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Evaluation of host and pathogen factors associated with chronic and recurrent dermatophytosis

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Abstract: *Background:* Dermatophytosis is one of the most common superficial fungal infections affecting keratinized tissues such as skin, hair, and nails. In recent years, chronic and recurrent dermatophytosis have emerged as significant clinical problems due to persistent infection, frequent relapse, and increasing misuse of topical medications. Both host-related and pathogen-related factors are believed to contribute to the persistence and recurrence of infection; however, their relative roles remain inadequately defined. *Methods:* This cross-sectional observational study was conducted over 18 months (December 2022–June 2024) in the dermatology outpatient department of a tertiary care hospital. A total of 403 patients fulfilling the clinical criteria for chronic or recurrent dermatophytosis were enrolled from approximately 4200 screened individuals. Detailed demographic, clinical, and behavioral data were collected using a structured case record form. Mycological confirmation was performed using potassium hydroxide (KOH) microscopy and fungal culture on Sabouraud's dextrose agar. Associations between host factors and disease type were analyzed using the Chi-square test, with $p< 0.05$ considered statistically significant. *Results:* Among 403 patients, recurrent dermatophytosis constituted 349 (87%) cases, while chronic dermatophytosis accounted for 54 (13%). The majority of patients belonged to the 30–40-year age group, with significant association between age and type of dermatophytosis ($p < 0.0001$). Male predominance was observed in both groups. Annular lesions were the most common morphological pattern, and multiple-site involvement was the most frequent presentation. Significant associations were observed with occupation ($p = 0.001$), inflammation of lesions ($p = 0.0001$), addiction ($p = 0.01$), spouse infection ($p < 0.0001$), use of over-the-counter topical medications ($p = 0.001$), topical steroid use ($p = 0.003$), presence of comorbidities ($p < 0.0001$), exposure to domestic animals ($p < 0.0001$), and bathing frequency ($p < 0.0001$). *Conclusion:* Recurrent dermatophytosis was more common than chronic dermatophytosis in the present study. Several modifiable host factors, including irrational use of topical corticosteroids, poor hygiene practices, and presence of comorbid conditions, were significantly associated with persistent infection. Identification and modification of these risk factors, along with rational antifungal therapy and patient education, are essential for effective management and prevention of chronic and recurrent dermatophytosis.

Keywords: Dermatophytosis, Chronic Dermatophytosis, Recurrent Dermatophytosis, Host Factors, Topical Steroid Misuse, Clinico-Mycological Study.

Introduction

Superficial mycoses represent the most common fungal infections encountered in humans and are primarily caused by keratinophilic fungi collectively termed dermatophytes. These organisms invade keratinized tissues - skin, hair, and nails - by utilizing keratin as a source of nutrition during infection. Based on the morphology and arrangement of their asexual reproductive structures (conidia), dermatophytes are classified into three genera: Trichophyton, Microsporum, and Epidermophyton. Nearly 30 dermatophyte species have been documented to be pathogenic to humans [1]. There is no universally accepted definition for the entity chronic dermatophytosis [2].

Clinically, it is generally described as a persistent infection lasting longer than one year, with or without recurrence, despite receiving adequate antifungal therapy [3]. In comparison, recurrent dermatophytosis is defined as reappearance of cutaneous dermatophyte infection within six weeks after discontinuation of antifungal treatment, with at least two such episodes occurring over a six-month period [4].

Individuals affected with chronic and recurrent dermatophytosis act as important reservoirs of infection for household contacts and the wider community, thereby contributing to both public health burden and economic impact. In addition to transmissibility, the condition produces substantial cutaneous morbidity due to severe pruritus, cosmetic concerns, psychosocial distress, and reduction in quality-of-life [5].

Multiple host-related factors (including immune status, hygiene practices, environmental exposure, and associated comorbidities) as well as pathogen-related factors (such as virulence characteristics and emerging antifungal resistance) have been proposed to influence persistence and recurrence of infection. However, the actual prevalence of chronic and recurrent dermatophytic infections and their associated risk factors remain insufficiently defined.

Therefore, the present study has been undertaken to evaluate host- and pathogen-related risk factors associated with chronic and recurrent dermatophytic skin infections.

