



## RESEARCH ARTICLE

# Microbiological Survey of Ear Infections in Inhabitants of Erbil City

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## ABSTRACT

This study was carried out to indicate the number of infected individuals with ear infection from different genders and ages determine the antibiotic sociability for the ear swab bacterial isolates. A total of 82 ear swabs were obtained in Erbil City from various hospitals and laboratories. Males made up 48 (59%) of the 81 samples, while females made up 33 (41%). 0–10 years had the most bacteria isolated from ear swabs, followed by 11–20 years and then 21–40 years. *Pseudomonas* spp. was the most prevalent bacteria found in all of the swabs (43%). Pathogenic bacteria were found in 70% of the samples, while no growth was seen in 30% of the swabs. Many bacterial isolates were found to be sensitive to the antibiotic Amikacin, which was determined to have the best effect on 35 of them. Clotrimazole was shown to be the least effective antibiotic on numerous bacterial strains, with 19 being resistant.

**Keywords:** Ear infection, antibiotic sensitivity test, *Pseudomonas*, amikacin

## INTRODUCTION

Infections of the ear can affect either the inner or outer ear. Ear infections are divided into three different forms, according to the Centers for Disease Control and Prevention. Acute otitis media (AOM), otitis media with effusion (OME), and otitis externa, sometimes known as swimmer's ear, are the three forms. Children are the ones that get ear infections the most. According to the National Institutes of Health (NIH), three out of every four children will have at least one ear infection by the age of three (NIH).<sup>[1]</sup>

A bacterial or viral infection of the middle ear is known as an ear infection. Inflammation and fluid accumulation in the ear's interior canals are caused by this illness. The middle ear is a space behind the eardrum which is exposed to air. It has vibrating bones that translate sound from outside the ear into impulses that the brain can understand. Ear infections are unpleasant, because inflammation causes the eardrum to swell.<sup>[2]</sup>

The most common respiratory infection in children is middle ear infection, also recognized as otitis media. Middle ear infection is caused mainly by *Streptococcus pneumoniae* (pneumococcus). Pneumococcal conjugate vaccines are being used to protect young children from severe pneumococcal infections such as meningitis and pneumonia.<sup>[3]</sup>

Ear infections can occur as a result of poor needle technique, excessive needle retention, or the patient's inability to properly care for his or her ear just after treatment. Because the ear has a lower blood circulation than the rest of the body,

once an infection occurs or involves the cartilage, it will be extremely difficult to treat. Infections that are severe enough can cause the ear to swell and the cartilage to deteriorate.<sup>[4]</sup>

In general, there are three types of ear infections: AOM (inflammation of the middle ear). The term "ear infection" is commonly used to refer to AOM. If there is fluid in the middle ear, indications or symptoms of infection, and the onset of symptoms was relatively rapid, the doctor will most likely make this diagnosis. Medial otitis with effusion, where the clinician finds evidence of fluid in the middle ear if the diagnosis is OME, but no signs or symptoms have appeared. Chronic otitis media with suppuration is when a doctor confirms chronic suppurative otitis media (CSOM), he or she discovers that a persistent ear infection caused the eardrum to tear or perforate. Antibiotics are not always effective to control ear infections. What is best for the patient is determined by several of factors, including the patient's age and the severity of his or her symptoms.<sup>[5]</sup>

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Infections of the ears are still a problem in the community. Hearing loss affects 360 million individuals globally, 32 million of them are children.<sup>[6]</sup> During a year, 653,025 instances of middle ear infection were recorded in Iraq, 1,737,214 cases in Iran, 144,405 cases in Jordan, 58,098 cases in Kuwait and 463,669 cases in Syria, and many other nations in the area (Right Diagnosis from Health Grades Inc., 2015). Otitis media was reported to affect 36.7% of the population in Erbil City.<sup>[7]</sup>

Ear infections are a huge issue all across the world, as the below data demonstrate. In recent years, there has been some new information about this virus in the area. As a result, the following objectives were set for this research: Record the number of ear infection cases in Erbil City in relation to age and gender and to investigate the antibiotic sensitivity and resistance of the isolated bacteria to a variety of antibiotics.

## MATERIALS AND METHODS

Study design this was a 4-month prospective research that was conducted from December 2017 to March 2018. In Erbil City, the patients have been treated for ear infections at several hospitals and private laboratories.

The samples of the study were collected from 82 patients, 48 men and 33 women.

