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RESEARCH ARTICLE

Dermatophytosis Associated with Animal Contact: A Clinico-Mycolgical study.

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Abstract

Dermatophytes are classified into geophilic, zoophilic and anthropophilic fungi, based on their ecological traits. Zoophilic dermatophytosis primarily is responsible for infection in animals, and the inflammatory reaction often tends to be more severe than skin lesions inflicted by anthropophilic species. **Objective:** The purpose of this study is to evaluate clinical and epidemiological zoophilic dermatophytosis associated with animal contact, in an effort to elucidate the link between the causative organism and the route of infection. **Method:** We performed clinical and mycological study on 109 cases of dermatophytosis out of which 71 were associated with prior animal contact, at the department of dermatology, Himalayan Institute of Medical Sciences, Swami Ram Nagar, Dehradun for a period of 18 months. **Result:** The most common age group to be affected was 21-30 years (24.8%). Tinea corporis was commonest in the age group of 21-30 years (28.8%) and was the commonest presentation in cases with history of having domesticated animals. Out of 71 clinically diagnosed cases of Dermatophytoses with pets , males were more commonly affected (56%) than females (44%). Out of 71 cases with history of domesticated animals fungal isolates were recovered from 38 cases (45%). Out of 38 fungal isolates obtained, *Trichophyton* species were 57.9% while *Microsporum* species were 42.1%. *Trichophyton mentagrophytes* was the commonest (39.4%) followed by *Microsporum canis* (28.9%). In cases of chronic infection and recurrent infections *Trichophyton mentagrophytes* was the commonest causal isolate causing 23.8% and 23.5% infections respectively. **Conclusion:** As the leisure and recreational activities of people become more diverse and more extensive, and as the interaction with domestic animals increases, it would be wise for us to strive to come up with an effective strategy for prevention and epidemiological studies.

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Introduction:-

Superficial mycoses are among the world's most common skin diseases affecting millions of people worldwide (1). Dermatophytes because of their widespread involvement of population at large and their prevalence all over the world are the commonest reported cause of cutaneous fungal infections (2). The trend of living in communities, contact with animals, the use of antibiotics, corticosteroids and antineoplastic drugs are some of the factors that contribute to the increase in the risk of infection by fungi especially dermatophytes (3). In recent years the number of pets inside their owners' homes and the interest in having animals as pets at one's home have increased markedly. Considering the close contact between pets and their owners, especially between children and cats and dogs, these animals that are often asymptomatic carriers of dermatophytes can be important sources of infection and/or carriers

of infection (4). Exotic companion animals as rabbits, rodents, ferrets, hedge hogs are also common and they can be a potential source of zoonotic infections transmissible to their owners (5). Human beings are usually infected from animals mostly through direct contact or via fungus-bearing hair and scales from infected animals.

Dermatophytosis is defined as the infection of the skin, hair and nails caused by a group of closely related keratinophilic fungi called dermatophytes all of which produce enzyme keratinase (6). Originally soil inhabitants, dermatophytes have evolved to infect animals and humans and are accordingly classified into geophilic, zoophilic, and anthropophilic species based on their main habitat or host. Three dermatophytes genera *Trichophyton*, *Microsporum*, and *Epidermophyton* comprise more than 40 different species (7,8). Animals can be infected by a great variety of dermatophytes, mostly zoophilic but also geophilic species, and exceptionally anthropophilic dermatophytes (9). The understanding of ringworm epidemiology, diagnosis, treatment and control in pets is very important for reducing the spread of fungal infections in animals and the subsequent transmission to humans who are domesticating these animals and are in close contact with them.

Table1: Zoophilic and Geophilic dermatophytes species in animals

Dermatophyte species	Main Source	Others
<i>Microsporum canis</i>	Cat,dog ,Horse	All mammals
<i>Microsporum gallinae</i>	Poultry	Dog,cat
<i>Microsporum gypseum</i>	Soil	All mammals
<i>Microsporum nanum</i>	Soil	Pig
<i>Microsporum persicolor</i>	Microtid rodents	Dog,Cat
<i>Trichophyton equinum</i>	Horse	Cat, Dog (rare)
<i>Trichophyton erinacei</i>	Hedgehog	Dog
<i>Trichophyton mentagrophytes</i>	Rodents	All mammals
<i>Trichophyton simii</i>	Primate	Fowl, Dog, Cat
<i>Trichophyton verrucosum</i>	Cattle, other ruminants	All mammals

Results:-

The current Study was carried out at Himalayan Institute of Medical Sciences, Swami Ram Nagar, Dehradun. The study was conducted over a period of 18 months. Out of a total of 124 cases of superficial mycoses, 109 cases were suspected of having dermatophytic infections. Out of 109 suspected cases 71 cases were having domesticated animals with history of recurrent contact with these animals. The 109 clinically diagnosed cases of Dermatophytoses were distributed between the range of 8-63 years with a mean of 33.50 ± 13.29 years (mean \pm Standard deviation). The most common age group to be affected was 21-30 years (24.8%) followed by 31-40 years (23.9%). These were the age groups mostly involved with animal contact also. Least common age group affected was >60 years (0.9%) .

