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A Study for Determining the Risk Factors and Mycological Spectrum in Patients with Otomycosis

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Abstract

Introduction: Otomycosis is a superficial fungal infection of the external auditory canal commonly seen in tropical climates, associated with itching, pain, and discharge. Behavioral and environmental factors play a key role in its development.

Objective: To evaluate the risk factors and determine the mycological spectrum in patients with otomycosis.

Methods: A hospital-based cross-sectional study was conducted over 18 months including 125 patients. Clinical evaluation and otoscopic examination were performed. Samples were analyzed using KOH mount and fungal culture on Sabouraud Dextrose Agar.

Result: Most patients were aged 21–30 years with male predominance. Itching (91.2%) was the most common symptom. Self-cleaning trauma (65.6%) was the leading risk factor. Maximum cases occurred during monsoon (37.6%). Culture positivity was 96.8%, with Aspergillus niger (39.7%) as the most common isolate followed by other Aspergillus species and Candida albicans.

Conclusion: Otomycosis is strongly associated with modifiable behavioral factors and humid climate. Aspergillus species are the predominant pathogens. Early diagnosis and prevention of risk factors are essential for effective management.

Keywords: Otomycosis, Risk Factors, Aspergillus, Candida, Mycological Spectrum.

Introduction

Otomycosis is a superficial fungal infection of the external auditory canal characterized by symptoms such as pruritus, otalgia, aural fullness, ear discharge, and conductive hearing impairment. It is particularly common in tropical and subtropical regions where warm and humid conditions promote fungal growth. Predisposing factors include habitual ear manipulation, use of unsterile objects for ear cleaning, excessive moisture exposure, prolonged use of topical antibiotic or steroidal ear drops, and immunocompromised states. Aspergillus and Candida genera constitute the predominant etiological

agents, though species distribution varies across geographical regions.

The external auditory canal maintains a delicate ecological balance through epithelial migration, cerumen production, and an acidic environment that collectively inhibit microbial growth. Disruption of this balance by mechanical, chemical, or environmental factors can facilitate fungal colonization and subsequent infection. In recent years, lifestyle and behavioral changes such as frequent use of earphones, increased water exposure during bathing or recreational activities, and widespread self-medication with topical preparations have altered the ear canal environment, increasing susceptibility to otomycosis.

Clinically, otomycosis presents a diagnostic dilemma because its manifestations closely resemble those of other inflammatory conditions, particularly bacterial otitis externa. Consequently, empirical treatment without confirmation of fungal etiology is common, which may result in persistent symptoms, recurrence, and inappropriate medication use. Repeated or inadequate treatment can further modify the local ear environment, creating a cycle of temporary improvement followed by recurrence.

This highlights the importance of a more systematic and evidence-based approach to diagnosis.

Beyond its immediate symptoms, otomycosis can significantly affect quality of life by causing persistent discomfort, irritation, and hearing disturbances. It also contributes to increased healthcare utilization through repeated outpatient visits and medication use. Furthermore, irrational antimicrobial therapy may influence microbial ecology and contribute to drug resistance.

The etiological agents of otomycosis and the associated risk factors vary according to environmental, geographical, and host-related factors. Therefore, identifying the predominant fungal species and understanding local predisposing factors are essential for effective treatment and prevention of recurrence.

Rationale of the Study: Despite being a common otological condition, otomycosis remains underdiagnosed and underreported due to its overlapping clinical features with bacterial otitis externa and the lack of routine mycological investigations. Empirical use of antibiotics and steroids often leads to relapse and possible antifungal resistance. Given the regional variations in fungal flora, climate, socioeconomic conditions, and healthcare access in India, localized epidemiological studies are crucial for understanding the mycological spectrum and guiding appropriate management strategies.

Aim and Objectives

Aim

To evaluate the risk factors and determine the mycological spectrum in patients diagnosed with otomycosis attending the Department of Otorhinolaryngology at KDMCH & RC, Mathura.

Objectives

Primary Objectives

- To identify and analyze the various predisposing risk factors associated with otomycosis.
- To isolate and identify the different fungal species responsible for otomycosis.

