

# Otomycosis and associated factors in chronic suppurative otitis media patients at a tertiary hospital in Central part of Ethiopia: an original article

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## Abstract

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**Background:** Otomycosis is a fungal infection of the ear canal caused by different species of fungus. There is a wide variation in its prevalence depending on the geographical locations where the studies are conducted.

**Objective:** This study aimed to assess the magnitude of otomycosis and elaborate on the associated factors in chronic suppurative otitis media patients at the Ear, Nose, and Throat (ENT) outpatient clinic.

**Methods:** A cross-sectional study was conducted at a tertiary hospital in central Ethiopia from September 2021 to December 30, 2021. The study included 423 patients who were selected using a convenient sampling method. A structured questionnaire was used for data collection, and otomicroscopy was employed for diagnosing fungal infections. Data entry was performed using Epi info 7 software and analyzed using SPSS version 20, including descriptive statistics, univariate, and multivariable logistic regression to control for confounding variables.

**Result:** Among the 423 patients with chronic otitis media, 97 (22.9%) were diagnosed with otomycosis. The highest prevalence of otomycosis was observed in the age group of 16-30 years. Factors associated with otomycosis in patients with chronic suppurative otitis media included being female (adjusted odds ratio [AOR] = 2.191, 95% confidence interval [CI] 1.276-3.760), being Muslim (AOR = 2.026, 95% CI 1.222-3.361), having diabetes (AOR = 5.389, 95% CI 2.352-12.350), and being HIV positive (AOR = 3.480, 95% CI 1.303-9.294).

**Conclusion:** Otomycosis frequently occurs in individuals with chronic suppurative otitis media, and its occurrence is significantly associated with the use of topical antibiotic ear drops, being female, being Muslim, having diabetes, and being HIV positive.

**Keywords:** Chronic Otitis Media, Ethiopia, Prevalence, Factors, Otomycosis.

## Background

Otomycosis is a superficial fungal infection of the ear that may include the pinna, external auditory canal, or middle ear (1). This fungal infection has been reported in both humans and animals. Local lesions observed in otitis, such as congestion, increased vascular permeability, and raised temperature, create favorable conditions for the growth of fungi and development of mycoses both in the external and middle ear, as well as in post-operative cavities, especially in cases of open-type surgery where it can present as a contaminant (2).

In recent years, there has been a dramatic increase in the incidence of mycotic infections including otomycosis (1). Otomycosis is found throughout the world. However, it is more prevalent in tropical and subtropical countries because of a high degree of humidity and hot weather. The causative agents of otomycosis involve various types of fungi, such as hyaline saprophytic mold, dematiaceous saprophytic mold, yeasts, and, rarely, pathogenic molds like dermatophytes. Notably, the most common causative agents of otomycosis are *Aspergillus*, particularly *Aspergillus Niger* and *Candida Albicans*, which has been reported by many studies (1,3,4). However, some authors have reported more than 50 causative fungi species (5). The main risk factors for otomycosis include moisture, minor inflammation, the use of broad-spectrum antibiotics, steroids, chemotherapeutic agents, topical ear drops, physical injury; living in warm and humid climates, frequent bathing or swimming, and immunocompromising conditions (6).

The clinical features of otomycosis include intense itching, discomfort or pain in the ear, watery discharge with a musty odor, ear blockage, and otalgia (7). Examined with an otomicroscope, *Aspergillus Niger* appears as black-headed filamentous growth, *Aspergillus fumigatus* as pale blue or green, and *Candida spp.* as a white or creamy deposit (2).

Otomycosis is a prevalent condition worldwide, with reports from different countries indicating a high prevalence rate ranging from 49.96% to 88.6% (4,5,8-12)). The literature consistently identifies females, young adults, and individuals practicing the Muslim faith as the main risk factors associated with otomycosis (3,6,7,9,13-15).

The clinical diagnosis of otomycosis is usually done through history and otomicroscopic evaluations which could be confirmed by fungal culture of the ear swabs (16-18). It is reported that clinical diagnosis can detect 98%

of culture-positive cases (17) with no difference between the two otomycosis diagnosis approaches (18).

