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Childhood Asthma and Its Relationship with Tonsillar Tissue

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SUMMARY The aim of this study was to evaluate the prevalence of asthma among 4–17 years old school children and to determine the relationship between frequent tonsillitis, tonsillar hypertrophy and asthma-related symptoms. A total of 2,000 school children, aged 4–17 years, in Denizli were surveyed using the ISAAC questionnaire; the size of the tonsils was evaluated by physical examination. A total of 1,784 questionnaires were completed giving an overall response rate of 89.2%. The prevalence of lifetime wheezing, 12-month wheezing and lifetime doctor-diagnosed asthma were 16.4%, 6.2% and 1.7%, respectively. The prevalence of frequent tonsillitis and tonsillar hypertrophy were 19.9% and 3.4%, respectively. Tonsillar hypertrophy was positively correlated with a history of frequent tonsillitis. Frequent tonsillitis and tonsillar hypertrophy could be evaluated as risk factors for asthma due to their significant association with asthma-related symptoms.

Asthma is the most common chronic disease in the pediatric population.[1] An estimated 5- 15% of children have asthma, and there are worldwide variations in the prevalence of the different symptoms of asthma.[2] The prevalence of asthma is increasing in western and developing countries.[3,4]

Acute respiratory tract infections are the most common diseases of childhood. Most respiratory infections are upper airway infections.[5] Upper respiratory tract infections including nasopharyngitis, pharyngitis, tonsillitis and otitis media constitute 87.5% of the total episodes of respiratory infections. The majority of acute upper respiratory tract infections are caused by viruses.[5,6]

The majority of acute asthma episodes are triggered by respiratory viral infections in which recruitment of Th2-type cells into the lungs might be responsible.[7] The frequency of upper respiratory tract infections was reported to be higher in asthmatic children than in controls.[8]

The tonsils are part of Waldeyer's ring, the basic function of which is antibody formation and defence against antigens. Allergic sensitization of the airways occurs partly in the mucosa of the afflicted organ, but also partly in the lymphatic stations draining these structures. Adenoids and tonsils are the

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relevant lymphatic stations of the nasal mucosa in humans. Allergy and sensitivity to different kinds of allergens are thought to be risk factors for adenoid hypertrophy (AH) in children.[9]

There are few studies on the relationship between asthma symptoms and tonsillar tissue in the literature. In this study, we aimed to evaluate the prevalence of asthma-related symptoms among 4–17 year old school children and to determine its relationship with frequent tonsillitis and tonsillar hypertrophy.

MATERIALS AND METHODS

A total of 2,000 children, aged 4–17 years, in six day-care centers, four primary schools and four high schools in Denizli were surveyed using the ISAAC questionnaire[10] between March and May 2003. Children from each class level were included to provide an equal distribution of children according to age.

The questionnaire included questions on the history of frequent tonsillitis, tonsillectomy and/or adenoidectomy and symptoms of asthma. A detailed form was completed for each child by the parents. Thereafter, the size of the tonsils was evaluated by a pediatrician in all children and scored on a four-point scale as follows: Grade 1, tonsils were in the tonsillary fossa, barely seen behind the anterior pillars; Grade 2, tonsils were visible behind the anterior pillars; Grade 3, tonsils extended three-quarters of the way to the midline; Grade 4, tonsils were completely obstructing the airway.[11-13] Grades 3 and 4 were accepted as tonsillar hypertrophy. The interrelationship between tonsillar hypertrophy and asthma-related symptoms was examined by the chi-squared test, and the 95% confidence interval (CI) was calculated for the differences where appropriate. Those with tonsillectomy and/or adenoidectomy were excluded. Frequent tonsillitis was defined as more than two episodes of tonsillitis per year. The interrelationships between a history of frequent tonsillitis, tonsillectomy and/or adenoidectomy and asthma-related symptoms were examined by the chi-squared test. A significant difference was indicated by a p-value < 0.05. Odds ratios and 95% confidence limits for risk factors were calculated with coefficients and standard errors.

RESULTS

Of the 2,000 children, 216 were excluded due to refusal (160 children) and absenteeism (56 children). A total of 1,784 questionnaires were completed with an overall 89.2% response rate. Of 1,784 children, 803 (45%) were boys and 981 (55%) were girls. The male to female ratio was 0.82. Demographic data of the study population are given in Table 1.

