears as rough, circular patches on the skin that spread easily when animals come in contact with each other or share contaminated equipment. Cattle dermatophytosis is a major public and veterinary health concern, not only because of its high zoonotic impact, but also because of economic losses in cattle farms attributed to hide damage, loss of weight, decimated meat and milk, contagiousness among animals, treatment costs, and difficulty to implement control measures (Shams-Ghahfarokhi *et al.*, 2009) [15]. Individuals working closely with animal such as farmers, veterinarians, and animal care professionals are at increased risk of infection, either through direct contact with animals or indirectly through contaminated tools and equipment (Lagowski *et al.*, 2019) [8]. Ringworm is usually enzootic in cattle herds and is more prevalent in calves of less than one year of age (Chermette *et al.*, 2008) [3]. This may be explained by stressors such as rapid growth, weaning, or parasite burden which weakens their immunity and skin health, as well as close confinement, dietary factors (deficiencies), and production systems (Papini *et al.*, 2009) [11]. Asymptomatic adult animals appear to carry and spread the infection to young calves during early stage of their life (Singh and Kushwaha, 2010) [16]. Importantly, *Trichophyton verrucosum* is the predominant zoophilic dermatophyte causative species of dermatophytosis in cattle which is characterized by rapidly spreading among susceptible animals and can occasionally spread to humans through direct contact with cattle or infected fomites, causing highly inflammatory skin and hair dermatophytosis (Monod *et al.*, 2014) [9].

In India, reports of ringworm in cattle come from many states but the influence of factors such as breed, age, and sex on disease susceptibility remains poorly understood. The role of seasons in disease occurrence is also not well understood. These knowledge gaps make it hard to give farmers specific advice on protecting their herds.

Materials and Methods

The prevalence study was undertaken to investigate the epidemiological pattern of dermatophytosis in calves in the Tarai region of Uttarakhand. Data were collected from the Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Pantnagar, Uttarakhand, as well as from various villages, gaushalas, dairy farms, and veterinary hospitals located in the surrounding Tarai areas. A total of 2007 calves were screened for dermatophytosis based on clinical examination. Calves showing characteristic dermatological lesions such as alopecia, scaling, and crust formation were considered positive and included for prevalence estimation. The occurrence of dermatophytosis was assessed with respect to factors such as gender, age, breed and seasonal variations. Data obtained were compiled systematically and used for estimation of overall and group-wise prevalence. The investigation was conducted during the period from January, 2025 to December, 2025.

Results and Discussion

Overall prevalence

In the present study, a total of 2007 calves below one year of age, irrespective of sex and breed, were clinically screened for dermatophytosis. Of these, 589 calves exhibited characteristic dermatological lesions suggestive of dermatophytosis and were considered clinically positive. The overall prevalence of dermatophytosis recorded during the study period in the Tarai region of Uttarakhand was 29.34% (589/2007) among the examined calves, as shown in Table 1. Area-wise analysis revealed variation in the prevalence of dermatophytosis, with the highest occurrence observed in Haldwani (39.7%) as compared to other areas.

The findings of the present study were in agreement with the earlier report of Kandpal (2024) [7], who documented an overall prevalence of 29.08% (536/1843) of dermatophytosis in calves from the Tarai region of Uttarakhand. Similar prevalence rates were also reported by Parmar *et al.* (2018) [12], who observed an overall prevalence of 32.69% (17/52) among cattle in Gujarat. In contrast, Gafoorali (2011) [4] reported a comparatively lower prevalence of 17.38% (81/466) in the Parbhani district of Maharashtra, India, which may be attributed to regional differences in management practices, environmental conditions, and animal husbandry systems.

The observed overall prevalence indicates that dermatophytosis is a commonly encountered dermatological condition among calves in the Tarai region of Uttarakhand. The endemic nature of the disease in this region may be influenced by a combination of environmental conditions, management practices and animal husbandry systems prevailing in the area. Factors such as close rearing of calves, frequent animal contact, and variations in hygiene and housing conditions may contribute to the persistence and spread of infection.