Secondary Objectives

- To study the demographic distribution of patients with otomycosis in terms of age and gender.
- To assess the association of environmental factors (such as season and humidity) with the occurrence of otomycosis.
- To evaluate the clinical presentation and symptom profile of patients with otomycosis.

- To determine the relative frequency of different fungal isolates (e.g., Aspergillus, Candida, etc.).

Materials and Methods

Study Design

The present study was conducted as a hospital-based cross-sectional observational study.

Study Setting

The study was carried out in the Department of Otorhinolaryngology (ENT), K.D. Medical College, Hospital and Research Centre, Mathura, Uttar Pradesh, over a period of 18 months (May 2024 to November 2025) after obtaining approval from the Institutional Ethics Committee.

Study Population

The study included patients clinically diagnosed with otomycosis attending the ENT outpatient department (OPD).

Sample Size Calculation

Sample Size - 125 patients

Sample size (n)= Z2.p.q/ d2

= (1.96)2 .9 .91/ (5)2

= 3144.96/ 25

= 125.79

Where Z = confidence level at 95%

p= estimated prevalence or proportion of the project

q= 1-p

d= absolute error or precision

Selection of Subjects:

Inclusion Criteria

- Patients clinically diagnosed with otomycosis based on history and otoscopic findings
- Patients willing to participate and provide informed consent

Exclusion Criteria

- Patients without otoscopic evidence of fungal infection
- Patients not consenting for microbiological evaluation

Variables Studied

- Demographic variables (age, gender, occupation)
- Risk factors [poor hygiene, self-cleaning trauma, oil instillation, antibiotic/ steroid ear drops prolonged use, water exposure- swimming/ pond bathing, associated ear pathology (including CSOM), immunocompromised status, seasonal variation]
- Type of fungal organism isolated

Assessment of Risk Factors

Detailed evaluation of predisposing factors was carried out using a structured proforma.

1. Poor Hygiene (Operational Definition)

Poor hygienic condition was assessed based on:

- Habit of inserting contaminated objects (matchsticks, pins, earbuds)
- Presence of visible dirt/ debris around the pinna and external auditory canal
- Wearing occlusive ear devices (hearing aids/ earphones) for prolonged periods without cleaning them regularly.

Patients fulfilling one or more of these criteria were categorized as having poor aural hygiene.

2. Seasonal Variation Classification (Operational Definition

Seasonal variation was assessed on the basis of calendar month classification into five categories:

- Spring: March to April
- Summer: May to June
- Monsoon (Rainy): July to September
- Post-monsoon/Autumn: October to November
- Winter: December to February

Each case was categorized based on the month of presentation, and its association with otomycosis incidence and fungal species was analyzed.

Result & Discussion

Table 1: Age Distribution

Age Group (Years)	Number	Percentage
≤10	8	6.4
11–20	22	17.6
21–30	39	31.2
31–40	26	20.8
41–50	18	14.4
>50	12	9.6
Total	**125**	**100**

With respect to age distribution, the highest incidence in our study was observed in the 21–30 years age group (31.2%), followed by 31–40 years (20.8%),11–20 years (17.6%) and 41-50 years (14.4%). This predominance in young adults aligns closely with the findings of Singh TD et al.[1], who reported the highest prevalence in the 21–30 years age group among 100 patients. The consistency of these findings suggests that increased environmental exposure, outdoor activity, occupational dust contact, and frequent self-cleaning practices in younger adults significantly contribute to disease occurrence. The relatively lower prevalence in extremes of age in our study is comparable to Khandagale P et al.[2], reinforcing the concept that otomycosis is largely a disease of active age groups rather than pediatric or geriatric populations.

Table 2: Gender Distribution

Gender	Number	Percentage
Male	69	55.2
Female	56	44.8

Our study demonstrated a slight male predominance with male constituting 55.2% and females 44.8%, similar to Agarwal P et al.[3] and Moorthy RP et al.[4]. However, contrasting observations were made by Somo Iwewe et al.[5] who documented female predominance. These differences likely reflect sociocultural and occupational variations across regions rather than inherent biological susceptibility. In our region, higher male involvement may be attributed to increased agricultural and outdoor occupations, which was also supported by occupation-based analysis.

