

Otitis Media in Children at Riyadh Capital City of KSA

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Objective: To determine the prevalence of otitis media (OM) among children in Riyadh Capital City of Kingdom of Saudi Arabia and to determine relevant risk factors in affected children.

Methods: Through a cross-sectional study, 1500 children in the age range 7 - 14 years were randomly selected from 15 malls in Riyadh region. A questionnaire was used to determine risk factors for OM. Otoscopy was used to diagnose and confirm OM. Mothers of children were asked to complete a questionnaire evaluating child's level of activity performance.

Results: Prevalence of OM in the study population was 10% (150/1500). In univariate analysis, it was strongly associated with age less than 8 years ($p < 0.0001$; OR = 4.23, 95% CI: 2.85 - 6.29), family size more than 4 members in the household ($p < 0.0001$; OR = 4.45, 95% CI: 2.23 - 8.88), mother education less than secondary school education ($p < 0.0001$; OR = 2.2, 95% CI: 1.47 - 3.29), recurrent acute otitis media (AOM) ($p < 0.0001$; OR = 5.73, 95% CI: 3.47 - 9.45), and hearing loss symptom ($p < 0.0001$; OR = 3.39, 95% CI: 1.92 - 5.99). It is less strongly associated with history of preschool AOM ($p = 0.002$; OR = 3.15, 95% CI: 1.67 - 5.97), nasal discharge ($p = 0.003$; OR = 1.91, 95% CI: 1.24 - 2.93) and snoring ($p = 0.03$; OR = 1.76, 95% CI: 1.06 - 2.94). OM was significantly higher in schools located in rural districts ($p < 0.001$, OR = 2.82, 95% CI: 1.86 - 4.28). In multivariate regression model, five of these factors were found to be predictors of OM: age less than 10 years (OR = 5.052, 95% CI: 3.289 - 7.762), family size more than 5 members in the household (OR = 4.192, 95% CI: 2.033 - 8.643), rural school district (OR = 3.037, 95% CI: 1.933 - 4.772), mother education lower than secondary school education (OR = 2.041, 95% CI: 1.602 - 3.877) and recurrent AOM (OR = 4.914, 95% CI: 2.677 - 9.02) compared to normal children ($p = 0.067$). No significant preschool daycare attendance ($p = 0.17$; OR = 0.71, 95% CI: 0.44 - 1.16), home exposure to cigarette smoke ($p = 0.4$; OR = 1.34, 95% CI: 0.68 - 2.65), visits to ENT clinic ($p = 0.13$; OR = 0.58, 95% CI: 0.29 - 1.18), and ENT operations ($p = 0.12$; OR = 0.46, 95% CI: 0.17 - 1.27).

Conclusion: Prevalence of OM in Riyadh reaches 10% in school children. Age less than 10 years, family size more than 5 members in the household, mother education less than secondary school education, living in rural area and in this population of children, otoscopy should be used as screening tools for OM.

Keywords: Otitis Media; Prevalence; Risk

Introduction

Otitis media with effusion (OM) is a multifactorial disease with infection, possibly biofilm in nature and Eustachian tube dysfunction) are the most widely accepted etiologies. Many risk factors have been associated with this disease: low mother education, low socioeconomic status day care attendance parental smoking, upper respiratory tract infections allergy and snoring [1,2].

Although it is a self-limiting condition in the majority of cases, OM may become chronic to the extent that it affects child education and quality of life. Long term effects of this disease on language and academic achievement have been reported, even after the disease had resolved.

In Jazin prevalence of OM was 17% and in Abha it was 5%. In Riyadh region, no similar studies have been conducted. The purpose of this research is to determine prevalence of OM children in Riyadh region [3-5].

Patients and Methods

Fifteen malls were randomly selected from the 23 malls in Riyadh region. From each mall, 100 children in the age range 7 - 14 years were randomly selected (1500 out of 3000 children).

The study was conducted through November 2016 to the end of May 2017. A specific questionnaire was designed in which questionnaire items included child age, gender and grade, number of family members, mother education (illiterate, primary, preparatory, secondary and university), exposure to cigarette smoke at home, preschool daycare attendance, preschool AOM, hearing loss as reported by parents, recurrent AOM necessitating antibiotic and analgesic treatment, nasal discharge, snoring, visit to ENT clinic and ENT operations (adenoidectomy, tonsillectomy). Questionnaires were taken with consent forms from parents through mall visit; the day before examination of children. Mothers were asked to classify child's performance as active, lethargy, lazy).