Table 1: Overall prevalence in Tarai region of Uttarakhand

S. No.	Area	Total No. of calves screened	No. of Dermatophytosis cases	Prevalence rate (%)
1	Pantnagar	324	89	27.46
2	Lalkuan	201	49	24.37
3	Rudrapur	198	68	34.34
4	Kichha	173	64	36.99
5	Haldwani	204	81	39.7
6	Halduchaur	156	51	32.69
7	Gadarpur	188	40	21.27
8	Dineshpur	167	38	22.75
9	Shantipuri	162	46	28.39
10	Kashipur	136	42	30.88
11	Sitarganj	98	21	21.42
	Total	2007	589	29.34

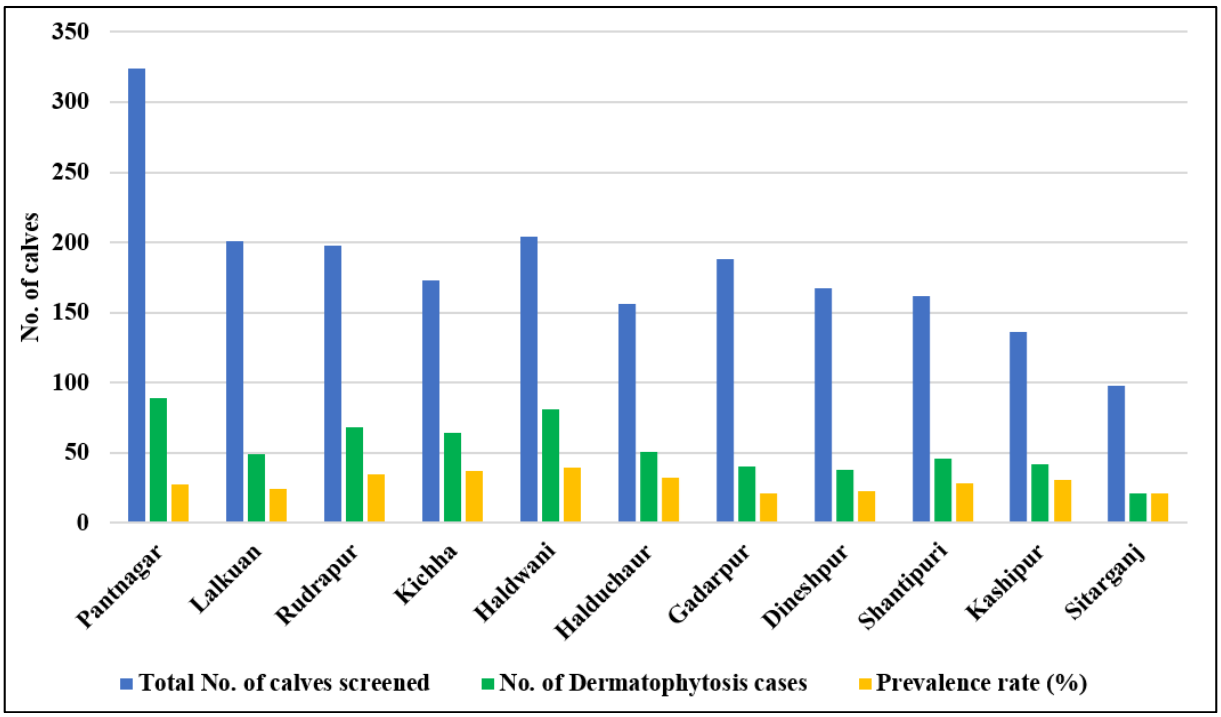

Fig 1: Bar-graph depicting overall prevalence in Tarai region of Uttarakhand

Sex-wise prevalence

In the present study, sex-wise analysis of dermatophytosis revealed a higher prevalence in female calves as compared to male calves. Out of 1231 female calves screened, 391 were found clinically positive for dermatophytosis, resulting in a prevalence rate of 31.76%. In contrast, among 776 male calves examined, 198 cases of dermatophytosis were recorded, with a comparatively lower prevalence rate of 25.51%, as shown in Table 2.

These findings are in accordance with the observations of Rahman *et al.* (2018) [14], who reported a higher prevalence of dermatophytosis in female cattle (3.52%) compared to males (3.25%) in Bangladesh. Likewise, Haggag *et al.* (2017) [6] also documented a higher prevalence of dermatophytosis in female cattle (50%) than in males (22%) in Egypt. In contrast, Terefe *et al.* (2017) [18] reported a slightly higher prevalence of dermatophytosis in male cattle (46.75%) compared to females (42.67%). Similarly, Gafoorali (2011) [4] observed a higher prevalence of dermatophytosis in male cattle (22.09%) than in females (4.09%). Such variations in sex-wise prevalence reported across different studies may be attributed to differences in management practices, climatic conditions, sample size, and husbandry systems prevailing in different regions.

