

The Effect of Maternal Factors in the Etiology of Otitis Media with Effusion in Children

Çocuklarda Efüzyonlu Otitis Media Etiyolojisinde Anneye Ait Faktörlerin Etkisi

M. Tarhun YOSUNKAYA^a

^aDepartment of Ear, Nose and Throat Diseases, Lokman Hekim University Faculty of Medicine, Ankara, TURKEY

ABSTRACT Objective: The controllable and preventable maternal factors are important in the etiology of the otitis media with effusion (OME) in children as it includes both environmental and genetic features. We aimed to investigate the importance of mothers' smoking during pregnancy, breastfeeding duration, smoking in the same environment with children, education level and allergy history on the etiology of OME in children. **Material and Methods:** In this study, 108 children (37 girls, 71 boys) between the ages of 4-12 and diagnosed with OME and 60 healthy children were included. Maternal factors of children with OME and healthy children were investigated. **Results:** In this study, no relationship was found between the duration of breastfeeding, smoking during pregnancy and OME in children ($p>0.05$). However, an association was found between the increase in mother's education level, smoking in the same environment with the child and OME ($p<0.05$). We found that, mothers of children with OME had a high rate of allergy history. According to this result, the relationship between the history of allergy in the mother and OME was statistically significant ($p<0.05$). **Conclusion:** It is important to identify the risk factors of OME, both to prevent its development and to define the correct treatment method for these children. Maternal factors should be considered in the etiology of OME in children since they are both controllable and preventable. Mothers of affected children should be informed about the cause and consequences of OME. Physicians and mothers should cooperate on preventive measures.

Keywords: Maternal factors; otitis media with effusion; children; etiology

ÖZET Amaç: Çocuklarda efüzyonlu otitis media (EOM) etiyolojisinde, hem çevresel hem de genetik özellikler içermesi nedeniyle kontrol edilebilir ve önlenebilir olan anneye ait faktörler önemlidir. Annelerin gebelikte sigara içmesi, emzirme süresi, çocukla aynı ortamda sigara içmesi, eğitimi düzeyi ve alerji öyküsünün çocuklarda EOM etiyolojisini üzerindeki önemini araştırmasını amaçladık. **Gereç ve Yöntemler:** Çalışmaya EOM tanısı alan 4-12 yaş arası 37 kız, 71 erkek 108 çocuk ve 60 normal çocuk dahil edildi. EOM'lı çocukların ve sağlıklı çocukların anneye ait faktörleri araştırıldı. **Bulgular:** Bu çalışmada çocuklarda emzirme süresi, gebelikte sigara kullanımı ve OME arasında ilişki bulunmadı ($p>0.05$). Annenin eğitim düzeyindeki artışı, çocukla aynı ortamda sigara içmesi ve EOM arasında bağlantı bulundu ($p<0.05$). EOM'lı çocukların annelerinde yüksek oranda alerji öyküsü olduğunu bulduk. Bu sonuca göre annedeki alerji öyküsü ile EOM arasındaki ilişki istatistiksel olarak anlamlıydı ($p<0.05$). **Sonuç:** EOM'nın risk faktörlerini belirlemek, hem gelişimini önlemek hem de bu çocukların için doğru tedavi yöntemini tanımlamak açısından önemlidir. Anne faktörleri hem kontrol edilebilir hem de önlenebilir oldukları için çocukların EOM etiyolojisinde dikkate alınmalıdır. Etkilenen çocukların anneleri, EOM'nın nedeni ve sonuçları hakkında bilgilendirilmeliidir. Doktorlar ve anneler önleyici tedbirler konusunda iş birliği yapmalıdır.

