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**Original article****Fungal flora of hearing aid moulds and ear canal in hearing aid wearers in school children in Ahvaz, Iran (2008)****Ali Zarei Mahmoudabadi<sup>1</sup>, Hassan Abshirini<sup>2</sup>, Rozita Rahimi<sup>1</sup>**<sup>1</sup>*Department of Medical Mycoparasitology, School of Medicine, and Infectious and Tropical Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*<sup>2</sup>*Department of ENT, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran***Received:** November 2008**Accepted:** January 2009

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**Abstract**

The aim of study was to determine the presence and nature of fungal flora on hearing aid ear moulds and ear canal in hearing aid wearers. Only 'behind the ear' (BTE) acrylic hearing aid moulds were included in this study. Hearing aid ear moulds and ear canal were swabbed and samples were cultured on Sabouraud's dextrose agar to determine qualitatively and quantitatively the mycoflora present. Seventeen out of 120 (14.2%) BTE wearers had different fungi in their hearing aids or ear canal. The most common fungi were *Aspergillus niger* (eight cases) followed by *A. flavus* (three cases), *Rhizopus* (three cases), *Penicillium* (two cases) and *C. albicans* (three cases). BTE wearers have a varied fungal flora on their ear moulds and ears canal. The fungal flora, including recognized pathogen that colonizes ear canal may lead to otomycosis.

**Keywords:** Hearing aid, Normal flora, Ear canal, Yeast, Mould**Introduction**

A hearing aid is a device used to help hard-of-hearing people hear sounds better. Behind the ear (BTE) aids have a small plastic case that fits behind the ear and conducts sound to the ear canal, through an earmold. BTEs can be used for mild to profound hearing losses and are especially useful for children. Because hearing aid moulds are often handled by patients, audiologist, parents and their teachers (in children), audiologists come into contact with a large number of hearing aid ear moulds and these could potentially harbor pathogenic microorganisms, with the risk of subsequent cross infection. Wearing hearing aid ear moulds has been implicated as a

predisposing factor in the development of chronic otitis externa [1,2]. Hearing aids have been identified as a potential source of microbial transmission [3]. Long-term wearing of hearing aid is a factor for the colonization of fungi. Both expected and unexpected strains of bacteria and/or fungi are microbial growth on hearing aid surfaces, which included [4]. This colonization may result in levels sufficiently high to give rise to otomycosis. Otomycosis is an acute, subacute or chronic fungal infection of the pinna, the external auditory meatus and the ear canal [5]. However the disease may occur in the middle ear, in the case of perforated tympanic membrane [6].

Otomycosis is caused by some species of the saprophytic fungi, such as moulds and yeasts; especially *Aspergillus niger* [7,8]. Other etiologic agents including *A. flavus*, *A. fumigatus*, *Penicillium*, *Allescheria boydii*, *Scopulariopsis*, *Rhizopus*, *Absidia* and *Candida* species. [8-10]. The aim of the present study was to determine the presence and nature of fungal flora on hearing aid ear moulds and ear canal in hearing aid wearers.

### Materials and methods

One hundred and twenty primary and secondary school students were considered for the present study. Imam Ali and Rodaky schools are only two schools for hearing impaired students in Ahvaz. Most of the students in above schools wear one hearing aid and few use both ears. A brief history was obtained from the parents/school teachers that included demographics. Sterile cotton swabs moistened with sterile saline were used for sampling from the ear canal and surface of hearing aid [3]. The BTE hearing aids were removed without any contact with the ear mould and a swab was used to rub the surface of the mould, which lies within the external auditory. All samples transferred to medical mycology laboratory (Department of Medical Mycoparasitology, Ahvaz Jundishapur University of Medical Sciences).

Samples were contained 99 swabs from the hearing aids and 215 from the ear canal. Swabs were rolled and inoculated over the surface of Sabouraud's dextrose agar (Merck KGaA, Darmstadt, Germany) with chloramphenicol. Cultures were incubated at laboratory ambient (25-27°C) for one week, aerobically. Fungal isolates (moulds) were identified based on colonial morphology and slide cultures. The isolate of *Candida albicans* was identified based on colony morphology on the CHROMagar Candida (CHROMagar Candida Company, Paris, France), germ tubes, and chlamydoconidia production tests.

### Results and discussion

The ages of the students ranged between 4-17 years with a mean of 10.5 years. The examined students contained 62 females (51.6%) and 58 males (48.4%). In the present study, the cultures of 17 samples (5.4%) contained hearing aid (eight cases), ear canal with hearing aid (six cases) and ear canal without hearing aid (three cases) have several fungi. The saprophytic fungi identified included eight isolates (47.1%) of *A. niger*, three isolates (17.6%) of *A. flavus*, three isolates (17.6%) of *Rhizopus* and two isolates (11.8%) of *Penicillium*. In the present study one isolate (5.9%) of *C. albicans* was also recovered from hearing aids.

Many of the people who seek hearing healthcare services have compromised immune system. As a result, these are more susceptible to common microorganisms that cause infection. The recovered fungi from earmoulds are ubiquitous or widely distributed throughout the environment (saprophytic fungi). On the other hand, *C. albicans* is typically thriving on the mucous surfaces. Although the recovered fungi from hearing aid surfaces are in nature, the hallmark of immuno-suppression is characterized by susceptibility of disease-prone individuals to these very same organisms. Hawke *et al.* [11] have believed that the presence of an ear mold was associated with a greater frequency of mixed infections (bacteria and fungi) in the group with chronic otitis externa. Handling hearing aids (removing or accepting a hearing aid) may encourage inadvertent cross-infection via contact transmission [12]. In the event transmission occurs, microbes naturally entry into the body by nose, ears or via the epithelial layer of the skin. Nosocomial infections are an important cause of morbidity and contaminated equipment may contribute to this [13].

The saprophytic fungi such as, *Aspergillus* and *Penicillium* are the common organisms in the environment. Several studies reported *Aspergillus*, especially *A. niger* as the most common causes of

otomycosis [6,14-16]. However, other saprophytic fungi, *A. fumigatus*, *A. flavus* and *Penicillium* have been reported as otomycosis agents [8, 9]. In our study, 47.1% of isolates were *A. niger* and totally 64.7% were *Aspergillus* species. *C. albicans* is a part of normal human flora.

When contaminated hearing aid is inserted into the ear canal, it gives microorganisms uncontested access to a dark, warm, and moist environment. When obstructed by a hearing instrument or earmold, the ear canal becomes an even warmer, darker, and moister environment, one that changes the pH balance of cerumen and results in an environment conducive to microbial proliferation. In conclusion, BTE wearers have a varied fungal flora on their ear moulds and ears canal. The fungal flora, including recognized pathogens that colonize ear canal may lead to otomycosis.

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