Tinea corporis was commonest in the age group of 21-30 years (28.8%) and was also found to be the commonest type in all age groups with maximum numbers being between 11 years to 50 years. In fact Tinea corporis was the commonest presentation in cases with history of having domesticated animals. Out of 71 clinically diagnosed cases of Dermatophytoses with pets, males were more commonly affected (56%) than females (44%). Male to female ratio was 1.38:1. T.corporis which was the most common clinical type of Dermatophytoses was more commonly seen in males (52.5%) than females (47.5%). In all types of Dermatophytoses males outnumbered the females. However T.unguium (58.3%). and T. unguium with corporis (66.7%) were more common in females. In the present study, farmers (26.6%) constituted majority of cases. Second largest group was students and housewives which constituted 23.9% and 22.9% respectively. 61% of cases were from a rural background.

Out of 109 clinically suspected cases of Dermatophytoses, fungi was demonstrated in 60 cases (55%) either by KOH mount and/or culture. Thirty eight cases (34.9%) were positive by both KOH mount and culture. Twelve cases (11%) were positive by KOH mount only. Ten cases (9.2%) were positive by culture only. Forty nine cases (45%) were negative both by KOH mount and culture. Out of these 109 cases of suspected Dermatophytoses, 48 were positive by culture.

**Table2a : Comparison of KOH mount with culture findings
(n=109)**

KOH mount	Culture		Total (%)
	Positive	Negative	
Positive	38	12	50 (45.9%)
Negative	10	49	59 (54.1%)
Total	48 (44.0%)	61 (56.0%)	109

**Table2b: Comparison of KOH mount with culture findings
(n=109)**

	KOH and/or culture Positive	KOH and Culture Positive	KOH Positive Culture Negative	KOH Negative Culture Positive	KOH Negative Culture Negative
Number of Cases	60	38	12	10	49
Percentage	55.0%	34.9%	11.0%	9.2%	45.0%

Dermatophytes were isolated in 34.9% cases. However out of 71 cases with history of domesticated animals fungal isolates were recovered from 38 cases (45%) whereas 10 fungal isolates were obtained in cases with no history of domesticated animals i.e thirty eight cases. Out of 38 fungal isolates obtained, *Trichophyton* species were 57.9% while *Microsporum* species were 42.1%. *Trichophyton mentagrophytes* was the commonest (39.4%) followed by *Microsporum canis* (28.9%). Rest of the isolates comprised of *Trichophyton verrucosum*, *Trichophyton rubrum* and *Microsporum gypseum*. The difference in the rates of isolation of fungi from cases with and without history of contact with domesticated animals was found to be statistically significant (P value <0.006).

Table 3: Distribution of cases according to history of contact with animals (n=109)

	T.corporis	T.cruis	T.unguim	T.capitis	T.pedis	T.faciei	T.manuum	T.corporis with T. cruis	T.unguim with T. corporis	T. imbricata	Total	Percentage
H/O Domesticated animals	41	6	6	2	10	2	0	2	2	0	71	65.1%
No H/O Domesticated animals	18	1	6	1	5	3	1	0	1	2	38	34.9%

Table 4: Profile of fungi isolated from patients giving history of contact with animals(n=109)

	<i>T.mentagrophytes</i>	<i>M.canis</i>	<i>T.verrucosum</i>	<i>M.gypseum</i>	<i>M.audouinii</i>	<i>T.tonsurans</i>	<i>T.rubrum</i>	FI	NFI	Percentage
*H/O domesticated animals	15	11	2	5	0	0	5	38	33	79.1%
NO H/O domesticated animals	3	1	1	1	1	1	2	10	28	20.9%

FI-Fungi isolated

* $\chi^2 = 4.55$ P value= 0.006 (significant)

N FI-No Fungi isolated

Chronic dermatophytoses (> 1 year) was seen in 21 cases (19.3%) and 91.2% of them had contact with animals. Out of 21 cases with chronic disease 7 cases were culture positive and all these 7 cases were involved with animal contact in one form or the other. Majority of the cases (35.8%) were suffering from disease since 1-6 months. Out of 21 cases of chronic dermatophytoses, chronic lesions were seen mainly with *T.corporis* and *T.unguim*. The commonest fungal isolate obtained from chronic cases of dermatophytoses was *Trichophyton mentagrophytes* (23.8%) and it was isolated from *T.corporis* and *T. unguim*.

