

Prevalence of Allergic Diseases and Risk Factors in Preschool Children

Nafiz Sarışık¹, Uğur Altaş^{2*}, Mehmet Yaşar Özkars³

¹Department of Pediatrics, Faculty of Medicine, Kahramanmaraş Sütçü İmam University, Kahramanmaraş Turkey

²Department of Pediatric Allergy and Immunology, Ümraniye Training and Research Hospital, University of Health Sciences, İstanbul, Turkey

³Department of Pediatric Allergy and Immunology, Faculty of Medicine, Kahramanmaraş Sütçü İmam University, Kahramanmaraş Turkey

Article History

Received 11 Aug 2023

Accepted 16 Oct 2023

Published Online 20 Oct 2023

*Corresponding Author

Uğur Altaş

Department of Pediatric Allergy and Immunology

Ümraniye Training and Research Hospital

University of Health Sciences

İstanbul, Turkey

Phone: +90 2166321818

E-mail: druguraltas@gmail.com

Doi:10.56766/ntms.1345987

Authors' ORCIDs

Nafiz Sarışık

<http://orcid.org/0000-0003-3317-7745>

Uğur Altaş

<http://orcid.org/0000-0001-5871-2033>

Mehmet Yaşar Özkars

<http://orcid.org/0000-0003-1290-8318>



Content of this journal is licensed under a Creative Commons Attribution 4.0 International License.

Abstract: Allergic diseases are very common in children. The aim of this study is to obtain information about the frequency and risk factors of allergic diseases in kindergarten children aged 3-6 years. This study was carried out between 13.02.2018 and 30.12.2018 in kindergartens, in accordance with the ISAAC Phase I protocol for children aged 3-6 years. The study was carried out by distributing 3000 questionnaires in 20 kindergartens. 2001 out of 2040 collected questionnaires were included in the study. Of the participants, 986 (49.3%) were female and 1015 (50.7%) were male. The frequency of asthma symptoms was 30.4% (n=608). The frequency of allergic rhinitis symptoms was found to be 37.1% (743 people). The risk of asthma symptoms was significantly higher in males, those whose mothers smoked during pregnancy, those born preterm, those with a smoker at home and those with mold in the home (p<0.05). The risk of allergic rhinitis symptoms was significantly higher in smokers and those with mold in the home (p<0.05 for both). The presence of smokers and mold were both risk factors for both allergic rhinitis and asthma symptoms. Awareness should be increased in families of high risk patients. ©2023 NTMS.

Keywords: Asthma; Allergic Rhinitis; Children.

1. Introduction

It is reported that there is a significant increase in the prevalence of childhood allergic diseases in the world.

¹ Comparing the prevalence of allergic diseases with international systematic methods is necessary to understand the global epidemiology of these diseases, to generate new hypotheses and to evaluate the possible causes of existing hypotheses. Asthma is an important health problem worldwide and is the most common chronic disease of childhood in most countries ¹⁻³. Its prevalence in children reported to be as nearly 11.0% and varies between different age groups ⁴. In the National Burden of Disease Study conducted in our country in 2000, it was reported that when the diseases

were ranked in terms of burden, asthma was ranked fourteenth in urban areas with a rate of 1.3%, and it was ranked ninth in rural areas with a rate of 1.1% ⁵.

Allergic rhinitis (AR) or allergic rhinosinusitis is characterized by bouts of sneezing, runny nose, and nasal congestion, and is often accompanied by symptoms of itching in the eyes, nose, and palate ⁶. In a study conducted in children aged 6-7 years in Türkiye, the frequency of AR was found to be between 2.9 and 43.5% ⁷.

In this study, we target to inform families about allergic diseases that occur and are frequently encountered in every four or five of our children, to help understand

the importance of the disease ^{8,9}. With the questionnaire prepared in accordance with the ISAAC (International Study of Asthma and Allergy in Childhood) protocol¹⁰, it was aimed to obtain information about allergic diseases among children and determine the frequency and risk factors of allergic diseases in preschool children between the ages of 3-6 years, and their distribution according to socio-demographic features.

2. Material and Methods

This cross-sectional type of study was planned to reach a population of 3,000 children aged 3-6 years by evaluating similar literature, and at least 70% of the population was screened. The study was carried out in kindergartens between 13.02.2018 and 30.12.2018. In the study, a total of 20 kindergartens were screened. 3,000 questionnaires were distributed under the control of teachers to be sent to their families. The teachers were given detailed information about the subject and the purpose of the survey. 2040 of the distributed questionnaires could be recollected five days later and 2001 questionnaires were included in the study since 39 questionnaires, which were determined to be filled inattentively, were not considered appropriate to participate in the study.