Anahtar Kelimeler: Anneye ait faktörler; efüzyonlu otitis media; çocuklar; etiyoloji

Otitis media with effusion (OME) is characterized by the accumulation of serous or mucous fluid in the middle ear space behind the intact tympanic membrane and the absence of signs of infection. The rate of OME varies between 2-18% in different studies and the disease appears mostly in early childhood. It is the most common ear disease and is the cause of hearing loss in childhood. Insufficient immune system and im-

maturity of the Eustachian tube are considered to be the main factor in the occurrence of OME. When the disease is inadequately treated or not treated, it can lead to sequelae and complications such as retraction pockets, tympanosclerosis, and adhesive middle ear inflammation. Impairment in speech and language development occur due to hearing loss. Different factors are involved in the etiopathogenesis of OME. Epi-

Correspondence: M. Tarhun YOSUNKAYA
Department of Ear, Nose and Throat Diseases, Lokman Hekim University Faculty of Medicine, Ankara, TURKEY/TÜRKİYE
E-mail: tarhun.yosunkaya@lokmanhekim.edu.tr



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demiological, familial and environmental factors are effective in the etiology of this disease. In many studies, familial predisposition has been reported in OME. This predisposition can result from common genes and environmental differences. In the etiology of the OME, familial maternal factors have both environmental and genetic characteristics and are very important because they can be controlled and preventable.¹⁻⁵

In this study, smoking in pregnancy, breastfeeding, smoking in the same environment with the child, education level and allergy history of the mothers of children with OME were investigated.

MATERIAL AND METHODS

In this prospective study conducted between 2014 and 2017, 108 children (37 girls, 71 boys) aged 4-12 years diagnosed with OME and 60 healthy children recruited from hospital staff (21 girls, 39 boys aged 5-11 years) were included. Maternal factors of children with OME were investigated.

Patients who were previously treated and operated for OME were also included in the study. Each patient was inspected by the same ear, nose and throat (ENT) physician. Dullness of the eardrum, increased vascularization, thickening and differences in the position of the manubrium, the appearance of air-fluid and the aspect of air bubbles were accepted as evidence for OME. Middle ear pressures below -250 mm H₂O and type B or C tympanograms found in children with OME were accepted as positive signs of OME.

Maternal factors of children with OME and healthy children were investigated. The mothers of the children were asked face-to-face questions about smoking during pregnancy, breastfeeding duration, education level, smoking in the same environment with the child, history of allergy and their answers were recorded.

The duration of breastfeeding were arranged in accordance with the recommendations of the World Health Organization (WHO).

The exposure of the children to passive cigarette smoke was questioned smoke was questioned as only mothers smoke in the same environment with the child at home. It was not questioned whether other family members smoked in the same environment with the children.

Allergy history of mothers who were treated according to Allergic Rhinitis and Its Effect on Asthma guidelines used for the diagnosis and management of allergic rhinitis were accepted as positive.⁶

Ethics committee approval was received for this study from the Özel Kavaklıdere Umut Hospital Ethics Committee (approval date/no: 5 Dec, 2013/1). Our study has been prepared following the Helsinki Declaration Principles and informed consent was obtained from all of our patients mothers to participate in this study.

STATISTICAL ANALYSIS

The results of the study were evaluated using statistical analysis program (Statistical Package for the Social Sciences (SPSS) version 22.0, SPSS Inc. Chicago, IL, USA). Chi-square test was used to assess the differences between groups. Statistical significance level accepted as p<0.05.

RESULTS

In the current study, no difference was found between the children with OME and healthy children in terms of the duration of breastfeeding and smoking status of mothers during pregnancy (**Table 1**, **Table 2**).

The education level of the mothers was examined, the education level of most of the mothers of children with OME was university (48%), and the education level of most of the mothers of normal children was primary school (43%) (**Table 3**).

The frequency of OME was higher in the children with mothers having higher education level (p=0.025). The smoking characteristics of mothers in the same environment with their child at home were evaluated, it was found that 71% of the mothers of children with OME smoke in the same environment

TABLE 1: Distribution of smoking status of mothers of children with otitis media with effusion and healthy controls during pregnancy.

Mother smoking during pregnancy	Children with OME	Healthy controls
Smoke (+)	15 (14%)	7 (11%)
Smoke (-)	94 (86%)	53 (89%)
Total	108	60

OME: Otitis media with effusion.