Children with perforated eardrum at the time of study, cholesteatoma, craniofacial anomalies or immunodeficiency syndromes were excluded from the study.

While collecting the questionnaire, middle ear was assessed with an otoscope. The instrument used was Titan middle ear analyzer (Interacoustics, Assens, Denmark) with a probe frequency of 226 Hz and air pressure range of -400 to +100 mm H₂O. Tympanograms were evaluated according to Fielau-Nikolajsen's modification of Jerger's system: type A: peak between +100 to -100 mm H₂O; type C1: peak between -101 to 200 mm H₂O; type C2: peak between -201 to 300 mm H₂O and type B: no peak detected or pressure could not be measured. Children with obstructive wax that prevents detailed otoscopy had their ear cleaned in the hospital clinic before otoscopy. All children with an abnormal otoscopic appearance of OM. Statistical analysis was performed using SPSS for Windows (Release 17.0 Chicago, SPSS Inc. Chicago, Illinois, USA). Univariate analysis was used to determine association of OM with each studied variable. Partial logistic coefficient b, odds ratio and 95% confidence interval were determined for each variable. Risk factors with p-values less than 0.08 were put into multivariate logistic regression model for further investigations. A forward stepwise modeling strategy was applied [4,6].

Results

Out of 3000 candidate children, 1500 were analyzed. Wax was obstructive in 150 children (10%) and was removed in the hospital clinic. Results of univariate analysis of risk factors with OM are summarized in table 1. We found 10% of children (150/1500) suffering from persistent OM (> 3 months) in at least one ear. OM was bilateral in 35 cases (5.2%) and unilateral in 100 cases (8.3%). Of all children, 7.3% of girls (53/721) and 7.6% of boys (59/767) had OME (Figure 1) without a statistically significant difference between the two genders (p = 0.8 OR = 1.05).

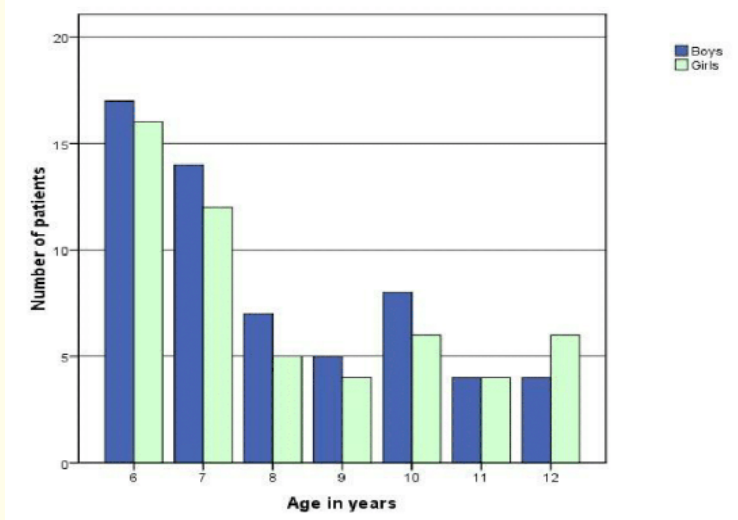


Figure 1: Number of children with OM according to their age.

Risk factor	Normal		OME		OR and (coefficient b)	P - Value	OR 95% CI
	1500	93%	150	10%			
Total no of children	1500	93%	150	10%			
Boys	790	51%	59	7.6%	1.05 (0.05)	0.8	(0.71 - 1.54)
Girls	710	45%	53	7.3 %			
Age (y)							
7 - 8	1128	18%	53	52%	4.23(1.44)	< 0.0001*	(2.85 - 6.29)
9 - 4	248	82%	59	48%			
Family size							
≤ 5 members	385	28%	9	8%	4.45 (1.49)	< 0.0001*	(2.23 - 8.88)
≥6 members	991	72%	103	92%			
Mother education							
Low ^a	619	45 %	72	64 %	5.3(0.79)	< 0.0001*	(1.47 - 3.29)
High ^b	757	55 %	40	36%			
Day care attendance	351	25.5%	22	20%	0.71 (- 0.34)	0.17	(0.44 - 1.16)
Exposure to cigarette smoke	94	7%	10	9%	1.34 (0.29)	0.4	(0.68 - 2.65)
Preschool AOM	55	4%	13	11.5%	3.15 (1.15)	0.002*	(1.67 - 5.97)
Hearing loss	69	5%	17	15%	3.39 (1.22)	< 0.0001*	(1.92 - 5.99)
Recurrent AOM	69	5%	26	23%	5.73 (1.75)	< 0.0001*	(3.47 - 9.45)
Nasal discharge	247	18%	33	30%	1.91 (0.65)	0.003*	(1.24 - 2.93)
Snoring	151	11%	20	18%	1.76 (0.57)	0.03*	(1.06 - 2.94)
Visit to ENT specialist	179	13%	9	8%	0.58 (- 0.54)	0.13	(0.29 - 1.18)
ENT operations	103	7.5%	4	3.5%	0.46 (- 0.78)	0.12	(0.17 - 1.27)