In our study, the prevalence of lifetime wheezing, wheezing in the previous year, and lifetime doctor-diagnosed asthma were 16.4%, 6.2%, and 1.7%, respectively. The prevalence of other asthma-related symptoms is given in Table 2.

The prevalence of frequent tonsillitis was 19.9%. The results of tonsil scoring were as follows: Grade 1, 62.7%; Grade 2, 28.4%, Grade 3, 3.3%; Grade 4, 0.1%; tonsillectomy, 5.5%. Ninety-eight

Table 1 Demographic data of the study population

Number of the study population	1,784
Sex, n (%)	
Male	803 (45)
Female	981 (55)
Age, median years (range)	11 (4-17)
Children with frequent tonsillitis, n (%)	349 (19.9)
Children with tonsillar hypertrophy, n (%)	60 (3.4)
Children with tonsillectomy and/or adenoidectomy, n (%)	98 (5.5)
Children with only adenoidectomy, n (%)	40 (2.2)

patients were found to have had a tonsillectomy and/or adenoidectomy. The prevalence of tonsillar hypertrophy in the school children was 3.4%.

A history of frequent tonsillitis was found to be significantly associated with tonsillar hypertrophy (Odds ratio [OR] = 3.45; 95% confidence interval [CI] = 2.03-5.88). The history of frequent tonsillitis and tonsillar hypertrophy decreased with increasing age (Fig. 1). The number of children with frequent tonsillitis and tonsillar hypertrophy who showed a high level of asthma-related symptoms was significant. Frequent tonsillitis was found to be significantly associated with lifetime wheezing (OR = 2.84; CI = 2.15-3.74), 12-month wheezing (OR = 1.56; CI = 0.95-2.56), exercise wheezing (OR = 2.32; CI =

Table 2 Prevalence of asthma and other symptoms

Question	N	%
Lifetime wheezing	293	16.4
Wheezing in last year	111	6.2
Attacks of wheezing in last year		
None	9	0.5
1–3	81	4.5
4–12	11	0.6
More than 12	7	0.4
Sleep disturbed by wheezing in last year		
Never woken with wheezing	51	2.9
Less than one night per week	40	2.2
One or more nights per week	14	0.8
Severe attacks of wheezing limiting speech in last year	23	1.3
Lifetime doctor-diagnosed asthma	31	1.7
Wheezing after exercise in last year	80	4.5
Waking with cough in last year	492	27.6
Total	1,784	100

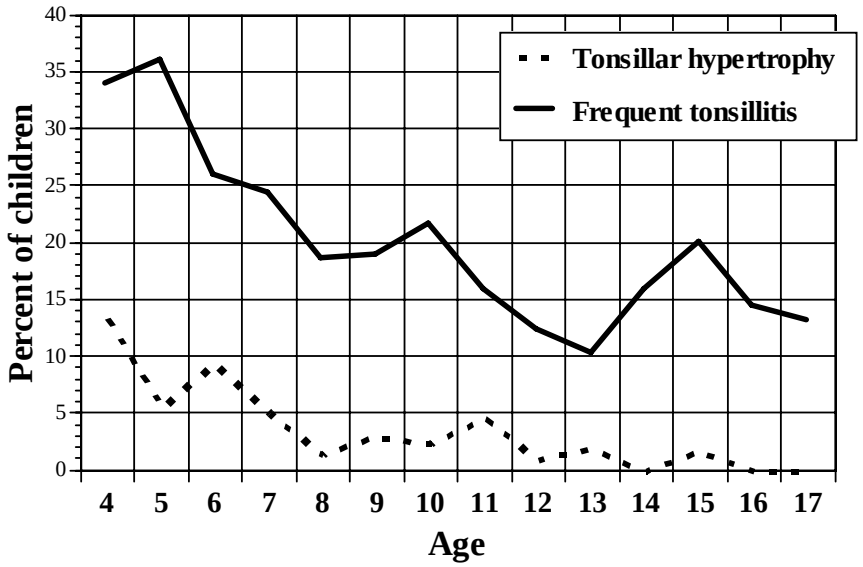

Fig. 1 The relationship between tonsillar hypertrophy and frequent tonsillitis according to age.

