Prevalence of allergic rhinitis and risk factors in 6- to 7-year-old children in İstanbul, Turkey

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The aim of this study was to evaluate the prevalence of allergic rhinitis and its relationship with various risk factors in 6-7-year-old children living in İstanbul. A total of 11,483 children aged 6-7 years in 75 primary schools from all districts of İstanbul were surveyed. Prevalence of symptoms of allergic rhinitis was assessed using a translated version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. Of them, 9,875 (50.7% M, 49.3% F) questionnaires were appropriately completed by the parents. The prevalence rates of lifetime, current and physician-diagnosed allergic rhinitis were 44.3%, 29.2% and 8.1%, respectively. There was nearly a two-fold variation in the prevalence rates of rhinitis between the districts of İstanbul. Frequent paracetamol and antibiotic use in the first year of life, history of frequent upper respiratory tract infections, adenotonsillectomy, breastfeeding less than six months, dog at home or perianal redness in the first year of life, and frequent trucks passing near the home were independent risk factors.

Key words: allergic rhinitis, prevalence, risk factors.

Allergic rhinitis (AR) is a common childhood disorder like other allergic diseases[1]. The etiology of AR and other allergic diseases remains poorly understood despite considerable research. According to worldwide studies, parents reported 12-month prevalence of rhinoconjunctivitis in the 6-7 years age group as ranging from 2.2% to 24.2%[2]. Reported prevalence rates of AR for Turkish school-aged children range from 4.5% to 43.5%[3-12]. Epidemiological studies have so far failed to reach their full potential because of lack of standardization in case definition and methodology. ISAAC, the International Study of Asthma and Allergies in Childhood, established a standardized methodology and facilitated making comparisons within and between countries[13].

It has been attempted to explain the large variations in the worldwide prevalence of symptoms of AR by environmental factors such as family history of atopy, passive smoking, pet at home, gender, and exposure to antibiotics and paracetamol early in life[14-16]. However, determinants contributing to the development of AR are still lacking.

The aim of this study was to evaluate the prevalence of AR using the standard ISAAC questionnaire in İstanbul, Turkey and to consider the various potential contributing risk factors.

Material and Methods

Study Area

The survey study was conducted in İstanbul between April 2004 and May 2005. İstanbul is the biggest metropolis, home to 13.5 million people, and one of the greatest business and cultural centers in Turkey. The city population represents 1/7 of Turkey's population and there are 32 districts. Two-thirds of the city's population live in the European part and the rest in the Asian part. Internal immigration towards İstanbul increased after the 1950's due to its being the fastest growing industrial center and growth continues at a great speed[17-19].

Study Population and Design

The number of primary school children attending Grade 1 in İstanbul was 211,446. Of those children, 5% from each district were planned to be included in the survey. The number of schools and children were calculated according to the number of children attending Grade 1 in each district. According to this calculation, a total of 11,483 children aged 6-7 years in 75 randomly selected primary schools of 32 districts without selection by urban or rural residence or variations in socioeconomic status were surveyed using the ISAAC questionnaire. The 6-7 years age group was chosen to reflect the early childhood years available in school. Questionnaires were distributed by teachers and completed by parents.

Questionnaire

The standardized ISAAC core symptom questionnaire for AR in 6-7 year olds included the six questions given below[13]:

1. Has your child ever had a problem with sneezing, or a runny or blocked nose when he/she DID NOT have a cold or the flu?

2. In the past 12 months, has your child had a problem with sneezing, or a runny or blocked nose when he/she DID NOT have a cold or the flu?

3. In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?

4. In which of the past 12 months did this nose problem occur?

5. In the past 12 months, how much did this nose problem interfere with your child's daily activities?

6. Has your child ever had hayfever?

Question 1, 2, 3, and 6 were asked to estimate the prevalence of lifetime rhinitis, current rhinitis, current rhinoconjunctivitis, and physician-diagnosed AR, respectively. A translated version of the ISAAC questionnaire was used. An additional questionnaire was used to identify demographic features and potential risk factors including: sex, paracetamol or antibiotic use in the first year of life, history of frequent upper airway infections, history of adenotonsillectomy, breastfeeding less than six months, exposure to tobacco smoke at home, maternal and paternal smoking, cat or dog ownership in the first year of life and in the past 12 months, person with scurf at home, perianal redness, television viewing per day (hours), heating system, exposure to diesel trucks, and being born in İstanbul.

