

# Dermatophytic Infections among the Patients Attending Di Skin Hospital and Research Center at Maharajgunj Kathmandu

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## ABSTRACT

**Background:** Dermatophytosis is the common and most significant superficial fungal infections because of their widespread involvement among the people all over the world. The clinical presentation, though very typical of ringworm infection, is often confused with other skin disorders, making laboratory diagnosis and confirmation necessary. The aim of this research is to study different clinical variants of dermatophytosis and its associated risk factor among the patients attending Di Skin Hospital and Research Center.

**Methods:** A descriptive cross-sectional study design was used. Total of 110 samples collected from suspected cases of dermatophytosis were studied among the patients attending DI Skin Hospital and Research Center at Maharajgunj, Kathmandu, Nepal. Skin, hair and nail specimens taken from the patients were processed by direct microscopy and culture using a standard protocol. Macroscopic appearance and microscopic morphology of micro and macroconidia were studied for proper identification of dermatophytes. Data were analyzed using the statistical package for the social sciences (SPSS) version 20 for windows.

**Results:** Dermatophytosis was more common in the age group of 21-30 (29.1%) years and was more predominant among male population with male to female ratio being 1.39:1. Among the total number of dermatophytosis cases only 52.72% showed fungal elements in KOH preparation and only 43.63% were culture positive. Most common clinical type was tinea corporis (29.1%) followed by tinea cruris (18.2%). Among the total isolates *T. rubrum* was most common (58.33%) followed by *T. mentagrophytes* (20.83%), other *Trichophyton spp* (12.5%) and *Microsporum gypseum* (8.33%). Most of the positive cases used to take bath, change their dresses and innerwear only once a week. Similarly, Sweating nature could be the possible cause for dermatophytic infection (P=0.006 at CI=95%) and also there was a significant relation between the sharing habit of dress materials and positive cases (P=0.033 at CI=95%). Among the total cases, most of the positive cases did not have any knowledge about fungal infection. Study concluded that more the knowledge of fungal infection less the chance of fungal infection (P=0.003 at CI=95%).

**Conclusions:** Tinea corporis was the commonest clinical pattern and overall predominance in the study was male with 21-30 being most affected age group. *T. rubrum* forms the commonest aetiological agent of dermatophytosis. Possible cause of dermatophytic infection was due to poor hygienic status and lack of knowledge on fungal infection and its preventive measures.

**Keywords:** Dermatophytosis; dermatophytes; isolation; identification.

## INTRODUCTION

Dermatophytosis is the common and most significant superficial fungal infections because of their widespread involvement among the people all over the world.<sup>1</sup> Dermatophytosis constitutes a group of superficial fungal

infections of the skin, hair and nails. There are about 40 species of dermatophytes reported to be pathogenic to human being and are classified according to their habitats e.g. anthropophiles (human sources), zoophiles (animal sources) or geophiles (soil sources).<sup>2, 3</sup>

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Clinically, the different types of dermatophytosis are classified according to body site involvement. The most important dermatophytes that cause infection in humans are classified into three genera: Trichophyton, Microsporum and Epidermophyton. Trichophyton cause infection of hair, skin and nail. Microsporum cause infection of hair and skin. Epidermophyton causes infection of skin and nails. The organisms colonize the keratin tissues and inflammation is caused by host response to metabolic by-products. The classical presentation of tinea infections is a lesion with center clearing surrounded by an advancing, red, scaly elevated border.<sup>4,6</sup>

Despite the availability of effective antifungal agents, dermatophytic infections continue to be one of the principal dermatological diseases throughout the world especially in tropical countries like Nepal. In Nepal the prevalence and distribution of the infections as well as the common dermatological agents are less studied as well as less published. In developing country like Nepal, the epidemiology of dermatophytoses is changing over time and it is important to review periodically the incidence of dermatophytes and their distribution which help in prioritizing the resources available to enhance both clinical and laboratory diagnosis and treatment of dermatophytic diseases.<sup>7,8</sup>

This research mainly focuses to study different clinical variants of dermatophytosis, causative agents and its associated risk factor among the patients attending Di Skin Hospital and Research Center.