Table 3: Occupational Distribution

Occupation	Number	Percentage
Agriculturists	33	26.4
Labourers	27	21.6
Students	28	22.4
Housewives / Maids	22	17.6
Indoor workers	15	12

Agriculturists are the most affected group (26.4%), followed by students (22.4%), labourers (21.6%), housewives/maids (17.6%), and indoor workers (12%), due to strong environmental exposure to fungal spores present in soil and decaying organic matter, similar with the findings from Moorthy RP et al.[4] and Agarwal P et al.[3] who highlighted rural populations and outdoor exposure as significant contributors.

Table 4: Presenting Symptoms

Symptom	Number	Percentage
Itching	114	91.2
Aural fullness	96	76.8
Earache	83	66.4
Aural discharge	72	57.6
Hearing impairment	68	54.4

The clinical presentation in our study demonstrated itching as the most common symptom. The predominance of itching is consistent across almost all major studies. Somo Iwewe et al.[5] documented 85%, and Khandagale P et al.[2] observed itching in 83% of cases. The high proportion of itching in our study strengthens its diagnostic significance as a cardinal symptom of otomycosis.

Table 5: Prevalence of Risk Factors

Risk Factor	Number	Percentage
Self-cleaning trauma	82	65.6
Poor hygiene	63	50.4
Oil instillation	48	38.4
Antibiotic/steroid ear drop prolonged use	46	36.8
Swimming / pond bathing	29	23.2
Associated ear pathology (including CSOM)	26	20.8
Immunocompromised status	14	11.2

In the present study, self-cleaning trauma was the most significant predisposing factor, identified in 65.6% of patients. This prevalence was higher than that reported by Prasad SC et al.[6] (32%), Moorthy RP et al.[4] (50%). This finding indicates that strong cultural tendency towards aggressive self-ear cleaning practices in our region. Similarly, Asok S et al.[7] recognized habitual ear manipulation with unsterile objects as the most common risk factor. Mechanical trauma to the external auditory canal disrupts the epithelial barrier, causes inflammation and desquamation, and removes the protective effect of cerumen, thereby facilitating fungal colonization. Poor hygiene was identified in 50.4% of our patients, described as a major risk determinant by Bojanović M et al.[8] and Al-Oebady et al.[9]

Table 6: Seasonal Distribution

Season	Cases	Percentage
Summer	30	24
Monsoon	47	37.6
Autumn / Post-monsoon	22	17.6
Winter	15	12
Spring	11	8.8
Total	**125**	**100**

The present study demonstrated a clear seasonal variation in otomycosis incidence, with the highest prevalence during the monsoon season (37.6%), followed by summer (24%), post-monsoon (17.6%), winter (12%), and spring (8.8%). This monsoon predominance is comparable to the findings of Samorekar et al.[10], who reported a peak incidence during post-monsoon months (58.25%).

These observations are also consistent with the climatic associations described by Bojanović M et al.[8], emphasizing the role of tropical and subtropical humidity in the development of otomycosis. Increased humidity promotes fungal sporulation and moisture retention within the EAC, creating favourable conditions for fungal growth, suggesting that environmental conditions may amplify predisposing habits.

Table 7: Fungal Culture Results

Culture Result	Number	Percentage
Culture Positive	121	96.80%
Culture Negative	4	3.20%
Total	**125**	**100%**

The culture positivity rate in our study was remarkably high at 96.8%, exceeding the rates reported by Diop A et al.[11] (85.37%), Javidnia J et al.[12] (51%) and Itor E et al.[13] (46.22%). This high positivity rate likely reflects meticulous sample collection, appropriate laboratory

processing, and the inclusion of clinically typical cases of otomycosis.

Nazari T et al.[14] noted that molecular diagnostic techniques may identify a wider range of fungal species than conventional culture methods. Nevertheless, despite relying on traditional methods, our findings demonstrated a predominance of Aspergillus and Candida species comparable to molecular studies. This suggests that conventional culture remains a reliable and practical diagnostic tool for routine clinical evaluation of otomycosis.

