

## Microbial Prevalence of Dermatitis in Dogs and Their Owners in Odisha

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### ABSTRACT

Due to increasing awareness with respect to “One Health Program”, an attempt has been made to find out the comparative prevalence of microbial isolates both in owners and their pet dogs in the present study. In the present study, 45 dogs presented with skin infections from Feb 2021 to Dec 2022 were subjected to microbial analysis and their antimicrobial susceptibility pattern were depicted. The owners of the pets were asked to state their skin condition for observation in order to correlate and thereby isola-

tion of microbial aetiology in relation to them if any. Out of forty-five (45) dog owners, only seventeen (17) dog owners complained against skin itching, occasionally dermatitis with alopecia and redness of skin of the owners and other signs like pruritis and allergic reactions in some portions of skin are common conditions in them. Out of seventeen owners two owners developed trauma due to severe itching leading to atopic dermatitis and also may be due to prevalence of persistent skin infections. Skin infections like pyoderma in dogs (n=22) itching and allergic inflammation (n=5) and alopecia (n=28) dogs were observed in the study.

**Keywords** Dermatitis, Dog, Odisha, One health, Prevalence.

### INTRODUCTION

One health is the integrative effort of multiple disciplines working locally, nationally, globally to attain optimal health for people, animals and environment (WHO guidelines). The irrelevant use of antimicrobials in both human beings and animals is leading to antimicrobial resistance expansion, one of the main threats of demography and is responsible for pandemic and infections globally threatening public health care system (Brinkac *et al.* 2017). Pets also acts as the reservoir for transmission of antimicrobial resistant zoonotic bacteria. The pet associated bacterial zoonoses represent a relatively neglected area. so, in the present study an emphasize will be given to the potential antibiotic resistance pattern of both human beings and pets living in common environment.

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## MATERIALS AND METHODS

In this study antimicrobial and antifungal susceptibility of dog's skin infection will reveal the potential microbial isolates that are present in dogs. Similarly,

the history (Table 1) will be collected from family members of the owners corresponding to the pets for their ailment and antimicrobial treatment. The breed wise microbial isolates will reveal the prevalence of the particular breed. The data obtained in this study

**Table 1.** History of the dogs presented to TVCC.

Sl. No.	Breed	Age	Sex	History
1	German shepherd	2.6 yrs	m	Pruritis, erythematous lesions on belly, nose bridge, mouth
2	Spitz	6 months	f	Alopecia, intense pruritis
3	German shepherd	5 yrs	f	Patchy alopecia
4	German shepherd	3.6 yrs	m	Alopecia, pruritis
5	Spitz	10 m	m	Red colored patchy lesions all over the body
6	German shepherd	2 yrs	m	Pododermatitis
7	Spitz	6 m	f	Pruritis, lesions in interdigital space, alopecia
8	Spitz	1.4 y	f	Intense pruritis, bad odor, blackish discoloration on thigh
9	German shepherd	4 y	f	Pruritis, alopecia
10	German shepherd	2.8 y	m	Alopecia, pustule
11	Spitz	10 m	f	Alopecia in forelimbs and hind limbs
12	German shepherd	1.3 y	f	Intense pruritis, erythematous patches around elbow, back, shoulders
13	Spitz	5 m	m	Alopecia, pruritis
14	German shepherd	1.4 yrs	f	Alopecia, reddened lesions around groin and thighs
15	Spitz	2 y	m	Alopecia, erythematous lesions in some parts of the body
16	German shepherd	1y	m	Patchy alopecia in abdominal region, hardening of skin in hairless part
17	Spitz	2.5 yrs	f	Pruritis, redness in tail region
18	Spitz	2 y	m	hyperpigmentation
19	Spitz	3 months	m	Lesions over the axillary region
20	Spitz	5 y	m	Pruritis, erythematous lesions all over body
21	German shepherd	2.5 y	f	Pruritis, erythematous lesions at ventral abdomen, pododermatitis
22	German shepherd	1 y	f	Alopecia, red skin lesions in hind and forelimbs
23	Spitz	6 months	m	Alopecia, pruritis, all over the body
24	Spitz	3 m	f	Lesions over groin region, right elbow, pruritis,
25	German shepherd	1.5 y	M	Erythematous lesions all over body and interdigital space, alopecia
26	Spitz	2.7 y	f	Lesions around eye, erythematous lesions all over the body
27	German shepherd	4 m	f	Alopecia, redness in ventral portion of abdomen and in medial side of thigh
28	Spitz	5	m	Pruritis and redness over belly
29	German shepherd	6 m	m	Alopecia around eyes, pruritis
30	Spitz	2 y	m	Reddened lesions on legs, nose, belly
31	German shepherd	2.7 y	f	Alopecia, severe skin infection
32	Spitz	1.5 y	f	Alopecia, erythematous lesions on abdomen
33	German shepherd	4.5 y	m	Patchy dry skin
34	Spitz	5 m	m	Patchy dermatitis
35	Spitz	1y	f	Alopecia, pruritis
36	Spitz	6 m	f	Redness over limbs, pruritis
37	German shepherd	45 d	f	Pruritis, scab around ear, mouth
38	Spitz	4 y	f	Alopecia, allergic conjunctivitis
39	German shepherd	1.2 y	m	Pruritis, alopecia on the dorsal part
40	German shepherd	3 y	m	Patchy alopecia, lesions over the limbs
41	Spitz	1 y	m	Pruritis, erythematous lesions around extremities
42	Spitz	1y	f	Erythematous lesions all over body, pruritis
43	Spitz	4 y	f	Alopecia
44	Spitz	5 y	M	Alopecia, pruritis
45	German shepherd	3.5 y	M	Patchy alopecia

