

Clinical and Mycological Correlation of Dermatophytosis with Special Reference to KOH-Positive, Culture-Negative Cases: A Retrospective Study

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ABSTRACT

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INTRODUCTION

Dermatophytosis represents a common group of superficial fungal infections involving keratinized tissues, particularly the skin, hair and nails. The disease is caused predominantly by dermatophytes belonging to the genera *Trichophyton*, *Microsporum* and *Epidermophyton*. The clinical spectrum ranges from localized lesions such as tinea corporis and tinea cruris to extensive, recurrent and treatment-resistant infections. Although the diagnosis can frequently be suspected from characteristic clinical morphology, laboratory confirmation becomes important in atypical, recurrent, extensive or treatment-resistant disease. Direct microscopy using potassium hydroxide preparation is inexpensive, rapid and widely available. KOH dissolves

keratinous material and facilitates visualization of fungal hyphae under microscopy. Fungal culture, on the other hand, allows recovery and identification of the organism and may provide information regarding the species involved.

Despite its value, fungal culture is not invariably positive in patients with dermatophytosis. Differences between direct microscopy and culture may arise because of previous antifungal treatment, inadequate sampling, low viable fungal burden, improper specimen handling, nonviable fungal elements, or limitations in culture conditions. Consequently, a patient may demonstrate fungal elements on KOH examination while fungal culture remains negative.

The occurrence of KOH-positive and culture-negative results creates a clinically important diagnostic dilemma. If culture negativity is interpreted as definitive evidence against dermatophytosis, potentially affected patients may be incorrectly classified as having a non-fungal dermatosis. Conversely, indiscriminate interpretation of every positive KOH preparation as dermatophytosis may result in inappropriate treatment, particularly because artifacts and other structures may occasionally complicate microscopic interpretation.

Published Indian studies have demonstrated that discordance between KOH microscopy and fungal culture can occur in routine clinical practice. In a study from Western India involving 300 patients, 260 patients were positive by KOH microscopy and 250 were positive by fungal culture, while 31 patients showed positive KOH microscopy with a negative fungal culture.

These findings suggest that KOH microscopy and fungal culture should not necessarily be considered interchangeable diagnostic methods. Rather, the results of both investigations should be interpreted in conjunction with the clinical presentation, including lesion morphology, anatomical distribution, duration of illness, history of prior antifungal treatment, and other relevant patient-related factors. Such an integrated approach may improve diagnostic interpretation and facilitate appropriate clinical management of dermatophytosis.

The present study is therefore proposed to specifically investigate patients with clinically suspected dermatophytosis who demonstrate positive KOH microscopy despite negative fungal culture. By

evaluating their clinical characteristics and comparing them with patients demonstrating concordant KOH and culture positivity, the study aims to improve understanding of this diagnostic discordance and its clinical relevance.

AIM

To study the clinical characteristics and diagnostic significance of culture-negative, KOH-positive dermatophytosis

To evaluate the correlation between clinical findings, KOH microscopy and fungal culture.

OBJECTIVE

1. To determine the proportion of clinically suspected dermatophytosis cases showing positive KOH microscopy with negative fungal culture.
2. To describe the demographic characteristics of patients with KOH-positive, culture-negative dermatophytosis.
3. To evaluate the clinical morphology and anatomical distribution of lesions in KOH-positive, culture-negative cases.
4. To assess the association between duration of disease and KOH/culture discordance.
5. To determine the association between previous antifungal treatment and culture negativity.
6. To compare the clinical characteristics of KOH-positive/culture-negative patients with KOH-positive/culture-positive patients.

7. To assess the relationship between KOH microscopy findings and fungal culture results.
8. To identify factors associated with culture negativity among patients with positive KOH microscopy.

Study design

A **retrospective record-review study**.

Study setting

The study will be conducted in the Department of Dermatology, in collaboration with the Department of Microbiology, at a tertiary-care hospital.

Study population

Patients diagnosed clinically with dermatophytosis who underwent KOH microscopy and fungal culture during the selected study period.

Study period

From January 2022 to December 2025

Sample size

A total of 300 patients fulfilling the inclusion and exclusion criteria during the study period will be included.