Table 8: Fungal Infection Pattern

Infection Type	Number	Percentage (%)
Pure fungal	108	89.3
Mixed	13	10.7
Total	**121**	**100**

One of the notable findings of our study was the predominance of pure fungal infections (89.3%) compared to mixed infections (10.7%). This distribution is comparable to the findings of Agarwal P et al.[3], who reported mixed infections in 11% of cases, suggesting that primary fungal colonization remains the principal pathogenic process in most patients. In contrast, Itor E et al.[13] reported a considerably higher mixed fungal–bacterial colonization rate of 32.44%, indicating significant regional variation in microbial ecology.

Prasad SC et al.[6] documented the coexistence of bacterial pathogens such as Staphylococcus aureus and Pseudomonas aeruginosa with fungal isolates and also identified fungal organisms in 42% of healthy external auditory canals. These observations highlight the importance of distinguishing colonization from true infection and demonstrate the dynamic interplay between fungal and bacterial flora. Although bacterial co-isolates were not systematically evaluated in our study, the marked predominance of pure fungal infections suggests that fungal overgrowth, rather than polymicrobial synergy, is the dominant pathogenic mechanism in our study population.

Table 9: Mycological Spectrum

Fungal Species	Number	Percentage (%)
Aspergillus niger	48	39.7
Aspergillus flavus	23	19
Aspergillus fumigatus	19	15.7
Candida albicans	17	14
Candida tropicalis	5	4.1
Candida krusei	3	2.5
Penicillium	2	1.7
Mucor	2	1.7
Alternaria	1	0.8
Fusarium	1	0.8
Malassezia	0	0
Total	**121**	**100**

In our study Aspergillus species predominated, with Aspergillus niger (39.7%) being the most common isolate, followed by A. flavus (19%), A. fumigatus (15.7%), and Candida albicans (14%). These findings are in agreement with several previous studies by Prasad SC et al.[6], Moorthy RP et al.[4], Samorekar et al.[10], T B et al.[15], Khandagale P et al.[2], and Sogebi O et al.[16], all of whom reported A. niger as the predominant etiological agent of otomycosis. The systematic review and meta-analysis by Nazari T et al.[14] also confirmed the global predominance of Aspergillus species, particularly A. niger. Candida species constituted the second most common group of isolates in our study, comparable to the findings of Moorthy RP et al.[4], Javidnia J et al.[12], and Nazari T et al.[14] Rare isolates such as Penicillium, Mucor, Alternaria,

and Fusarium were identified only occasionally, indicating limited fungal diversity.

Table 10: Risk Factors vs Fungal Species

Fungal Species	Self cleaning	Poor Hygiene	Oil instillation	Antibiotic /steroid ear drops prolonged use	Swimming	Ear pathology (including CSOM)	Immuno-compro-mised
Aspergillus niger	31	24	14	14	11	9	5
Aspergillus flavus	18	12	6	8	6	5	3
Aspergillus fumigatus	15	11	8	6	4	3	2
Candida albicans	10	9	12	10	4	6	3
Candida tropicalis	3	2	4	3	1	1	1
Candida krusei	2	1	2	1	1	1	0
Penicillium	1	1	1	1	1	1	0
Mucor	0	1	1	1	0	0	0
Alternaria	1	0	0	0	0	0	0
Fusarium	0	0	0	0	0	0	0
Malassezia	0	0	0	0	0	0	0

The association between specific risk factors and fungal species in our study further strengthens the etiopathogenic correlation. Self-cleaning trauma, poor hygiene, oil instillation and prolonged antibiotic use were predominantly associated with Aspergillus species, while among Candida infections (mainly Candida Albicans) oil instillation was one of the major risk factors. This pattern closely mirrors findings from Moorthy RP et al.(4), who observed a strong association of Aspergillus isolates with habitual self-cleaning and Candida with oil instillation practices. Such correlations provide mechanistic insight: mechanical trauma facilitates spore implantation and colonization by environmental molds like Aspergillus, whereas oil-induced maceration and altered microflora favor opportunistic yeast proliferation.

