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# Study of Risk Factors in Children with Recurrent Acute Otitis Media

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## Abstract

**Background:** One of the most frequent infections observed in children is acute otitis media (AOM). It continues to be the primary reason children visit doctors and the most prevalent cause of antibiotic administration. Various factors contribute to the development of AOM. These factors can be categorized into two groups: host-related and environmental.

**Aim:** This work aims to study the risk factors that are associated with recurrent episodes of acute otitis media in children.

**Patients and methods:** The research involved 80 patients (45 males and 35 females) who had recurrent acute otitis media. The patients' ages ranged between 2 and 12. We analyzed various risk factors that may be related to RAOM.

**Results:** The findings revealed that among the patients studied, 30 individuals (37.5%) had allergic rhinitis, 36 individuals (45%) had obstructive adenoid, 30 individuals (37.5%) had chronic nasal obstruction, 37 individuals (46.3%) had recurrent upper respiratory tract infections (URTI), four individuals (5%) had gastroesophageal reflux disease (GERD), five individuals (6.3%) had bronchial asthma, and 30 individuals (37.5%) had atopic diseases. Additionally, 71 patients (88.8%) belonged to a low socio-economic status (SES), while nine patients (11.3%) had a moderate SES. In terms of maternal education, 17 patients (21.3%) had education levels below secondary school. Furthermore, 38 patients (47.5%) were exposed to passive smoking, and 38 patients (47.5%) regularly attended daycare.

**Conclusion:** Study showed that there are reliably identified

**Keywords:** acute otitis media; Recurrent acute otitis media

## 1. Introduction

Acute otitis media (AOM) is a prevalent infection among children and continues to be the primary reason for pediatric doctor visits. Antibiotics are prescribed to children for this reason more often than any other.<sup>1</sup>

Otitis media, or acute otitis, is an inflammation of the mucosa of the middle ear. In its acute form, symptoms can manifest both locally and systemically, and middle ear inflammation can be seen very quickly. Infectious agents, such as viruses or bacteria, can trigger this disorder.<sup>2</sup>

Patients are diagnosed with recurrent acute otitis media (RAOM) if they have three episodes of the condition within six months or four episodes within twelve months. Keep in mind that otoscopy results should display full

normalcy in the intervals between these episodes.<sup>3</sup>

Many things can trigger acute otitis media (AOM), making it a complicated condition. Since many different factors contribute to its development, we call it a multifactorial disease. Host factors and environmental variables are the two main classes into which these risk factors fall. A number of variables can increase a person's risk of developing AOM, including their age, sex, ethnicity, genetic predisposition, craniofacial defects, atopy (allergic tendencies), immunodeficiency, adenoid hypertrophy, digestive issues, and reflux disease. Contrarily, environmental influences include things like going to daycare, being around older siblings, using pacifiers, not breastfeeding, being in a polluted environment, the time of year, and the route of delivery.<sup>4</sup>

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Preventative measures for acute otitis media (AOM) mainly aim to lessen the effect of risk factors while amplifying preventive variables. This is achieved through the implementation of various interventions, including behavioral modifications, environmental changes, and therapeutic measures.<sup>5</sup>

Therefore, this study aims to identify the risk factors associated with recurrent episodes of acute otitis media in children.

## 2. Patients and methods

Eighty patients made up the research sample. Patients with chronic acute otitis media presented to the otorhinolaryngology department at Al Karnak International Hospital in Luxor, comprising 45 men and 35 females. The research spanned the months of March 2022 through May 2023. Patients' ages ranged from 2 years to 12 years. Individual inclusion or Exclusion was according to the following criteria: patients aged 2-12 y and At least three episodes of acute otitis media occurring in 6 months were included; previous chronic otitis media with effusion, children who underwent tympanostomy, tubes insertion, and children who will not continue the follow-up period for at least six months were excluded.

Every patient was submitted to the following: Complete history taken from every patient; Personal history (Name, Age, Sex, job, special habits, Residence, and Phone number); complaint and its duration: (Earache, ear discharge, diminution of hearing, Tugging, or pulling at one or both ears), Present history: Discharge: (Side – Onset- Course -Duration – What increase – what decrease -Predisposing factors), Earache/fullness in the ear, irritability or feeding difficulties, ear tugging, Fever, vomiting, diarrhea, Nasal obstruction, Mouth breathing and snoring, Sleep disruptions/obstructive sleep apnea Reduced auditory acuity Severe soreness in the throat, A growth on the neck, The length of time a baby is breastfed, the prevalence of allergies, the usage of pacifiers, and premature birth are all factors to consider. Past medical conditions: chronic ear pain, stuffy nose, and sore throat. Background information: the number of siblings (family size) and whether or not either parent smoked.

