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Original Research Article

Clinicomycological study of dermatophytosis in adults at rural tertiary care hospital: A cross- sectional study

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Abstract

Background: Dermatophytosis is a common fungal infection affecting skin, hair, and nails, is a significant public health concern in India, with a rising trend of recurrent, recalcitrant, and chronic cases. Despite its high prevalence, dermatophytosis remains a neglected disease, with limited understanding of its epidemiology, clinical profile, and pathogenetic behavior. The lack of evidence-based approaches to diagnosis and management has contributed to the emergence of dermatophytosis as a major public health concern, necessitating early prioritization among dermatologists.

Objectives: The present study was conducted to isolate, speciate, and analyze the clinicoepidemiological patterns of dermatophytosis in newly diagnosed, recurrent, and steroid-modified cases in adults.

Materials and Methods: It was a cross-sectional descriptive study among 100 clinically diagnosed dermatophytosis cases conducted on an out-patient basis over a period of 18 months in a rural tertiary care hospital in Karnataka, India. We collected detailed information on epidemiology, clinical parameters, treatment history, and other host factors. Potassium hydroxide (KOH) mount and fungal culture were done from samples of skin scrapings and were analyzed.

Results: Females slightly outnumbered males with a male-to-female ratio of 0.96:1. The mean age was 39.02 ± 12.71 years, with young to middle-aged adults primarily affected. Most patients were from a lower socioeconomic background. Recurrent cases were most common (41%), followed by steroid-modified (33%) and newly diagnosed cases (26%). Tinea corporis (33%) and Tinea corporis et cruris (33%) were the predominant diagnoses. KOH mount and culture positivity rates were 64% and 69%, respectively. Trichophyton mentagrophytes was the most common causative organism overall, particularly in newly-diagnosed and steroid-modified cases, while Trichophyton rubrum was most common in recurrent cases.

Conclusion: For optimal treatment outcomes and prevention of antifungal resistance, an evidence-based approach for fungal species identification is necessary. Positive family history, fomite transmission, and misuse of topical corticosteroids can contribute to recurrent and steroid-modified infections.

Keywords: Dermatophytosis, Recurrent dermatophytosis, Steroid modified Tinea, Trichophyton, Tinea.

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1. Introduction

Dermatophytosis is a regularly encountered disease and constitute more than 50% of cases in dermatology outpatient departments.[1] Although it is not a life-threatening disease, the severe itching and distressing lesions which are persistent and prolonged causes a lot of social embarrassment and stress leading to significant emotional, physical and mental morbidity to the patients.[2,3]

Dermatophytosis includes superficial infection of keratinized tissues like skin, hair and nails caused predominantly by arthrodermataceae family that contains 40 species which are divided among the 3 major genera i.e., Trichophyton, Epidermophyton and Microsporum.[4] Prevalence of superficial mycotic infection is 20-25% of the world population, with primarily dermatophytosis causing them.[5] Currently prevalence in India which has a tropical climate for most parts falls in a very wide range (6.09%–61.5%). A prevalence of 6.09% to 27.6% has been reported in studies from south India, while a high prevalence of 61.5% has been recorded in north India.[6]

The predominant species of the fungus varies from each clinical profile and each region. The geographical distribution scenario is evolving with changing clinical pattern and

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pathogenic behaviour, there has been a rising trend of dermatophytosis all over India in the last 6-8 years with increase in recurrent, recalcitrant and chronic cases in an epidemic like situation.[2]

Due to several factors like erratic use of antifungal agents, topical steroid abuse, genetic susceptibility, impact of climate change, poor compliance, overcrowding, treatment resistance, dermatophytosis is emerging as a major public health concern in recent times which needs early prioritization among the dermatologists.[7]

This calls for the need of evidence-based approach. Hence, the present study to explore clinicoepidemiological profile, utilize conventional culture methods for isolation and identifications of dermatophyte species mainly among newly diagnosed, recurrent and steroid modified cases in a rural setting.