could be utilized to guide empirical antibiotics selection treatment both in pets and their owners. Study period was from February 2021 to December 2022 with concentrated on presented dog cases of Teaching Veterinary Clinical Complex (TVCC) of the college with certain skin infections.

## RESULTS AND DISCUSSION

### Prevalence of dermatophytes breed wise

All 45 dog skin samples were investigated thorough isolation, characterization, direct microscopic examination and cultural examination and revealed that 21 cases yielded dermatophytes with an overall incidence rate of 46.66% (21/45). Out of the two breeds German shepherd and spitz screened for fungal infection, it was observed that the highest fungal infection was found in the spitz accounting for 38.1% (8/21) and in the German shepherd 61.9% (13/21). The breed-wise prevalence of canine dermatomycosis was depicted in Table 2. This highest prevalence in spitz might be due to long hair coat and higher humid conditions also play role in faster multiplication and propagation of fungal elements as per Bhardwaj *et al.* (2012).

### Age-related prevalence of dermatophytes in dogs

In this study, it was observed that the younger population aged between 6 months to 1.5 years was relatively more susceptible to dermatomycotic infection with a higher rate of occurrence 47.6% than the 1year-1.5-year-old age group 28.6% further it was observed that the age group above 3years the rate of incidence of ringworm was 23.8%. The age-wise occurrence of dermatomycosis in dogs was given in the Table 3. Earlier researchers like Singathia *et al.* (2014) also reported that a higher incidence rate was found be-

**Table 2.** Breed-wise occurrence of dermatomycosis in canine species.

Breed	Total no. of cases	No. of positive cases	Percent from total no. of positive cases (N=21)
German shepherd	20	13	61.9%
Spitz	25	8	38.1%
Total	45	21	100

**Table 3.** Age-wise occurrence of dermatomycosis in dogs.

Age group	No. of positive cases	Percent from total no. of positive cases	<i>Microsporum</i> spp. (%)	<i>Trichophyton</i> (%)
6-1.5 yrs	10	47.6	26.62	6.2
1.5-3 yrs	6	28.6	13.48	3.9
Above 3yrs	5	23.8	9.2	2.1
Total	21	100	49.3	12.2

tween the age group of 6 months to 1.5 years. Devi and Vijayakumar (2013) observed that the highest rate of incidence was found in the age group between 1-6 months. This might be due to a poorly developed immune system and deficiency of the fungistatic linoleic acid. The observations of the present study are in correlation with studies reported by Singathia *et al.* (2014), Mancianti *et al.* (2003), Devi and Vijayakumar (2013) and Reddy (2022).

### Sex-related prevalence of dermatophytosis

After the thorough examination of all the samples, it was revealed that out of 21 dogs from which fungi were isolated 7 bitches with an incidence rate of 33.3% and 14 dogs with an incidence rate of 66.67% were infected with the dermatophytes. Table 4 below depicts the rate of occurrence of dermatophytes according to the sex. Present findings are in agreement with the reports of Brilhante *et al.* (2003), Bhardwaj *et al.* (2012), Murmu *et al.* (2015) and Reddy (2022). However, Menelaos (2006) and Ivaskiene *et al.* (2009) suggested that sex had no significant effect on the prevalence of dermatophytes.

### Isolation of various species of dermatophytes from dogs

*Microsporum* (49.3%) and *Trichophyton* (12.2%)

**Table 4.** Sex-wise occurrence of dermatomycosis in dogs.

Sex	No. of the animals positive	Percent
Females	7	33.33
Males	14	66.67
Total	21	100

were isolated from the dogs as the two predominant causative agents in dermatophytes which is in accordance with Beigh *et al.* (2014). Brihante *et al.* (2003) and Murmu *et al.* (2015) reported that the prevalence of *Trichophyton* spp. was in the third order among the dermatophytes. These isolates were identified by the presence of well-developed macroconidia with septa and small microconidia with stalked appearance. These were isolated by culturing onto the dermatophyte test medium.