The higher prevalence observed in female calves may be attributed to management-related factors rather than inherent sex predisposition. Female calves are generally retained for breeding purposes and reared for longer durations under farm conditions, which may lead to prolonged exposure to infective agents. Moreover, increased stocking density, close housing, and variations in hygiene and housing practices may further facilitate the spread of dermatophytosis among female calves.

Table 2: Sex-wise prevalence in Tarai region of Uttarakhand

S. No.	Gender	Total No. of calves screened	No. of Dermatophytosis cases	Prevalence Rate (%)
1	Male	776	198	25.51
2	Female	1231	391	31.76

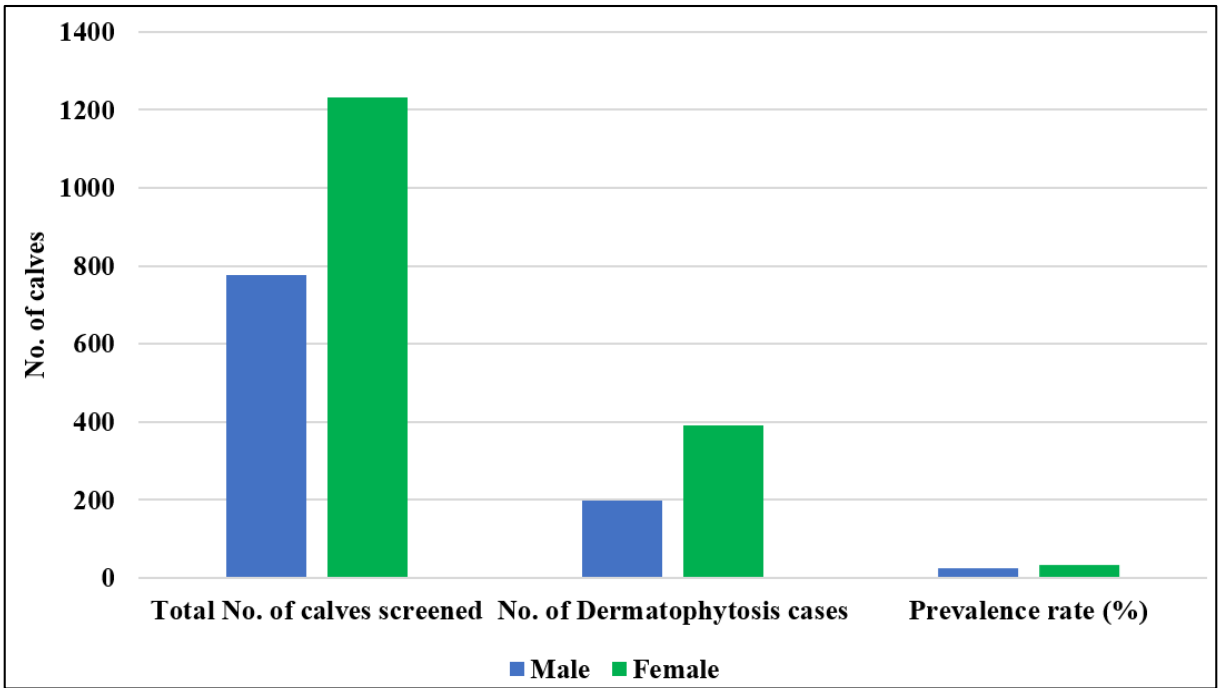

Fig 2: Bar-graph depicting sex-wise prevalence in Tarai region of Uttarakhand

Age-wise prevalence

In the present study, age-wise analysis of dermatophytosis revealed variation in prevalence rates among different age groups of calves. Among the 602 calves aged 0-3 months, 192 were clinically positive, resulting in a prevalence rate of 31.89%. The 4-6 months age group showed the highest prevalence, with 226 cases identified out of 569 calves examined (39.71%). In the 7-9 months age category, 105 out of 490 calves were affected (21.42%), while the oldest age group (10-12 months) exhibited the lowest prevalence, with 66 cases detected among 346 calves screened (19.07%) (Table 3).

These findings are in agreement with previous reports. Abd-Elmegeed *et al.* (2020) [1] documented a prevalence of 32.2% in calves under 6 months of age, whereas Tartor *et al.* (2020) [17] observed a higher prevalence in the 4-6 months age group (59.97%) compared to calves aged 6-12 months (40.49%). Such comparisons indicate that younger calves are generally more susceptible to dermatophytosis across different regions.

