

Survey on the Prevalence of Allergic Rhinitis in Junior High School Students in Isfahan, Iran

*Tooba Momen¹, Mahdie Saffari², Mohsen Jari³, Kamyab Karimpour², Armindokht Shahsanai², Seyed Javad Sayedi⁴

¹Department of Allergy and Clinical Immunology, Child Growth and Development Research Center, Research Institute for Primordial Prevention of Non-communicable Disease, Isfahan University of Medical Sciences, Isfahan, Iran. ²Faculty of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

³Pediatric Ward, Isfahan University of Medical Sciences, Isfahan, Iran.

⁴Neonatal Research Center, Dr. Sheikh Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract

Background

Allergic rhinitis (AR) is a common form of nose inflammatory disease that occurs when the mucosal immune system overreacts to environmental allergens especially in the air. It's absolutely clear that the prevalence of AR varies between different countries, and even between the various areas of a country. The purpose of present investigation is to determine the prevalence of AR, as most common allergic disorders, in the children of middle schools in Isfahan, Iran.

Materials and Methods

This investigation performed from February 2016 to July 2016, thoroughly, 1191 Junior high school children aged 13-14 years old were screened in our study. Authenticated ISAAC questionnaire was interviewer-administered to gather data on parentally informed symptoms, clinician diagnoses and environmental exposures.

Results: The students were averagely 13.57 ± 0.5 years old; 779 (65.4%) of them had been suffering from AR and 696 (58.4%) of them had the symptoms of rhinitis over the preceding year. Symptoms of conjunctivitis such as Itch and watery eyes have been reported in 35.1% of cases. Among examined students, 644/1191 (54.1%) were females ($P= 0.000$). The relationship of allergic rhinitis and exposure to parental smoking, domestic and type of feeding in infancy were not significant ($P= 0.655, 0.459, 0.946$, respectively), but exposure to house planting was statistically significant ($P=0.000$). Daily activity was affected in 43(3.6%).

Conclusion

Prevalence of allergic rhinitis was considerably high in Junior high school students of Isfahan and frequently is undiagnosed. In addition the association of allergic with gender and keeping house plants was significant.

Key Words: Allergic disease, Allergic rhinitis, Children, Iran.

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*Corresponding Author:

Tooba Momen (M.D), Address: Emamhossein Hospital, Isfahan, IRAN.

Email: Toobamomen@gmail.com

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1- INTRODUCTION

Allergic rhinitis (AR) is a common form of nose inflammatory disease that occurs when the mucosal immune system overreacts to environmental allergens especially in the air (1, 2). Inflamed mucosa of nose, red and sneezing eyes, and swelling around the orbital cavity are some of the common signs and symptoms of aforementioned condition (3, 4). AR is naturally initiated by environmental agents such as air dust, pollen, cigarette smoke and pet hair (5). Genetically and environmentally factors involved in pathogenesis of AR, in this condition, immunoglobulin E (IgE) attached to exposure allergen and this attachment cause the release of inflammatory substances such as histamine from mast cells (6, 7). In general, AR divided into two categories: seasonal and perennial. The first type of AR occurs after exposed to seasonal allergens and it has been reported that seasonal AR does not typically develop till after six years of age. In contrast, perennial AR occurs through the year and is generally seen in younger children (8, 9).

In the recent years, the prevalence of AR and other allergic disorders has been increasing in developed and developing communities. Western life-style, increased air pollution and changed dietary habits are some of the proposed factors that associated with high occurrence of allergies in the current world (10, 11). It's absolutely clear that the prevalence of AR varies between different countries, and even between the various areas of a country (12). The results of previous cross sectional studies indicated that the prevalence of AR in Iran is high. Based on meta-analysis that performed by Mohammadzadeh et al. (2013) the assembled prevalence of AR in Iran was 11.9% in elementary school children and 21.2% in middle school children (13). The ISAAC (International Study of Asthma

and Allergies in Childhood) questionnaire is an international plan for investigating the incidence of AR, asthma, eczema and other allergic disorders in developed and developing countries (14). Aforementioned program offers a non-invasive and unique method for assessing asthma, AR and eczema prevalence in children. Many studies that aimed to check out the prevalence of childhood allergic disorders used ISAAC questionnaire. The purpose of present investigation was to determine the prevalence of AR, as most common allergic disorders, in the children of middle schools in Isfahan, Iran.