When creating the survey, demographic characteristics (age, gender), risk factors for allergic diseases (familial and environmental factors) and allergic disease symptoms, frequency and severity were included in the study questions in accordance with the ISAAC protocol. The frequency of allergic diseases were

determined by "parents's self report" via used questionnaire.

2.1. Statistical analysis

Statistical analysis was performed using the SPSS 22.0 for Windows (SPSS, Inc.; Chicago, USA) package program. Descriptive statistics are given as number (n), percent (%). Chi-square test was used to compare categorical variables. Logistic regression analysis was performed for the multivariate analysis. Statistical significance level was accepted as $p < 0.05$.

2.2. Ethics

Ethics committee approval was obtained from the Ethics Committee of University of Kahramanmaraş Sütçü İmam Faculty of Medicine on 22.11.2017 with decision number 06.

Permission was obtained from the Directorate of National Education for the study to be carried out in schools.

3. Results

This study is carried out with the participation of 2001 children (3-6 years old) attending kindergarten to determine the frequency of allergic diseases and their risk factors. Of the participants, 986 (49.3%) were female and 1015 (50.7%) were male. Of the children, 6.2% (n=124) had mother who had smoked during pregnancy. The percentages of children having smokers and mold at home were 28.6% (n=573) and 7.8% (n=157), respectively. Other sociodemographic characteristics of the children participating in the study are given in Table 1.

Table 1: The sociodemographic characteristics of the children participating in the study.

	n	%
Gender		
Female	986	49.3
Male	1015	50.7
Did you smoke cigarettes during your pregnancy?		
Yes	124	6.2
No	1877	93.8
Did you have full-term pregnancy?		
Yes	1720	86.0
No	281	14.0
What type of birth did you have for your baby?		
Vaginal delivery	582	29.1
Cesarean birth	1419	70.9
Did your child go to kindergarten?		
No, she/he didn't.	1729	86.4
Yes, she/he did.	272	13.6
Does anyone smoke at your home?		
Yes	573	28.6
No	1428	71.4
Do you have mold on the walls of the house you live in?		
Yes	157	7.8
No	1844	92.2

n=number, %=percentage.

The frequency of asthma symptoms was 30.4% (n=608). When the factors related to the development of asthma symptoms were evaluated, asthma symptoms were significantly more common in males, in children whose mothers smoked during pregnancy, and who was born pretermly and with cesarean sections ($p<0.05$). In

addition, asthma symptoms were observed at a higher rate in children having smokers and mold at home and in those who attended kindergarten ($p<0.05$). The comparison of the sociodemographic characteristics of the children participating in the study with the asthma findings is given in Table 2.

Table 2: The comparison of the sociodemographic characteristics of the children participating in the study with the asthma findings.

	Has your child ever had a wheezing sound at his/ her chest while breathing?				p*
	No		Yes		
	n	%	n	%	
Gender					
Female	711	72.1	275	27.9	0.017
Male	682	67.2	333	32.8	
Did you smoke cigarettes during your pregnancy?					
No	1319	70.3	558	29.7	0.013
Yes	74	59.7	50	40.3	
Did you have full-term pregnancy?					
No	160	56.9	121	4.1	<0.001
Yes	1233	71.7	487	28.3	
What type of childbirth did you have for your baby?					
Cesarean birth	958	67.5	461	32.5	0.001
Vaginal delivery	435	74.7	147	25.3	
Did your child go to kindergarten?					
No, s/he didn't.	1221	70.6	508	29.4	0.014
Yes, s/he did.	172	63.2	100	36.8	
Does anyone smoke at your home?					
No	1032	39.6	396	27.7	<0.001
Yes	72.3	27.7	212	37.0	
Is there any mold on the walls of the bathroom or any room of the house you live in?					
No	1303	70.7	541	29.3	<0.001
Yes	90	57.3	67	42.7	

n=number, %=percentage, *Pearson's chi-square test.