Material and Methods

This cross-sectional, observational, hospital-based study was conducted over a period of 18 months (December 2022 to June 2024) in the Dermatology Outpatient Department of a tertiary care teaching hospital. The study protocol was approved by the Institutional Ethics Committee prior to commencement, and written informed consent was obtained from all participants. The study was carried out in coordination with the Departments of Pathology, Microbiology, Biochemistry and Radiology.

All consecutive patients presenting with clinically suspected dermatophytic infection were screened during the study period. Among approximately 4200 screened individuals, 403 patients fulfilling predefined criteria for chronic or recurrent dermatophytosis were enrolled. Patients of all age groups and both sexes were eligible for inclusion if they satisfied the clinical definitions of chronic or recurrent dermatophytosis and consented to participate. Patients with hair or nail involvement and those unwilling to provide consent were excluded.

For the purpose of the study, recurrent dermatophytosis was defined as cutaneous dermatophytic infection recurring within six weeks after completion of adequate antifungal therapy, with at least two episodes in the preceding six months. Chronic dermatophytosis was defined as infection persisting for more than one year with intermittent exacerbations and remissions.

A detailed clinical history was obtained using a structured case record form. Information collected included demographic characteristics, duration and site of lesions, frequency and interval of recurrence, associated symptoms, family history of similar lesions and atopy, treatment history including over-the-counter medications, and lifestyle factors such as personal hygiene practices and sharing of clothes or footwear. History of comorbidities including diabetes mellitus, hypertension, tuberculosis, and immunocompromised status was also documented. All patients underwent thorough general, systemic and dermatological examination, and lesion morphology, distribution, colour, erythema, induration and extent of involvement were recorded.

Mycological examination was performed in all patients. After cleaning the lesion with 70% ethanol, skin scrapings were collected from the active margin using a sterile scalpel. Direct microscopy was carried out using 10% potassium hydroxide preparation. Samples were cultured on Sabouraud's dextrose agar containing chloramphenicol and cycloheximide, followed by subculture on antibiotic-free medium. Dermatophyte species identification was attempted based on colony morphology and microscopic characteristics using lactophenol cotton blue staining.

Skin biopsy was performed in selected clinically atypical cases after obtaining additional consent. Under local anaesthesia with lignocaine and adrenaline, a punch biopsy specimen was obtained, fixed in formalin and processed for histopathological examination using hematoxylin-eosin and periodic acid–Schiff staining. Additional laboratory investigations such as complete blood count, blood glucose estimation, ESR, CRP, ELISA for HIV, VDRL, rheumatoid factor testing and Tzanck smear were performed wherever clinically indicated. Final diagnosis was established by correlating clinical, microbiological and histopathological findings.

All cases of dermatophytosis coming during study period were included in the study. All collected data were entered into Microsoft Excel and analysed using Epi Info (version 1.6) and Primer statistical software. Qualitative variables were expressed as frequencies and percentages. Associations between categorical variables were analysed using the Chi-square test, and a p-value <0.05 was considered statistically significant.

Results

The present study included a total of 403 patients with dermatophytosis. Among them, recurrent dermatophytosis constituted the majority of cases, accounting for 349 (87%), whereas chronic dermatophytosis was observed in 54 (13%) patients (Table 1).

Table-1: Proportion-wise distribution of Chronic & Recurrent Dermatophytes

Chronic/ Recurrent Dermatophytosis	Total (%)
Chronic Dermatophytosis	54 (13%)
Recurrent Dermatophytosis	349 (87%)
Total	403 (100%)

With respect to demographic characteristics, the majority of patients with chronic dermatophytosis belonged to the 30–40 years age group (33%), followed by 50–60 years (20%) and 40–50 years (19%). In recurrent dermatophytosis, the highest proportion of cases was observed in the 30–40 years age group (30%), followed by 40–50 years (25%) and 20–30 years (22%). A statistically significant association was observed between age group and type of dermatophytosis (χ^2=27.759, p<0.0001). Male predominance was observed in both groups, with 76% males in the chronic group and 70% in the recurrent group; however, this association was not statistically significant (p=0.509). Regarding occupation, employees constituted the largest proportion in recurrent dermatophytosis (47%), whereas in chronic dermatophytosis both employees and unemployed individuals each accounted for 26% of cases. Occupation showed a statistically significant association with the type of dermatophytosis (χ^2=17.692, p=0.001) (Table 2).