2- MATERIALS AND METHODS

Present survey is a cross-sectional study that carried out on school children in the Isfahan city, Isfahan province of Iran. This investigation performed from February 2016 to July 2016 to determine the commonness of AR. In order to sample the second grade secondary schools in the 5th district of the city were selected randomly. Students in each school were entered to study according to the entry criteria (Given an approximate prevalence of 15%, a confidence interval of 95%, the minimum sample size was determined to include 1,300 individuals).

We extracted all demographic information of children from their papers. Authenticated ISAAC questionnaire was interviewer-administered to gather data on parentally informed symptoms, clinician diagnoses and environmental exposures. ISAAC consists of three phases. The first phase (which we used as the basis for conducting the present study) is based on simple methods for measuring the prevalence of symptoms of allergic rhinitis in children and adolescents in order to make proper international comparisons between different geographical areas with different languages. According to the ISSAC questionnaire, six questions are asked on the symptoms of allergic rhinitis.

This questionnaire translated into Persian, its validity and reliability is verified. (15). Parents/guardians gave written informed agreement. The project was permitted by the local research ethics committee from Isfahan University of medical sciences (MUI), Isfahan, Iran. The inclusion criteria were: Age of 13-14 years old, personal satisfaction and residence in Isfahan over the past year. The children who could not complete the questionnaire were excluded. Statistical analysis was executed using the SPSS statistical package, version 20.0 (Chicago, IL, USA). Significant differences were determined using a Chi square test. A $P < 0.05$ was accepted as statistically significant

3- RESULTS

In this study 1,300 students from junior high schools of Isfahan were surveyed (8.38% attrition of study

population). Among them 1,191 students filled the questioners; 547 one of them (45.9%) were males and the other 644 (54.1%) were females. These students were averagely 13.57 ± 0.5 years old; 779 (65.4%) of them had been suffering from AR and 696 (58.4%) of them had the symptoms of rhinitis over the preceding year. Based on our statistical analysis, 38.7% (n=302) of those who had been suffering from this condition were males and the other 61.3% of the affected children were females which difference was statistically significant ($P=0.000$). Symptoms such as Itch and watery eyes have been reported in 35.1% of cases. Daily activity was affected by AR in 43 of 1191(3.6%). Physician diagnosed hay fever was reported by 96 of 1191 (8.1 %) of the students (**Table.1**).

Table-1: The prevalence rate of rhinitis and associated symptoms among 1191 students.

Symptoms	Boys, Number (%)	Girls, Number (%)	Total, Number (%)	P-value
Life time Rhinitis	302 (25.3)	477 (40)	779 (65.4)	0.000
Rhinitis in the past 12 months	246(20.6)	450(37.7)	696 (58.4)	0.000
Itchy eyes in the past 12 months	183(15.3)	280(23.5)	463(38.8)	0.000
Rhinitis interfering with daily activities	20(1.6)	23(1.9)	43 3.6)	0.438
Hay fever	15(1.2)	81(6.8)	96 (8.1)	0.000

Evaluating the association of assessed risk factor with allergic rhinitis (n=1191) showed that exposure to parental smoking, domestic and type of feeding in infancy were not significant ($P= 0.655, 0.459, 0.946$, respectively), but exposure to house planting was significant ($P=0.000$). Results showed that 23.6% of people with allergic rhinitis (n=184) had smoker fathers and 5% (n=4) of them had smoker mothers; 76.5 (n=596) of the affected children had houseplants in their houses and 31.4% (n=596) of them had pets. As an infant, 67.2% (n=524) of them had been fed by

breastmilk; 27.9% (n=218) by both breast milk and infant formula and the others (4.7%, n=37) had been fed by the mixture of breast milk, infant formula and whole cow's milk (**Table.2**). Results showed that among 779 patients with allergic rhinitis, the maximum prevalence of AR was during the Early Spring in March (24.4%), and April (21%), and also Early Fall in September (18.8%). The minimum prevalence has been during summer in June (11.6%), July (11.7%), and August (10.2%).