The frequency of allergic rhinitis symptoms was found to be 37.1% (n=743). When the factors related to the development of allergic rhinitis symptoms were evaluated, allergic rhinitis symptoms were significantly more common in children who was born pretermly and with cesarean sections ($p<0.05$). In addition, allergic rhinitis symptoms were observed at a higher rate in children having smokers and mold at home and in those who attended kindergarten ($p<0.05$). The comparison of the sociodemographic characteristics of the children participating in the study with the findings of allergic

rhinitis is given in Table 3. With the logistic regression test, the predictors of the presence of asthma symptoms were evaluated. The presence of smokers and mold at home were risk factors for asthma symptoms ($p<0.001$ for both). Other risk factors for asthma were male gender, having smoking mother during pregnancy and to be born pretermly ($p=0.019$, $p=0.038$, $p<0.001$). According to the logistic regression analysis, age, type of delivery, going to kindergarten had no significant effect on asthma symptoms (Table 4).

Table 3: The comparison of the sociodemographic characteristics of the children participating in the study with the findings of allergic rhinitis.

	Has your child ever had problems of sneezing, runny or stuffy nose when they didn't have a cold or flu?				p*
	n	No %	n	Yes %	
Gender					
Female	640	64.9	346	35.1	0.063
Male	618	60.9	397	39.1	
Did you smoke cigarettes during your pregnancy?					
No	1188	63.3	689	36.7	0.127
Yes	70	56.5	54	43.5	
Did you have a full-term pregnancy?					
No	161	57.3	120	42.7	0.037
Yes	1097	63.8	623	36.2	
What type of childbirth did you have for your baby?					
Cesarean birth	869	61.2	550	38.8	0.019
Vaginal delivery	389	66.8	193	33.2	
Did your child go to kindergarten?					
No, s/he didn't.	1102	63.7	627	36.3	0.043
Yes, s/he did.	156	57.4	116	42.6	
Does anyone smoke at your home?					
No	926	64.8	502	35.2	0.004
Yes	332	57.9	241	42.1	
Is there any mold on the walls of the bathroom or any room of the house you live in?					
No	1172	63.6	672	36.4	0.029
Yes	86	54.8	71	45.2	

n=number, %=percentage, *Pearson's chi-square test.

Table 4: The evaluation of the predictors of the presence of asthma symptoms by the logistic regression analysis of the independent variables.

	B	Wald	p	OR	95% CI	
					Lower Limit	Upper Limit
Age	-0.010	1.565	0.211	0.990	0.975	1.005
Gender						
Male (ref.=female)	0.236	5.479	0.019	1.266	1.039	1.542
Did you smoke cigarettes during your pregnancy?						
Yes (ref.=no)	0.414	4.295	0.038	1.512	1.023	2.237
Did you have a full-term pregnancy?						
No (ref.=yes)	0.534	15.143	<0.001	1.705	1.303	2.231
Type of delivery						
Vaginal delivery (ref.= cesarean birth)	-0.160	1.903	0.168	0.852	0.678	1.070
Did your child go to kindergarten?						
Yes (ref.=no)	-0.211	2.167	0.141	0.810	0.612	1.072
Does anyone smoke at your home?						
Yes (ref.=no)	0.411	13.755	<0.001	1.508	1.214	1.873
Do you have mold on the walls of the house?						
Yes (ref.=no)	0.700	14.852	<0.001	2.014	1.411	2.875

OR=odds ratio, CI= confidence interval.

With the logistic regression test, the predictors of the presence of allergic rhinitis symptoms were evaluated. The presence of smokers and mold at home were risk factors for allergic rhinitis ($p=0.002$ and $p=0.001$, respectively). According to the logistic regression

analysis, gender, to have smoking mother during pregnancy, to be born pretermly, type of delivery and going to kindergarten had no significant effect on allergic rhinitis symptoms (Table 5).

Table 5: The evaluation of the predictors of the presence of allergic rhinitis symptoms by the logistic regression analysis of the independent variables.

	B	Wald	p	OR	%95 CI	
					Lower Limit	Upper Limit
Gender						
Male (ref.=female)	0.183	3.664	0.056	1.200	0.996	1.447
Did you smoke cigarettes during your pregnancy?						
Yes (ref.=no)	0.312	2.473	0.116	1.366	0.926	2.016
Did you have a full-term pregnancy?						
Yes (ref.=no)	-0.156	1.333	0.248	0.855	0.656	1.115
Type of delivery						
Vaginal delivery (ref.=cesarean birth)	-0.045	0.174	0.676	0.956	0.772	1.183
Did your child go to kindergarten?						
Yes (ref.=no)	-0.111	0.644	0.422	0.895	0.683	1.173
Does anyone smoke at your home?						
Yes (ref.=no)	0.326	9.355	0.002	1.385	1.124	1.706
Do you have mold on the walls of the house?						
Yes (ref.=no)	0.587	10.302	0.001	1.799	1.257	2.576

OR=odds ratio, CI= confidence interval.