TABLE 2: Distribution of breastfeeding duration of children with otitis media with effusion and healthy controls.

Breast-feeding duration	Children with OME	Healthy controls
Less than 6 months	42 (38%)	19 (31%)
6-12 months	39 (36%)	24 (40%)
More than 12 months	27 (26%)	17 (29%)
Total	108	60

OME: Otitis media with effusion.

TABLE 3: Distribution of maternal education level of children with otitis media with effusion and healthy controls.

Maternal education level	Children with OME	Healthy controls
Primary school	34 (31%)	26 (43%)
High school	23 (21%)	19 (32%)
University	51 (48%)	15 (25%)
Total	108	60

OME: Otitis media with effusion.

TABLE 4: Distribution of mothers smoking near the children with otitis media with effusion and healthy controls.

Maternal smoking near the children	Children with OME	Healthy controls
Smoke (+)	77 (71%)	14 (23%)
Smoke (-)	31 (29%)	46 (77%)
Total	108	60

OME: Otitis media with effusion.

TABLE 5: Distribution of mothers' allergy history of children with otitis media with effusion and healthy controls

Mother's allergy history	Children with OME	Healthy controls
*ARIA (+)	59 (54%)	16 (26%)
ARIA (-)	49 (46%)	44 (74%)
Total	108	60

OME: Otitis media with effusion; *ARIA: Allergic rhinitis and its effect on asthma.

with their children while the ratio of smoking mothers of healthy children was 23% (**Table 4**). Children who have a smoking mother nearby had higher frequencies of OME ($p=0.032$).

The history of allergy in the mothers was examined, 59 (54%) of the mothers of children with OME had a history of allergy, while 16 (26%) of the mothers of healthy children had a history of allergy (**Table 5**). This result was statistically significant ($p=0.043$).

DISCUSSION

Although OME is a self-limiting condition in the majority of cases, it may become chronic to extent that it affects child education and quality of life.^{7,8} In children, most of OME, disappears spontaneously within 3 months while 30-40 percent have recurrent episodes.^{9,10} Due to the high currency of disease and the significance of complications, risk parameters for OME should be recognized in order to diagnose early and prevent potential hearing diseases, speech impairment, educational and physico-social problems. In recent studies, the topics discussed include demographic features, socioeconomic status, passive smoking, breastfeeding, allergy and family history of otitis media.¹¹⁻¹³ The different results that may occur in the studies may be due to the variability of the study groups and environments.

This study revealed that, the frequency of OME was higher in children with smoking mother nearby, mother's having higher education level, and children with allergy history. The duration of breastfeeding and smoking status of mothers during pregnancy were not differing between the children with OME and healthy children.

In studies related to smoking during pregnancy, it has been reported that prenatal exposure to smoking causes many pathologies in children and may delay mental and emotional development by leaving permanent effects on children's physical development.^{14,15}

Studies have found that breastfeeding is protective against upper respiratory tract infections and OME. It has been recognized worldwide that breastfeeding has a protective effect on infants. Breast milk is a biologically active substance that contains antimicrobial, anti-inflammatory and immunomodulatory agents of the infant immune system. The WHO advises exclusive breastfeeding for the first 6 months of life, based research on many infectious and chronic diseases that persists for decades. In many studies, it has been reported that breastfeeding protects infants against infections. Studies have found that the protective effect of breastfeeding in infants is valid in the first years of life, not during school years.¹⁶⁻¹⁹

Various studies show that low socioeconomic status (SES) is a risk factor for the progress of middle ear infections considering overcrowding, malnutrition and poor hygiene.²⁰ Some studies did not find an association between SES and otitis media, while others found that the disease was more common at low SES.^{21,22} According to Daly et al., low mother education was found to be a risk factor for OME and also low level of maternal education was associated with poor knowledge about otitis media in children.²³ Some studies have found that high SES is associated with a high prevalence of otitis media.^{24,25} The reason for OME being seen in high SES has been shown to be the population in the urban area and the possibility of caring for children in daycare centers.^{26,27} In this study, it was found that OME was seen more frequently in mothers with high education levels. This may be due to the fact that highly educated families are more sensitive to the issue, particularly refer to ENT physicians and pediatrician. Some families applied to the family physician and these children received symptomatic treatment, but the main reason was not investigated and the correct diagnosis could not be made for these children.