1.44-3.74) and waking with a cough (OR = 2.31; CI = 1.81-2.96) (Table 3). Frequent tonsillitis and asthma-related symptoms were found to decrease with increasing age except for 12-month wheezing which showed two peaks at 5 and 16 years, respectively (Fig. 2). Tonsillar hypertrophy was found to be significantly associated with lifetime wheezing (OR = 1.95; CI = 1.08-3.52). The interrelationships between frequent tonsillitis, tonsillar hypertrophy and asthma-related symptoms are shown in Table 3.

Children with tonsillectomy and/or adenoidectomy rarely experienced exercise-induced wheezing in the previous year (OR = 0.14; CI = 0.02-1.02). In addition, tonsillectomy and/or adenoidectomy was not associated with lifetime wheezing (OR = 0.73; CI = 0.44-1.22), 12-month wheezing (OR = 0.58; CI = 0.20-1.69), lifetime doctor-diagnosed asthma (OR = 0.38; CI = 0.05-2.81), or waking with a cough (OR = 1.08; CI = 0.69-1.50) (Table 4).

DISCUSSION

Our study is the first epidemiologic survey on allergic diseases using the ISAAC protocol among 4–17 year old school children, held in Denizli, the second largest and fast-developing city after Izmir in the Aegean Region of Turkey. It is one

Table 3 The relationship between adenotonsillar tissue and symptoms of asthma

	Children with frequent tonsillitis n (%)	**Children without frequent tonsillitis** n (%)	**OR** (95% CI)	***p* value**	**Children with tonsillar hypertrophy** n (%)	**Children without tonsillar hypertrophy** n (%)	**OR** (95% CI)	***p* value**
Lifetime wheezing	105 (30.2)	183 (13.2)	2.84 (2.15 - 3.74)	< 0.001	16 (27.6)	277 (16.3)	1.95 (1.08-3.52)	0.02
Wheezing in last year	47 (44.8)	61 (34.1)	1.56 (0.95 - 2.56)	0.04	7 (43.8)	104 (38.1)	1.26 (0.46-3.50)	0.41
Lifetime doctor-diagnosed asthma	8 (2.3)	334 (1.7)	1.40 (0.62 - 3.17)	0.26	0 (0)	31 (1.8)	–	0.35
Wheezing after exercise in last year	28 (8.3)	311 (3.7)	2.32 (1.44 - 3.74)	0.001	0 (0)	80 (4.8)	1.05 (1.03-1.06)	0.06
Waking with cough in last year	149 (43.2)	340 (24.7)	2.31 (1.81 - 2.96)	< 0.001	21 (36.2)	471 (28.0)	1.46 (0.84-2.52)	0.11

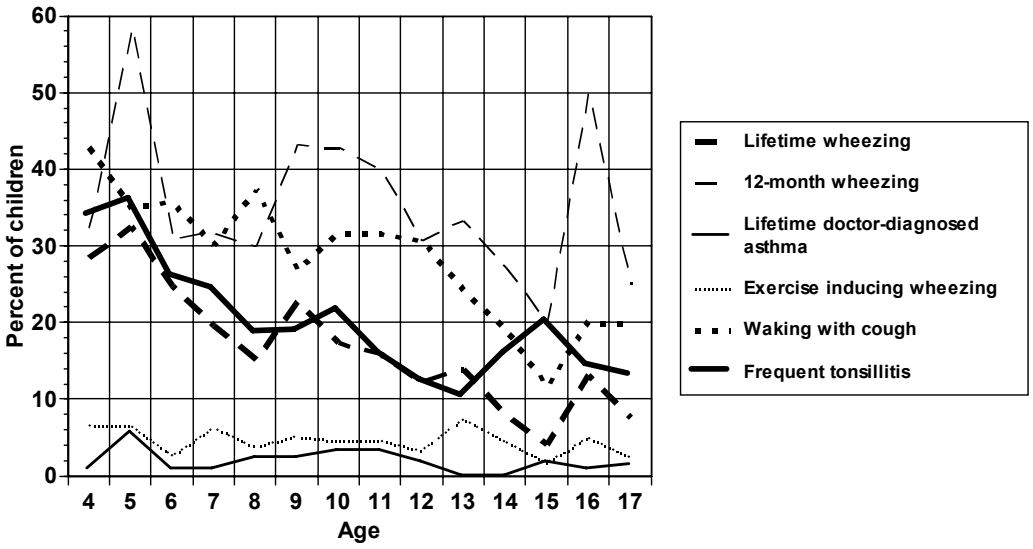

Fig. 2 The relationship between frequent tonsillitis and asthma-related symptoms according to age.