4. Discussion

In this study, the rate of wheezing in children during their childhood was found to be 30.4% ($n=608$). In a study conducted by Topal et al., on school children aged 6-7 years, the rate of wheezing in their childhood was found to be 20.3%¹¹. Similar to the literature, we thought that approximately one third of the children in our study may have symptoms that may be caused by asthma at least once in their lifetime. In our study, the frequency of asthma symptoms was found to be higher in boys than in girls. Similarly, in the logistic regression analysis, asthma symptoms were found to be more frequent in boys than in girls in a statistically significant way. In a study conducted by Strannegard et al. the incidence of asthma was found to be higher in boys than in girls¹².

In the multicentric ISAAC Phase III study, conducted with children aged 6-7 years between 2002 and 2003, it was reported that the frequency of AR varied between 2.2-27.8%¹³. In the study of Akcay et al. the frequency of AR was reported as 33.5% and the frequency of physician-diagnosed AR as 6.1%¹⁴. In a different study, the prevalence of current AR in children aged 6-7 years was reported as 15.0% (95% CI:13.8-16.3%)¹⁵. In our study, the frequency of AR was 37.1% and the frequency of physician-diagnosed AR was found to be 14%. When we look at the literature, it has been observed that the frequency of AR varies among

regions. We thought that the reasons for these differences were environmental factors, climatic changes, allergic predisposition of the patients, genetic predisposition, and the inability to differentiate allergic rhinitis from rhinoconjunctivitis.

In a study by Harju M et al.¹⁶, it was concluded that smoking during pregnancy increases the risk of asthma in children, and quitting smoking significantly reduces this risk. In our study, we found a significant relationship between smoking during pregnancy and the presence of asthma symptoms at any time. Similarly, in the logistic regression analysis between smoking during pregnancy and allergic symptoms in our study; children of mothers who smoked during pregnancy had asthma symptoms more frequently than those who did not smoke. The results were statistically significant. In the study conducted by Turan M et al. a significant relationship was found between smoking during pregnancy and AR symptoms¹⁷. However, in our study, no significant relationship was found between smoking during pregnancy and AR symptoms. In our study, we concluded that children who were born by cesarean section developed asthma symptoms at a higher rate than those who were born by vaginal delivery. Similar to our study, in a cohort study conducted by Rusconi et al.¹⁸ evaluating 67,613 deliveries from nine countries, it was concluded that the risk of asthma is higher in those born by cesarean

section. In a cohort study by Bager et al.¹⁹ in Denmark, including 9,722 cases, it was concluded that cesarean delivery did not pose a risk for AR. On the other hand, in our study, the frequency of AR symptoms was found to be higher in children born by cesarean section. We thought that the reason for this difference was regional climate change and environmental factors.

The frequency of asthma symptoms was found to be higher in children born prematurely than those born after full-term pregnancy (43.1% vs 28.3%), in our study. Similar to the results of our study, in a study conducted by Matheson MC et al.²⁰, it was found that the prevalence of asthma in children born prematurely was higher in later ages compared to those born after full-term pregnancy. In the logistic regression analysis of our study, asthma symptoms were found to be more frequent in premature babies than in full term ones in a statistically significant way. In the study of Sucu et al., no significant relationship was found between premature birth and the appearance of AR symptoms. In our study, the frequency of AR symptoms was found to be higher in children born as premature compared to those born as full term at a statistically significant level. In our study, the frequency of asthma symptoms was higher in children who went to kindergarten. In a study by Yeh KW et al.²¹ that included 3863 children aged 3-6 years between 2007 and 2008, it was reported that there was an increase in the frequency of asthma symptoms in children who went to kindergarten, similar to our study. In our study, the frequency of AR symptoms was found to be higher in children who went to kindergarten. In a study conducted by Pekkanen et al.²², it was concluded that the probability of AR is higher in children who attend kindergarten, similar to our study.