### Sample Collection

The presence of purulent material in all of the ear infections led the expert healthcare workers to conclude that they were infected. Only one swab (Sterilin, U.K.) was taken from each patient. Each ear's exudate was meticulously collected according to departmental regulations. To avoid the swabs drying out, the samples were delivered to the microbiology laboratory within 1 h of being collected.

Isolation and identification of bacteria swabs were inoculated on MacConkey agar, Chocolate agar, and Blood agar (Oxoid, U.K.) right away and incubated aerobically for 24–48 h at 37°C. Due of logistical issues, anaerobic cultures were not performed. Bacterial colonies on agar plates were identified using Gram staining. Bacterial isolates were identified and classified using biochemical techniques.

Standard microbiological procedures were used to characterize bacterial isolates.<sup>[8]</sup> Gram stain, morphological and cultural features on agar, spore stain, motility and carbohydrate fermentation tests, nitrate reduction, catalase, hydrogen sulfide production, and indole production were among the tests that were performed.

Citrate utilization, gelatin liquefaction, the Methyl Red-Voges Proskauer test, coagulase, hemolysis on blood agar, morphological and cultural characteristics on mannitol salt, and eosin-methylene blue agar are along with the other tests performed.

## ANTIBIOTIC SENSITIVITY TEST

The Kirby–Bauer disk diffusion method was used to test antibiotic susceptibility, and the results were interpreted using the National Committee for Clinical Laboratory Standards' recommendations. Antibiotics that were applied included in the study:

Table 1 shows the antibiotics used in the susceptibility test on bacteria isolated from ear swabs.

**Table 1:** List of Antibiotics used to record the sensitivity and resistance of the isolated bacteria.

Abbreviation (MIC*)	Antibiotic
A (10 µg)	Actinomycin
AK (10 µg)	Amikacin
AM (10 µg)	Ampicillin
AMC (25 µg)	Amoxicillin-clavulanic acid
AMK (30 µg)	Amikacin
AMP (10 µg)	Ampicillin
AT (10 µg)	Aztreonam
AUC (25 µg)	Amoxicillin-clavulanic Acid
AZ (30 µg)	Azlocillin
C (30 µg)	Chloramphenicol
CAZ (30 µg)	Ceftazidime
CD (30 µg)	Cefdinir
CEC (30 µg)	Cefaclor
CEF (30 µg)	Cefazoline
CEP (30 µg)	Ceftriaxone
CIP (5 µg)	Ciprofloxacin
CIT (30 µg)	Citalopram
CLT (25 µg)	Clotrimazole
CPO (5 µg)	Ciprofloxacin
CRO (30 µg)	Ceftriaxone
CTA (25 µg)	Closthioamide
CTR (30 µg)	Ceftriaxone
CTX (30 µg)	Cefotaxime
E (15 µg)	Erythromycin
G (10 µg)	Penicillin
GEN (10 µg)	Gentamicin
IMP (30 µg)	Imipenem
IP (30 µg)	Imipenem
IPM (30 µg)	Imipenem
MT (25 µg)	Metronidazole
NA (30 µg)	Nalidixic Acid
NET (30 µg)	Netilmicin
P (10 µg)	Penicillin
PI (100 µg)	Piperacillin
TCC (25 µg)	Ticarcillin-clavulanic acid
TI (30 µg)	Ticarcillin
TOB (10 µg)	Tobramycin
VA (30 µg)	Vancomycin

## RESULTS

Swabs the total number of swabs collected in the current study was 81 ear swabs from different hospitals and private laboratories in Erbil City. Gender of patients from the 81 samples, 48 (59%) were male and 33 (41%) were female [Figure 1].

## Bacterial Isolates

*Pseudomonas* spp. was found to be the predominant bacteria isolated from ear infection, 35 (43%). No growth of bacteria represented 24 (30%) of the samples, while the other bacterial species showed a lower percentage [Figures 2 and 3].

Age of patients ear infections was found to be common in children, but they were found in all ages. The results showed that the children age group of (0–10) years had the highest number of cases for ear infections, compared to the other age groups [Figure 4].

Antibiotic sensitivity and resistance the antibiotic Amikacin were found to have the best effect on many bacterial isolates, where 35 isolates were sensitive [Figure 5a and b].

The antibiotic Clotrimazole was found to be the least effective on many bacterial isolates, where 19 isolates were resistant [Figure 6a and b].