Table-2: Represents the association of assessed risk factors with allergic rhinitis

Risk Factors		Allergic rhinitis		Total	P value
		Yes	No		
Gender	Male	302(55.2%)	245(44.8%)	547	0.000
	Female	477(74.1%)	167(25.9%)	644	
Parents smokers	Father	184(65.5%)	97(34.5%)	281	0.655
	Mother	4(50.0%)	4(50.0%)	8	
	None of them	591(65.5%)	311(34.5%)	902	
Feeding in infancy	Breastfeeding	524(65.7%)	274(34.3%)	798	0.946
	Breastfeeding+ formula	218(64.7%)	119(35.3%)	337	
	Breastfeeding + Formula + cow's milk	37(66.1%)	19(33.9%)	56	
House planting	Yes	596(68.7%)	272(31.3%)	868	0.000
	No	183(56.7%)	140(43.3%)	323	
Pets kept at home	Yes	245(66.9%)	121(33.1%)	366	.459
	No	534(64.7%)	291(35.3%)	825	

4- DISCUSSION

Based on our review literature, the present study is the first surveys that performed in Isfahan for determine the prevalence of AR in junior high school children. In our study, it was found that 65.4% of subjects had been suffering from the AR and 58.4% of them had the symptoms of rhinitis over the preceding year. So far, some surveys investigated the prevalence of AR in various cities of Iran. Ranjbar et al. (2005) reported the 28.2 % prevalence in Rasht (16), and Bazzazi et al. (2007) informed the 35.3 % prevalence in Gorgan (17). Rahimi Rad and his colleagues in a cross sectional study that performed in Urmia (2007) described the 23.6% prevalence of AR (18). Some of the other cross sectional investigations that performed in Hamedan (19), Babol (20), and Ahvaz (21) performed for assessed the prevalence of AR in aforementioned cities. In a systematic review by mohammadzade et al. (2003), the pooled prevalence of allergic rhinitis in children 6-7 years of age

in Iran was 11.9% and in children aged 13-14 was 21.2% (13). All of above studies investigated the AR prevalence of AR in 13-14 years old children. Nasiri et al. reported the prevalence of 29.7% allergic rhinitis in Sanandaj in both age group (6-7 and 13-14 years old) (22). In comparison with the above studies in Iran, the prevalence of AR was higher in Isfahan. It can be explained by difference in the time of study, climate variable and air pollution, the sample size and genetic factors. Present study is a cross sectional study that performed for determination of AR prevalence in school children of Isfahan, Iran. Based on our results, the prevalence of AR in females was significantly higher than in males. Previous surveys have been reported controversial results on this issue. Some cross sectional studies that performed in the North East of England limited to subjects aged six-seven and thirteen- fourteen years old found a higher occurrence of AR in pre-pubertal boys,

with a moderately higher prevalence among teenage girls (23). Also, an investigation in Belgium that executed for determination of AR and associated allergic disorders prevalence in six – seven years old children reported higher occurrence of AR and eczema in male gender (24). Osman et al. (2007) in their study explore the gender specific presentation for asthma and AR in primary care (23). One of the strongest results that reported in aforementioned study was male predominance for AR and asthma in childhood and female predominance in adolescents. In the excellent Iranian cross sectional that performed by Ghaffari et al. (2011) in Sari (North of Iran), has been declared that the prevalence of allergic conditions such as AR in male gender is higher than female that don't match to the results of our study (12). Sahebi and co-workers performed a similar investigation in Tabriz (North Western Iran) (2010), in their study the prevalence of allergic and AR symptoms were more in male gender than in female (25).

To sum up, this can be said that the alteration in occurrence of AR between two genders was determined to be statistically significant in some investigations and non-significant in some others but, the issue is open to discussion. Exposure to tobacco smoke is a risk factor for pediatric allergies; on the other hand, one of the strongest predictors for allergic reaction occurrence in children is exposed to smoke (26). In our study revealed that 23.6% of AR subjects their father smoked and 7 percent of them their mothers smoked. Smoking has been described to be obviously associated with symptoms of AR, and AR has been presented to be a crucial risk factor for the development of asthma and other respiratory disease (27-29). Some studies reported significant correlation between passive smoking and AR in children (30). Feleszko et al. recommended that passive smoking might

change the balance of some immune cells specially, T helper cells, to the allergic pathway. Children exposure to experimental tobacco smoking might adjust immune responses and so contribute to the clarification of allergic conditions (31). The results of our investigation are in agreement with the studies that reported the positive correlation between parental smoking and occurrence of AR in their children. Exposure to pet allergens has been concerned as a risk factor for allergic condition, but this correlation has been challenging to assess in individual studies because of the large possible of selection prejudice. In some surveys, it has been revealed that individuals with allergic disease renounce from having animal pets at home but, the issue is open to discussion (32). The results from present survey suggested that keeping animal pets increases the risk of the pediatric AR.