Table 5: Distribution of fungi isolated in cases of chronic dermatophytoses (n=21)

Clinical Type	Fungi isolated			NFI	Total
	<i>T.mentagrophytes</i>	<i>M.canis</i>	<i>T.verrucosum</i>		
T.corporis with/without T.cruris	4	1	1	6	12 (57.1%)
T.unguim	1	0	0	5	6 (28.6%)
T. pedis	0	0	0	3	3 (14.3%)
TOTAL	5(23.8%)	1(4.8%)	1(4.8%)	14	21

NFI-No Fungi isolated

In 15.6% cases a prior history of similar infection was reported. Out of the 12 culture positive cases 10 cases were seen in cases with history of pets while only 2 were reported in patients with no history of pets. A previous history of *T. corporis* (35.3%) was the commonest followed by *T. pedis* (29.4%) and *T. unguium* (23.5%). *Trichophyton mentagrophytes* was the commonest isolate (23.5%) followed by *Microsporum canis* (17.6%) in cases giving previous history of similar lesions.

Table 6: Distribution of cases on the basis of recurrence of disease and fungi isolated (n=109)

Clinical Type	No. of cases (percentage)	Fungi isolated	No. of cases with Pets n=71	No. of cases with out Pets n=38
T. corporis	6(35.3%)	<i>Trichophyton mentagrophytes</i>	4	1
T. pedis	5(29.4%)	<i>Microsporum canis</i>	3	0
T. unguium	4(23.5%)	<i>Trichophyton rubrum</i>	1	1
T. corporis with T. cruris	2(11.7%)	<i>Trichophyton verrucosum</i>	2	0
TOTAL	17(15.6%)		10	2

Discussion:-

Dermatophytosis are the most frequent fungal infections of pets and livestock and play an important role in animal and human health due to their zoonotic potential. Ringworm in animals is very contagious for humans (10). Farmers, veterinary surgeons, artificial insemination experts and each individual that is in contact with a diseased animal are at high risk of contagion. In our study the most common age group to be affected was 21-30 years (24.8%) followed by 31-40 years (23.9%) and the majority population comprised of agricultural workers (26.6%) and students who had domesticated animals and were in close contact with them. Animal over-crowding is nowadays a major problem in rural and urban areas. On farms livestock overcrowding is aimed at meeting the growing demand for food supplies, while the satisfaction of cultural, emotional and psychological needs is responsible of pet over-crowding in towns. Both instances create opportunities for animal-human transmission of pathogen micro-organisms, with health and epidemiological consequences that are sometimes hard to manage. Major difficulties arise with “animalization” of the environment, which means a widespread dispersion of hair, feathers, dropping and other organic matters that creates an optimal medium for exuberant proliferation of pathological microorganisms potentially targeting humans and animals in the territory. Zoonotic consequences are facilitated by poor compliance with hygiene and health regulations as well as by abandoned stray animals(11).

Many studies have focused on the prevalence rates of dermatophytosis in varied animals like cats, dogs, pigs, horses, cattle and poultry (10,12). In this study also majority of the cases were having domestic animals and detailed history revealed that the patients were having close proximity to these animals including bathing and feeding them at frequent intervals and the difference in the rates of isolation of fungi from cases with and without history of contact with domesticated animals was found to be statistically significant (P value <0.005). Majority of our study group also belonged to the lower socioeconomic group and low levels of hygiene coupled with the close proximity to these animals could have accentuated the transmission of infection manifold.

In the current study *T. corporis* was found to be the commonest clinical type of superficial mycoses followed by *P. versicolor*, *T. unguim* and *T. pedis*. *T. corporis* has been reported to be the commonest type of clinical presentation in almost all Indian studies conducted on superficial mycoses (13,14,15). Most of the cases of *T. pedis* were seen in farmers since they work bare feet in the fields and are thus more exposed to these keratinophilic fungi due to the

nature of their work and our study group mainly comprised of farmers (26.6%). In the present study most of the cases were farmers (26.6%) followed by students (23.9%) and housewives (22.9%). This group was also more associated with animals hence this may be due to increased physical activity and increased opportunity for exposure to plants, animals and soil in agricultural workers. The same observation has also been reported by Balakumar et al in their study from Tiruchirapalli (15). Other studies have also reported that Occupational and environmental risk Factors of *Tinea corporis* include contact with animals and outdoor occupations. *Tinea corporis* contracted from infected animals, particularly kittens and puppies, is often intensely inflammatory (16).