The higher prevalence observed in younger calves, particularly those aged 4-6 months, may be attributed to the relative immaturity of the immune system rendering them more susceptible to dermatophyte infection. Additionally, younger calves are often reared in close housing conditions, which can facilitate transmission. In contrast, older calves (10-12 months) may have developed partial immunity through prior exposure, resulting in comparatively lower prevalence. Management practices, housing, and environmental conditions likely also contribute to these age-related differences in dermatophytosis prevalence.

Table 3: Age-wise prevalence in Tarai region of Uttarakhand

Age in Months	Total No. of calves screened	No. of Dermatophytosis cases	Prevalence rate (%)
0-3	602	192	31.89
4-6	569	226	39.71
7-9	490	105	21.42
10-12	346	66	19.07

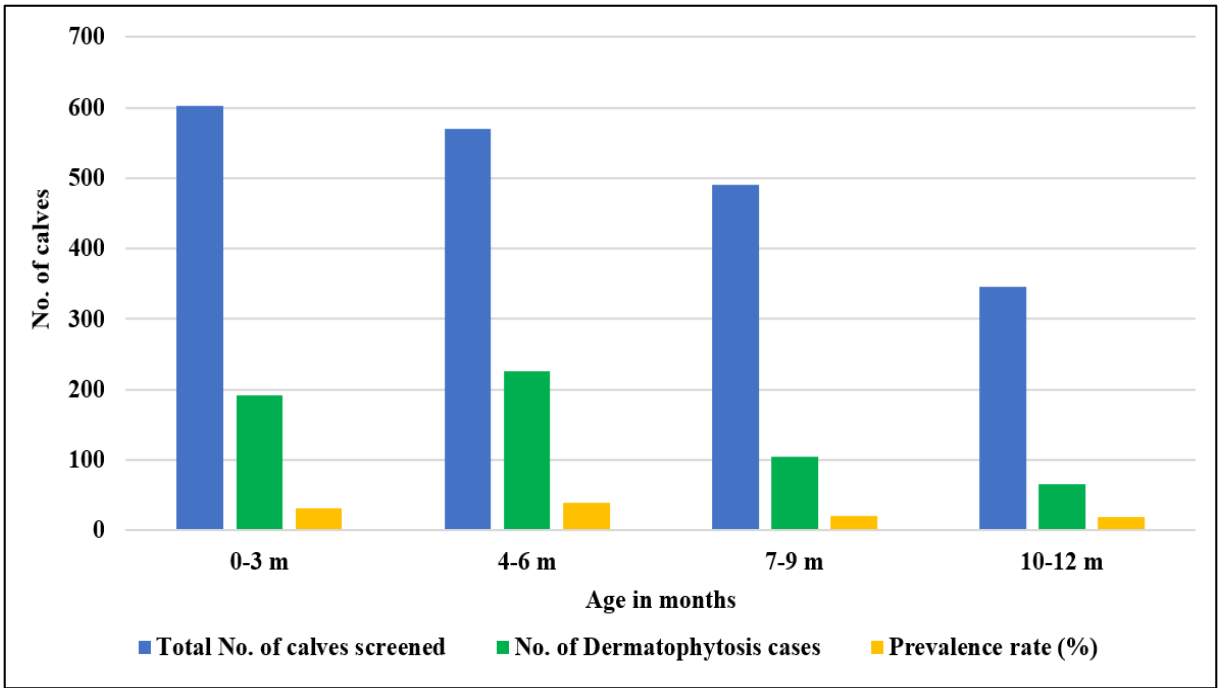

Fig 3: Bar-graph depicting age-wise prevalence in Tarai region of Uttarakhand

Breed-wise prevalence

Breed-wise analysis showed considerable variation in the prevalence of dermatophytosis among different breeds of calves. The highest prevalence was recorded in HF crossbred calves, with 169 cases out of 396 animals screened, accounting for a prevalence rate of 42.67%. This was followed by Jersey crossbred calves, which exhibited a prevalence of 31.84% (64/201). Among indigenous breeds, Sahiwal calves showed a prevalence rate of 28.12% (198/704), while Badri calves exhibited a comparatively lower prevalence of 18.91% (14/74). Non-descript calves recorded a prevalence of 22.78% (144/632), as shown in Table 4.