Table-2: Association of Demographic parameters with Chronic & Recurrent Dermatophytosis (N=403)

Demographic Parameters	Category	Chronic Dermatophytosis (n = 54)	Recurrent Dermatophytosis (n = 349)	Chi-Square Value (d.f)	P value	Significance
Age Group	<20 years	2 (4%)	9 (3%)			
	20–30 years	4 (7%)	78 (22%)			
	30–40 years	18 (33%)	106 (30%)			
	40–50 years	10 (19%)	86 (25%)	27.759 (6)	<0.0001	S
	50–60 years	11 (20%)	22 (7%)			
	60–70 years	6 (11%)	33 (10%)			
	70–80 years	3 (6%)	12 (3%)			
Gender	Male	41 (76%)	246 (70%)	0.436 (1)	0.509	NS
	Female	13 (24%)	103 (30%)			
Occupation	Beggar	3 (6%)	0 (0%)			
	Employee	14 (26%)	163 (47%)			
	Farmer	7 (13%)	19 (5%)			
	Housewife	12 (22%)	92 (26%)	17.692 (4)	0.001	S
	Retired	0 (0%)	3 (1%)			
	Student	4 (7%)	26 (7%)			
	Unemployed	14 (26%)	46 (13%)			

Analysis of clinical patterns revealed that the annular morphological pattern was the most common presentation in both chronic (63%) and recurrent dermatophytosis (87%). Other morphological patterns observed in chronic dermatophytosis included papulosquamous (11%), eczematous (9%), lichenoid (7%), pseudoimbricata (6%), and pustular (4%). In recurrent dermatophytosis, apart from annular lesions, papulosquamous (4%), pseudoimbricata (3%), pustular (5%), and pityriasis rosea-like lesions (1%) were noted. A statistically significant association was observed between morphological pattern and type of dermatophytosis (p=0.0001). Regarding the site of involvement, multiple site involvement was the most common presentation in both chronic (70%) and recurrent dermatophytosis (75%) groups, followed by groin involvement in 30% and 23% respectively, and this association was not statistically significant (p=0.767). Inflammation was present in 50% of chronic cases and 78% of recurrent cases, showing a statistically significant association with the type of dermatophytosis (p=0.0001) (Table 3).

Table-3: Association of Clinical Pattern with Chronic & Recurrent Dermatophytosis (N = 403)

Clinical Pattern	Category	Chronic Dermatophytosis (n = 54)	Recurrent Dermatophytosis (n = 349)	P value
Morphological Pattern	Annular	34 (63%)	305 (87%)	0.0001
	Eczematous	5 (9%)	0 (0%)	
	Lichenoid	4 (7%)	0 (0%)	
	Pityriasis rosea like	0 (0%)	3 (1%)	
	Papulosquamous	6 (11%)	13 (4%)	
	Pseudoimbricata	3 (6%)	10 (3%)	
	Pustular	2 (4%)	18 (5%)	
Site of Dermatophytosis	Abdomen	0 (0%)	3 (1%)	0.767
	Buttock	0 (0%)	4 (1%)	
	Groin	16 (30%)	79 (23%)	
	Legs	0 (0%)	2 (1%)	
	Multiple site	38 (70%)	261 (75%)	
Inflammation	Present	27 (50%)	273 (78%)	0.0001
	Absent	27 (50%)	76 (22%)	

Assessment of risk factors showed that addiction was present in 33% of chronic cases and 18% of recurrent cases, demonstrating a statistically significant association (p=0.01). A history of spouse having dermatophytosis was significantly more common among chronic cases (94%) compared to recurrent cases (58%) (p<0.0001). Use of over-the-counter topical medications was reported in 76% of chronic cases and 51% of recurrent cases, which was statistically significant (p=0.001). Similarly, a history of topical steroid use was observed in 74% of chronic cases and 51% of recurrent cases (p=0.003). Co-morbid conditions were present in 52% of chronic dermatophytosis cases compared to 15% in recurrent cases, showing a highly significant association (p<0.0001). Exposure to domestic animals was also significantly associated with chronic dermatophytosis (26%) compared to recurrent dermatophytosis (9%) (p<0.0001).