Despite the significant HIV burden, rising prevalence of diabetes and cancer, and favorable geo-climatic conditions in Ethiopia, otomycosis has not received sufficient attention. Moreover, there is a lack of adequate data on the prevalence of otomycosis among patients presenting with ear complaints. Therefore, the objective of this study was to determine the magnitude and identify factors associated with otomycosis among patients with chronic suppurative otitis media attending Ear Nose and Throat outpatient clinics.

## Methods

### Study area and setting

Hospital-based cross-sectional study was conducted from September 01, 2021, to December 30, 2021. The study was conducted at ENT OPD, St. Paul's Hospital millennium medical college (SPHMMC) in Addis Ababa, Ethiopia. The college offers postgraduate otolaryngology training among other resident and subspecialty fellowship training. The college hospital is one of the largest tertiary hospitals in the country providing medical care for patients referred from all over the country.

### Study Population and Sampling

A convenient sampling technique was employed for this research. All patients with chronic suppurative otitis media, visiting ENT otology OPD at SPHMMC during the Study period were considered as the source population. And those consecutive patients who fulfill the inclusion criteria are included in the study until the sample size was met.

### Eligibility criteria

Patients who are diagnosed to have chronic suppurative otitis media (those who have continuous or intermittent purulent otorrhea that persists for more than 12 weeks and have perforated tympanic membrane on otomicroscope evaluation) were included and profound hearing loss was used as exclusion criteria as it affects proper communication.

### Sample size

The Sample size was calculated using the single population proportion formula with the assumption of a 95% level of confidence, 5% of margin

of error, and  $Z=1.96$ . Since there was no previous study, the prevalence was estimated as 50 % and by adding a nonrespondent rate of 10%, the final sample size was 423.

### Data collection instruments and techniques

Data was collected by ENT residents working in the otology outpatient clinic. Case report format (CRF) was used to collect clinical history, and clinical examination (otomicroscopic) findings. After providing verbal informed consent patients with chronic suppurative otitis media (CSOM) were enrolled in this study. Sociodemographic data (age, gender, religion, workplace, place of residence, etc.), predisposing factors (water exposure/swimming, ear trauma, use of topical ear drops), comorbid illnesses (DM, HIV), and presenting symptoms were recorded through the questionnaire. Clinical examination via otomicroscope was performed by the residents and findings were carefully recorded using CRF. Diagnosis of otomycosis in our setup is settled by history and otomicroscopic observation of fungal elements (hyphae or spores).

### Data analysis

Once the questionnaires were carefully reviewed for errors and assigned codes, the data were entered into Epi info 7 and then transferred to the SPSS version 20 software for analysis. Descriptive statistics were conducted to summarize the data. Binary logistic regression was utilized to examine potential associations between independent variables and otomycosis, while multivariable logistic regression was employed to identify independent predictors of the condition controlling for the effects of confounders. Model fitness was checked using the Hosmer-Lemeshow test which was 0.353. Findings were presented in the form of tables, figures, and text, utilizing frequencies and summary statistics to describe the study population. A p-value below 0.05 was considered statistically significant. The strength of the association between independent and dependent variables was assessed using odds ratios and 95% confidence intervals.

## Results

### Socio-demographic characteristics

A total of 423 chronic otitis media patients were included in the study with a 100% response rate. The mean age at presentation was  $28.3 \pm 12.7$  yrs. The median age was 26 years with a range of 6-80 yrs. Nearly two-thirds of the respondents, 262(62.1%) were female. The majority 297(70.2%) of them were Christians and 126(29.8%) were Muslim. Two hundred fifty-

eight (61%) of the patients reside in urban areas, of which 109(25.8%) were from Addis Ababa, 149(35.2%) were from regional towns and the remaining 165(39%) were rural dwellers.