The higher prevalence observed in crossbred calves in the present investigation is in agreement with earlier reports. Rahbari (1986) [13] reported a higher prevalence of dermatophytosis in foreign breeds such as Holstein (36.6%) compared to native breeds (23%). Similarly, Tartor *et al.* (2020) [17] observed that crossbred calves were more frequently affected by ringworm (84.11%) than purebred calves. Comparable findings were also documented by Abdel-Rady and Kotb (2008) [2], who recorded a higher prevalence in Friesian cattle (28.94%) than in indigenous breeds (8.33%). Gafoorali (2011) [4] further reported greater susceptibility in non-descript and crossbred cattle as compared to well-adapted indigenous breeds.

The comparatively greater susceptibility of crossbred calves, particularly HF cross, may be attributed to their lower adaptability to tropical and subtropical climatic conditions, which predisposes them to dermatophyte infections. Crossbred animals are also more prone to environmental and management-related stress, which may adversely affect skin integrity and immune responses. In contrast, indigenous breeds such as Badri and Sahiwal are better adapted to local climatic conditions which may confer relative resistance to dermatophytosis. Additionally, variations in housing systems, stocking density, hygiene, and overall management practices among different breeds may influence the transmission dynamics of dermatophytosis. Crossbred calves are often reared under intensive or semi-intensive management systems involving closer animal contact, thereby facilitating the spread of infection.

Table 4: Breed-wise prevalence in Tarai region of Uttarakhand

S. No.	Breed	Total No. of calves screened	No. of Dermatophytosis cases	Prevalence rate (%)
1	Badri	74	14	18.91
2	Sahiwal	704	198	28.12
3	Jersey cross	201	64	31.84
4	HF cross	396	169	42.67
5	Non-descript	632	144	22.78

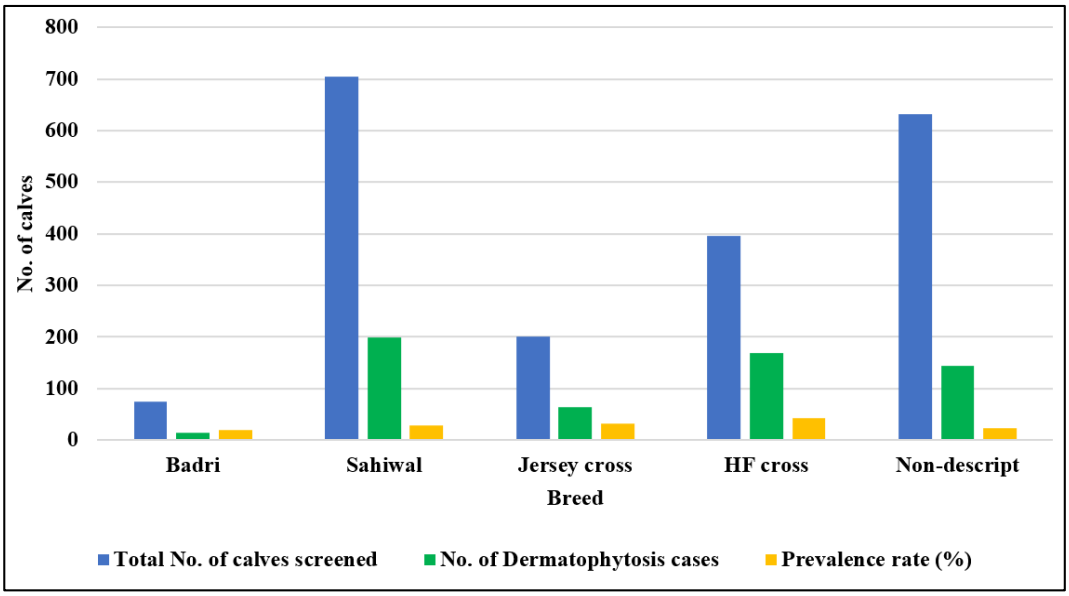

Fig 4: Bar-graph depicting breed-wise prevalence in Tarai region of Uttarakhand

Season-wise prevalence

Season-wise analysis revealed marked variation in the prevalence of dermatophytosis among calves across different seasons. The highest prevalence was recorded during the winter season, where 398 cases were observed out of 781 calves screened, resulting in a prevalence rate of 50.96%. This was followed by the rainy season with 112 cases among 598 calves examined, corresponding to a prevalence rate of 18.72%. The lowest prevalence was noted during the summer season, where only 79 cases were detected out of 628 calves screened, accounting for a prevalence rate of 12.57%, as presented in Table 5.