Statistical Analysis

Statistical significance of differences was assessed by the chi-square test. A p value less than 0.05 was considered as significant. Prevalence estimates were calculated by dividing positive responses to the given question by the total number of completed questionnaires, while missing or inconsistent responses were excluded from subsequent univariate analyses, according to ISAAC recommendations[20,21]. The children with no response for a question were excluded from analysis of the relevant variable.

The relation between risk factors and physician-diagnosed AR prevalence was performed by univariate analysis using chi-squared tests and univariate odds ratio (uOR) and its 95% confidence interval (CI). Significant factors from the univariate analysis were taken into multivariate logistic regression analysis to assess the independent effects of risk factors on physician-diagnosed AR with adjusted odds ratio (aOR) and its 95% CI.

The Statistical Package for the Social Sciences (SPSS) software package version 12.0 was used for all statistical analyses.

Ethical Consideration

Permission was obtained from the Ethics Committee of İstanbul University, İstanbul Faculty of Medicine (27.01.2004/3661).

Results

Participants

A total of 11,483 questionnaires were distributed and 10,183 questionnaires were completed by parents (response rate: 88.7%). Respondents who were outside the 6-7 years age range and/or did not complete the questionnaire properly were excluded from the analysis, leaving a sample size of 9,875, with a response rate of 86%. There were 4,835 girls (49.3%) and 4,972 boys (50.7%); the gender was unavailable in 68 questionnaires.

Prevalence

The prevalence rates for symptoms of AR are presented in Table I. The prevalences for rhinitis

ever (lifetime rhinitis), current rhinitis (rhinitis in past year), current rhinoconjunctivitis (rhinoconjunctivitis in past year), and physician-diagnosed AR (hay fever ever) were 44.3%, 29.2%, 8.5%, and 8.1%, respectively.

The prevalence of AR and related symptoms according to the districts of İstanbul are presented in Table II. The prevalence for rhinitis ever, current rhinitis, current rhinoconjunctivitis, and physician-diagnosed AR were slightly higher in the districts located on the European side (44.7%, 29.6%, 9.0%, and 8.4%, respectively) than in those located on the Asian side (44.2%, 28.7%, 7.6%, and 7.7%, respectively), but the difference was not statistically significant.

There was nearly a two-fold variation in the prevalence of rhinitis ever, rhinitis in the past year, rhinoconjunctivitis in the past year, and physician-diagnosed AR between districts. The prevalence rates for rhinitis ever ranged from 25.8% to 55.6%. Districts with the lowest prevalence for rhinitis ever were Bakırköy (25.8%) and Silivri (32.9%), while districts with the highest prevalence were Büyükçekmece (54.0%), Beykoz (55.0%) and Küçükçekmece (55.6%). Prevalence rates for rhinitis in the past year ranged from 17.5% to 37%, and the districts with the lowest and highest prevalence were Bakırkoy and Beykoz, respectively.

Prevalence rates for rhinoconjunctivitis in the past year ranged from 4.1% to 15.6%, and the districts with the lowest prevalence were Eyüp (4.1%) and Zeytinburnu (4.1%), while those with the highest were Sultanbeyli (15.6%) and Küçükçekmece (15.1%). The prevalence rates for physician-diagnosed AR ranged from 5.4% to 12.5%. The districts with the lowest prevalence were Küçükçekmece and Zeytinburnu (5.4%) and with the highest prevalence were Eminönü (12.5%) and Güngören (12.0%). Prevalence rates for severe rhinoconjunctivitis in the past year between districts showed a 4.5-fold variation ranging from 6.0% (Kadıkoy) to 27.0% (Beykoz).

Risk Factors

Frequent paracetamol (aOR = 1.86, 95% CI = 1.55-2.24) and antibiotic use in the first year of life (aOR = 1.41, 95% CI = 1.15-1.73), history of frequent upper respiratory tract infections (aOR = 1.39, 95% CI = 1.13-1.71), adenotonsillectomy (aOR = 1.75, 95% CI = 1.28-2.39), breastfeeding less than six months (aOR = 1.37, 95% CI = 1.07-1.75), dog at home in the first year of life (aOR = 1.96, 95% CI = 1.13-3.41), perianal redness in the first year of life (aOR = 1.58, 95% CI = 1.32-1.89), and frequent truck passing near the home (aOR = 1.36, 95% CI = 1.14-1.62) were independent risk factors for AR. Paracetamol given in the first 12 months was a protective factor for AR (aOR = 0.77, 95% CI = 0.60-0.98) (Table III).