Examinations: General examinations included General appearance: Nourishment and build, Facies: adenoid facies, and Vitals: Pulse– Temperature – Respiratory rate – blood pressure. A thorough evaluation of the patient's circulatory, neurological, genitourinary, gastrointestinal, and respiratory systems was part of the systemic evaluation. Some of the things that ENT exams look for include a stuffy or bulging eardrum (otorrhea) and a nasal allergy (allergic rhinoconjunctivitis). In order to detect any

craniofacial anomalies, such as cleft palate (whether it is visible or not), an oral examination is performed. If you want to know if you have tonsillar hypertrophy or adenoid hypertrophy, you can do an oropharyngeal exam.

Investigations included Radiological: Nasopharyngeal plain x-ray (lateral view), Audiological: Siegalization, Audiometry, and Tympanometry.

Treatment included: Antibiotics remain the initial therapy of choice for AOM; a 10-day course of amoxicillin/clavulanate 80-100 mg/kg twice daily was conducted. Other pharmacologic therapies were used according to symptoms, such as analgesic and antipyretic, decongestants, and antihistamines. The assessment of the clinical outcome was conducted post-treatment and at four-week intervals using otoscopy for six months. The antibiotic treatment was administered again if acute otitis media recurred. An early recurrence of acute otitis media is defined as the return of symptoms and indications within one month of their initial recovery. After one week of treatment, the efficacy of the medication is assessed based on whether the acute infection symptoms persist or become worse. A case of recurrent acute otitis media (RAOM) was defined as three or more occurrences of acute otitis media within a six-month period. All the collected data were calculated and tabulated using a statistical social science package program (USA, SSPP).

## 3. Results

Based on the demographic information gathered from all the patients who were part in the research, the average age was  $5.48 \pm 2.3$  years, with a range of 2 to 11 years. Among the patients, 45 were male (56.3% of the total) and 35 were female (43.7% of the total). In relation to socioeconomic status (SES), 71 patients (88.8%) belonged to the low SES category, while nine patients (11.3%) were classified as moderate SES. In terms of residence, 43 patients (53.8%) were from rural areas, while 37 patients (46.3%) were from urban areas. As regards family history, there were four patients (5%) with positive family history and 76 patients (95%) with negative family history in the studied patients (Table 1). There were 38 patients (47.5%) on regular daycare attendance, there was mother education blow secondary in 17 patients (21.3%), there was family size > 6 members in 28 patients (35%), there was passive smoking in 38 patients (47.5%), there was premature birth in 47 patients (58.8%), there was low birth weight in 8 patients (10%) and Pacifier use in 28 patients (35%). As regards feeding type, there were 20 patients (25%) with breastfeeding, ten patients (12.5%) with artificial feeding, and 50 patients (62.5%) with mixed feeding. Bottle feeding was done in 47 patients (58.8%). As regards

nutritional status, there was good nutrition in 41 patients (51.3%) and mal-nutrition in 39 patients (48.8%). As regards seasonality, it was in winter in 43 patients (53.8%), in summer in 11 patients (13.8%), in spring in 14 patients (17.5%), and in autumn in 12 patients (15%) (Table 2). As shown in the previous table, there was fever in 62 patients (77.5%), Otalgia in 67 patients (83.8%), Otorrhea in 41 patients (51.3%), vomiting in 35 patients (43.8%), anorexia in 36 patients (45%) and diminished hearing in 19 patients (23.8%) of the studied patients (Table 3). As shown in the previous table, there was allergic rhinitis in 30 patients (37.5%), craniofacial anomalies in 2 patients (2.5%), obstructive adenoid in 36 patients (45%), chronic nasal obstruction in 30 patients (37.5%), recurrent URTI in 37 patients (46.3%), GERD in 4 patients (5%), bronchial asthma in 5 patients (6.3%) and atopic diseases in 30 patients (37.5%) of the studied patients (Table 4). As shown in the previous table, type A is in 85 ears (53.1%), type B is in 50 ears (31.2%), and type C is in 25 ears (15.6%) of the studied patients (Table 5). As shown in the previous table, there was normal hearing in 85 ears (53.1%), Mild conductive hearing impairment in 43 ears (26.9%), and Mild conductive hearing loss in 32 ears (20%) of the studied patients (Table 6).