## METHODS

A descriptive cross-sectional study was carried among the patients attending Di Skin Hospital and Research Center at maharajgunj, Kathmandu, Nepal. Clinically suspected 110 cases of dermatophytic infection were included in our study between September 2013 to June 2014.

A detailed history of selected cases was taken in relation to name, age, sex, address, occupation, duration of illness and involvement of more than one site and other risk factor of the diseases like personal hygiene, sweating nature, sharing habit of dress materials, Knowledge on fungal infection and its prevention. Patients on topical and systemic antifungal treatments were excluded. Ethical approval for the study was taken from NHRC.

The materials for the study were skin scrapings, hair pluckings and nail clippings. The first step of the sample collection process is thorough cleaning of the infected area with 70% ethanol cotton swabs to remove dirt and

contaminants, then after drying, skin scrapings were collected from the active edge of the lesions with the help of sterilized scalpel blade. All the samples collected were subjected to direct microscopy and culture.<sup>9,10</sup>

The skin scrapped materials was placed on a microscope slide and few drop of 10% KOH solution was added on it. A cover slip was placed with a little pressure. The slide was gently heated, taking care not to boil, to hasten digestion. In case of nail specimen, 40% KOH was used and it was kept for longer time in order to digest the material properly. In case of hair specimen, it was examined as soon as possible after mounting in 10% KOH solution since the infected hairs are very delicate. After proper digestion of the materials it was examined microscopically using the 10X and 40 X objectives.<sup>10,11</sup>

The skin scrapped materials was inoculated into Dermatophyte test medium (DTM) slope and Sabouraud's dextrose agar containing Chloramphenicol (0.05%) and cycloheximide (0.5%). It was incubated at room temperature (25-30°C) for 3-4 weeks observing periodically in every 2-3 days before discarding the plate as a negative. Fungal isolate was identified based on colony morphology, pigmentation, growth rate, microscopy, urease test, hair perforation test and rice grain test.<sup>12,13</sup>

The factors that contribute to positive cases of dermatophytosis i.e. Age, sex, bathing habit, dress changing habit, innerwear changing habit, sharing habits, sweating nature and knowledge on fungal infection were taken as independent variables of the study. Dependent variable was positive dermatophytic case which is also known as ringworm or tinea infection.

Data analysis was done by using SPSS version 20 for windows. Data were analysed and interpreted in percentage, mean and chi square. Chi square test was applied to explain the association of sweating nature, sharing habit of dress materials and knowledge on fungal infection with positive dermatophytic infection. P value was obtained and p value less than 0.05 were considered as significant. Moreover Sensitivity and specificity value were also compared to show the reliability of direct microscopy taking culture as gold standard in diagnosis of dermatophytosis.

## RESULTS

Total numbers of 110 cases were distributed between the ranges of 2-80 years. There was preponderance of both males and females in the age group 20-30. Males were more commonly infected with 64 cases (58.2%)

than females with 46 cases (41.8%). Male to female ratio was 1.39:1 (Table1)

**Table 1. Age and Sex Wise distribution of cases in the study group.**

Age of patients	Number of cases		Total (Percentage)
	Male	Female	
≤10	1	1	2 (1.8%)
11-20	10	4	14 (12.7%)
21-30	18	14	32 (29.1%)
31-40	12	12	24 (21.8%)
41-50	10	7	17 (15.5%)
51-60	7	4	11 (10.0%)
61-70	4	3	7 (6.4%)
71-80	2	1	3 (2.7%)

Total	64	46	110 (100%)
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Most common clinical type was tineacorporis (29.1%) followed by tineacruris (18.2%) and tineapedis (13.6%). Few mixed type of infection was also seen, among which tineacorporis with tineacruris (3.6%) and tineacorporis with tineapedis (3.6%) was more common. (Table 2)

*T.rubrum* being a major isolation, it was isolated mostly from tineacorporis, tineacruris and tineamanuum with 9, 8 and 4 cases respectively. *T. mentagrophyte* was isolated mostly from tineapedis and tineacorporis with 4 and 3 cases respectively. Trichophyton species was mostly isolated from tineacorporis and tineapedis with 2 cases each. *M. gypseum* was mostly isolated from tineacorporis with 3 cases (Table 2).