Among the dermatophytes, *Trichophyton* species (57.9%) were the commonest out of which *Trichophyton mentagrophytes* (39.4%) was the most frequent followed by *Microsporum canis* (28.9%). Dermatophytes are known to grow best in warm and humid environments and are therefore more common in tropical and subtropical regions. However, the geographic distribution varies with the organism (17,18). Of the three genera that make up the dermatophytes, the *Trichophyton* and *Microsporum* species are the dominant species colonizing the animals and have often been classified as both human and animal pathogens. Animals serve as reservoirs for the zoophilic dermatophytes and the infections caused by them have a significant zoonotic importance. Epidermophyton, the third genera, is reportedly a human pathogen but there are scanty reports of its isolation from animals (19,20). A study carried out by Nooruddin and Singh in Ludhiana found *Trichophyton mentagrophytes*, *Trichophyton verrucosum*, *Microsporum gypseum*, *Trichophyton rubrum*, *Epidermophyton floccosum*, *Trichophyton violaceum* to be the most common fungi isolated from cattle and the farm workers (21).

Recurrence was seen mainly in cases of *T. corporis* with and without associated *T. cruris* (47%). Chronic dermatophytoses was seen mainly in cases of *T. corporis* (57.1%) and *T. unguium* (28.6%). Patients with Dermatophytoses tend to ignore initial skin lesions and seek health care advice more frequently in the later stage of acute infection due to associated persistent itching and discomfort. Das et al and Bindu et al have reported that 32% and 35% of cases in their studies respectively gave previous history of similar type of infections (22, 23). Recurrence and chronicity have been seen frequently in cases of *T. corporis* and the same was noted in our study too (23,24). *Trichophyton rubrum* is a well established anthropophilic fungi which is associated with chronic infections(25,15,26). However in our study *Trichophyton mentagrophytes* was the commonest species isolated from chronic and recurrent lesions. This could be explained by the fact that a maximum percentage of our cases were in contact with animals and *Trichophyton mentagrophytes* is a well known zoophilic dermatophyte and also the commonest dermatophyte isolated in our subjects who were in perpetual contact with animals. The potential of zoophilic dermatophytes to cause recurrent and chronic infections too cannot thus be ignored.

Hence In-depth analysis of the animal's habitat is crucial for making a predictive risk assessment of trans-mission to the receptive host. Epidemiological charts with the distribution, prevalence and incidence of various species of fungi in diverse animal species are essential. They provide an organic picture of any given situation in a determined area and enable a co-ordinated targeted strategy to be developed. They also provide information about risk factors and triggers of the fungal infection and monitor the epidemiological impact over time. Furthermore, predictive risk charts can foster collaboration and exchange of information among the diverse structures engaged in safeguarding human and animal health. Understanding the clinical pictures in animals as well as the complex epidemiological and management issues will provide the dermatologist with in-depth information for treating and managing the infection in humans (11).

However, the attitude and perspective of people who cope with these problems have improved greatly over the years, thanks to profound socio-cultural modifications. Farmers have become more professional and more attentive to animal well-being. Animal lovers in the general population have become more aware as the social and emotional value of pets was recognized. Individual knowledge of health and hygiene has increased, creating demands not only for better levels in the individual but also for prevention of any potential health hazard in the environment. These new attitudes have focussed attention on all the major assessment criteria for epizoonotic fungal control, which implicate a remarkable commitment of human and financial resources involving several branches of human and animal health. It has already yielded interesting data on the epidemiology, pathogenesis, clinical features, diagnosis, therapy and prevention of fungal infections. An in-depth analysis of the animal's habitat is crucial for making a predictive risk assessment of transmission to the receptive host.

Conclusion :-

Dermatophytoses are the most common infectious skin diseases detected in animals, in veterinary clinics. The knowledge about epidemiology, clinical presentation and diagnosis of ringworm are important for treatment, prevention, and control, besides public health problem, as the pet population has increased in the last years and these animals are more inserted in our daily life, maintaining close contact with us, especially with our children. Moreover fomites and environment are important and efficient sources of transmission due to high resistance of dermatophyte arthroconidia. Hence routine screening of all animals and fungal treatment where an infection is proven to exist could be very useful in managing this situation and reducing infection and subsequent transfer from animals to humans.

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