Bathing frequency showed a significant association with the type of dermatophytosis, with 50% of chronic cases bathing on alternate days compared to only 16% of recurrent cases, whereas daily bathing was more common in recurrent dermatophytosis (77%) than chronic cases (40%) (p<0.0001). Other factors such as family history of dermatophytosis, personal or family history of atopy, change of undergarments, use of tight clothes, washing frequency of tight clothes, sharing of clothes, towels, footwear, and washing all family clothes together did not show statistically significant associations (Table 4).

Table-4: Association of Risk Factors with Type of Dermatophytosis (N = 403)					
Parameter	**Category**	**Chronic Dermatophytosis (n=54)**	**Recurrent Dermatophytosis (n=349)**	**Chi-Square (d.f)**	**P value**
Addiction	No	36 (67%)	287 (82%)	6.179 (1)	0.01
	Yes	18 (33%)	62 (18%)		
Family history of recent dermatophytosis	No	9 (17%)	73 (21%)	0.292 (1)	0.589
	Yes	45 (83%)	276 (79%)		
History of spouse having dermatophytosis	No	3 (6%)	126 (42%)	24.878 (1)	<0.0001
	Yes	46 (94%)	174 (58%)		
Personal history of atopy	No	47 (87%)	315 (90%)	0.237 (1)	0.626
	Yes	7 (13%)	34 (10%)		
Family history of atopy	No	50 (93%)	315 (90%)	0.088 (1)	0.767
	Yes	4 (7%)	34 (10%)		
OTC topical medicines	No	13 (24%)	170 (49%)	10.478 (1)	0.001
	Yes	41 (76%)	179 (51%)		
History of use of topical steroid	No	14 (26%)	170 (49%)	8.888 (1)	0.003
	Yes	40 (74%)	179 (51%)		
Co-morbid conditions	No	26 (48%)	298 (85%)	38.818 (1)	<0.0001
	Yes	28 (52%)	51 (15%)		
Change of undergarments daily	No	27 (50%)	155 (44%)	0.431 (1)	0.512
	Yes	27 (50%)	196 (56%)		
Use of tight clothes	No	30 (56%)	159 (46%)	1.497 (1)	0.221
	Yes	24 (44%)	190 (54%)		
Frequency of washing tight clothes	Once/week	16 (67%)	126 (66%)	0.065 (2)	0.968
	Twice/week	5 (29%)	37 (20%)		
	Fortnightly	3 (4%)	27 (14%)		
Sharing of clothes	No	39 (72%)	269 (77%)	0.372 (1)	0.542
	Yes	15 (28%)	80 (23%)		
Sharing of towels	No	10 (19%)	66 (19%)	0.014 (1)	0.906
	Yes	44 (81%)	283 (81%)		
Sharing of footwear	No	18 (33%)	122 (35%)	0.902 (1)	0.342
	Yes	36 (67%)	227 (65%)		
Washing all family clothes together	No	15 (28%)	147 (42%)	3.427 (1)	0.06
	Yes	39 (72%)	202 (58%)		
Exposure to domestic animals	No	40 (74%)	318 (91%)	12.030 (1)	<0.0001
	Yes	14 (26%)	31 (9%)		
Bathing frequency	Alternate day	27 (50%)	55 (16%)	35.590 (2)	<0.0001
	Daily	22 (40%)	268 (77%)		
	Irregularly	5 (9%)	26 (7%)		

Discussion

The majority of study subjects belonged to the 30–40 years age group, followed by 40–50 years and 20–30 years. A statistically significant association was observed between age and type of dermatophytosis (p<0.0001). Recurrent dermatophytosis was more common in the 20–30 years age groups, whereas chronic dermatophytosis was relatively more frequent in 50–60 years age groups. Similar findings have been reported by Pathania et al [6], Sharma et al [7] & Senthamil et al [8]. Younger adults have more active sebaceous and eccrine gland activity, resulting in

increased sweating and moisture, which provide a favourable environment for fungal growth. In contrast, elderly individuals may develop chronic disease due to immunological decline and associated systemic illnesses.

Male predominance was observed in both chronic (76%) and recurrent dermatophytosis (70%); however, this association was not statistically significant. Similar male predominance has been reported in several studies including Pathania et al [6], and Sharma et al [7]. Earlier studies by Svejgaard E [9] and Agarwalla A [10] also documented higher prevalence among males. A statistically significant association was observed between occupation and type of dermatophytosis ($p = 0.001$) (Table 2). Labourers and housewives constituted a major proportion of recurrent dermatophytosis cases, while unemployed individuals and farmers showed relatively greater association with chronic dermatophytosis. Similar occupational patterns have been reported by Ghosh et al [11] who noted higher prevalence among manual labourers and homemakers. Increased physical activity, perspiration, and exposure to humid environments in manual occupations may facilitate dermatophyte growth and persistence.