Uchida and co-workers (2016) in a case control study investigated the association between keeping animal pets and AR (33). Their results indicated the positive correlation between keeping animal pets and occurrence of AR. Our results are in agreement with the aforementioned survey. Keeping indoor plants is one of the other proposed risk factor that associated with occurrence of AR. In the recent years, use of ornamental plants was increased in the private and public places and most individuals are exposed to aforementioned plants. Our investigation showed the positive correlation between ornamental allergens and AR. There is indication that both environmental and genetic factors play crucial roles in the pathogenesis of AR, and that even small increases in the air pollutants concentrations can cause adversarial health effects (2, 34). Based on our results, the most frequent AR was in the early spring and early autumn. The amount of air pollutants and pollen plants plays an important role in the pathogenesis of the AR. Recently; pollen-related AR has

attracted more consideration in cross-sectional investigations. A comprehensive survey that performed between November 2003 to October 2004 to explore the distribution of airborne pollen and its association with pollinosis in twelve cities in Hubei province of China recognized 61 pollen genera within the 257,520 collected pollen samples (35). The highest distribution of air pollens occurred in spring and autumn. The other study that performed in Beijing (China) showed that the summer-autumn pollen concentration peaked from August to September (36). It seems, there was a markedly relationship between amount of pollen concentration and the number of subjects sensitized to aforementioned pollens, as well as between pollen concentration and the onset of AR symptoms. Immunoglobulin E-mediated allergic conjunctivitis usually accompanied with AR (37-38), and the world health organization (WHO) offered that the condition be properly termed allergic rhino-conjunctivitis.

So far, the precise association between AR and conjunctivitis was not more identified. In our investigation AR was accompanied with conjunctivitis in 35.1% of subjects. One of the main factors that associated with Allergic Rhino-conjunctivitis is air pollen (39-40). Isfahan is one of the most polluted cities in Iran and it aforementioned condition is related with prevalence of conductivities symptoms in AR subjects, but the issue is open to discussion. In present survey, the researchers used an ISAAC questionnaire for assessing AR and conductivities.

The original ISAAC questions proscribe examining this topic as the presence or absence of "itchy-watery eyes" as the most prevalent ocular symptoms that associated with AR, was only requested as a nested question to those who had given a confirmatory answer to their rhinitis question. Perkin et al. (2015) in their cross

sectional study investigated the inter-relationship between allergic rhinitis, conjunctivitis and Rhino-conjunctivitis and related factors in United Kingdom children (38). The results of aforementioned survey indicated that, more children had parent-reported allergic conjunctivitis than AR. The majority of children with both AR and conjunctivitis condition also reported symptoms with the other condition.

5- CONCLUSION

Prevalence of allergic rhinitis was considerably high in junior high school students of Isfahan and frequently is undiagnosed. Attention to prevention measures and finding the risk factors of allergic rhinitis in large cities of Iran is needed.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. Kang HY, Moon SH, Jang HJ, Lim DH, Kim JH. Erratum: Acknowledgments Addition. Validation of "quality-of-life questionnaire in Korean children with allergic rhinitis" in middle school students. *Allergy, Asthma and Respiratory Disease*. 2016;4(6):463.
2. Deng Q, Lu C, Li Y, Sundell J, Norbäck D. Exposure to outdoor air pollution during trimesters of pregnancy and childhood asthma, allergic rhinitis, and eczema. *Environmental research*. 2016;150:119-27.
3. Bahceciler NN, Galip N. Allergic rhinitis symptoms. *Future medicine*. 2014:6-15.
4. Skoner DP. Allergic rhinitis: definition, epidemiology, pathophysiology, detection, and diagnosis. *Journal of Allergy and Clinical Immunology*. 2001;108(1):S2-S8.
5. Turner PJ, Kemp AS. Allergic rhinitis in children. *Journal of paediatrics and child health*. 2012;48(4):302-10.
6. Seidman MD, Gurgel RK, Lin SY, Schwartz SR, Baroody FM, Bonner JR, et al. Clinical practice guideline: allergic rhinitis.

Otolaryngology–Head and Neck Surgery. 2015;152(1_suppl):S1-S43.