### Antifungal susceptibility test of dermatophytes

All the fungal isolates isolated from 21 dogs are subjected to an antifungal susceptibility test by agar-based disk diffusion method. This test resulted in the susceptibility of the antifungal drugs (Table 5) in the following way ketoconazole (15µg):16 (76.2%) sensitive, 3 (14.28%) intermediate, 2 (9.52%) resistance. Miconazole (10 µg):17 (80.95%) sensitive, 1 (4.77%) intermediate, 3 (14.28%) resistance. Fluconazole (25µg):18 (85.72%) intermediate, 3 (14.28%) resistance, clotrimazole (10µg):15 (71.42%) sensitive, 6 (28.58%) resistance. In this method of antifungal susceptibility test it was found that miconazole (10 µg) was found to be highly sensitive followed clotrimazole (10 µg) and ketoconazole (15 µg) against dermatophyte. The detailed sensitivity profile revealed that Miconazole (80.95%) was the effective/highest sensitive antifungal against dermatophytes. Yadav *et al.* (2013) earlier in Navi Mumbai reported that clotrimazole is effective against dermatophytes. In our study, we found that fluconazole had less activity against dermatophytes may be because of the use of different methods and media.

### Antifungal susceptibility test of dermatophytes in dog owners

Out of 45 dog owners' samples in this study only 17

**Table 5.** Antifungal susceptibility test of dermatophytes in dogs.

Result	Antifungal drugs			
	Ketoconazole (15 µg)	Miconazole (10 µg)	Fluconazole (25 µg)	Clotrimazole (10 µg)
Sensitive	16 (76.2%)	17 (80.95%)	-	15 (71.42%)
Intermediate	3 (14.28%)	1(4.77%)	18 (85.72%)	-
Resistance	2 (9.52%)	3 (14.28%)	3 (14.28%)	6 (28.58%)

**Table 6.** Antifungal susceptibility test of dermatophytes in dogs.

Result	Antifungal drugs			
	Ketoconazole (15 µg)	Miconazole (10 µg)	Fluconazole (25 µg)	Clotrimazole (10 µg)
Sensitive	14 (82.35%)	16 (94.12%)	-	15 (88.24%)
Intermediate	2 (11.76%)	-	17 (100%)	-
Resistance	1(5.89%)	1 (5.89%)	-	2 (11.76%)

were identified to be infected with fungi mainly *Microsporium* spp. and *Trichophyton* spp. All these identified fungal isolates were subjected to an antifungal susceptibility test. The results as depicted in Table 6 are as follows; ketoconazole (15µg):14 (82.5%) sensitive, 2 (11.76%) intermediate, 1 (5.89%) resistance, miconazole (10µg):16 (94.12%) sensitive, 1(5.89%) resistance, fluconazole (25µg):17 (100%) intermediate, clotrimazole (10µg): 15 (88.24%) sensitive, 2 (11.76%) resistant. On the disk diffusion method of the antifungal susceptibility test, it was found that miconazole (10µg) was found to be highly sensitive followed by clotrimazole (10µg) and ketoconazole (15µg) which is in congruent with the earlier report of Ngo *et al.* (2022). The epidemiological profiles of dermatophytosis and its transmission portals were also given new insights by this study, which will be helpful for future screening, management, control, and treatment of this disease, which is a public health issue in our area.

### Isolation of bacteria

In this study out of 45 samples collected, 51 bacterial isolates were identified through culturing onto the specific media and through gram staining. The most common bacterial spp. was *Staphylococcus* accounting for 82.35% (n=42), followed by *Pseudomonas* spp. 11.7% (n=6), *E. coli* 3.9% (n=2). On antimicrobial susceptibility testing by disc diffusion method (Table-7), it was found that *Staphylococcus* spp. isolates showed sensitivity to Gentamicin (76.19%), Amoxicillin+clavulanic acid (AMX20 µg+10 µg) (59.52%), followed by cephalexin (LEX, 30µg), Co-trimoxazole (SXT, 23.75 µg of sulphamethaxazole+1.25 µg of trimethoprim), and moreover, it was observed that Ciprofloxacin (CIP,5 µg), Clindamycin (CLI, 2 µg), Doxycycline (DOX, 30 µg) were less sensitive against *Staphylococcus* spp. and Gentamicin (GEN,10µg) showed good efficacy