Although smoking by the child's mother (or female guardian) during the child's first year of life, person with scurf at home and television viewing time per day were significant risk factors for physician-diagnosed AR by univariate analysis, their significances were lost when evaluated by multivariate analysis.

Sex, smoking by the child's mother (or female guardian) or father, number of cigarettes, number of persons at home who smoke, cat at home during the first year of life (child) or in the past 12 months, dog at home in the past 12 months, heating system, and being born in İstanbul did not affect the physician-diagnosed AR prevalence. Risk factors affecting the prevalence of physician-diagnosed AR are shown in Table III.

Discussion

This is the first study, using the ISAAC questionnaire, regarding the prevalence of symptoms of rhinitis in a large sample of patients in the 6-7 years age group living in İstanbul, Turkey. Our prevalence rates for rhinitis ever, current rhinitis, current rhinoconjunctivitis, and physician-diagnosed AR were 44.3%, 29.2%, 8.5%, and 8.1%, respectively. Akcakaya et al.[5] assessed the prevalence of asthma and AR in 2,276 6-15-year-old schoolchildren in the 1996-1997 school year in İstanbul using a translated version of the ISAAC questionnaire and found the cumulative prevalence of AR to be 17.6%. This discrepancy may be due to the difference in the age groups of the two studies. Our results may serve as a basis for further prevalence studies.

According to several studies performed with the ISAAC questionnaire in different regions of Turkey, prevalence rates for current rhinitis and physician-diagnosed AR ranged from 8.8% to

Table I. Summary of Parental-Completed Allergic Rhinitis Questionnaire Data (n: 9875)

Questionnaire	Female n (%)	Male n (%)	Total n (%)
Lifetime rhinitis	2087 (43.2)	2292 (46.1)	4379 (44.3)
12-month prevalence			
Rhinitis	1370 (28.3)	1510 (30.4)	2880 (29.2)
Associated itchy eye	410 (8.5)	426 (8.6)	836 (8.5)
Severe interference with daily tivity	304 (6.3)	341 (6.9)	645 (6.5)
Lifetime physician-diagnosed allergic rhinitis	410 (8.5)	393 (7.9)	803 (8.1)

62.1% and from 2.6% to 17.6, respectively[3-12]. However, only two of them, which were conducted in the Anatolian part of Turkey (Bursa and Denizli), were performed in the 6-7 years age group[6,7]. The prevalence rates for current rhinitis and physician-diagnosed AR were lower than our results (8.8% and 2.6% in Bursa; 23.1% and 6.1% in Denizli, respectively). The results of the present study were similar to the results of our previous study held in İstanbul, in the 6-12 years age group[10].

In the ISAAC Phase Three Study, 66 centers in 37 countries participated in the 6-7 years age group, and the study was held mostly in 2002 and 2003[22]. Prevalence rates for rhinitis ever were high in the Asian-Pacific region (Hong Kong, 42.4%; Taipei (Taiwan), 46.4%; Bangkok (Thailand), 47.9%), like our rates, low in Africa (Nigeria (Ibadan), 14.1%), Iran (12.6%), and India (13.9%), and moderate in Latin America (19.6%), North America (19.0%), Western Europe (21.7%), Eastern Mediterranean (22%), Northern & Eastern Europe (23%), and Oceania (27.1%). Prevalence rates for current rhinoconjunctivitis were also high in the Asian-Pacific region (27.5%) and in Latin America (27.9%), like our rates, low in Africa (11.7%) and India (11.4%), and moderate in Eastern Mediterranean (16.7%), North America (19.0%), Western Europe (17.7%), Northern & Eastern Europe (17.8%), and Oceania (23.8%). Our prevalence rate for physician-diagnosed AR was moderate and similar to the rates in Sweden (8.3%), Spain (8.4%) and Milan (8.0%), lower than the rates in North America (27.8%), Oceania (17.7%), Nigeria (14.4%), Poland (20.4%), United Kingdom (13.9%), Latin America (16.2%) except Mexico (4.7%), and Italy (9.5%) except Milan, and higher than the rates in Iran (2.2%), Portugal (4.2%), and most of the countries in Northern & Eastern Europe (Albania, 3.3%; Estonia, 3.5%; Georgia, 2.8%; Lithuania, 2.4%; Russia, 5.2%) and Western Europe (Austria, 4.3%; Belgium, 6.0%; Germany, 6.4%).