Many studies have revealed the harms of cigarette smoke. It is one of the main risk factors responsible for chronic diseases. WHO has reported the smoking rate in the world as 20-25%. This result reveals that the rate of passive smokers is so many.

Children are more affected and harmed by cigarette smoke than adults. In a study from China, it was found that 48.3% of the children were passive smokers at home, and 76.5 of the smoking parents smoke with their children.²⁸ Agius et al. found that, children exposed to cigarette smoke in their homes have impaired middle ear ciliary activity and reported that ciliary dysfunction due to passive smoking has an important effect on the etiology of OME.²⁹ According to the results of the studies, it was found that cigarette smoke impairs the function of ciliary activity and surface mucus quality in the middle ear and eustachian tube. Chemical irritation by cigarette smoke causes obstruction of the eustachian tube.³⁰⁻³²

The history of allergy in the mother is a risk factor that increases the likelihood of allergic diseases in the child. It has been found that some genes are effec-

tive in the emergence of the disease and some genes are effective in the severity of the disease in the development of allergy. It is thought that allergic diseases occur with the effect of genetic factors and environmental factors. In recent studies of otorhinolaryngologists, pediatricians and allergists, they found results that support the hypothesis that there is a relationship between otitis media and allergy.^{33,34} Various studies have found an association between nasal allergy and OME. Nasal congestion due to allergic rhinitis may be a predisposing factor for OME. In addition to nasal congestion, allergic nasal discharge can cause eustachian tube obstruction, which causes liquid to accumulate in the middle ear cavity.³⁵⁻³⁷

CONCLUSION

OME can lead to permanent ear diseases and hearing problems, resulting in delayed speaking and language improvement in children. The consequences of OME can be prevented with timely identification and treatment. But often, it is not possible to diagnose it early, as the disease is silent and occurs more frequently in young children. For this reason, it is important to identify the risk factors of OME, both to prevent its development and to define the correct treatment method for these children. Maternal factors should be considered in the etiology of OME, as they are both controllable and preventable. Mothers of affected children should be informed about the cause and consequence of OME. Physicians and mothers should cooperate on preventive measures.

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During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