The seasonal pattern observed in the present investigation is in close agreement with the findings of Kandpal (2024) [7], who reported the highest prevalence of dermatophytosis in calves during the winter season (52.31%) in the Tarai region of Uttarakhand. Similar seasonal trends have also been reported by Rahbari (1986) [13], who documented that dermatophytosis occurred throughout the year but was more prevalent during winter months (35.6%). Nooruddin and Singh (1987) [10] likewise observed a higher prevalence of dermatophytosis in cattle during the winter season.

The markedly higher prevalence during winter may be attributed to favourable environmental conditions such as lower ambient temperatures, increased humidity, and reduced exposure to sunlight which promote the survival and transmission of dermatophytes. Furthermore, animals are often housed in closer confinement during colder months leading to increased animal-to-animal contact and facilitating the spread of infection. In contrast, higher temperatures and increased ultraviolet radiation during summer months are known to inhibit fungal growth, which may explain the comparatively lower prevalence observed during this period.

Table 5: Season-wise prevalence in Tarai region of Uttarakhand

Season	Total No. of calves screened	No. of dermatophytosis cases	Prevalence rate (%)
Winter	781	398	50.96
Summer	628	79	12.57
Rainy	598	112	18.72

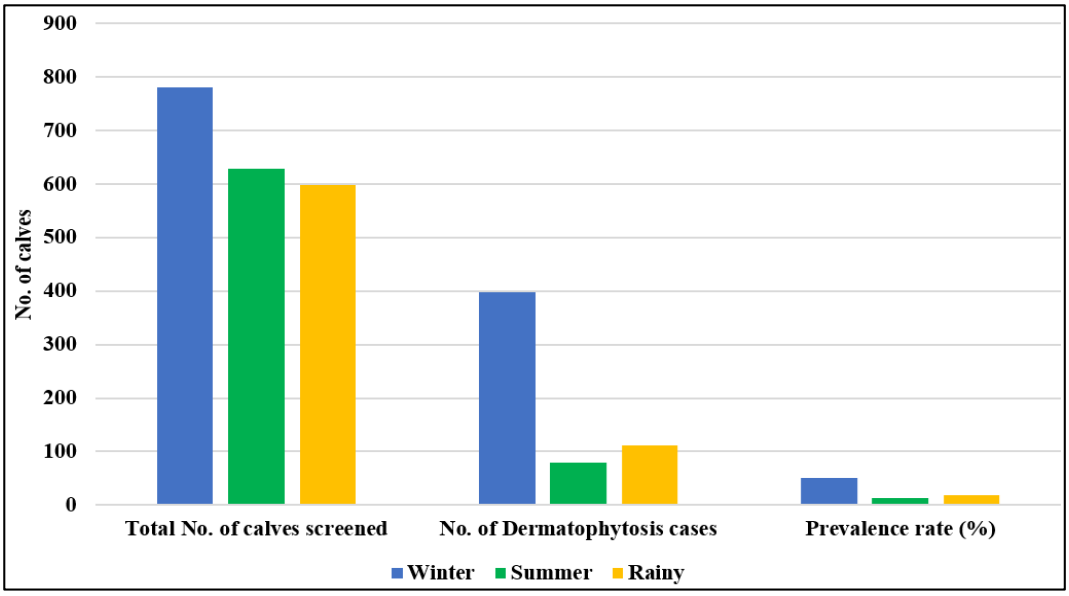

Fig 5: Bar-graph depicting season-wise prevalence in Tarai region of Uttarakhand

Conclusion

Dermatophytosis is a prevalent fungal infection among calves in the Tarai region of Uttarakhand, with an overall prevalence of 29.34%. Sex-wise analysis revealed higher susceptibility in female calves (31.76%) compared to males (25.51%), likely due to management practices and longer retention of females for breeding. Age-wise prevalence indicated that younger calves, particularly those aged 4-6 months, were most affected (39.71%), reflecting the influence of immature immunity and close housing conditions. Breed-wise analysis showed crossbred calves, especially HF cross (42.67%), to be more susceptible than indigenous breeds, highlighting the role of adaptability to local climatic and management conditions. Season-wise assessment demonstrated the highest prevalence during winter (50.96%), followed by the rainy (18.72%) and summer (12.57%) seasons, emphasizing the impact of environmental factors such as temperature, humidity and animal housing on fungal transmission. These findings underscore the significance of age, sex, breed and seasonal factors in the epidemiology of dermatophytosis in calves. Effective control strategies should focus on improving housing, hygiene and management practices, particularly during high-risk seasons and among vulnerable groups. Routine clinical screening, timely intervention, and targeted preventive measures are recommended to reduce the burden of dermatophytosis in calf populations.

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