Table 1. description of demographic data in all studied patients.

		STUDIED PATIENTS (N = 80)	
AGE (YEARS)	Mean	5.48 ± 2.3	
	±SD		
	Min - Max	2 - 11	
SEX	Male	45	56.3%
	Female	35	43.7%
SOCIAL ECONOMIC STATES(SES)	Low	71	88.8%
	Moderate	9	11.2%
RESIDENCE	Rural	43	53.8%
	Urban	37	46.2%
FAMILY HISTORY	No	76	95%
	Yes	4	5%

Table (2): description of present history in all studied patients.

		STUDIED PATIENTS (N = 80)	
DAY CARE ATTENDANCE	No	42	52.5%
	Yes	38	47.5%
MOTHER EDUCATION (BELOW SECONDARY)	No	63	78.8%
	Yes	17	21.3%
FAMILY SIZE > 6	No	52	65%
	Yes	28	35%
PASSIVE SMOKING	No	42	52.5%
	Yes	38	47.5%
FEEDING	Breast feeding	20	25%

PREMATURE BIRTH	Artificial feeding	10	12.5%
	Mixed feeding	50	62.5%
LOW BIRTH WEIGHT	No	76	95%
	Yes	4	5%
SEASONALITY	No	72	90%
	Yes	8	10%
	Winter	43	53.8%
NUTRITIONAL STATUS	Sumer	11	13.8%
	Spring	14	17.5%
	Autumn	12	15%
	Good nutrition	41	51.2%
	Mal-nutrition	39	48.8%
			%

Table 3. description of clinical manifestations in all studied patients.

		STUDIED PATIENTS (N = 80)	
CLINICAL MANIFESTATIONS	Fever	62	77.5%
	Otalgia	67	83.8%
	Otorrhea	41	51.3%
	Vomiting	35	43.8%
	Loss of Appetite	36	45%
	Diminished hearing	19	23.8%
	Diarrhea	10	12.5%

Table (4): description of associated diseases in all studied patients.

		STUDIED PATIENTS (N = 80)	
ASSOCIATED DISEASES	Allergic rhinitis	30	37.5%
	Craniofacial anomalies	2	2.5%
	Obstructive Adenoid	36	45%
	Chronic nasal obstruction	30	37.5%
	Chronic sinusitis	36	45%
	Recurrent URTI	37	46.3%
	GERD	4	5%
	Bronchial Asthma	5	6.3%
	Atopic diseases	30	37.5%

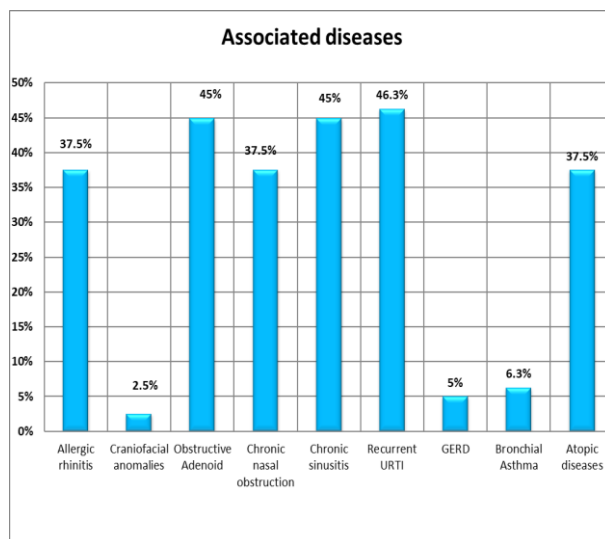


Figure 1. description of associated diseases in

all studied patients.

Table 5. description of tympanometry in all studied patients.