Table 1: Univariate analysis of risk factors for OME: odds ratio (OR), logistic coefficient b, P - value and 95% confidence limits (CI).

*statistically significant; ^ailliterate, primary or intermediate school education; ^bsecondary school or university education

Mean age of children with OM was 8.1 + 3.8 years and mean age of normal children was 9.4 + 2.7 years. OM is significantly higher in 6 - 7 year old children compared to older (8 - 12 years) children (Table 1) ($p < 0.0001$; OR = 4.23, 95% CI = 2.85 - 6.29). Fifty-two percent of children with OME (59/112) were 7- 8 years old; 19% (21/112) were 8 - 9 years old; 20% (22/112) were 10 - 13 years old and 9% (10/112) were 14 years old (Figure 1).

There was a statistically significant influence of family size on prevalence of OM. It was less common in small families (< 5 members) than in bigger families. Ninety-three of children with OM had more than 5 family members in the household compared to 72% of normal children ($p < 0.0001$; OR = 4.45, 95% CI = 2.23 - 8.88). OME was significantly more in families with mother education less than secondary school education ($p < 0.0001$, OR = 2.2; 95% CI = 1.47 - 3.29).

Our study regarding daycare attendance in school years, 20% of children with OM were sent to daycare centers compared to 25% of normal children and this was not statistically significant ($p = 0.17$; 95% CI = 0.44 - 1.16). Rate of home exposure to cigarette smoke was 7% in normal children and 9% in those with OM. This was again not statistically significant ($p = 0.4$, OR = 1.34, 95% CI = 0.68 - 2.65).

School AOM, hearing loss symptom as reported by parents and recurrent AOM were statistically higher in children. School AOM was present in 12.5% of children with OM compared to 4% of normal children ($p = 0.002$; OR = 3.15; 95% CI = 1.67 - 5.97). Hearing loss symptom was present in 18% of children with OM.

School District	Number of children	Normal		OME	
		No	%	No	%
School age	1820	850	45.8	85	69.6
Preschool age	1180	650	55.2	65	30.4
Total	3000	1500	100	150	100

Table 2: Prevalence of OME by School district.

$P < 0.001$ OR = 2.82, 95% CI = 1.86 - 4.28

Recurrent AOM was present in 23% of children compared to 5% of normal children ($p < 0.001$ OR = 5.73; %95 CI = 3.47- 9.45).

Nasal discharge and snoring were statistically higher in children with OM compared to normal children. Nasal discharge was reported in 32% of children with OM compared to 18% in normal children ($p = 0.003$; OR = 1.91 95% CI = 1.24 - 2.93). Snoring was present in 18% of those with OME compared to 11% of normal children ($p = 0.03$, OR = 1.76; 95% CI = 1.06 - 2.94) was not statistically significant ($p = 0.13$ and $p = 0.12$).

OM was significantly higher in schools ages. Seventy percent (78/150) of children with OM was school age compared to 45% (617/1500) of normal children preschool. Results of univariate analysis of factors with statistical significance < 0.05 (Figure 2) were reviewed using multivariate regression model (Table 3). Only five factors were found significant in this analysis: age less than 10 years (OR = 5.052, 95% CI:3.289 - 7.762), family size more than 5 members in the household (OR = 4.192, 95% CI: 2.033 - 8.643), school age (OR = 3.037, 95% CI: 1.933 - 4.772), mother education less than secondary school education (OR = 2.041, 95% CI: 1.602 - 3.877) and recurrent AOM (OR = 4.914, 95% CI: 2.677 - 9.02). Evaluation of school performance by responsible teachers revealed that there was statistical trend for children with OME to have poor performance (14/150 12.5%) compared to normal children (98/1376; 7.1%) although this trend did not reach level of statistical significance ($p = 0.067$) (Table 4).