Multiple-site involvement was the most common clinical presentation in both chronic (70%) and recurrent dermatophytosis (75%), followed by groin involvement. However, no significant association was observed between site of involvement and disease type ($p = 0.767$). Similar findings were reported by Pathania et al [6], who observed multiple-site involvement in 64.6% of recurrent dermatophytosis cases. The frequent involvement of the groin region may be explained by occlusion from undergarments, increased sweating, and higher humidity that favour fungal proliferation. Annular morphology was the most common lesion pattern in both chronic (63%) and recurrent dermatophytosis (87%), with a statistically significant association between morphological pattern and disease type ($p = 0.0001$). These findings are comparable with Pathania et al [6], where annular lesions were observed in 89.3% of cases. Other morphological patterns such as papulosquamous, pustular, and pseudo-imbricata lesions represent atypical or steroid-modified presentations of dermatophytosis. Topical corticosteroid misuse may alter the classical morphology, produce atypical clinical patterns and delay appropriate treatment.

Inflammatory lesions were significantly more common in recurrent dermatophytosis (78%) compared with chronic dermatophytosis (50%) ($p = 0.0001$). Similar observations were reported by Pathania et al [6], where inflammatory lesions were present in 80.6% of recurrent cases. Active inflammatory signs such as erythema, papules, plaques, and pustules typically indicate ongoing fungal activity, whereas chronic lesions may demonstrate less inflammation due to partial treatment or altered immune response. Several behavioural and clinical factors were significantly associated with chronic or recurrent dermatophytosis. Addiction showed a significant association with disease type ($p = 0.01$), with higher prevalence among chronic cases. Alcohol consumption may increase sweating and reduce personal hygiene, thereby promoting fungal colonization.

Use of over-the-counter (OTC) topical medications was significantly associated with chronic dermatophytosis ($p = 0.001$). Many OTC preparations contain combinations of antifungal agents and potent corticosteroids. Such irrational use can modify lesion morphology, suppress local immunity, and lead to incomplete treatment, resulting in persistent infection. Similarly, topical corticosteroid use showed a significant association with disease type ($p=0.003$). Corticosteroids may temporarily suppress inflammation but allow continued fungal proliferation, leading to steroid-modified tinea and treatment failure. A comparable proportion of steroid use was reported by Pathania et al [6], where approximately half of the patients had used corticosteroid-containing preparations prior to consultation.

Presence of co-morbid conditions was also strongly associated with dermatophytosis type ($p<0.0001$). Chronic dermatophytosis patients had a higher prevalence of systemic conditions such as obesity, diabetes, and immunosuppressive states. Immuno-compromised conditions are known to impair cell-mediated immunity and predispose

individuals to persistent fungal infections. Earlier studies have also reported associations between chronic dermatophytosis and systemic disorders such as diabetes and immunosuppressive states (Rebell G [12], Richard A.J.[13], Wade K.F.[14].

Exposure to domestic animals showed a significant association with chronic dermatophytosis ($p < 0.0001$). Animals can act as reservoirs for zoophilic dermatophytes, particularly *Microsporum* species, facilitating recurrent exposure and persistent infection. Bathing frequency was another significant factor ($p < 0.0001$). Patients with alternate-day bathing habits had a higher proportion of chronic dermatophytosis compared with those bathing daily. Regular bathing may reduce fungal load on the skin by removing keratin debris and fungal elements, thereby decreasing the risk of persistence. In contrast, factors such as family history of dermatophytosis, personal or family history of atopy, changing undergarments, wearing tight clothes, washing frequency of tight clothes, sharing of clothes, towels, footwear, and washing family clothes together did not show statistically significant associations in this study.

Conclusion

Overall, the findings of this study highlight that recurrent dermatophytosis is more common than chronic disease and that multiple demographic, clinical, and behavioural factors contribute to its persistence. Addressing modifiable risk factors, promoting rational use of antifungal medications, and improving patient education regarding hygiene and treatment adherence may help reduce the burden of chronic and recurrent dermatophytosis.

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