## DISCUSSION

The most common cause of ear infections is a bacterial or viral infection of the middle ear, which is the air-filled space behind the eardrum that contains the tiny vibrating bones of the ear.<sup>[8]</sup> In many parts of the world, it is a public health issue.<sup>[9]</sup>

Another ear infection that affects the middle ear is Otitis media, which is a common and major healthcare concern due

to the significant economic burden it spots on the health-care system. Eskimos, American Indians, and Australian aboriginal children, as well as dark-skin South Africans, have been found to have a high prevalence. Another major factor is poor living conditions and congestion. The widespread occurrence of CSOM in impoverished nations has been linked to poor hygiene and diet.<sup>[7]</sup>

Males were more affected (59%) than females, according to the findings of the present study (41%). According to other research, men are more likely than women to acquire ear infections.<sup>[10]</sup> The reason for sex dependence is still unknown.<sup>[11]</sup>

Ear infections are more common in children than in adults. Due to the inflammation and fluid buildup in the middle ear, ear infections are typically severe. Many studies in other regions, such as Australia, found that indigenous children were more likely than non-indigenous children to get ear infections faster and much more severe.<sup>[12]</sup> Similar results were obtained in our current study, where the highest number of cases was among the age group (0–10) followed by (11–20) years.

Aboriginal status was one of the most significant risk factors for otitis media in a population-based birth cohort research in Canada.<sup>[13]</sup> The National Longitudinal Survey of Children and Youth in 1994/1995, on the other hand, found that 53% of newborn to three-year-old children, excluding those living on First Nations reserves, had ear infections.<sup>[13]</sup>

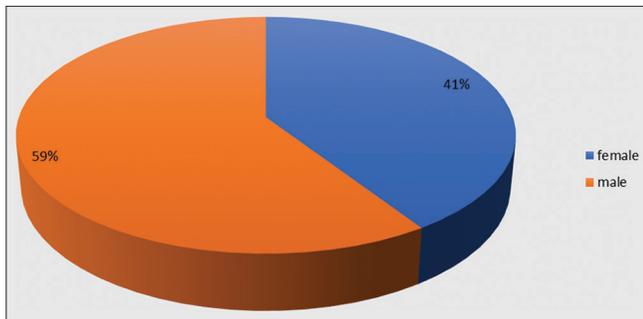


Figure 1: Males and females included in ear infections study

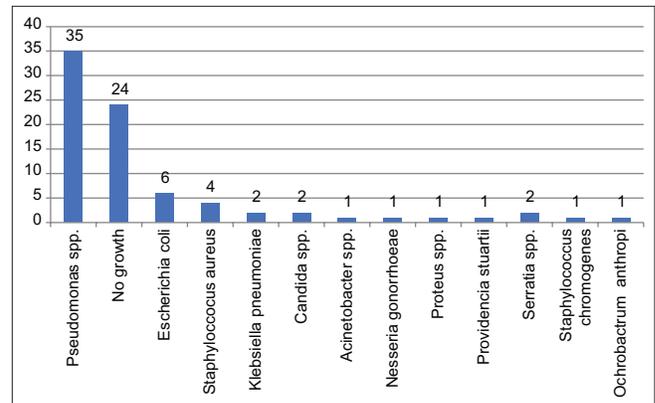


Figure 3: Types and numbers of bacterial species cultured from ear infections

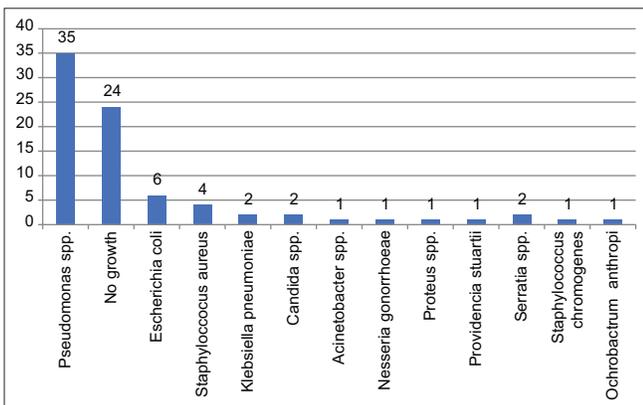


Figure 2: Percentage of bacterial species cultured from ear infections of patients included in the study