In the present study, the prevalence rates for current rhinoconjunctivitis and physician-diagnosed AR were similar and lower than the prevalence rates for rhinitis ever and current rhinitis. This similarity was also observed in the ISAAC Phase Three Study in Northern & Eastern and Western European regions[22]. This may be explained in part by rhinitis associated with eye symptoms being a better predictor for AR than rhinitis as a single symptom, since rhinitis alone can be caused by various factors such as infections and physical stimuli.

There are wide variations in the prevalence rates of AR among the districts of İstanbul. Generally, most of the districts have their own immigrants from particular cities of Turkey, and this creates genetic heterogeneity. In addition, every district has its own social, economic and geographical features, such that each district may be evaluated as a single region with its own dynamics. However, two of the districts with the highest prevalence for physician-diagnosed AR (Eminönü, Güngören) are inner cities on the European side, and the other district with a high prevalence (Adalar) is a chain of nine islands with rich forests. However, the districts with the lowest rates do not share common consistent risk factors.

Risk Factors

This study focused on physician-diagnosed AR for the evaluation of risk factors, since it best predicts AR.

According to several studies performed in

Turkey, significant risk factors for AR are family history of atopy[3, 8, 10,11, 23-26], respiratory infections in the past [10,23,25], passive smoking[11, 23,25], current indoor heating with gas store[24], perianal redness[10], red meat ingestion[23], dampness at home[10,11,24], cat at home[10] , and antibiotic use[10] in the first year of life.

In the present study, among the environmental factors, frequent paracetamol and antibiotic use in the first year of life, history of frequent upper respiratory tract infections, adenotonsillectomy, dog at home in the first year of life, and perianal redness in the first year of life were significantly associated with AR, which was in agreement with our previous report and other studies[10, 15, 23-36]. Frequent paracetamol and antibiotic use

Table II. Summary of the Prevalence of Allergic Rhinitis and Related Symptoms in Districts of İstanbul

	12-month prevalence					
Districts	Rhinitis ever	Rhinitis in past year	RCJ in past year	Severe RCJ in past year	Hay fever ever	n
Asian Side	1452 (44.2)	941 (28.7)	248(7.6)	359 (10.9)	252 (7.7)	3281
Adalar	40 (35.7)	23 (20.5)	8 (7.1)	10 (8.9)	13 (11.6)	112
Beykoz	104 (55.0)	70 (37.0)	22 (11.6)	29 (27.0)	12 (6.3)	189
Kadiköy	170 (39.3)	109 (25.2)	15 (31.1)	26 (6.0)	35 (8.1)	433
Kartal	181 (44.0)	115 (28.0)	28 (6.8)	48 (11.7)	36 (8.8)	411
Maltepe	122 (47.5)	77 (30.0)	26 (10.1)	28 (10.9)	20 (7.8)	257
Pendik	194 (45.9)	116 (27.4)	22 (13.0)	49 (11.6)	41 (9.7)	423
Sultanbeyli	67 (45.6)	45 (30.6)	23 (15.6)	18 (12.2)	10 (6.8)	147
Şile	35 (38.5)	23 (25.3)	8 (15.6)	14 (15.4)	8 (8.8)	91
Tuzla	90 (48.4)	62 (33.3)	12 (6.4)	24 (12.9)	16 (8.6)	186
Ümraniye	287 (44.6)	194 (30.1)	56 (8.7)	81 (21.3)	37 (5.7)	644
Üsküdar	162 (41.7)	107 (27.6)	28 (13.0)	32 (8.2)	24 (6.2)	388
European Side	2951 (44.7)	1953 (29.6)	595 (9.0)	775 (11.7)	556 (8.4)	6594
Avcılar	80 (40.8)	60 (30.6)	23 (11.7)	27 (13.8)	13 (6.6)	196
Bağcılar	235 (44.5)	142 (26.9)	52 (54.4)	59 (11.2)	40 (7.6)	528
Bahçelievler	191 (42.1)	131 (28.8)	38 (8.4)	46 (10.1)	49 (10.8)	454
Bakırkoy	62 (25.8)	42 (17.5)	11 (4.6)	15 (6.2)	21 (8.7)	240
Bayrampaşa	89 (42.8)	52 (25)	22 (10.6)	23 (11.1)	16 (7.7)	208
Beşiktaş	77 (35.5)	50 (23.0)	10 (4.6)	18 (8.3)	19 (8.8)	217
Beyoğlu	75 (47.5)	44 (27.8)	18 (11.4)	20 (24.1)	11 (7.0)	158
Büyükçekmece	281 (54.0)	184 (35.4)	48 (9.2)	80 (15.4)	51 (9.8)	520
Çatalca	55 (41.0)	39 (29.1)	10 (7.5)	10 (7.5)	11 (8.2)	134
Eminonü	50 (48.1)	35 (33.6)	11 (10.6)	13 (12.5)	13 (12.5)	104
Esenler	256 (47.3)	165 (30.5)	49 (9.1)	67 (12.4)	34 (6.3)	541
Eyüp	116 (36.5)	80 (25.2)	13 (4.1)	32 (10.1)	29 (9.1)	318
Fatih	153 (45.3)	111 (32.8)	27 (8.0)	39 (11.5)	33 (9.8)	338
Gaziosmanpasa	310 (47.5)	203 (31.1)	74 (11.3)	88 (13.5)	52 (8.0)	653
Güngören	125 (44.0)	92 (32.4)	22 (7.7)	32 (11.3)	34 (12.0)	284
Kağıthane	123 (43.8)	78 (27.8)	24 (8.5)	35 (12.5)	16 (5.7)	281
Küçükçekmece	257 (55.6)	169 (36.6)	70 (15.1)	78 (16.9)	25 (5.4)	462
Sarıyer	159 (50.6)	109 (34.7)	39 (12.4)	39 (12.4)	42 (13.4)	314
Silivri	56 (32.9)	31 (18.2)	8 (4.7)	11 (11.2)	15 (8.8)	170
Zeytinburnu	91 (46.6)	60 (24.9)	10 (4.1)	22 (9.1)	13 (5.4)	241
Şişli	110 (42.9)	76 (32.6)	16 (6.9)	21 (9.0)	19 (8.1)	233
Total	4403 (44.6)	2894 (29.3)	843 (8.5)	1134 (11.5)	808 (8.2)	9875