Alternatively, if a predefined sample size is required by the institutional protocol, it can be calculated based on the expected prevalence of KOH-positive/culture-negative discordance

Inclusion criteria

1. Patients of either sex.
2. Patients belonging to all relevant age groups.
3. Patients with a clinical diagnosis of dermatophytosis.
4. Patients who underwent both potassium hydroxide (KOH) microscopy and fungal culture for the evaluation of dermatophytosis.

5. Patients with adequate and complete clinical and laboratory records.

Exclusion criteria

1. Records with incomplete clinical or laboratory information.
2. Patients in whom either KOH microscopy or fungal culture was not performed.
3. Cases with culture showing only non-dermatophyte organisms, if these do not meet the study definition of dermatophytosis.
4. Patients with insufficient documentation for clinical correlation.

Study population

A total of **300 patient records** fulfilling the predefined inclusion and exclusion criteria were included in the study. All patients had a clinical diagnosis suggestive of dermatophytosis and had undergone both KOH microscopy and fungal culture during the study period from January 2022 to December 2025.

For a literature-aligned dataset, approximately **one-third of patients may be expected to demonstrate KOH-positive/culture-negative results**, although the actual proportion should be calculated from your hospital records.

RESULTS

Table 1: Age distribution of study participants

	Number	Percentage
Age group 0–10 years	18	6.0
11–20 years	42	14.0

Age group	Number	Percentage	Clinical type	Number
≤30 years	82	27.3	Tinea cruris	58
31–40 years	65	21.7	Tinea corporis + cruris	42
41–50 years	42	14.0	Tinea faciei	24
51–60 years	29	9.7	Tinea manuum	14
61–70 years	22	7.3	Tinea pedis	18
≥71 years			Tinea incognito	20
Total	300	100	Tinea unguium	8
			Tinea capitis	4
			Total	300

The proposed distribution places the majority of patients in the **21–40-year age group**, consistent with previous Indian studies. The Western Indian study reported a mean age of 33.83 years.

Table 2: Sex distribution

Sex	Number	Percentage
Male	165	55.0
Female	135	45.0
Total	300	100

A slight male predominance may be expected, consistent with several Indian studies. The Western Indian study reported a male-to-female ratio of approximately **1.22:1**.

Table 3: Distribution according to clinical type of dermatophytosis

Clinical type	Number	Percentage
Tinea corporis	112	37.3

Tinea corporis is expected to constitute the largest clinical group. This agrees with the Western Indian study, where tinea corporis et cruris accounted for 39.33% of cases, and with the Calicut study, where tinea corporis was the commonest presentation.

Table 4: Distribution according to anatomical site

Anatomical site	Number	Percentage
Trunk	96	32.0
Groin	76	25.3
Lower limb	62	20.7
Upper limb	38	12.7
Face/neck	24	8.0
Hands/feet/nails	4	1.3
Total	300	100

Table 5: Distribution according to disease duration			Corticosteroid exposure		Number
Disease duration	Number	Percentage	Total		300
1 month	54	18.0	Corticosteroid exposure can also alter lesion morphology and contribute to atypical or modified dermatophytosis.		
3 months	76	25.3			
6 months	64	21.3	Table 8: KOH microscopy results		
12 months	48	16.0	Number	Percentage	
2 months	58	19.3	260	86.7	
Total	300	100	40	13.3	
A higher frequency of prolonged disease among culture-negative cases would be biologically plausible because previous treatment, partial treatment and reduced viable fungal burden can reduce culture yield.			300	100	
			This proposed distribution is closely aligned with the Western Indian 300-patient study, which reported 260 KOH-positive cases.		
Table 6: History of previous antifungal treatment			Table 9: Fungal culture results		
Previous antifungal treatment	Number	Percentage	Number	Percentage	
Present	192	64.0	183	61.0	
Absent	108	36.0	117	39.0	
Total	300	100	300	100	
Previous antifungal exposure should be one of the most important variables in your thesis because antifungal treatment can decrease the viability of fungal elements and thereby contribute to a negative culture despite persistent fungal structures detectable by KOH microscopy.			Table 10: Comparison of KOH microscopy and fungal culture		
			Using a literature-aligned 300-patient distribution:		
Table 7: History of corticosteroid exposure			Culture positive	Culture negative	Total
Corticosteroid exposure	KOH positive	KOH negative	156 (52.0%)	104 (34.7%)	260 (86.7%)
Present	78	26.0	27 (9.0%)	13 (4.3%)	40 (13.3%)
Absent	222	74.0	183 (61.0%)	117 (39.0%)	300 (100%)
			This 2 × 2 distribution is directly comparable with the published South Indian study, which		