of the cities where air pollution is a problem due to textile, confection and leather industries.[14] The prevalence of asthma using the ISAAC questionnaire among school children has been reported to vary between 4.9% and 16.4% in Turkey[15–22] and between 2.1% and 30.2% in some other countries.[23] Turkey is a large country with different geographic regions, where plant cover, society structure, socioeconomic status, climate, and level of air pollution vary. These factors can explain the different prevalence ratios of allergic diseases obtained in different cities and countries. High rates for asthma and asthma-related symptoms were always reported in English-speaking countries.[24] Low rates may be due to underestimation of the term "wheezing" in countries such as Turkey where other languages are spoken. The discrepancy in the prevalence of symptoms of allergic diseases may be due to the selection of different age groups and regions and the fact that the parents completed the questionnaires. The low rates in Denizli may be associated with a lower awareness of allergic diseases.

There was a positive correlation between frequent tonsillitis and tonsillar hypertrophy; thus frequent tonsillar infection may cause tonsillar hypertrophy. Patients with a history of recurrent tonsillitis had larger tonsils than those without tonsillitis.[24] In the present study, children with tonsillar hypertrophy had significantly higher frequency of lifetime wheezing than children with a normal tonsil size. Other asthma-related symptoms were also common in children with tonsillar hypertrophy, but they were not statistically significant. These findings suggest that tonsillar hypertrophy might be a risk factor for asthma-related symptoms.

We also observed that the number of children with frequent tonsillitis who showed a high level of asthma-related symptoms was significant. Allergic children may have an increased tendency to upper airway diseases since the airways of asthmatics are more vulnerable due to allergic inflammation. Most asthmatic children might also have allergic rhinitis.[26] Children with allergic rhinitis usually had nasal congestion causing them to breathe through the mouth. This might lead to frequent tonsillopharyngitis and enlarged tonsils resulting in tonsillectomy. Since respiratory viruses were the most common cause of upper airway infections[5] and these were well recognized as major triggers of acute exacerbation of asthma in children,[7] frequent tonsillitis could trigger acute asthma episodes and asthma-related symptoms.

Exercise-induced wheezing in the previous year was statistically low in children with tonsillectomy/and or adenoidectomy. This might be explained by improvement in the course of the disease due to the removal of a triggering factor, the tonsils as the focal source of infection precipitating frequent upper airway infections in asthmatic children. The lack of a statistical relationship between other symptoms and tonsillectomy and/or adenoidectomy might be due to the small number of children with tonsillectomy/and or adenoidectomy.

The prevalence of asthma in Denizli was found to be lower than that reported for other cities in Turkey and other countries. This study would be a suitable baseline source for future trends on the prevalence, diagnoses and severity of asthma among 4–17 year old school children in Denizli, in western Turkey.

Frequent tonsillitis and tonsillar hypertrophy

Table 4 The relation between adenotonsillectomy and symptoms of asthma

	Children with tonsillectomy/ adenoidectomy n (%)	**Children without tonsillectomy/ adenoidectomy** n (%)	**OR** (95% CI)	***p* value**
Lifetime wheezing	18 (13.0)	272 (17.0)	0.73 (0.44–1.22)	0.14
Wheezing in last year	5 (27.8)	106 (39.6)	0.58 (0.20–1.69)	0.23
Lifetime doctor-diagnosed asthma	1 (0.7)	30 (1.9)	0.38 (0.05–2.81)	0.27
Wheezing after exercise in last year	1 (0.7)	79 (5.0)	0.14 (0.02–1.02)	0.01
Waking with cough in last year	39 (28.7)	451 (28.3)	1.08 (0.69–1.50)	0.49

could be evaluated as risk factors for asthma due to their significant association with asthma-related symptoms.

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