7. Shiraishi Y, Jia Y, Domenico J, Joetham A, Karasuyama H, Takeda K, et al. Sequential engagement of FcεRI on mast cells and basophil histamine H4 receptor and FcεRI in allergic rhinitis. *The Journal of Immunology*. 2013;190(2):539-48.
8. Durham SR, Creticos PS, Nelson HS, Li Z, Kaur A, Meltzer EO, et al. Treatment effect of sublingual immunotherapy tablets and pharmacotherapies for seasonal and perennial allergic rhinitis: Pooled analyses. *Journal of Allergy and Clinical Immunology*. 2016;138(4):1081-8. e4.
9. Lang K, Allen-Ramey F, Huang H, Rock M, Kaufman E, Dykewicz MS, editors. Health care resource use and associated costs among patients with seasonal versus perennial allergic rhinitis. *Allergy and Asthma Proceedings*; 2016: OceanSide Publications, Inc.
10. Takeuchi J, Kusunoki T, Morimoto T, Sakuma M, Mukaida K, Yasumi T, et al. Lifestyle Risk Factors for Allergic Rhinitis in Schoolchildren: Are Sports Activities a Negative Factor? *Journal of Allergy and Clinical Immunology*. 2013;131(2):AB112.
11. Yang Y, Wang Y, Lv L, Sun Y, Li C, Fan Y, et al. The prevalence and associated lifestyle risk factors of self-reported allergic rhinitis in Kazakh population of Fukang City. *Medicine*. 2017;96(39):e8032.
12. Ghaffari J, Mohammadzadeh I, Khalilian A, Rafatpanah H, Mohammadjafari H, Davoudi A. Prevalence of asthma, allergic rhinitis and eczema in elementary schools in Sari (Iran). *Caspian journal of internal medicine*. 2012;3(1):372.
13. Mohammadzadeh I, Barari-Savadkoohi R, Alizadeh-Navaei R. The prevalence of allergic rhinitis in Iranian children: A systematic review and descriptive meta-analysis. *Journal of Pediatrics Review*. 2013;1(2):19-24.
14. Asher M, Keil U, Anderson H, Beasley R, Crane J, Martinez F, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. *European respiratory journal*. 1995;8(3):483-91.
15. M. Gooya , A. Shirvani , R. Tahmasebi , A.M. Omrani , M.K Gheybi , H. Darabi , Sh.Farrokhi.Prevalence of Asthma and Allergic Diseases and Its Risk Factors in School Children Aged (6-7 and 13-14 Years) in Assalouyeh City, Bushehr Province Based on III ISAAC Protocol Phase I, in 2014. *Iran South Med J* 2017; 20(1): 57-69.
16. Abbasi Ranjbar Z. Prevalence of allergic rhinitis among children in Rasht. *Journal of Guilan University of Medical Sciences*. 2005;14(53):56-62.
17. Bazzazi H, Gharagozlou M, Kassaiee M, Parsikia A, Zahmatkesh H. The prevalence of asthma and allergic disorders among school children in Gorgan. *Journal of research in medical sciences*. 2007;12(1):28-33.
18. Rahimi Rad M, Hamzadeh A. Allergic disease in 6-7-year-old schoolchildren in Urmia, Islamic Republic of Iran. 2008.
19. Safari M, Jari M. Prevalence of allergic rhinitis in 13-14 year old school children in Hamedan. *Iranian Journal of Pediatrics*. 2008;18(Suppl 1):41-6.
20. Mohammadzadeh I, Ghafari J, Savadkoohi RB, Tamaddoni A, Dooki MRE, Navaei RA. The prevalence of asthma, allergic rhinitis and eczema in north of Iran. *Iranian journal of pediatrics*. 2008;18(2):117-22.
21. Shakurnia A, Assar S, Afra M, Latifi M. Prevalence of asthma among schoolchildren in Ahvaz, Islamic Republic of Iran/Prevalence de l'asthme chez les élèves d'Ahvaz (Republique islamique d'Iran). *Eastern Mediterranean Health Journal*. 2010;16(6):651.
22. Nasiri R, Homagostar G, Tajik M, Shekari A, Roshani D, Ataei P, et al.. Evaluation of Prevalence of Allergic Rhinitis Symptoms in Kurdistan, a Western Province in Iran. *Int J Pediatr*. 2015; 3(6.1):1039-46.
23. Osman M, Hansell AL, Simpson CR, Hollowell J, Helms PJ. Gender-specific presentations for asthma, allergic rhinitis and eczema in primary care. *Primary Care Respiratory Journal*. 2007;16:28-35
24. Wieringa M, Weyler J, Bever H, Nelen V, Vermeire P. Gender differences in respiratory, nasal and skin symptoms: 6–7 versus 13–