2. Materials and Methods

2.1. Study design, settings and participants

It was a cross-sectional descriptive study conducted over 18 months (October 2022 to March 2024) in the Department of Dermatology, Venereology, and Leprosy at a tertiary care teaching hospital in Mandya district, Karnataka. The study population included adults over 18 years of age, of either sex, attending the dermatology outpatient department with a clinical diagnosis of dermatophytosis willing to participate in the study. Patients with secondary bacterial infections, those on antifungal therapy (oral and/ or topical) in the last 4 weeks, individuals with immunocompromised states or on systemic immunosuppressants within the past 14 days, and pregnant or lactating women were excluded from the study.

2.2. Procedure of the study

One hundred patients with clinically diagnosed dermatophytosis who visited the dermatology outpatient department and met the specified inclusion and exclusion criteria were recruited for the study. Approval was obtained from the institutional ethics committee, and written informed consent was obtained from all patients before their participation in the study. A detailed patient history was taken using a structured questionnaire. Thorough socio-demographic information, along with a detailed medical history that included age, gender, disease duration, episode nature (first/recurrent), family history, occupation, use and sharing of fomites such as towels, soaps, and clothing, history of prior treatment (topical and/or systemic), including over-the-counter (OTC) topical steroid medication, and any associated risk factors contributing to the illness, were recorded. All patients were categorized into three groups: newly diagnosed (those who had not taken any topical/oral treatment, including self-medication), recurrent (reoccurrence of tinea four weeks after stopping treatment following clinical cure), and steroid-modified tinea (tinea altered by the use of topical corticosteroids but still diagnosable). Clinically suspicious cases with negative mycological findings were included only after a positive response to topical antifungal agents. A thorough skin examination was performed to assess the clinical type of tinea, with emphasis on lesion morphology, number, and distribution. Photographs were taken for each patient. A lesional skin scraping was collected from each patient and direct KOH mount and fungal culture (Sabouraud's dextrose agar with antibiotics) was done for primary isolation of dermatophytes. Further, microscopic examination of the culture was done by LPCB tease mount and slide culture.

2.3. Statistical analysis

The data collected was entered into a Microsoft Office Excel sheet and analyzed using SPSS software. Results were presented as appropriate percentages and proportions. Relevant inferential statistical tests, such as the chi-square test for qualitative data and the t-test for quantitative data, were conducted to interpret the results. A p-value of less than 0.05 was considered statistically significant.

2.4. Ethical issues

The purpose of the study was clearly explained to all participants, who were assured of confidentiality and provided with informed written consent. The study received approval from the Institutional Ethical Committee.

3. Observation & Results

The study revealed that the majority of patients (32%) were in the age group of 31-40 years, with a mean age of 39.02 ± 12.71 years. Females were slightly more affected than males, comprising 51% of the cases, with a male-to-female ratio of 0.96:1. Homemakers (24%) were the most commonly affected occupational group followed by students (15%), farmers (13%), shop owners (13%), labourers (10%), clerks (6%), teachers (5%), drivers (5%), office workers (4%), and software engineers (2%). Other miscellaneous occupations together accounted for 3 cases (3%). The highest incidence of dermatophytosis was observed in individuals from the lower socioeconomic status (54%). Maximum number of people were affected during the summer season (70%). A significant proportion of patients (47%) reported a disease duration of less than one month before seeking medical attention. The most common co-morbidity was diabetes mellitus (8%), followed by both hypertension and diabetes mellitus (6%), hypertension alone (4%), bronchial asthma and hypothyroidism (3% each). Recurrent tinea cases were the most frequent (41%), followed by steroid-modified (33%) and newly diagnosed cases (26%). 33% of the study population used over-the-counter (OTC) topical steroid medications and all these patients had steroid-modified tinea with clinical presentation mimicking eczema like presentation (13%) in majority of patients followed by airborne contact dermatitis-like presentations (4%). Poor hygiene was the most common risk factor for dermatophytosis (90%), followed by hyperhidrosis (77%),