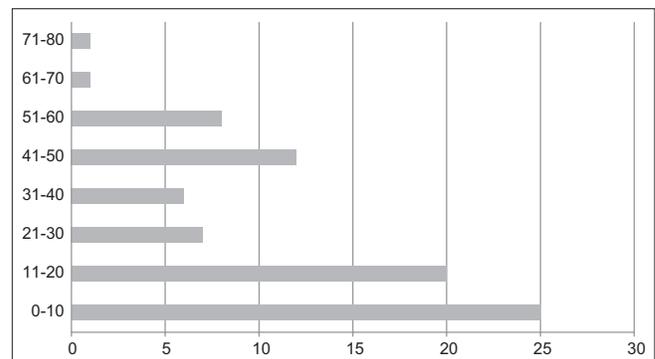
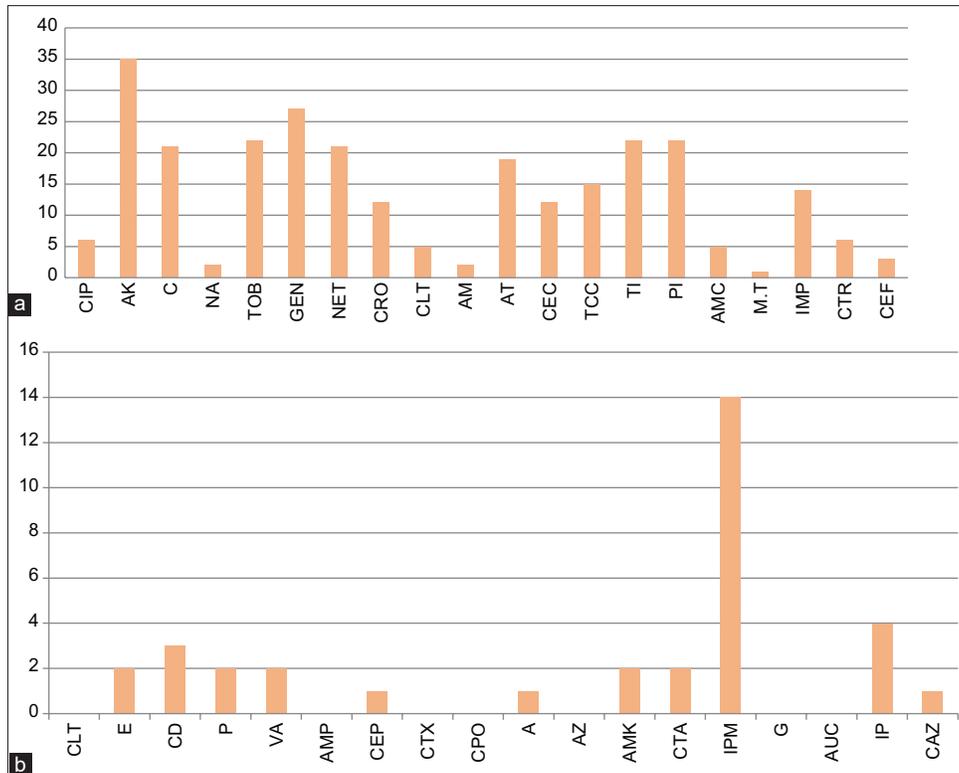


Figure 4: Ages of patients included in ear infections study



**Figure 5 (a and b):** Antibiotic resistance of bacterial isolates from ear infection

According to some sources, approximately 80% of children will be reported to have at least one episode of AOM and between 80% and 90% will suffer at least one episode of OME before reaching school age. During an acute viral upper respiratory tract infection, AOM is a complication of Eustachian tube dysfunction. In 50% to 90% of instances of AOM and OME, bacteria can be identified from middle ear fluid cultures.<sup>[14]</sup>

Furthermore, many studies have shown that breastfeeding protects against the development of otitis media.<sup>[10]</sup> This could be related to breast milk's immunological features, which include antibodies to respiratory infections. Furthermore, exposure to cigarette smoke has been linked to the development of ear infections in children, according to another study.<sup>[15]</sup>

*Pseudomonas* spp. was discovered to be the most common bacterial species (43%). *Pseudomonas* infections are caused by gram-negative bacteria of the genus *Pseudomonas*, particularly *Pseudomonas aeruginosa*. They can be found in soil and water all around the planet. These bacteria can be found in wet environments such as sinks, toilets, poorly chlorinated swimming pools and hot tubs, and antiseptic treatments that are old or inactive. These bacteria are occasionally found in the armpits and genital tract area of healthy humans.<sup>[16]</sup>

A high majority of cases (30%) showed no bacterial growth on the culture media used in the study. This could be due to bacteria that require media or incubation conditions to develop, or the bacteria could be anaerobic, or the cause could be fungal or viral.