**Table 7.** Antimicrobial susceptibility test for *Staphylococcus* spp. isolated from dog.

Antibiotics	Sensitive	Intermediate	Resistance
Ciprofloxacin (CIP, 5 µg)	19 (45.24%)	15 (35.71%)	8 (19.05%)
Clindamycin (CLI, 2 µg)	16 (38.1%)	19 (45.24%)	7 (16.66%)
Doxycycline (DOX, 30 µg)	18 (42.86%)	17 (40.47%)	7 (16.67%)
Gentamicin (GEN,10 µg)	32 (76.19%)	6 (14.29%)	4 (9.52%)
Co-trimoxazole (SXT, 23.75 µg of sulphamethaxazole + 1.25 µg of trimethoprim)	21 (50%)	11 (26.19%)	10 (23.81%)
Amoxicillin + clavulanic acid (AMX 20 µg+10 µg)	25 (59.52%)	4 (9.52%)	13 (30.95%)
Cephalexin (LEX, 30 µg)	23 (54.76%)	13 (30.95%)	6 (14.29%)

**Table 8.** Antimicrobial susceptibility test in dog owners.

Antibiotics	Sensitive	Intermediate	Resistance
Ciprofloxacin (CIP, 5 µg)	23(53.49%)	12 (27.91%)	8(18.6%)
Clindamycin (CLI, 2 µg)	21(48.84%)	9(20.93%)	13(30.23%)
Doxycycline (DOX, 30 µg)	18(41.86%)	12(27.91%)	13(30.23%)
Gentamicin (GEN,10 µg)	25(58.14%)	12(27.91%)	6(13.95%)
Co-trimoxazole (SXT, 23.75 µg of sulphamethaxazole + 1.25 µg of trimethoprim)	27(62.79%)	11(25.58%)	5(11.63%)
Amoxicillin+clavulanicacid (AMX 20 µg+10 µg)	28 (65.12%)	4(9.3%)	11(25.58%)
Cephalexin (LEX, 30 µg)	26(60.47%)	13(30.23%)	4(9.3%)

against *Staphylococcus* spp. Present findings are in accordance with Vanni *et al.* (2009), Souza Silva *et al.* (2022) and Khinchi *et al.* (2022). This resistance of antibiotics in *Staphylococcus* spp. is due to many mechanisms such as enzymatic inactivation, efflux, impermeability, low permeability of its cell wall and mutants as well as the combination of these different mechanisms. The significant difference in the prevalence of multidrug resistance and multi-drug sensitive isolates highlights the importance of preventing the further spread of multidrug resistance clones among the dog and human population.

#### Antimicrobial susceptibility test in dog owners

Among the 45 dog owner samples collected 43 isolates of *Staphylococcus* spp. were isolated. All these 43 isolates were subjected to the antimicrobial susceptibility test (Table 8). Among all the antibiotics tested, amoxicillin and clavulanic acid (65.12%) showed more sensitivity followed by co-trimoxazole (62.79%), cephalexin (60.47%), gentamicin (58.14%), ciprofloxacin (53.49%), clindamycin (48.84%) and doxycycline (41.86%). The doxycycline (30 µg) showed less sensitivity among all

antibiotics used in this study. Present findings are in parallel with Maksimovic *et al.* (2022), Alzaben *et al.* (2022) and Rasmi *et al.* (2022). These antimicrobial-susceptible profiles can be taken as guidance for future research. This irregular trend in the susceptible profiles should be kept in mind by the physician and veterinarian while prescribing antibiotics and it is better to prescribe antibiotics after conducting susceptibility testing in order to avoid transmission of resistance from animal to animal, animal to human, human to human. In our study more sensitivity to the penicillin may be due to this absence of *bla<sub>Z</sub>* genes in the isolated *Staphylococcus* spp or may be due to the population/sample variation. Detailed information can be known by doing molecular work further.

#### CONCLUSION

The present study was carried out on an innovative idea of “canine skin diseases in one health approach” in order to investigate bacterial as well as fungal skin infections both among the pet dogs as well as among their owners. It was concluded that German shepherd breeds were highly infected (61.9%) with certain skin infections. *Microsporum* spp. and *Staphylococcus*

spp. are more dominant spp. (49.3%), showing miconazole and gentamycin as the highest sensitivity antifungal and antibacterial in present study. Present study was of opinion about a possible way of spreading the skin infections either way between pet owners and their pets which might be considered as an eye opener for the field veterinarians which have to play a major role in preventing these zoonotic infections and contribute to one health by educating the owner, making them know what is zoonosis and by judiciously prescribing antibiotics. This judicious use of antibiotics at grassroot level of the country can be possible by conducting antibiotic sensitivity test which is easy, affordable. The further transmission and the specific species isolation can be done by molecular study.

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