REFERENCES

1. Atkinson H, Wallis S, Coatesworth AP. Otitis media with effusion. Postgrad Med. 2015; 127(4):381-5. [\[Crossref\]](#) [\[PubMed\]](#)
2. Takata GS, Chan LS, Morphew T, Mangione-Smith R, Morton SC, Shekelle P. Evidence assessment of the accuracy of methods of diagnosing middle ear effusion in children with otitis media with effusion. Pediatrics. 2003; 112(6 Pt 1):1379-87. [\[Crossref\]](#) [\[PubMed\]](#)
3. Hardani AK Sr, Moghimi Esfandabadi F, Delphi M, Ali Samir M, Zamiri Abdollahi F. Risk factors for otitis media in children referred to Abuzar Hospital in Ahvaz: a case-control study. Cureus. 2020;12(8):e9766. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
4. Williamson I. Otitis media with effusion. Clin Evid. 2002;(7):469-76. Update in: Clin Evid. 2002;(8):511-8. [\[PubMed\]](#)
5. Daly KA, Hoffman HJ, Kvaerner KJ, Kvistad E, Casselbrant ML, Homoe P, et al. Epidemiology, natural history, and risk factors: panel report from the Ninth International Research Conference on Otitis Media. Int J Pediatr Otorhinolaryngol. 2010;74(3):231-40. [\[Crossref\]](#) [\[PubMed\]](#)
6. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, et al; World Health Organization; GA(2)LEN; AllerGen. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). Allergy. 2008;63 Suppl 86:8-160. [\[PubMed\]](#)
7. McCormick DP, Johnson DL, Baldwin CD. Early middle ear effusion and school achievement at age seven years. Ambul Pediatr. 2006;6(5):280-7. [\[Crossref\]](#) [\[PubMed\]](#)
8. Martines F, Bentivegna D, Di Piazza F, Martinciglio G, Sciacca V, Martines E. The point prevalence of otitis media with effusion among primary school children in Western Sicily. Eur Arch Otorhinolaryngol. 2010;267(5):709-14. [\[Crossref\]](#) [\[PubMed\]](#)
9. Vítek P, Jehlička J, Ascaso C, Mašek V, Gómez-Silva B, Olivares H, et al. Distribution of scytonemin in endolithic microbial communities from halite crusts in the hyperarid zone of the Atacama Desert, Chile. FEMS Microbiol Ecol. 2014;90(2):351-66. [\[Crossref\]](#) [\[PubMed\]](#)
10. Eden A, Fireman P, Stool SE. Otitis media with effusion: sorting out the options. Patient Care. 2000;29:32-56.
11. Gravel JS, Wallace IF. Effects of otitis media with effusion on hearing in the first 3 years of life. J Speech Lang Hear Res. 2000;43(3): 631-44. [\[Crossref\]](#) [\[PubMed\]](#)
12. Mudry A, Young JR. Otitis media with effusion: Politzer's 100 year legacy. Int J Pediatr Otorhinolaryngol. 2020;136:110160. [\[Crossref\]](#) [\[PubMed\]](#)
13. Zielhuis GA, Heuvelmans-Heinen EW, Rach GH, van den Broek P. Environmental risk fac-tors for otitis media with effusion in preschool children. Scand J Prim Health Care. 1989; 7(1): 33-8. [\[Crossref\]](#) [\[PubMed\]](#)
14. Gustavson K, Ystrom E, Stoltzenberg C, Susser E, Surén P, Magnus P, et al. Smoking in pregnancy and child ADHD. Pediatrics. 2017;139(2):e20162509. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
15. Geirsson RT, Tolosa JE. Smoking, tobacco exposure and pregnancy. Acta Obstet Gynecol Scand. 2010;89(4):414-5. [\[Crossref\]](#) [\[PubMed\]](#)
16. Kørvel-Hanquist A, Djurhuus BD, Homøe P. The effect of breastfeeding on childhood otitis media. Curr Allergy Asthma Rep. 2017;17(7): 45. [\[Crossref\]](#) [\[PubMed\]](#)
17. Chirico G, Marzollo R, Cortinovis S, Fonte C, Gasparoni A. Antiinfective properties of human milk. J Nutr. 2008;138(9):1801S-6S. [\[Crossref\]](#) [\[PubMed\]](#)
18. Abrahams SW, Labbok MH. Breastfeeding and otitis media: a review of recent evidence. Curr Allergy Asthma Rep. 2011;11(6):508-12. [\[Crossref\]](#) [\[PubMed\]](#)
19. Chantry CJ, Howard CR, Auinger P. Full breastfeeding duration and associated decrease in respiratory tract infection in US children. Pediatrics. 2006;117(2):425-32. [\[Crossref\]](#) [\[PubMed\]](#)