Table 11: Otoscopic Findings vs Fungal Species

Fungal Species	Black/Pepper-like	Yellowish-Green / Pale Green	Greyish-Green / Smoky Green	Thick Creamy White	Cream to slightly Yellow	White to Grey cotton wool like	Blue-Greenish fluffy	Dark Brown to Black	Row Total
Aspergillus niger	48	0	0	0	0	0	0	0	48
Aspergillus flavus	0	23	0	0	0	0	0	0	23
Aspergillus fumigatus	0	0	19	0	0	0	0	0	19
Candida albicans	0	0	0	17	0	0	0	0	17
Candida tropicalis	0	0	0	0	5	0	0	0	5
Candida krusei	0	0	0	0	3	0	0	0	3
Penicillium	0	0	0	0	0	0	2	0	2
Mucor	0	0	0	0	0	2	0	0	2
Fusarium	0	0	0	0	0	1	0	0	1
Alternaria	0	0	0	0	0	0	0	1	1
Total	**48**	**23**	**19**	**17**	**8**	**3**	**2**	**1**	**121**

Black debris was predominantly associated with Aspergillus niger, the most common isolate in our series (48 cases). Aspergillus flavus (23 cases) consistently produced yellowish-green or pale-green debris, while Aspergillus fumigatus (19 cases) characteristically showed greyish-green or smoky-green appearances. These findings support the long-standing clinical observation that fungal colony pigmentation often reflects the causative species. In contrast, Candida infections typically presented with white or creamy debris. Candida albicans accounted for 17 cases (13.6%), all demonstrating thick creamy or curdy-white material. Candida tropicalis (5 cases) and Candida krusei (3 cases) also produced lighter-colored debris ranging from cream to pale yellow, highlighting the relatively non-pigmented nature of Candida species compared to Aspergillus.

T B et al.[15] and Diop A et al.[11] observed that Aspergillus niger was frequently associated with black or dark-colored otoscopic debris.

Less common molds such as Penicillium (blue-green), Mucor and Fusarium (white-to-grey cotton-wool appearance), and Alternaria (dark brown to black) also demonstrated their characteristic pigment patterns.

The consistent association between fungal species and debris pigmentation observed in our study suggests that otoscopic examination can provide valuable preliminary diagnostic clues before culture confirmation. This strong correlation highlights the importance of careful otoscopic assessment in the early diagnosis and targeted management of otomycosis.

Conclusion

This study suggests that otomycosis is a multifactorial disease in which environmental exposure, behavioral habits, and host-related factors collectively contribute to the development and progression of infection. The condition predominantly affects young and active individuals, particularly those exposed to humid environments and engaged in outdoor occupations.

The study highlights that modifiable behavioral practices are quite prevalent in patients with otomycosis. Habitual self-cleaning of the ear, poor hygiene practices, oil instillation, and inappropriate or prolonged use of topical antibiotic or steroid ear drops significantly disturb the natural defense mechanisms of the external auditory canal. These practices lead to epithelial trauma, alteration of normal microbial flora, and retention of moisture, thereby creating a favorable environment for fungal colonization and growth. The strong association of these factors with infection emphasizes the importance of preventive counseling and community education.

Clinically, otomycosis commonly presents with pruritus as the most prominent symptom, often accompanied by aural fullness, earache, discharge, and varying degrees of hearing impairment. The infection is usually unilateral, although bilateral involvement may occur in individuals with persistent risk factors such as poor hygiene and oil instillation. Otoscopic examination often provides characteristic findings that aid in preliminary diagnosis; however, laboratory confirmation remains essential for definitive identification of the causative organism.

The mycological analysis confirms that filamentous fungi, particularly species of Aspergillus, constitute the predominant etiological agents, while Candida species represent the principal yeast pathogens. The predominance of Aspergillus reflects its widespread presence in soil, dust, and organic matter, especially in tropical and agricultural environments. Yeast infections appear to be more closely related to altered canal conditions resulting from oil instillation and antibiotic misuse. Seasonal variation observed in the study further reinforces the role of humidity and moisture in enhancing fungal proliferation.

The findings of this study underscore the importance of accurate microbiological diagnosis, meticulous aural toileting, and appropriate topical antifungal therapy for effective management. Equally important is the need to discourage harmful ear practices and promote rational use of medications to prevent recurrence and complications.

In conclusion, otomycosis is a common yet preventable fungal infection strongly influenced by behavioral and environmental factors. A comprehensive strategy integrating early diagnosis, targeted treatment, and public health education is essential to reduce disease burden, prevent recurrence, and improve overall patient outcome.

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