use of tight-fitting clothing (64%), obesity (51%), habit of sharing of fomites (50%), overcrowding (46%), contact history to animals/pets (32%) and soil (20%) respectively. A family history of dermatophytosis was reported in 66% of patients, with the highest occurrence in recurrent cases (43.9%). The most common clinical diagnoses were Tinea corporis and Tinea corporis et cruris, each accounting for 33% of cases. Among recurrent cases, T. corporis et cruris and T. corporis were the most frequent diagnoses (29.3% each), while T. corporis was the most common in steroid-modified cases (36.4%), and T. corporis et cruris in newly diagnosed cases (42.3%). Direct KOH examination was positive in 66% of samples, with the highest positivity in newly diagnosed cases (80.8%). Culture positivity was seen in 69% of cases. 74.24% of skin scrapings were both KOH and culture positive. The most commonly isolated fungal species was T. mentagrophytes (71.01%), followed by T. rubrum (20.28%), other less common isolates included E. floccosum and T. tonsurans, each in 2 cases (2.8%), and T. Verrucosum and M. Canis, each in 1 case (1.4%). T. mentagrophytes was the predominant isolate in newly diagnosed (34.7%) and steroid-modified cases (44.9%), while T. rubrum (85.7%) was most common in recurrent cases. Among clinical diagnoses, T. mentagrophytes was most frequently isolated in cases of T. corporis (32.7%), T. corporis et cruris (34.7%) and T. cruris (12.2%).

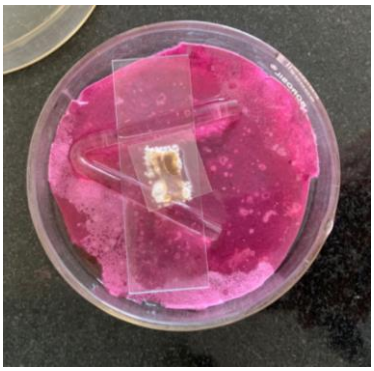

Figure 1: Slide culture showing growth.

Figure 2: KOH mount showing fungal hyphae and spores

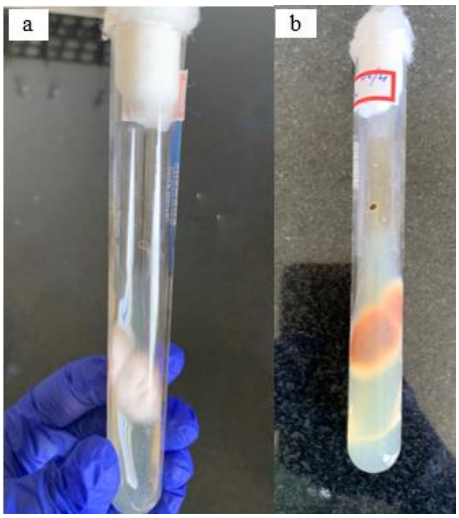

Figure 3: (**a**) Growth on Sabouraud's dextrose agar (obverse). (**b**) Growth on Sabouraud's dextrose agar (reverse with pigmentation). Suggestive of T. rubrum.