Out of 110 cases of dermatophytosis, 58 were positive

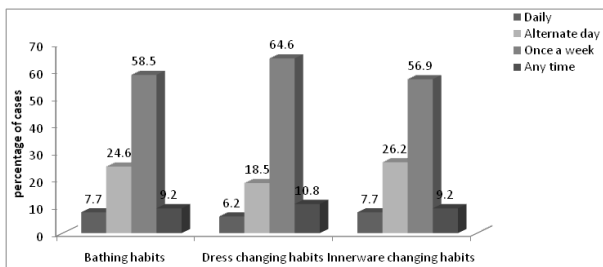
**Table 2. Dermatophytes isolated from various clinical types.**

Clinical types	No.	<i>T. rubrum</i>	<i>T. mentagrophyte</i>	Other		Total
				Trichophyton species	<i>M. gypseum</i>	
Tineacorporis	32	9	3	2	3	17(35.41%)
Tineacruris	20	8	-	-	-	8(16.66%)
Tineapedis	15	2	4	2	-	8(16.66%)
Tineaunguium	11	2	1	1	-	4(8.33%)
Tineamanuum	10	4	-	-	-	4(8.33%)
Tinea capitis	6	-	-	1	-	1(2.08%)
Tineafaciei	5	2	-	-	-	2(4.16%)
Tineacorporis with tineacruris	4	1	1	-	-	2(4.16%)
Tineacorporis with tineapedis	4	-	-	-	1	1(2.08%)
Tineapedis with tineamanuum	3	-	1	-	-	1(2.08%)
<b>Total</b>	<b>110</b>	<b>28 (58.33%)</b>	<b>10 (20.83%)</b>	<b>6 (12.5%)</b>	<b>4 (8.33%)</b>	<b>48(100%)</b>

in direct microscopy (KOH) and a total of 48 were positive by culture. 41 cases were positive by both direct microscopy and culture whereas 17 cases were positive by direct microscopy and negative by culture. Similarly, 7 cases were negative by direct microscopy but positive by culture and 45 cases were negative both by direct microscopy and culture. Assuming culture as a gold standard, KOH preparation was found to be 85.41% sensitive and 72.58% specific in the diagnosis of dermatophytosis (Table 3).

**Table 3. Comparison of KOH preparation and culture of dermatophytic infections.**

Culture	Number of cases		Total
	Culture positive	culture negative	
KOH positive	41	17	58
KOH negative	7	45	52
<b>Total</b>	<b>48</b>	<b>62</b>	<b>110</b>
Sensitivity=85.41%			
Specificity=72.58%			



**Figure 1. Hygienic status of positive cases.**

Regarding the hygienic status of positive cases samples like bathing habits, dress changing habits and innerwear changing habits, most of them took bath only once a

week (58.5%), they change their dresses once a week (64.6%). Similarly was the case in innerwear changing habits which also showed once a week (56.9%) (Fig 1)

Most of the positive cases had sweating nature (80%). Statistical analysis showed that there was a significant association between the sweating nature and positive cases (P=0.006 at CI =95%) (OR=3.20). A simple linear regression was carried out to ascertain the extent to which sweating nature can predict positive dermatophytic infection. A low positive correlation was found between sweating nature and positive dermatophytic infection (r = 0.262) and the regression model predicted 7% of the variance. (Table 4 and 5)

**Table 4. Sweating nature, Sharing habit of dress materials and knowledge on fungal infection of suspected case.**

		Sweating nature		Total	P value	Odd ratio
		Yes	No			
Dermatophytic infection	Positive Cases	52 (80%)	15 (20%)	65 (100%)	0.006	3.20
	Negative Cases	25 (57.77%)	19 (42.22%)	45 (100%)		

		Sharing habit of dress materials		Total	P value	Odd ratio
		Yes	No			
Dermatophytic infection	Positive cases	50 (76.92%)	15 (23.07%)	65 (100%)	0.033	2.43
	Negative cases	26 (57.77%)	19 (42.22%)	45 (100%)		

		Knowledge on fungal infection		Total	P value	Odd ratio
		Yes	No			
Dermatophytic infection	Positive cases	11 (16.92%)	54 (83.07%)	65 (100%)	0.003	0.27
	Negative cases	19 (42.22)	26 (57.77%)	45 (100%)		