The antibiotic Amikacin was shown to have the best effect on numerous bacterial isolates in this research, with 35 isolates being sensitive, while Clotrimazole was found to be the least effective, with 19 isolates being resistant. Antibiotic resistance is a regular phenomenon in most infections, with ear infections being among the most known.<sup>[17,18]</sup>

In general, variations between the current study and other studies could be attributable to changes in inclusion criteria, sample sizes, microbiological approach, climate, and geographical areas, among other things.<sup>[19]</sup>

### CONCLUSION

A total of 81 ear swabs were collected in the present study from various hospitals and commercial laboratories in Erbil City. Of the 81 samples, 48 (59%) were male and 33 (41%) were female. The age group that had the highest number of bacteria isolated from ear swabs was 0–10 years followed by 11–20 years. The most common bacterial species isolated from all swabs were *Pseudomonas* spp. (43%). Most of the samples collected demonstrated the presence of pathogenic bacteria (70%), whereas 30% of the swabs demonstrated no growth. The antibiotic Amikacin was found to have the best effect on many bacterial isolates, where 35 isolates were sensitive. The antibiotic Clotrimazole was found to be the least effective on many bacterial isolates, where 19 isolates were resistant.

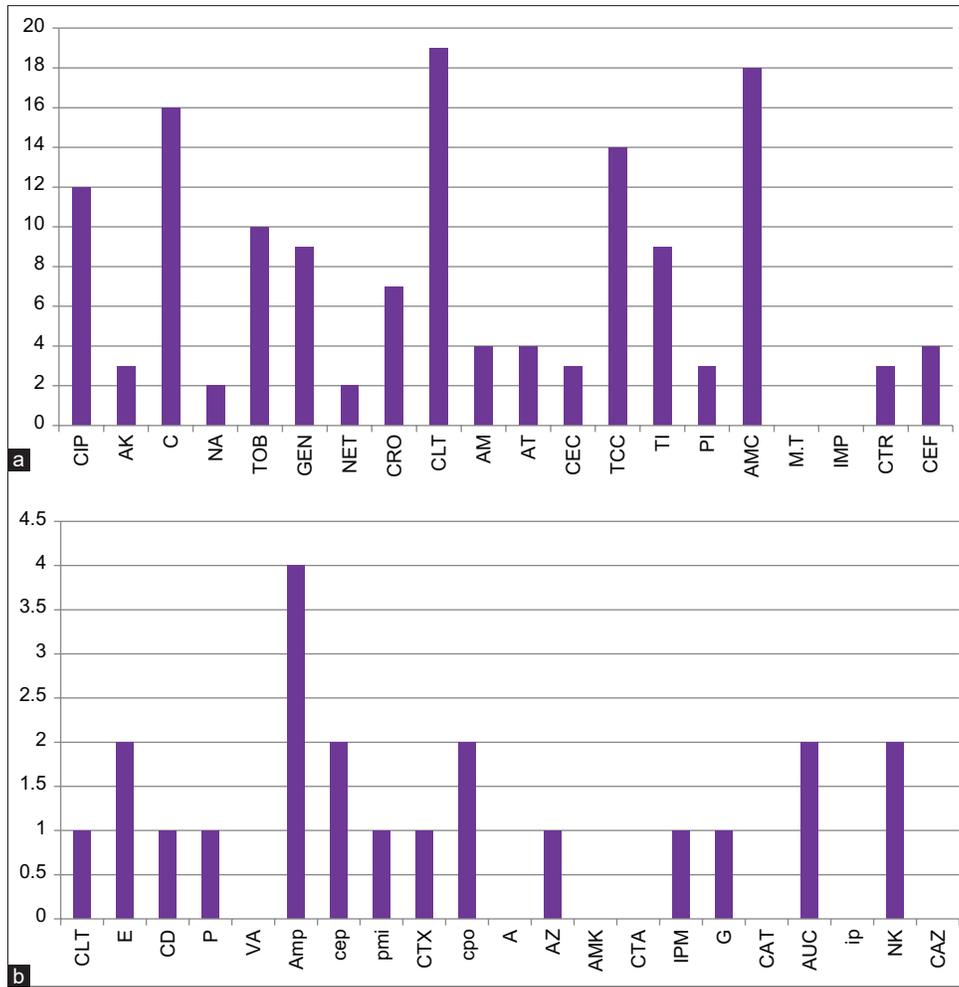


Figure 6 (a and b): Antibiotic sensitivity of bacterial isolates from ear infection

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