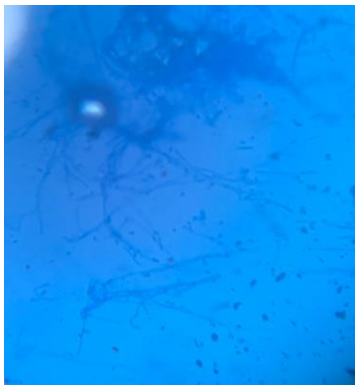

Figure 4: LPCB mount of T. rubrum showing tear drop microconidia

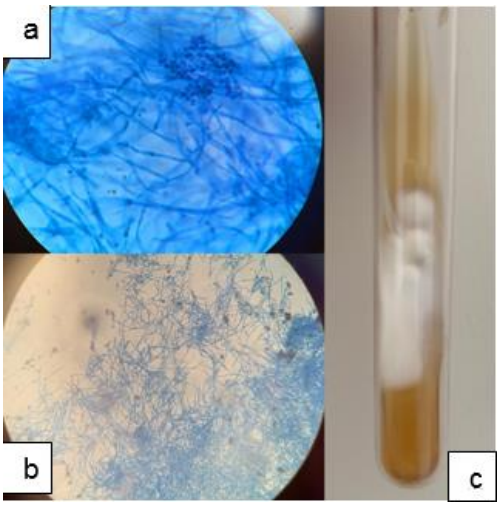

Figure 5: (**a**): 100x & (**b**): 40x LPCB mount showing grape like clusters of microconidia. (**c**) Growth on Sabouraud's dextrose agar (obverse). Suggestive of T. mentagrophytes.

Figure 6: Newly diagnosed case of T. Facei

Figure 7: Steroid- Modified Tinea mimicking eczema like presentation

4. Discussion

In the present study, majority of the patients were in the age group of 31-40 years (32%), similar to study done by Janardhan B et al[8] (32%). In contrary to our study, Saha et al[9] (20.7%), Agarwal et al[10] (30.3%), Hanumanthappa et al[6] and Singh et al[4] (27.8%) did observe that most of the patients were in the age group of 21-30 years (**Table 1**).

The higher incidence of dermatophytosis in the age group 31-40 years can be attributed to patients' involvement in extensive outdoor activities, such as agriculture and manual labour, which expose them to environmental infections, or indoor activities like cooking among homemakers, resulting in increased perspiration. This creates a hot and humid environment favourable for the growth of dermatophytes.[11,12]

An overall female preponderance was observed, which was consistent with studies conducted by Vineetha et al[11] (M:F-1: 1.7) and Saha et al(M:F -1:1.7).[9] In particular, female preponderance was also noted among our newly diagnosed cases, in concordance with the observations of Saha et al[9] and Vineetha et al.[11] Conversely, male preponderance seen in recurrent cases is comparable to the findings of Vineetha et al[11] **(Table 2)**. Recent trends observe a shift in the gender ratio for dermatophytosis, with a higher incidence now in women compared to men.[9]

Majority of the study population were homemakers (24%), which is comparable to the findings of Rudramurthy et al[15] (25.1%) and Ghosh RR et al[16] (29%). In contrast, Vineetha et al[11] (52%) and Janardhan B et al[8] (41%) observed that manual labourers were most commonly affected. **(Table 3).** In the present study, the increased incidence among housewives can be attributed to increased perspiration resulting from domestic chores and cooking, which involve exposure to high temperatures and humidity.[12]

Among the study population, majority of patients (54%) belonged to the lower socioeconomic status, which was in concordance with studies done Poluri LV et al[1] (67.74%) and Hanumanthappa H et al[6] (65.4%). Inadequate living conditions, poor hygiene, overcrowding, and malnutrition in lower socioeconomic groups create an environment conducive to the proliferation of dermatophytes, thereby increasing the likelihood of infection, recurrence and chronicity.

In the present study, highest incidence was observed in the summer season (70%), followed by the monsoon season (24%). This finding is consistent with the results reported by Janardhan B et al,[8] who also found a higher incidence during the summer season (64%) and rainy season (28%). The higher incidence during the summer season can be attributed to the increased heat that creates a humid environment and leads to increased perspiration[8].

In the present study, majority of patients (47%) reported a disease duration of less than 1 month before seeking medical attention. A study done by Singh et al[4] found that most patients (42.76%) presented with a disease duration of less than 1 month. In contrast, Saha et al[9] reported a significantly longer disease duration of patients (51.4%) having symptoms for more than 6 months before seeking medical attention.