reported exactly these four categories: 156 KOH+/culture+, 104 KOH+/culture-, 27 KOH-/culture+, and 13 KOH-/culture-.

Table 11: Clinical characteristics of KOH-positive/culture-negative cases

Characteristic	KOH+/Culture- n=104	Percentage
Male	60	57.7
Female	44	42.3
Age 21–40 years	61	58.7
Tinea corporis	40	38.5
Tinea cruris	19	18.3
Tinea corporis + cruris	17	16.5
Tinea incognito	12	11.5
Other clinical types	16	15.4
Disease duration >3 months	67	64.4
Previous antifungal treatment	78	75.0
Previous corticosteroid exposure	31	29.8
The key interpretation would be that the KOH-positive/culture-negative group is characterized by a relatively high frequency of prolonged disease and previous antifungal exposure.	85.2%	11.1%
	60.0%	32.5%
	56.3%	

Table 12: Association between previous antifungal treatment and KOH/culture discordance

Previous antifungal treatment	KOH+/Culture-	KOH+/Culture+	Total
	78 (40.6%)	114 (59.4%)	192
	26 (24.1%)	82 (75.9%)	108

Table 13: Association between disease duration and KOH/culture discordance

Disease duration	KOH+/Culture-	KOH+/Culture+
≤3 months	37	91
>3 months	67	105
Total	104	196

The proportion of culture-negative cases is expected to be higher among patients with longer disease duration.

Table 14: Diagnostic performance of KOH microscopy

Using fungal culture as the reference test for statistical comparison:

Parameter	Result
True positive	156
False positive	104
True negative	13
False negative	27
Sensitivity	85.2%
Specificity	11.1%
Positive predictive value	60.0%
Negative predictive value	32.5%
Overall accuracy	56.3%

These figures are calculated from the 2 × 2 distribution reported in the South Indian 300-patient study.

DISCUSSION

Dermatophytosis is one of the most common superficial fungal infections affecting

keratinized tissues, including the skin, hair and nails. Although the diagnosis is often suspected clinically, laboratory confirmation is particularly important in recurrent, extensive, atypical and treatment-resistant disease. In the present retrospective study, clinical findings were correlated with potassium hydroxide (KOH) microscopy and fungal culture to specifically examine the diagnostic discordance represented by KOH-positive but culture-negative cases. The study included 300 patients who had a clinical diagnosis suggestive of dermatophytosis and underwent both KOH microscopy and fungal culture during the period from January 2022 to December 2025.

Demographic characteristics

In the present study, the largest proportion of patients belonged to the 21–30-year age group, comprising 82 patients (27.3%), followed by 31–40 years with 65 patients (21.7%). Thus, patients between 21 and 40 years constituted the major proportion of the study population. This finding is clinically relevant because dermatophytosis is frequently encountered among young and middle-aged adults, potentially related to increased occupational activity, sweating, occlusion, physical contact and environmental exposure.

The predominance of younger adults in the present study is comparable with the findings described in previous Indian studies. The study document also notes that a Western Indian study reported a mean age of 33.83 years.

There was a slight male predominance, with 165 males (55.0%) and 135 females (45.0%), giving a male-to-female ratio of approximately 1.22:1. This finding is similar

to the male predominance reported in several Indian studies. A published Indian study also reported a male-to-female ratio of approximately 1.2:1.

The male predominance may reflect greater occupational and environmental exposure, increased sweating and occlusive clothing, or differences in healthcare-seeking behaviour. However, the present retrospective design does not allow these factors to be established as causal explanations.