RCJ: Rhinoconjunctivitis.

Table III. Associations of Risk Factors with Physician-Diagnosed Allergic Rhinitis

Factors	Children with allergic rhinitis (%)	Univariate analysis uOR (95%CI)	Multivariate analysis aOR (95%CI)
Sex			
M	9.1	0.92 (0.79-1.06)	-
F	9.9	1.00	
Paracetamol given in the first 12 months			
Yes	10.2	1.47 (1.22-1.78)*	0.77(0.60-0.98)*
No	7.2	1.00	1.00
Frequency of paracetamol given in the past 12 months			
At least once per month	15.4	2.41 (2.08-2.80)*	1.86(1.55-2.24)*
Never or at least once a year	7.0	1.00	1.00
Antibiotics given in the first 12 months of life			
Yes	12.1	2.13 (1.81-2.51)*	1.41(1.15-1.73)*
No	6.1	1.00	1.00
History of frequent upper respiratory tract infections			
Yes	13.1	2.34 (1.99-2.74)*	1.39(1.13-1.71)*
No	6.0	1.00	1.00
Adenotonsillectomy			
Yes	18.3	2.29 (1.74-3.00)*	1.75 (1.28-2.39)*
No	8.9	1.00	1.00
Breastfeeding <6 months			
No	12.9	1.48 (1.19-1.84)*	1.37 (1.07-1.75)*
Yes	9.1	1.00	1.00
Smoking by child's mother (or female guardian) during child's first year of life			
Yes	11.1	1.27 (1.06-1.54)	NS
No	8.9	1.00	
Smoking by child's mother (or female guardian)			
Yes	9.8	1.08 (0.92-1.29)	-
No	9.1	1.00	
Number of cigarettes			
8 or more	8.6	0.74 (0.55-0.98)	-
1-7	91.4	1.00	
Smoking by child's father			
Yes	9.2	0.94 (0.80-1.09)	-
No	9.8	1.00	
Number of cigarettes			
8 or more	9.4	1.00 (0.80-1.26)	-
1-7	9.4	1.00	
Number of persons at home who smoke			
2 or more	9.2	0.90 (0.74-1.10)	-
1	10.1	1.00	
Cat at home during the first year of life			
Yes	10.5	1.15 (0.79-1.67)	-
No	9.3	1.00	