In our study, diabetes mellitus was the most frequent comorbidity, among 8% of patients, followed by both hypertension and diabetes in 6%, hypertension alone in 4%, and bronchial asthma and hypothyroidism each in 3%. Similarly, Bindu et al[17] found that 10.6% of their patients had diabetes mellitus as a comorbidity, while Rudramurthy et al[15] reported it in 6.1% of their patients.

In our study, majority of patients had recurrent dermatophytosis (41%), followed by steroid-modified tinea (33%) and newly diagnosed cases (26%). This is in contrast to the study by Saha et al[9] where the majority of patients were treatment-naïve cases (45.9%), followed by recurrent cases (12.6%) and steroid-modified tinea (7.2%). In the study done by Rudramurthy et al,[15] majority of patients were recurrent cases (60%), followed by newly diagnosed cases (40%) **(Table 4).**

In the present study, 33% used over-the-counter (OTC) topical steroid medications which was higher than that reported by Singh et al[4] (21.7%) and Bindu et al[17] (7.3%)**.** However, studies done by Vineeta et al[11] (63%) and Saha et al[9] (49.5%) reported a higher number of patients using OTC topical steroids **(Table 5).**

All the patients had steroid-modified tinea, eczema like lesions was the commonest presentation followed by airborne contact dermatitis-like presentations (4%). However, in the study done by Saha et al[9] erythema along with follicular and non-follicular papules was the commonest observation followed by peripheral pustules and pseudoimbricata.

Potent steroid-containing creams are easily accessible over the counter without a prescription, and their low cost and immediate relief properties further contribute to their use. They are often recommended by pharmacists, friends, or prescribed by general practitioners, leading to prolonged and erratic use by patients. The wide range of dermatoses that steroid-modified dermatophytosis can mimic presents a clinical diagnostic challenge delaying early management.

In our study, the most common predisposing risk factor was poor hygiene (90%), In concordance with our study Hosthota A et al[18] also found poor hygiene (32.0%) as the major risk factor. Poor hygiene practices (such as infrequent bathing, not changing undergarments daily, and irregularly washing clothes or not washing them separately) along with sharing fomites and overcrowding promote the spread of infections and result in recurrences.**(Table 6).** Sharing of fomites among family members was most common among recurrent cases (85.4%), followed by steroid-modified cases (30.3%) and newly diagnosed cases (19.2%). This association was found to be statistically significant (P-value<0.001). In a study done by Saha et al,[9] sharing of fomites was significantly more in chronic cases (94.7%), followed by recurrent cases (87.5%) and treatment-naïve cases (62.7%). Hyperhidrosis was observed in 77% of the patients, significantly higher compared to the 15% reported by Bobade HG et al[19] and 2.2% reported by Mahajan et al.[20] Use of tight fitting clothes, hyperhidrosis or obesity provide damp and moisture-trapping microenvironment, particularly in skin folds which are prone to friction creates an ideal setting for dermatophyte growth.

In the present study, family history was positive in 66% of patients which was higher than that observed in studies done by Singh et al[4] (48.8%) and Bindu et al[17] **(**16.6%) and lower than that observed in study done by Saha et al[9] (73.9%) **(Table 7).** Positive family history was maximum in recurrent cases (43.9%) followed by steroid-modified (28.8%) and newly diagnosed dermatophytosis (27.3%). These results were comparable with the study done by Saha et al[9] (Recurrent - 87.5% followed by newly diagnosed- 62.7%).