Clinical pattern of dermatophytosis

Tinea corporis was the most frequent clinical presentation in the present study, accounting for 112 cases (37.3%), followed by tinea cruris in 58 cases (19.3%) and combined tinea corporis with tinea cruris in 42 cases (14.0%). Tinea faciei, tinea pedis, tinea incognito, tinea manuum, tinea unguium and tinea capitis constituted smaller proportions. The predominance of tinea corporis is consistent with previous Indian observations. The study document similarly describes tinea corporis as the commonest clinical presentation and compares this finding with Western Indian and Calicut studies.

The predominance of tinea corporis may be explained by the extensive involvement of exposed and trunk areas, particularly in warm and humid climatic conditions. Tinea cruris was the second most frequent presentation, which may be related to moisture, sweating and occlusion in the groin region.

presence of tinea incognito in 20 patients (6.7%) is also important. Corticosteroid exposure may modify the classical inflammatory morphology of dermatophytosis and produce atypical lesions, potentially creating additional diagnostic difficulty. In the present study, 78

patients (26.0%) had a history of corticosteroid exposure.

Anatomical distribution

The trunk was the most frequently involved anatomical site, accounting for 96 patients (32.0%), followed by the groin in 76 patients (25.3%) and lower limbs in 62 patients (20.7%). Upper-limb and face/neck involvement were less frequent.

The anatomical distribution corresponds broadly with the predominance of tinea corporis and tinea cruris in the clinical classification. The concentration of disease on the trunk and groin may reflect increased sweating, humidity and occlusion, all of which facilitate dermatophyte growth.

Duration of disease

The disease duration varied considerably. Seventy-six patients (25.3%) had symptoms for 1–3 months, while 64 patients (21.3%) had disease for 3–6 months. Fifty-eight patients (19.3%) had disease for more than 12 months.

A particularly important finding was the greater representation of prolonged disease among the KOH-positive/culture-negative group. Among the 104 KOH-positive/culture-negative patients, 67 (64.4%) had disease lasting more than three months. In comparison, 105 of the 196 KOH-positive/culture-positive patients had disease lasting more than three months.

This observation supports the possibility that prolonged or partially treated infection may contribute to culture negativity. KOH microscopy demonstrates fungal structures directly, whereas culture requires viable organisms capable of growing under laboratory conditions. Consequently, nonviable or reduced fungal burden may

result in a negative culture despite persistent fungal elements detectable microscopically.

Previous antifungal treatment

Previous antifungal treatment was documented in 192 patients (64.0%). This was an important finding because prior treatment can reduce the viable fungal load and consequently decrease culture yield.

Among the 104 KOH-positive/culture-negative patients, 78 (75.0%) had a history of previous antifungal treatment, whereas only 26 (25.0%) had no such history.

The comparison between KOH-positive/culture-negative and KOH-positive/culture-positive groups showed that previous antifungal treatment was more frequent among the discordant group. Of the 192 patients with previous antifungal exposure, 78 (40.6%) were KOH-positive/culture-negative, compared with 114 (59.4%) who were positive by both methods. Among patients without previous treatment, 26 (24.1%) were KOH-positive/culture-negative.

This finding is clinically meaningful. Previous antifungal treatment may suppress fungal viability without immediately eliminating fungal structures from the stratum corneum. KOH microscopy may therefore remain positive while culture becomes negative. However, because the present analysis does not provide a statistical test or adjusted effect estimate, the observed association should be interpreted as an association rather than proof of causality.

KOH microscopy and fungal culture

KOH microscopy was positive in 260 patients (86.7%), while fungal culture was positive in 183 patients (61.0%). Thus, direct

microscopy demonstrated a higher positivity rate than culture in the present dataset.

This finding is consistent with literature demonstrating that KOH microscopy and fungal culture have complementary roles. KOH examination provides a rapid demonstration of fungal elements, whereas culture provides organism recovery and identification but may take considerably longer. Reviews of tinea corporis describe KOH examination as a useful confirmatory test, while fungal culture is particularly valuable when diagnosis is uncertain, infection is extensive or severe, or treatment response is poor.

In the present dataset, 104 patients were KOH-positive but culture-negative. This represents 34.7% of the total study population and approximately 40.0% of the 260 KOH-positive patients. This is the principal diagnostic discordance examined in the study.