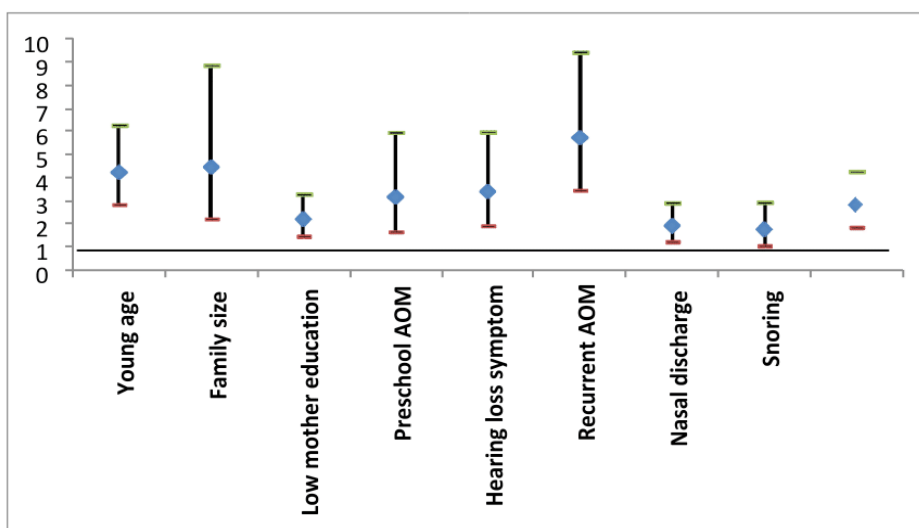


Figure 2: Odds ratio and 95% confidence interval of statistically significant risk factors.

Risk factor	Coefficient	Standard error	Odds ratio (95%CI)	p-value
Recurrent AOM	1.592	0.31	4.914 (2.677 - 9.02)	< 0.001
Young age	1.653	0.22	5.052 (3.289 - 7.762)	< 0.001
Low mother education	0.919	0.226	2.041 (1.602 - 3.877)	< 0.001
Large family size	1.433	0.369	4.192 (2.033 - 8.643)	< 0.001

Table 3: Multivariate logistic regression for predicting OM.

School performance	Number of children	Normal		OME	
		No	%	No	%
Active	371	343	24.9	28	25
Lethargy	683	636	46.	47	42
lazy	206	196	14.2	10	8.9
Total	1488	1376	100	112	100

Table 4: School performance of normal children and those with OM.

$$p = 0.067$$

Discussion

In our study, overall prevalence of OME was 10%. This rate is less than what has been reported by Zainah., *et al.* in Jazin (17%) and more than reported by Abolfotouh., *et al.* in Abha (5%). There is also a considerable variation in the prevalence of OM in worldwide studies. It was 18% in Turkey, 5.8% in Italy, 9.5% in Netherlands and 6.5% in Greece. It seems that OM is affected by the type of population studied, the geographical area and its prevailing climate [7,8].

In our study, maximum prevalence was in the first two school grades (Figure 1) and it tends to decrease in later grades. In multivariate regression model, there (was a statistically significant correlation between OME and ageless than 8 years ($p < 0.0001$; OR = 5.052, 95% CI: 3.289 - 7.762). Our results go with the opinion that age is one of the most important risk factors for OM. Zielhuis., *et al.* used the age specific prevalence of OM and concluded that there are two peaks for the disease: one around 3 years and the other around 5 years While OM generally decreases after the age of five, it continues to be seen in a significant proportion of school-age children [9,10].

In our study, we found no significant association between genders in prevalence of OM (OR = 1.05 95% CI = 0.71 - 1.54). Our results are similar to study done Zainah. In these studies, neither male nor female gender was identified as strong predictor of OM in school age. Other studies showed higher prevalence among girls or among boys. According to Tos., *et al.* gender difference in otitis media represents mainly the influence of cultural factors. In our study, children with OM had larger number of family members in household than normal children ($p < 0.0001$). From multivariate regression model, we found that family size of more than 4 members is one of the strongest predictors of OM (OR = 4.192, 95% CI: 2.033 - 8.643). They found that presence of older siblings is an important factor in occurrence of OM. Probability of disease increases with each additional brother or sister. In Australia, Jacoby P., *et al.* found higher risk of carriage of bacteria causing otitis media in aboriginal children compared to non-aboriginal children. They highlighted the need to reduce the crowding in Aboriginal households [10,11].