Regarding the sharing habit of dress materials by suspected cases, most of the positive cases had sharing habit (76.92) and few of them did not have the sharing habit (23.07). Statistically, there was significant difference between the sharing habit of dress materials and positive cases (P=0.033 at CI=95%) (OR=2.43). A low positive correlation was found between sweating nature and positive dermatophytic infection (r = 0.204) and the regression model predicted 4% of the variance. (Table 4 and 5)

Regarding the knowledge of fungal infection, it was found that 83.07% of cases did not have any knowledge of fungal infection and only 16.92% had knowledge of fungal infection. Statistical analysis showed that there was a significant relation between preventive measures and fungal infection (P=0.003 at CI=95%) (OR= 0.27). A simple linear regression model shows a low negative correlation between sweating nature and positive dermatophytic infection (r = -0.279) and the regression model predicted 8% of the variance.(Table 4 and 5)

**Table 5. Simple linear regression model for the assessment of risk factors.**

Independent variable	r	R <sup>2</sup>	Unstandardized coefficients		standardized coefficients	P value
			B	Std. error	B	
Sweating nature	0.262	0.069	0.281	0.100	0.262	0.006
Sharing habit of dress materials	0.204	0.041	0.217	0.100	0.204	0.033
Knowledge on fungal infection	- 0.279	0.078	-0.308	0.102	-0.279	0.003

Dependent variable: Positive dermatophytosis

## DISCUSSION

The present study shows that dermatophytosis was more common in the age group of 21-30 (29.1%) years followed by 31-40 (21.8%) years. There was a preponderance of both male and female cases in the age group of 21-30. This is comparable to study done by Ameen (2010) which shows that most commonly infected age group was 21-30 (31.33%). So, the highest incidence of this infection in the age group 21-30 years may be due to increased physical activity and increased opportunity for exposure.

In the present study, males (58.2%) were more commonly affected than females (41.8%). Male to female ratio was 1.39:1. Male predominance in the present study may be due to increased outdoor activities and increased opportunity for exposure to infection than females.

Tineacorporis (29.1%) was the common clinical type followed by tineacuris (18.2%) and tineapedis (13.6%). This is comparable with other studies.<sup>5,6</sup> Few mixed infections were also seen in this study like tineacorporis with tineacuris (3.6%) and tineacorporis with tineapedis (3.6%). Mixed infection can be from same type of dermatophyte or sometimes different types of dermatophyte are responsible to cause an infection.

The predominant species of dermatophyte isolated in the present study was *Trichophyton rubrum* (58.33%) followed by *Trichophyton mentagrophytes* (20.83%), which is consistent with various studies.<sup>5, 8</sup> In many of the clinical types, *T. rubrum* was the major isolation. It was isolated mostly from tineacorporis with 9 cases followed by tineacuris with 8 cases. *T. mentagrophytes* was isolated in higher number from tineapedis with 4 cases followed by tineacorporis with 3 cases. *Trichophyton mentagrophytes* is a zoonotic; it can be spread from animals to human through direct contact. Apart from these two *Trichophyton* species isolated there are some other *Trichophyton* species which were isolated but difficult to identify up to species level. Least isolation was *Microsporum gypseum* (8.33%) and it could be due to the patient's interaction with the soil and

domestic animals. In this study, *Microsporum gypseum* was isolated mostly from the cases of tineacorporis (17.64%).

Out of 110 cases of dermatophytosis, 65 cases (59.09%) were positive for fungi either by KOH and/or culture. Forty one cases (37.27%) were positive by both KOH and culture. Seven cases (6.36%) were negative by KOH but culture positive and seventeen cases (15.45%) were positive by KOH and negative by culture. Similarly, forty five cases (40.90%) were negative both by KOH and culture, which is comparable with the study done by Singh et al (2003). The reason behind KOH positive but culture negative cases may be because of non-viability of fungal elements in a culture medium. In some cases, there is a KOH negative but culture positive and it is mainly because during direct microscopy some of the microscopic field may be missed during observation, especially when the ample amount of sample is available for the study. The same sample when cultured in an appropriate medium then fungus grows well and flourishes whole into the plate. Assuming culture as a gold standard, KOH preparation was found to be 85.41% sensitive and 72.58% specific in the diagnosis of dermatophytosis.