		STUDIED PATIENTS (N = 80 PATIENTS = 160 EAR)	
TYMPANOMETRY	Type A	85	53.2%
	Type B	50	31.2%
	Type C	25	15.6%

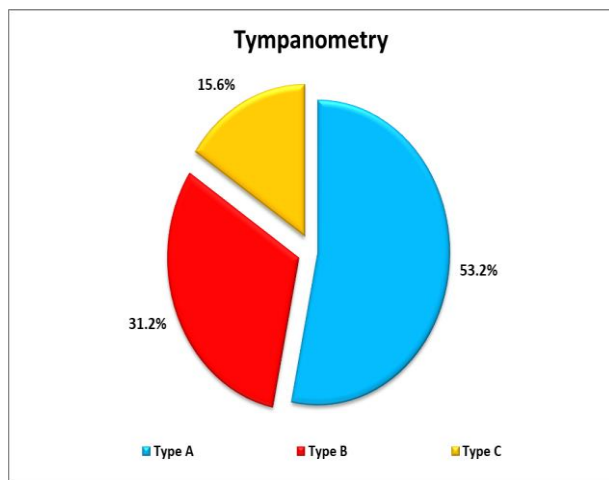


Figure 2. description of tympanometry in all studied patients.

Table 6. description of audiometry in all studied patients.

		STUDIED PATIENTS (N = 80 PATIENTS = 160 EAR)	
AUDIOMETRY	Normal hearing	85	53.1%
	Mild conductive hearing impairment	43	26.9%
	Mild conductive hearing loss	32	20%

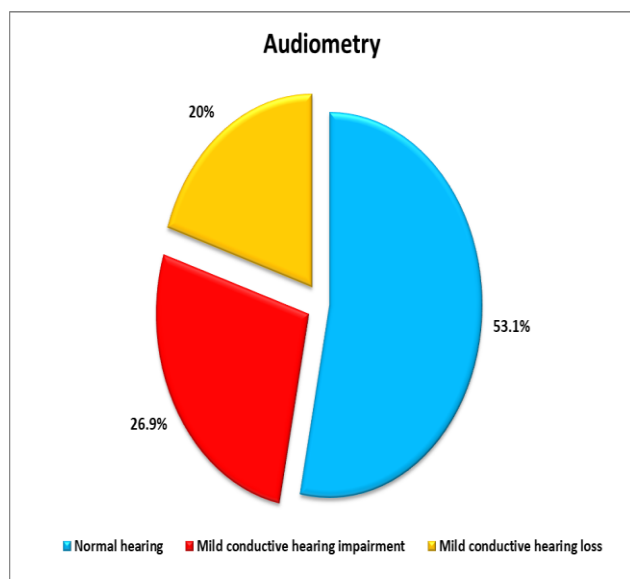


Figure 3. description of audiometry in all studied patients.

#### 4. Discussion

Numerous factors contribute to the development of OM in relation to etiopathogenesis. These factors include demographics, genetics, the environment, and medical conditions like infections, allergies, asthma, cleft palate, eustachian tube dysfunction, cleft lip, and adenoid hypertrophy.<sup>5</sup>

The purpose of our research was to identify potential causes of recurrent AOM in pediatric patients. There were 45 males (56.3%) and 35 females (43.7%) among the patients studied, with a higher proportion of males than females, and an average age of  $5.48 \pm 2.3$  years. The present investigation confirmed the results of Abd Alsalam et al.,<sup>6</sup> which found that being male was a significant risk factor for the incidence of AOM.

In our study, male children were more exposed to environmental pollution as they played in dusty weather and practiced some jobs.

In our study, there were 71 patients (88.8%) of low socio-economic status with SES and nine patients (11.3%) with moderate SES. In the same line, Ghonaim et al.<sup>7</sup> evaluated three hundred patients with OM to assess possible risk factors of OM. The authors showed that low socioeconomic standard (SES) was a major risk factor for the occurrence of OM ( $P < 0.01$ ).

As regards nutritional status, 41 patients (51.3%) had good nutrition, and 39 patients (48.8%) had malnutrition. In accordance with the current results, Ghonaim et al.,<sup>7</sup> demonstrated that Malnutrition has been reported as a significant risk factor for OM.

Our results showed that there was allergic rhinitis in 30 patients (37.5%), obstructive adenoid in 36 patients (45%), chronic nasal obstruction in 30 patients (37.5%), recurrent URTI in 37 patients (46.3%), GERD in 4 patients (5%), bronchial asthma in 5 patients (6.3%) and atopic diseases in 30 patients (37.5%) of the studied patients.