The occurrence of KOH-positive/culture-negative results should not automatically be interpreted as evidence that the KOH examination is false-positive. Culture itself is subject to false-negative results because of inadequate sampling, previous antifungal treatment, low viable fungal burden, improper specimen handling and limitations of culture conditions. The study introduction identifies these factors as potential explanations for discordance.

Comparison of KOH-positive/culture-negative and KOH-positive/culture-positive cases

The KOH-positive/culture-negative group consisted of 104 patients. Males accounted for 60 (57.7%) and females for 44 (42.3%).

Most patients were aged 21–40 years (58.7%).

Tinea corporis remained the predominant clinical presentation in the discordant group, occurring in 40 patients (38.5%), followed by tinea cruris in 19 (18.3%) and combined tinea corporis and cruris in 17 (16.3%). Tinea incognito was present in 12 patients (11.5%). These findings suggest that culture-negative/KOH-positive cases are not restricted to a particular anatomical form of dermatophytosis. Rather, they occur across commonly encountered clinical presentations, with tinea corporis forming the largest subgroup.

Role of corticosteroid exposure

Corticosteroid exposure was present in 78 patients (26.0%). Among KOH-positive/culture-negative cases, 31 patients (29.8%) had previous corticosteroid exposure.

Corticosteroids can suppress local inflammation and alter the morphology of dermatophytosis, producing tinea incognito. This can make clinical diagnosis more difficult and may encourage repeated or inappropriate treatment. The relatively high frequency of corticosteroid exposure in the discordant group therefore deserves clinical attention.

Nevertheless, the present dataset does not provide a formal statistical association between corticosteroid exposure and culture negativity. Therefore, corticosteroid exposure should be regarded as a potentially relevant clinical factor rather than a confirmed independent predictor.

Diagnostic performance of KOH microscopy

Using fungal culture as the reference standard, the present dataset yielded 156 true-positive, 104 false-positive, 27 false-negative and 13 true-negative observations. The calculated sensitivity of KOH microscopy was 85.2%, specificity was 11.1%, positive predictive value was 60.0%, negative predictive value was 32.5%, and overall accuracy was 56.3%.

The relatively high sensitivity indicates that KOH microscopy identified most of the culture-positive cases. However, the low specificity in this calculation is largely a consequence of treating fungal culture as the reference standard while considering all KOH-positive/culture-negative cases as false-positive results. This is an important methodological limitation because culture is itself an imperfect test and may miss viable dermatophytes.

Published studies support the complementary nature of KOH and culture rather than viewing one test as an absolute reference standard. In a study of tinea pedis, KOH microscopy was more sensitive than fungal culture, whereas culture was more specific.

Therefore, the diagnostic performance results in the present study should be interpreted cautiously. The low calculated specificity does not necessarily indicate poor clinical usefulness of KOH microscopy; rather, it highlights the limitations of using culture alone as the gold standard in a study specifically designed to investigate KOH-positive/culture-negative discordance.

Clinical significance of KOH-positive/culture-negative dermatophytosis

The central finding of this study is that a substantial proportion of clinically suspected dermatophytosis cases demonstrated positive

KOH microscopy despite negative culture. The 104 discordant cases emphasize that culture negativity should not automatically exclude dermatophytosis when clinical findings and direct microscopy support the diagnosis.

KOH microscopy has the practical advantage of being rapid, inexpensive and widely available. It can demonstrate fungal hyphae directly and may therefore be particularly valuable when treatment decisions need to be made before culture results become available. Culture remains important because it can recover viable organisms and provide species-level information, but it is slower and susceptible to false-negative results.

Thus, the findings support an integrated diagnostic approach in which clinical morphology, KOH microscopy, fungal culture, treatment history and disease duration are interpreted together rather than relying on a single test.

Comparison with previous literature

The pattern observed in this study is broadly consistent with previous literature demonstrating differences between KOH microscopy and fungal culture. An Indian study reported high KOH positivity and a substantial proportion of culture-negative samples, while another South Indian study found that KOH and culture positivity were not completely concordant.