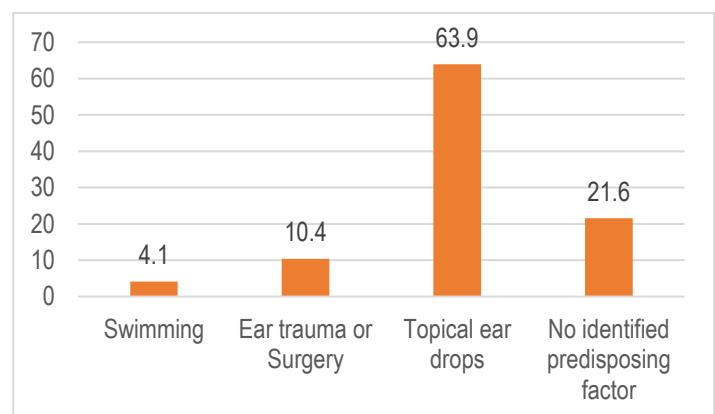
Out of the 423 patients with chronic otitis media, 97 (22.9%) were diagnosed with otomycosis. Among them, 75 (77.3%) were female and 22 (22.7%) were male. Fifty-eight (59.8%) were Christian and 39(40.2%) were Muslim (Table 1). The minimum age affected by otomycosis was 11 years and the maximum was 63 years. The highest prevalence of otomycosis was seen in the 21–30 years age group. (Table 1.)

**Table 1.** Sociodemographic characteristics and status of otomycosis at SPHMMC, ENT clinic, 2021

		Status of otomycosis		Total
		yes	no	
Gender	Female	75	187	262
	Male	22	139	161
Religion	Christian	58	239	297
	Muslim	39	87	126
Age group	<10 years	0	8	8
	11-20 years	22	110	132
	21-30 years	35	106	141
	31-40 years	24	61	85
	41-50 years	13	22	35
	51-60 years	1	9	10
	> 60 years	2	10	12
Total		97	326	423

### Predisposing Factors

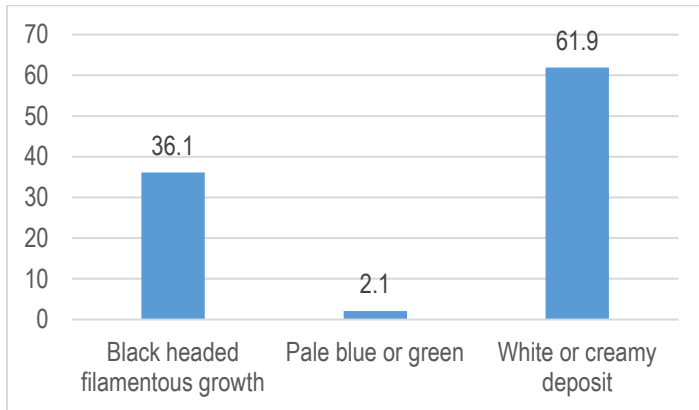
Use of topical ear drops, ear trauma/surgery, and history of swimming were found in 63.9%, 10.4%, and 4.1% of otomycosis patients, respectively. In the remaining 21.6% of cases, there was no additional identified predisposing factor other than chronic suppuration.



**Figure 1.** predisposing factors for otomycosis at SPHMMC, ENT clinic, 2021

## Clinical Features

Common presenting symptoms were ear discharge in 80.4% of cases followed by itching (55.7%), decreased hearing (45.4%), ear pain (26.8%), and aural fullness (13.4%). On otomicroscopy, white or creamy deposits were seen in 61.9%, black-headed filamentous fungal hyphae/spores were seen in 36.1%, and pale blue or green-like discharge or growth was seen in 2.1% of patients (figure2).



**Figure 2.** Microscopic findings in otomycosis patients at SPHMMC, ENT clinic, 2021.

## Known comorbid diseases

Among the total patients, 78(18.4%) had known comorbidities. The common comorbidities observed in this study were 27(6.4%) diabetes, 19(4.5%) HIV, and 32(7.5%) other chronic illnesses together (including hypertension, bronchial asthma, chronic kidney disease, and heart failure). From the total 97 patients with otomycosis, 15(15.5%) were diabetic, 8(8.2%) were HIV positive and 5(5.15%) had other chronic illness.

## Associated Factors with Otomycosis

In the binary logistic regression, the place of residence, gender, ethnicity, workplace, religion, educational status, predisposing factors, and comorbid diseases (DM, HIV, and other illnesses) were tested. Gender, religion, predisposing factors, DM, and HIV were found to have statistically significant associations with the occurrence of otomycosis with a p-value of  $\leq 0.034$ . Educational status, ethnic background, place of work, and residence did not show any significant association with otomycosis.