This study's findings are in line with those of a meta-analysis by Saad et al.,<sup>8</sup> that found that infections of the upper respiratory tract were a major contributor to the incidence of AOM. In a study involving 530 children younger than 6 years old, Athbi et al.,<sup>9</sup> discovered that AOM is frequently caused by viral infections of the upper respiratory tract, which are followed by microbial colonization of the nasopharynx and middle ear. It was found that 6.8% of people had otitis media (OM). We found a strong correlation ( $P < 0.05$ ) between OM and several variables, such as bottle feeding, exposure to passive smoking, allergic rhinitis, nasal discharge, recurrent URTIs, and recurrent tonsillitis. Nasal discharge (OR=4.9), allergic rhinitis (OR=5.5), bottle-feeding (OR=5.8), snoring (OR=3.2), and other factors were found to

independently predict OM by multivariate regression analysis.

Ghonaim et al.<sup>7</sup> undertook a study to investigate potential risk variables in 300 OM patients, ranging in age from 3 months to 12 years. Using a control group of 300 typically developing youngsters of the same age and gender, they compared these patients to the patients. Findings from the study indicate that certain medical conditions, including allergic rhinitis, adenoid hypertrophy, chronic tonsillitis, URTI, LRTI, and foreign bodies in the ears, significantly increase the likelihood of having OM. Significant ( $P < 0.01$ ).

Saad et al.<sup>8</sup> collected data from 2003 pediatric patients, 1,000 of them were boys (50.7%). There were a total of 310 children with OME, with 159 being males (51.3%). Hypertrophy of the adenoids and tonsils, sinusitis, polyps in the back of the nose, allergic rhinitis, recurrent UTIs, and GERD were all substantially associated with recurrent OME in a multi-factor logistic regression study.

Roditi et al.<sup>10</sup> analyzed data from approximately 1.5 million pediatric visits recorded in the National Hospital Ambulatory Medical Care Survey and the National Ambulatory Medical Care Survey between 2005 and 2010. Their findings revealed a notable correlation between allergic rhinitis and OME in children.

Miura et al.<sup>11</sup> found that patients with otitis media with effusion (OME) had a notably increased occurrence of gastroesophageal reflux. They linked this notable connection to the inhalation of pepsin into the airways, leading to heightened inflammatory responses and, consequently, the accumulation of fluid in the middle ear.

The findings of the recent study indicated that 17 patients (21.3%) had mothers with an educational background below the secondary level.

OM was discovered to be significantly more common in households where the mother did not finish secondary school. Consistent with these results, a prior study by Mukara et al.,<sup>12</sup> found that parental education significantly predicted OM. Ceylan et al.<sup>13</sup> randomly selected 530 children younger than 6 for their investigation. A strong statistical association ( $P < 0.05$ ) was found between parents with lower levels of education and otitis media (OM), according to the study's findings. However, our results are contradicted by Aydemir and Ozkurt<sup>14</sup>, who found no association between OME and parents' educational status. The fact that each study focused on a different geographic region might explain the disparity.

Of the patients we evaluated, 38 (47.5%) were

found to have been exposed to passive smoking. We mentioned that one of the risk factors for OME is youngsters being exposed to passive smoking at home. These findings align with the results of Ceylan et al.,<sup>13</sup> who discovered that smoking cigarettes can cause effusion by impacting both the mucociliary transport system and the regular functioning of the Eustachian tube. In another case-control study of 100 infants by Athbi et al.,<sup>9</sup> 50 of them were infected with AOM, and the others were not. The study showed that Infants exposed to cigarette smoking identified a significant risk factor for AOM at a p-value of 0.001.

In our study, 38 patients (47.5%) were in regular daycare attendance. These findings align with the research conducted by Baljošević et al.<sup>15</sup> which indicated that children who go to daycare are more frequently exposed to ear and respiratory infections.

#### 4. Conclusion

The risk factors for the recurrence of acute otitis media in the age of 2-12 years are daycare attendance, low socioeconomic status, low education of mother, large family size, passive smoking, premature birth, low birth weight, Pacifier use, bottle feeding, mal-nutrition, winter, allergic rhinitis, craniofacial anomalies, obstructive adenoid, chronic nasal obstruction, recurrent URTI, GERD, bronchial asthma, and atopic diseases.

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The authors have no financial interest to declare in relation to the content of this article.

#### Authorship

All authors have a substantial contribution to the article

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#### Conflicts of interest

There are no conflicts of interest.

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