In our study, Tinea corporis (33%) and Tinea corporis et cruris (33%) were the most common clinical diagnoses, followed by Tinea cruris (13%). These findings are consistent with previous studies by Singh et al,[4] who reported Tinea corporis as the most common diagnosis (39.5%), and Vineetha et al,[11] who found it to be the most common in 35% of cases. However, our results differ from those of Krishan et al[21] who reported Tinea cruris as the most common diagnosis in 53% of cases, and Grover et al,[22] who found Tinea pedis to be the most common in 29.2% of cases. Among recurrent cases (41.0%) the most common clinical diagnosis was T. corporis and T. corporis et cruris (29.3% each). Among steroid-modified cases (33%), the most common clinical diagnosis was T. corporis (36.4%). Among newly diagnosed cases (26.0%), the most common clinical diagnosis was T. corporis et cruris (42.3%).

In our study, KOH positivity (66%) was comparable with the similar studies done by Saha et al[9] (66.2%) and Bindu et al[17] (64%). In contrary Janardhan B et al[8] (90%) and Singh et al[4] (97.7%) reported a much higher positive KOH mount results.

In the present study, dermatophyte species were isolated by culture in 69% of patients, which is similar to the findings of Singh et al[4] (73.6%) and Janardhan et al8 (72%). However, Bindu et al[4] (45.3%), Mahajan et al[20] (52.4%), and Saha et al[11] (39.6%) reported significantly lower culture positivity results. In our study, the most common isolated organism was T. mentagrophytes (71.01%) followed by T. rubrum (20.28%), which was consistent with the findings of Nenoff et al[23] (93.21%), Tigga et al[24] (97.2%), and Mahajan et al[20] (75.9%). However, our results differ from those of Hanumanthappa et al[6] (58.9%) and Poluri LV et al[1] (58.06%), who found T. rubrum to be the most prevalent fungal isolate, followed by T. mentagrophytes. **(Table 8).**

Most common causative organism among newly diagnosed cases was T. Mentagrophytes (34.7%), in recurrent cases, T. Rubrum (85.7%) was the most common causative organism and in steroid-modified cases, T. Mentagrophytes (44.9%) was the most common causative organism. In a similar study by Saha et al[11] detected T. Mentagrophytes to be the commonest causative organism for steroid modified cases. Recurrent cases and newly diagnosed cases predominantly demonstrated T. Rubrum to be the commonest isolate. The recent resurgence of T. mentagrophytes is attributed to several factors, including environmental changes (humidity), its easy adaptation from animal to human hosts, sharing of fomites among family members which facilitates transmission and widespread use of topical steroids.[12]

Table 1: Age distribution of patients in present and previous studies.

Authors with similar study	Most Common Age Group Affected (Years)	Clinical presentation		
		Newly diagnosed	Recurrent	Steroid modified
Vineetha et al[11]	10-20	10-20	40-50	-
Saha et al[9]	21-30	21-30	40-50	-
Singh et al[4]	21-30	-	-	-
Janardhan B et al[8]	31-40	-	-	-
Agarwal et al10	21-30	-	-	-
Hanumanthappa H et al[6]	21-30	-	-	-
Present Study	31-40	21-30	31-40	21-30

Table 2: Gender distribution of patients in present and previous studies.

Authors with similar study	M:f ratio	Clinical presentation		
		Newly diagnosed	Recurrent	Steroid modified
Vineetha et al[11]	1: 1.7 (F>M)	1:1.1(F>M)	1.5:1 (M>F)	-
Saha et al[9]	1:1.7 (F>M)	0.45:1(F>M)	1:1.4(F>M)	-
Present Study	0.96:1(F>M)	0.52:1(F>M)	1.41:1(M>F)	0.94:1(F>M)

Table 3: Distribution of occupation among patients in present and previous studies.

Occupation	Rudramurthy et al.[15]	Ghosh rr et al.[16]	Vineetha et al.[11]	Janardhan b et al.[8]	Present study
Farmer	11.8%	16%	-	-	13%
Homemaker	25.1%	29%	27%	17%	24%
Labourer	14.9%	21%	52%	41%	10%
Office worker	21.5%	-	-	-	4%
Shop owner	-	-	-	-	13%
Student	20%	-	-	14%	15%
Teacher	-	-	-	-	5%
Driver	-	-	-	-	5%
Software engineer	-	-	-	-	2%
Clerk	-	-	-	-	6%
Sedentary workers	-	-	16%	26%	-
Others	6.7%	-	-	2%	3%

Table 4: Comparison of clinical presentation of dermatophytosis in present and previous studies.