Variables (with p-value  $\leq 0.2$ ) in the binary logistic regression were entered into a multivariable logistic regression. In the multivariable

analysis gender, religion, and those with underlying chronic illnesses such as DM and HIV have statistically significant associations with otomycosis.

There was a positive association between otomycosis and female gender, females were about 2.191 times more likely to develop otomycosis than males [AOR=2.191, 95% CI (1.276-3.760)]. Muslims were about 2.026 times more likely to develop otomycosis compared to Christian respondents [AOR=2.026, 95% CI (1.222-3.361)]. When we see the comorbid diseases, diabetic patients are 5.389 times more likely to develop otomycosis than non-diabetics [AOR=5.389 95% CI (2.352-12.350)] and HIV-positive respondents are 3.480 times more likely to have otomycosis compared to seronegative ones [AOR=3.480, 95% CI (1.303-9.294)].

**Table 2.** Binary and multivariable logistic regression of associated factors with otomycosis in CSOM patients at SPHMMC, ENT clinic, 2021, (n=423)

Variables		Status of otomycosis		Crude OR (95% CI)	Adjusted OR (95% CI)
		Yes	No		
Gender	Female	75	187	2.534 (1.501-4.277)	2.191 (1.276-3.760) *
	Male	22	139	1	1
Educational status	Can't read & write	16	51	0.837 (0.394-1.776)	
	Read & write	16	28	1.524 (0.690-3.368)	
	Primary	20	100	0.533 (0.266-1.068)	
	Secondary	24	91	0.703 (0.359-1.379)	
	College degree	21	56	1	1
Religion	Muslim	39	87	1.847 (1.150-2.968)	2.026 (1.222-3.361) *
	Christian	58	239	1	1
Place of residence	Rural	35	130	0.851 (0.532-1.362)	
	Urban	62	196	1	1
Work place	Outdoor	41	129	1.118 (0.706-1.771)	
	Indoor	56	197	1	1
Predisposing factors	Swimming	4	1	54.857 (5.866-513.050)	
	Ear trauma/surgery	10	12	11.429 (4.424-29.520)	
	Topical ear drops	62	25	34.011 (17.902-64.617)	
	No identified predisposing factor	21	288	1	1
Diabetes	Yes	15	12	4.787 (2.157-10.621)	5.389 (2.352-12.350)*
	No	82	314	1	1
HIV	Yes	8	11	2.574 (1.005-6.594)	3.480 (1.303-9.294) *
	No	89	315	1	1
Other illnesses	Yes	5	27	0.602 (0.225-1.608)	
	No	92	299	1	1

Note: \*- statistically significant results, 1-reference category, OR- odds ratio, CI- confidence interval.

## Discussion

Otomycosis is one of the most common infections, especially in humid tropical and subtropical climates. Fungal infections of the middle ear are common as fungi thrive well in moist pus (2). In this study, otomycosis was diagnosed in 22.9 percent of chronic suppurative otitis media patients. Similar studies have reported different rates of infection. Suharshi Gupta, Than Khin Mya, Ologe, and Mahmoudabad AZ reported a higher prevalence of otomycosis ranging from 45.6 to 54.62 % (3,4,8,9). Much higher prevalence rates of otomycosis 72.72%, 74.7%, 81.3%, and 88.6% have been reported by Chander J, Kour R, Pardhan Bibhu, and Paulose KO respectively (5,7,10,11). These variations are probably associated with a difference in the geographic location of the study population and the selection of participants. In some studies, only the individuals with a strong clinical suspicion of otomycosis were included while this study enrolled all patients with chronic suppurative otitis media. Although infection occurred in all age groups, the highest prevalence was observed in 21–30 years (36.1%) followed by 31–40 years (23.7%); similar to the studies done by Mugliston T, Suharshi G, et al and Kaur R (1,3,7). There is no clear explanation for this finding, but this may be because people of this age group are the active age group involved in different activities which may expose them to the infectious environmental fungal agents present in the air. This finding is in disagreement with the findings by Ozcan KM and Colleagues (15). The present study revealed a higher prevalence of otomycosis in females compared to males. Female patients accounted for 77.3% of otomycosis cases, while males constituted 22.7% of the cases. This finding correlates well with the observations of Mahmoudabadi and Zeba A et al (9,13). This may be because females are highly involved in household work which exposed them to dusty air containing spores making them vulnerable to ear infections. In this study, the majority of the patients had unilateral disease (84.5%) and 15.5% of patients had bilateral disease. This percentage is slightly lower compared to Studies by Paulose KO and Mugliston T (1,5). In this study, the right ear (50.5%) was more commonly affected than the left (34%). This result was different from studies by Suharshi Gupta, et al, where the right ear was involved in 44.4% and the left ear in 55.6% of cases (3) Two or more of the aural symptoms were found in all the patients. The common presenting symptoms in our study in decreasing order of frequency were ear discharge, itching, decreased hearing, ear pain, and aural fullness, in 80.4%, 55.7%, 45.4%, 26.8%, and 13.4% each respectively. This finding is comparable with the observation of Bohra and