Dermatophytic infections occur by not maintaining good personal hygiene. Most of the fungal spores naturally inhabit the skin surface. Under normal conditions they don't harm the host but when there is enough heat and sweatiness in the body then fungi grow and multiply by feeding on dead keratinized skin layers resulting in infection.<sup>14,15</sup>

When the cases were analyzed in terms of their bathing habit, dress changing habit and innerwear changing habit, most of the positive cases were found to take the bath only once a week (58.5%) followed by an alternate day (24.6%). Similarly, most of the positive cases had the habit of changing dress material only once a week (64.6%) and some changed at alternate days (18.5%). Also, most of the patients change their innerwear once a week (56.9%) and few of them changed at alternate



day (26.2%). This information given by the patient shows their habit of cleanliness. In the big crowded city, where there is lots of pollution and population people rush here and there for various personal regions. So, once a week is a really long period to take bath and to change a dress materials and innerwear materials. Similarly, one week is an enough period for the organism to get a favorable condition in order to colonize and start an infection.

Likewise, excessive sweating nature could be another main cause for the dermatophytic infections. In this study, most of the positive cases had excessive sweating nature (80%) whereas only few didn't have excessive sweating nature (20%). There was significant association in the sweating nature and positive cases ( $P=0.006$  at  $CI=95\%$ ) ( $OR=3.20$ ). People who have excessive sweating nature were 3.20 times at high risk from tinea infections and this may be because infection is facilitated in the presence of more moisture.. A low positive correlation was found between sweating nature and positive dermatophytic infection ( $r = 0.262$ ) and the regression model predicted 7% of the variance, which indicates that 7% variation in positive dermatophytic infection can be explained by the variability in the sweating nature. 93% variation in dermatophytosis can be explained by the factors other than sweating nature in the linear regression model.

Similarly, most of the positive cases had the sharing habit of dress material (76.92%). Many of the people in our society has the habit of sharing same towel, combs, cloth and other dress material with the family member resulting high risk of infection among them. Especially the students who live in hostel share everything with the friends that results into the sharing of diseases too. In the present study, we found that there was a significant difference between the sharing habit of dress materials and positive cases ( $P=0.003$  at  $CI =95\%$ ) ( $OR=2.43$ ). This implies that person with sharing habit of dress materials were 2.43 times more likely to get infection than the person who does not share dress materials. A low positive correlation was found between sweating nature and positive dermatophytic infection ( $r = 0.204$ ) and the regression model predicted 4% of the variance.

Also, most of the positive cases did not have any knowledge about fungal infection (83.07%). There was a significant relation between the fungal infection and the positive cases ( $P=0.003$

at  $CI = 95\%$ ) ( $OR=0.27$ ). It conclude that higher the knowledge of fungal infection lower the chance of fungal infection ( $OR<1$ ). A simple linear regression model shows a low negative correlation between sweating nature and positive dermatophytic infection ( $r = -0.279$ ) and the regression model predicted 8% of the variance.

Some of the new or uncommon dermatophytes isolated during the study were difficult to identify with this conventional method of identification process. This research will obviously strengthen the research capability of the host institution i.e. Di Skin Hospital and Research Center. This type of research also helps the host institution to become more responsible and more open in conducting different research. It also helps the institution to widen the lab facility. It also helps in creating a scientific tradition in an institution which is very important factor in order to strengthen the research capability. The information obtained from this study will help in prioritizing the resources available to enhance both clinical and laboratory diagnosis and treatment of fungal diseases. Results obtain may be used as a baseline data for epidemiological studies of dermatophytosis in the country.

## CONCLUSIONS

Commonest clinical type was tinea corporis followed by tinea cruris and tinea pedis and overall predominance in the study was male with 21-30 being most affected age group. *T. rubrum* forms the commonest aetiological agent of dermatophytosis, which were mostly isolated from Tinea corporis, Tinea cruris and Tinea manuum. Possible cause of dermatophytic infection was due to poor hygienic status and lack of knowledge on fungal infection and its preventive measures.

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