Gultekin., *et al.* and Martines., *et al.* however, found no difference in the number of household between children with and without OM.

In our study, low mother education was found to be a risk factor for OM. In multivariate regression model, mother education less than secondary school education was found to be a predictor of OME ($p < 0.001$; OR = 2.041, 95% CI: 1.602 - 3.877). Similarly Gultekin., *et al.*

reported higher prevalence of OM in families with less parental education. Daly, *et al.* also found that lower levels of maternal education [12] were associated with poorer knowledge regarding otitis media.

In our study, AOM in preschool children was reported by Zainah.

In our study, one quarter of children without OM went to day care centers in preschool years compared to 20% of those with OM. Although we did not find a significant relationship between OM and daycare attendance ($p = 0.17$, $OR = 0.71$; %95 CI = 0.44 - 1.16), maintaining good hygiene in daycare facilities and their supervision by health and education officials are essential in order to reduce rates of upper respiratory tract infection in young children attending these facilities.

One of the most studied risk factors of OM is exposure to smoking at home. Some studies, using serum, salivary and urinary cotinine as indicator of passive smoke exposure, were able to demonstrate significant relationship to OM. In our study, rate of exposure to passive smoking was unexpectedly low (7%). We could not establish a statistically significant relation between exposure to passive smoking and development of OME ($p = 0.4$, $OR = 1.34$ 95% CI = 0.68 - 2.65). Higher rates of smoking were previously reported in Saudi families but it seems that parents are becoming increasingly aware of hazards of passive smoking on their children [13].

In our study, 12.5% of children with OM had preschool AOM compared to 5% of normal children and this was statistically significant ($p = 0.002$). In univariate analysis, children with OM were three times more likely to have preschool AOM ($OR = 3.15$, %95 CI = 1.67-5.97). Kiris, *et al.* report some of children continue to have middle ear problem secondary to Eustachian tube dysfunction and large adenoid, particularly in first or second grade [14].

From univariate analysis, hearing loss symptom was significantly higher in children with OM ($p = 0.0001$ $OR = 3.39$, 95%CI = 1.92 - 5.99). However, in multivariate analysis, it was not significant. In general, sensitivity of parent suspected hearing impairment seems to be quiet low (15% in our study). Only 8% of children with OM visited ENT clinic and 3.5% of them had ENT operations (adenoidectomy, tonsliectomy). Health education of parents helps to increase their awareness of this silent disease and this has been recommended by Zainah. In our study, In the multivariate regression model, we found recurrent Nasal discharge, when it is persistent or recurrent, affects the Eustachian tube and middle ear in children. Snoring whether due to rhinitis or large adenoids is more common in children with chronic ear problems. In our study, thirty two percent of children with OM had nasal discharge compared to 18% of normal children ($p = 0.003$, $OR = 1.91$ 95% CI = 1.24 - 2.93). Snoring was reported in 18% of children with OME compared to 11% of normal children ($p = 0.03$, $OR = 1.76$; 95% CI = 1.06 - 2.94). Relation of these two symptoms as risk factors associated with OM has been reported by Zainah [15].

In our study, OM was more prevalent in school age (Table 2) than in preschool age. This can be explained by low socioeconomic status and less access to healthcare facilities in multivariate regression model.

Regarding activity performance, we found only a statistical trend for students with OM to have lazy activity performance than normal children in the age ($p = 0.067$) (Table 3). Similarly Zainah found that children with OM had low success levels compared to normal children but the difference in their study was slight (10.7 vs. 6.8%). Conductive hearing loss especially when bilateral (32/112 children in our study) impairs child attention during classes. Using actual student scores in statistical analysis, instead of ranks or grades would have increased statistical power.

Limitations in our study is that we relied on self-reports from the parents. This may be a source of recall bias. 'Yes or no' choices in most of questionnaire items, used for its brevity, might not have allowed parents to give their exact response [16-31].

Conclusions

Prevalence of OM in Riyadh region reaches 710% in school children. Age less than 10 years, family size more than 5 members in the household, mother education less than secondary school education, school age less than preschool age. Otoscopy should be used as screening tools for OM [17].

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