Joshi (12). However, it is different from the study made by Zeba A et al where ear pain was the dominant symptom (13). Ho T and Kaur R found out Ear blockage and Otagia to be the two common presenting symptoms (7,20). Our study showed antibiotic ear drops are identified as the most common predisposing factors (63.9%) followed by ear trauma, and swimming. This was in agreement with the study of Fasanla et al (6). Trauma or surgery of the ear is one of the predisposing factors for otomycosis which could be due to the defect in the skin caused by the injuries. Skin acts as the primary defense against various pathogens; therefore, the lack of its normal structure facilitates colonization and infection by different microorganisms including fungi. Swimming in ponds and rivers is a common way of getting such an infection because water trapped in the ear canal after bathing in a humid climate can cause fungal infection of the ear and the use of antibiotic ear drops acts as a risk factor because the antibiotic potentially can alter the relative composition of the normal microbiota of the ear and provides ample opportunity for the growth of fungus (11). Patients with comorbidities like DM are known to be more prone to otomycosis. In this study, 6.4% of cases reported that they are Diabetic, which is slightly lower than other studies which reported 8% by Fasanla J and 16% by Satish HS (6,19). Diabetes is strongly associated with otomycosis (AOR=5.389, 95% CI (2.352-12.350), p=0.000) this may be due to Hyperglycemia which provides a good culture environment for fungus, hence the need to have a strict blood sugar level control. The other comorbidity having a significant association with otomycosis in this study is HIV in which 4.5% of otomycosis patients were known RVI (AOR=3.480, 95% CI (1.303-9.294), p=.006). This was different from the study by Suharshi G where there was no HIV-positive patient in the study (3)

## Conclusion

In conclusion, from this study, it is inferred that the prevalence of otomycosis in chronic suppurative otitis media patients is significant but lower compared to other studies. Otomycosis is mainly unilateral disease, more common in the female population within the age group of 21 - 30 years. Topical antibiotic ear drops are the most common predisposing factors to otomycosis in chronic suppurative otitis media patients. Gender, religion, DM, and HIV were significantly associated with the occurrence of otomycosis. We recommend healthcare providers to give due attention to patients at risk and we encourage future researchers to do further study on the mycology of otomycosis.

We recommend health care providers avoid prolonged use of antibiotic

ear drops and encourage close follow-up of chronic otitis media patients with comorbidity like HIV and Diabetes.

## Declarations

### Consent for publication

Not applicable.

### Ethical declaration

The study was conducted after ethical approval is obtained from SPHMMC institutional review board (IRB). Written consent and/ or assent (as appropriate) was obtained from each participant after informing the objective of the study.

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### Authors' contributions

NT conceptualized the research, designed the study, collect and analyzed the data, and drafted the manuscript. ST was involved in preparing the research proposal and revising the final manuscript. YZT was involved in conceptualizing the research, preparing the research proposal, and revising the final Manuscript. All authors of the manuscript have read and agreed to its content.

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### Competing interest

All authors read and approved the final manuscript. The authors declare that they have no competing interests.

### Availability of data and materials

The datasets used in the current study or data collection tool are available from the corresponding author with a reasonable request.

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