- 14-year-old children. *Acta Paediatrica*. 1999;88(2):147-9.
25. Sahebi L, Shabestary MS. The prevalence of asthma, allergic rhinitis, and eczema among middle school students in Tabriz (northwestern Iran). *Turkish Journal of Medical Sciences*. 2011;41(5):927-38.
26. Matsumoto M, Konno S, Kimura H, Suzuki M, Hashino S, Nishimura M. Six-Year Trend In The Prevalence Of Asthma And Allergic Rhinitis And Their Associated Factors In Young Adults: Analysis Of The Hokkaido University Students. *D106 Obesity And Nutrients In Lung Disease: Am Thoracic Soc*; 2017. p. A7459-A.
27. Plaschke PP, Janson C, Norrman E, Bjornsson E, Ellbjar S, Jarvholm B. Onset and remission of allergic rhinitis and asthma and the relationship with atopic sensitization and smoking. *American journal of respiratory and critical care medicine*. 2000;162(3):920-4.
28. Eriksson J, Ekerljung L, Sundblad BM, Lötvall J, Torén K, Rönmark E, et al. Cigarette smoking is associated with high prevalence of chronic rhinitis and low prevalence of allergic rhinitis in men. *Allergy*. 2013;68(3):347-54.
29. Polosa R, Knoke JD, Russo C, Piccillo G, Caponnetto P, Sarvà M, et al. Cigarette smoking is associated with a greater risk of incident asthma in allergic rhinitis. *Journal of Allergy and Clinical Immunology*. 2008;121(6):1428-34.
30. Saulyte J, Regueira C, Montes-Martínez A, Khudyakov P, Takkouche B. Active or passive exposure to tobacco smoking and allergic rhinitis, allergic dermatitis, and food allergy in adults and children: a systematic review and meta-analysis. *PLoS medicine*. 2014;11(3):e1001611.
31. Feleszko W, Zawadzka-Krajewska A, Matysiak K, Lewandowska D, Peradzyńska J, Dinh QT, et al. Parental tobacco smoking is associated with augmented IL-13 secretion in children with allergic asthma. *Journal of Allergy and Clinical Immunology*. 2006;117(1):97-102.
32. Takkouche B, González-Barcala FJ, Etminan M, Fitzgerald M. Exposure to furry pets and the risk of asthma and allergic rhinitis: a meta-analysis. *Allergy*. 2008;63(7):857-64.
33. Kaneko M, Kawa S. Association Between Keeping Pet Animals and Allergic Rhinitis: A Case-Control Study Among Japanese University Students. 2016; 79(4): E1-E8.
34. Deng Q, Lu C, Yu Y, Li Y, Sundell J, Norbäck D. Early life exposure to traffic-related air pollution and allergic rhinitis in preschool children. *Respiratory medicine*. 2016;121:67-73.
35. Liu G-h, Zhu R-f, Zhang W, Li W-j, Wang Z-x, Chen H. Survey of airborne pollen in Hubei province of China. *Chinese Medical Sciences Journal*. 2008;23(4):212-7.
36. Ouyang Y, Zhang D, Fan E, Li Y, Zhang L. Correlation between symptoms of pollen allergic rhinitis and pollen grain spreading in summer and autumn. *Zhonghua er bi yan hou tou jing wai ke za zhi= Chinese journal of otorhinolaryngology head and neck surgery*. 2012;47(8):623-7.
37. Gradman J, Wolthers OD. Allergic conjunctivitis in children with asthma, rhinitis and eczema in a secondary outpatient clinic. *Pediatric allergy and immunology*. 2006;17(7):524-6.
38. Perkin MR, Bader T, Rudnicka AR, Strachan DP, Owen CG. Inter-relationship between rhinitis and conjunctivitis in allergic rhinoconjunctivitis and associated risk factors in rural UK children. *PLoS One*. 2015;10(11):e0143651.
39. Riediker M, Monn C, Koller T, Stahel WA, Wüthrich B. Air pollutants enhance rhinoconjunctivitis symptoms in pollen-allergic individuals. *Annals of Allergy, Asthma & Immunology*. 2001;87(4):311-8.
40. Jalbert I, Golebiowski B. Environmental aeroallergens and allergic rhino-conjunctivitis. *Current opinion in allergy and clinical immunology*. 2015;15(5):476-81.