Authors with similar study	Clinical Presentation		
	Newly diagnosed	Recurrent	Steroid modified
Saha et al.[9]	45.9%	12.6%	7.2%
Rudramurthy et al.[15]	40%	60%	-
Present Study	26%	41%	33%

Table 5: History of use of (OTC) topical steroid medication in present and previous studies.

Authors with similar study	OTC Medication
Singh et al[4]	21.7%
Mahajan et al[20]	70.6%
Bindu et al[17]	7.3%
Vineeta et al[11]	63%
Saha et al[9]	49.5%
Present Study	33%

Table 6: Comparison of risk factors among patients in present and previous studies.

Risk factors	Hosthata A et al[18]	Rudramurthy et al[15]	Mahajan et al.[20]	Vineetha et al[11]	Saha et al[9]	Bindu et al[17]	Bobade HG et al[19]	Present study
Sharing of fomites	-	-	-	21.6%	73.1% (overall). Chronic cases (94.7%); Recurrent cases (87.5%); Treatment-naïve cases (62.7%).	-	-	50%
Overcrowding	-	-	-	-	-	-	-	46%
Tight fitting clothes	-	-	-	38.3%(overall) New case-13% Chronic-50%	-	69.3%	-	64%
Hyperhidrosis	-	-	2.2%	-	-	-	15%	77%
Contact with soil	-	13.3%	-	-	-	-	-	20%
Contact with animals/pets	2.7	14.3%	-	-	-	-	-	32%
Poor hygiene	32%	-	-	-	-	-	25%	90%
Obesity	-	-	-	-	-	-	13%	51%

Table 7: Comparison of positive family history in present and previous studies.

Authors with similar study	Positive family history
Singh et al[4]	48.8%
Ghosh et al[16]	48%
Bindu et al[17]	16.6%
Vineeta et al[11]	49%- Overall (Chronic -28%) (Newly diagnosed-21%)
Saha et al[9]	73.9%- Overall (Chronic- 94.7%) (Recurrent - 87.5%) (Newly diagnosed- 62.7%)
Present study	66%- Overall (Recurrent – 43.9%) (Newly diagnosed- 27.3%) (Steroid modified cases- 28.8%)

Table 8: Comparison of the predominant fungal isolate in current and previous studies.

Authors with similar study	Predominant Species (%)
Rudramurthy et al[15]	T. interdigitale (66.1)
Mahajan et al[20]	T. mentagrophytes (75.9)
Poluri et al[1]	T. rubrum (58.06)
Agarwal et al[10]	T. mentagrophytes (37.9)
Vineetha et al[11]	T. rubrum (21)
Saha et al[9]	T. mentagrophyte(15.3%) & T.rubrum (15.3%)- Overall Newly diagnosed & recurrent cases- T. rubrum (41.1%) & (41.6%) Chronic & Steroid modified cases- T. Mentagrophyte (46.1%) & (71.4%)
Present study	Overall- T. mentagrophytes (71.01%) Newly diagnosed and steroid modified- T. Mentagrophyte (34.7% & 44.9%) Recurrent- T. Rubrum (85.7%)

5. Conclusion

Several factors contribute to the rise of dermatophytosis as a major public health concern. Tackling the challenges of recurrent and steroid-modified dermatophytosis requires a comprehensive approach. By integrating clinical research, regulatory measures, and public education, we can effectively address this growing health concern and improve patient outcomes. Dermatologists must stay informed and adopt evidence-based practices to manage this evolving issue successfully.

6. Source of Funding

None.

7. Conflict of Interest

None.

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