20. Shaheen MM, Raquib A, Ahmad SM. Chronic suppurative otitis media and its association with socio-economic factors among rural primary school children of bangladesh. Indian J Otolaryngol Head Neck Surg. 2012;64(1):36-41. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
21. Apostolopoulos K, Xenelis J, Tzagarakoulakis A, Kandilopoulos D, Yioutakis J, Papafragou K. The point prevalence of otitis media with effusion among school children in Greece. Int J Pediatr Otorhinolaryngol. 1998;44(3):207-14. [\[Crossref\]](#) [\[PubMed\]](#)
22. Tong MC, Yue V, Ku PK, Lo PS, Wong EM, van Hasselt CA. Risk factors for otitis media with effusion in Chinese schoolchildren: a nested case-control study and review of the literature. Int J Pediatr Otorhinolaryngol. 2006;70(2):213-9. [\[Crossref\]](#) [\[PubMed\]](#)
23. Daly KA, Selvius RE, Lindgren B. Knowledge and attitudes about otitis media risk: implications for prevention. Pediatrics. 1997;100(6): 931-6. [\[Crossref\]](#) [\[PubMed\]](#)
24. Umapathy D, Alles R, Scadding GK. A community based questionnaire study on the association between symptoms suggestive of otitis media with effusion, rhinitis and asthma in primary school children. Int J Pediatr Otorhinolaryngol. 2007;71(5):705-12. [\[Crossref\]](#) [\[PubMed\]](#)
25. Zielhuis GA, Rach GH, van den Bosch A, van den Broek P. The prevalence of otitis media with effusion: a critical review of the literature. Clin Otolaryngol Allied Sci. 1990;15(3):283-8. [\[Crossref\]](#) [\[PubMed\]](#)
26. Sophia A, Isaac R, Rebekah G, Brahmadathan K, Rupa V. Risk factors for otitis media among preschool, rural Indian children. Int J Pediatr Otorhinolaryngol. 2010;74(6):677-83. [\[Crossref\]](#) [\[PubMed\]](#)
27. Siddartha, Bhat V, Bhandary SK, Shenoy V, Rashmi. Otitis media with effusion in relation to socio economic status: a community based study. Indian J Otolaryngol Head Neck Surg. 2012;64(1):56-8. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
28. Tarhun YM. The effect of passive smoking on the etiology of serous otitis media in children. Am J Otolaryngol. 2020;41(3):102398. [\[Crossref\]](#) [\[PubMed\]](#)
29. Agius AM, Smallman LA, Pahor AL. Age, smoking and nasal ciliary beat frequency. Clin Otolaryngol Allied Sci. 1998;23(3):227-30. [\[Crossref\]](#) [\[PubMed\]](#)
30. DiFranza JR, Lew RA. Morbidity and mortality in children associated with the use of tobacco products by other people. Pediatrics. 1996;97(4):560-8. [\[PubMed\]](#)
31. Amani S, Yarmohammadi P. Study of effect of household parental smoking on development of acute otitis media in children under 12 years. Glob J Health Sci. 2015;8(5):81-8. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
32. Patel MA, Mener DJ, Garcia-Esquinas E, Navas-Acien A, Agrawal Y, Lin SY. Tobacco smoke exposure and eustachian tube disorders in US children and adolescents. PLoS One. 2016;11(10):e0163926. [\[Crossref\]](#) [\[PubMed\]](#) [\[PMC\]](#)
33. Martines F, Martinciglio G, Martines E, Bentivegna D. The role of atopy in otitis media with effusion among primary school children: audiological investigation. Eur Arch Otorhinolaryngol. 2010;267(11):1673-8. [\[Crossref\]](#) [\[PubMed\]](#)
34. Ciprandi G, Torretta S, Marseglia GL, Licari A, Chiappini E, Benazzo M, et al. Allergy and otitis media in clinical practice. Curr Allergy Asthma Rep. 2020;20(8):33. [\[Crossref\]](#) [\[PubMed\]](#)
35. Skoner AR, Skoner KR, Skoner DP. Allergic rhinitis, histamine, and otitis media. Allergy Asthma Proc. 2009;30(5):470-81. [\[Crossref\]](#) [\[PubMed\]](#)
36. Norhafizah S, Salina H, Goh BS. Prevalence of allergic rhinitis in children with otitis media with effusion. Eur Ann Allergy Clin Immunol. 2020;52(3):121-30. [\[Crossref\]](#) [\[PubMed\]](#)
37. Yorgancıoğlu AA, Gemicioğlu B, Cingi C, Kalayci Ö, Kalyoncu AF, Bachert C, et al. ARIA 2019, allerjik rinite tedavi yaklaşımı-Türkiye. Turk Thorac J. 2020;21(2):122-33. [\[PubMed\]](#) [\[PMC\]](#)