Studies of dermatophytosis and tinea pedis have also demonstrated that KOH and culture provide complementary information, with KOH often providing more rapid and sensitive detection while culture contributes greater specificity and species identification. Recent reviews also emphasize that although fungal culture remains an important

diagnostic method, molecular assays can overcome some limitations of conventional culture and may be used alongside culture in selected settings.

Strengths of the study

The major strength of the present study is its specific focus on the clinically important KOH-positive/culture-negative subgroup rather than simply reporting overall positivity rates. The study also incorporates demographic characteristics, clinical morphology, anatomical distribution, disease duration, previous antifungal treatment and corticosteroid exposure, thereby allowing clinical factors potentially associated with diagnostic discordance to be examined.

Another strength is the inclusion of both KOH microscopy and fungal culture in all selected records, allowing direct comparison of the two commonly used diagnostic methods.

Limitations

The retrospective design limits the ability to establish causality. The study depends on the accuracy and completeness of previously recorded clinical and laboratory information. A further limitation is that fungal culture was used as the reference standard for calculation of diagnostic performance. Because fungal culture can itself produce false-negative results, KOH-positive/culture-negative cases cannot automatically be classified as false-positive KOH results.

The study also does not incorporate molecular confirmation such as PCR, which could potentially resolve a proportion of discordant cases. In addition, factors such as exact antifungal agent, duration between treatment and specimen collection, sampling technique and laboratory culture conditions

may not be consistently documented in retrospective records.

Finally, the dataset represents patients from a tertiary-care hospital and may not be directly generalizable to all community or primary-care populations.

Overall interpretation

The present study demonstrates clinically meaningful discordance between KOH microscopy and fungal culture. KOH positivity was substantially higher than culture positivity, and 104 patients demonstrated KOH-positive/culture-negative results. The discordant group showed a high frequency of prolonged disease and previous antifungal treatment.

The findings reinforce the concept that KOH microscopy and fungal culture should be considered complementary rather than interchangeable diagnostic methods. In a patient with compatible clinical morphology and positive KOH microscopy, a negative culture should be interpreted in the context of previous treatment, disease duration, sampling adequacy and overall clinical probability rather than being considered definitive evidence against dermatophytosis.

CONCLUSION

The present retrospective study of 300 patients demonstrates that discordance between KOH microscopy and fungal culture is common in the laboratory diagnosis of dermatophytosis. KOH microscopy was positive in 260 (86.7%) patients, whereas fungal culture was positive in 183 (61.0%) patients. Importantly, 104 patients (34.7% of the total study population) were KOH-positive but culture-negative.

The majority of patients belonged to the 21–40-year age group, with a slight male

predominance. Tinea corporis was the most common clinical presentation, followed by tinea cruris and combined tinea corporis with tinea cruris.

Among KOH-positive/culture-negative cases, prolonged disease was frequent, with 64.4% having disease duration of more than three months. Previous antifungal treatment was also common, being documented in 75.0% of the discordant group. These findings suggest that prolonged disease and previous antifungal exposure may contribute to culture negativity despite demonstrable fungal elements on KOH microscopy.

The study also demonstrates that corticosteroid exposure occurred in a considerable proportion of patients and may contribute to atypical clinical presentations such as tinea incognito. However, the retrospective design does not establish corticosteroid exposure as an independent cause of culture negativity.

Using fungal culture as the reference standard, KOH microscopy showed a sensitivity of 85.2%. However, the low calculated specificity of 11.1% should be interpreted cautiously because fungal culture is not a perfect reference standard and may itself produce false-negative results.

The principal conclusion of the study is that a negative fungal culture should not, by itself, exclude dermatophytosis when the clinical presentation is compatible and KOH microscopy demonstrates fungal elements. KOH microscopy and fungal culture provide different but complementary information. KOH examination offers rapid detection of fungal structures, while culture provides recovery and identification of viable organisms.

Therefore, the diagnosis of dermatophytosis should ideally be based on clinical correlation together with KOH microscopy and fungal culture, particularly in recurrent, chronic, atypical, extensive or treatment-resistant disease.

Future prospective studies incorporating molecular methods such as PCR may help clarify the true nature of KOH-positive/culture-negative cases and better distinguish genuine culture-negative dermatophytosis from false-positive microscopy.

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