Cat at home in the past 12 months			
Yes	9.4	1.00 (0.60-1.67)	-
No	9.4	1.00	
Dog at home during the first year of life			
Yes	14.9	1.71 (1.09-2.69)*	1.96 (1.13-3.41)*
No	9.3	1.00	1.00
Dog at home in the past 12 months			
Yes	11.5	1.25 (0.66-2.35)	-
No	9.4	1.00	
Person with scurf at home			
Yes	11.2	1.35 (1.16-1.58)*	NS
No	8.5	1.00	
Perianal redness			
Yes	15.1	2.18 (1.86-2.54)*	1.58 (1.32-1.89)*
No	7.5	1.00	1.00
Television viewing time per day			
≥3 hours	10.5	1.18 (1.01-138)*	NS
<3 hours	9.0	1.00	
Heating system			
Stove (wood or coal)	9.3	0.98 (0.85-1.24)	-
Central heating system	9.5	1.00	
Trucks passing on weekdays			
Frequently or almost through the day	12.0	1.54 (1.32-1.78)*	1.36 (1.14-1.62)*
Never or seldom	8.1	1.00	1.00
Born in İstanbul			
Yes	9.6	1.13 (0.92-1.39)	-
No	8.6	1.00	

*p<0.05 is considered significant.
aOR: Adjusted odds ratio. NS: Not significant. uOR: Univariate odds ratio.

in the first year of life and history of frequent upper respiratory tract infections may be due to misinterpretation of symptoms of AR as infections[10,27,28]. Another explanation may be the ability of paracetamol to deplete antioxidant defenses and promote Th2 response[27-33]. Antibiotics may alter the intestinal flora and/or prevent bacterial infections, leading to a skewing of the immune system to Th2 response[34-36]. Furthermore, vulnerability of the upper airways because of atopic inflammation may lead to frequent upper respiratory tract infections[10,37].

Despite the lack of knowledge on the exact etiological role of allergy in adenoid hypertrophy, it is reported as a frequent comorbidity of AR[37-40]. Thus, the significant association of adenoidectomy with AR may be the result of the coexistence of the two disorders.

Although some studies have shown that exposure to pets within the first months or year of life increases the risk of subsequent allergic diseases, some papers reported an inverse or no relationship between exposure to pets and risk of having allergies[41-45]. The ISAAC Phase Three Study Group reported that early-life exposure to cats was a risk factor for symptoms of rhinoconjunctivitis in children aged 6–7 years[45]. They also concluded that current exposure to cats and dogs combined, and to dogs only, was a risk factor for symptom reporting by adolescents. In our study, exposure to dogs in the first year of life was positively associated with physician-diagnosed AR. The discrepancies between the studies may be attributed to the genetic constitutions of both parents and children, extent of allergen exposure, housing conditions, and parental attitude towards pets[44].

We confirmed that perianal redness in the first year of life was a risk factor for AR[10]. Perianal redness due to mucosal inflammation associated with food allergy in early childhood may be an early sign of atopic march. Further studies are needed to reconfirm this finding.

Several studies have reported that traffic-related exposure may contribute to the development of respiratory allergies[10,46-48]. We also found a positive association between "frequent truck passing near the home" and AR.

In the present study, breastfeeding less than six months was found to be a risk factor for physician-diagnosed AR. Although breastfeeding is strongly recommended for its multiple benefits on child health, there are controversial reports about the protective effect of prolonged or exclusive breastfeeding against allergic diseases[49-54]. In the ISAAC Phase Three study, although within regions there were a small number of associations between breastfeeding and reduced symptom prevalence, no consistent association was found between breastfeeding use in the first year of life and current symptoms of rhinoconjunctivitis in 6-7- year-old children[55].

This study has several strengths. First, the ISAAC questionnaire used in this study has been validated worldwide. Our data can be compared easily with other studies done with the ISAAC questionnaire, since they would share the same standardized methodology. Secondly, the total number of questionnaires completed from the different districts is quite sufficient to reflect the whole target population of the city. However, the study has several limitations. The questionnaire data were completed by the parents of the 6-7-year-old children, and were obtained retrospectively. There are no objective data such as by physical examination or allergy screening tests.

In conclusion, our study shows that there are wide variations in the prevalence of AR-related symptoms in 6-7-year-old schoolchildren, even among the districts of İstanbul in Turkey. Environmental factors such as paracetamol and antibiotics, dogs, and breastfeeding in the first year of life may impact AR development.

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