In a study conducted with parents of asthmatic children 28.2% of the parents were smokers²³. In our study, we found a significant relationship between secondhand smoke exposure and asthma symptoms in childhood. As a result of a meta-analysis of 327 studies carried out by Saulyte J et al., it was concluded that exposure to cigarette smoking increases the risk of allergic diseases in children²⁴. Similarly, in our study, we found a significant relationship between the occurrence of AR symptoms and smoking at home. In logistic regression analysis, a positive correlation was found between smoking at home and the occurrence of AR symptoms. In our study, we found that the presence of mold in the house and the occurrence of asthma symptoms are associated with each other. Similarly, a positive correlation was found between the presence of mold in the house and the occurrence of asthma symptoms in the logistic regression analysis. In a study by Tarkan et al., it was reported that mold is among the important aeroallergens²⁵. Similar to our study, in a study conducted by Civelek et al. in 2009, it was concluded that the presence of mold in the house increased asthma symptoms²⁶. In a different study, it was reported that the presence of molds on bathroom walls leads 5% higher prevalence of allergic rhinitis.²⁷ We found that

AR symptoms were seen at a higher rate in children exposed to mold in their houses. In the logistic regression analysis, a positive correlation was found between the presence of mold in the house and the occurrence of AR symptoms.

5. Conclusions

As a result, in our study, it is observed that the frequency of asthma symptoms is 30% and it is more common in male children. The frequency of allergic rhinitis is 37% and there is no significant difference between male and female children. It is observed that asthma and allergic rhinitis symptoms are more common in children who lived with mold in their home. The presence of smokers and mold at home were both risk factors for both allergic rhinitis and asthma symptoms. Awareness should be increased in families of high risk patients. Precautions should be taken for the risk factors.

Limitations of the Study

The children in the study were participating from single city, thus results have limitation in reflecting the population of the whole country.

Acknowledgement

None declared by the authors.

Conflict of Interests

The authors declared no conflict of interest.

Financial Support

No funding was received.

Author Contributions

NS, UA and MYÖ designed the research. NS participated in data collection and data analysis. NS, UA and MYÖ wrote the manuscript, read and approved the final manuscript.

Ethical Approval

Ethics committee approval was obtained from the Ethics Committee of University of Kahramanmaraş Sütçü İmam Faculty of Medicine on 22.11.2017 with decision number 06.

Data sharing statement

All data relevant to the study are included in the article.

Consent to participate

Not applicable.

Informed Statement

Informed consent was obtained from parents.

References

1. Mazur M, Czarnobilska M, Dyga W, Czarnobilska E. Trends in the epidemiology of allergic diseases of the airways in children growing up in an urban agglomeration. *J Clin Med.* 2022; 11(8):2188.
2. Global Initiative for Asthma (GINA). Global Burden of Asthma Report. Available from: URL: <http://www.globalasthmareport.org/>. Accessed August 10, 2023.
3. Canitez Y, Cekic Ş. Bursa bölgesinde alerjik astım tanılı çocuklarda ağaç polen alerjenlerine duyarlılık oranlarının araştırılması. *J Curr Pediatr.* 2021;19:67-75.

4. Asher MI, García-Marcos L, Pearce NE, et al. Trends in worldwide asthma prevalence. *Eur Respir J*. 2020; 56:2002094.
5. Türk Toraks Derneği Astım Tanı ve Tedavi Rehberi 2016. Available from: URL: https://www.chiesi.com.tr/img/download/documen-ti/934_ttd-astim-tani-ve-tedavi-rehberi-2016. Accessed August 10, 2023.
6. Liva GA, Karatzanis AD, Prokopakis EP. Review of rhinitis: classification, types, pathophysiology. *J Clin Med*. 2021; 10(14):3183.
7. Ozdemir Ö, Elmas B. Alerjik rinitin değişken prevalansı ve prevalansı etkileyen risk faktörleri. *Kulak Burun Bogaz İhtisas Dergisi*. 2016; 26(6):371-82.
8. Ones U, Akcay A, Tamay Z, Guler N, Dogru M. Asthma knowledge level of primarschool teachers in Istanbul, Turkey. *Asian Pac J Allergy Immunol*. 2006; 24(1):9-15.
9. Akar HH, Çağ Y, Özkars MY, Yıldız M. Decreased annexin a2 (anxa2) levels in children with atopic dermatitis: A case-control study. *Ann Clin Anal Med*. 2021; 12(2):172-75.
10. Asher MI, Keil U, Anderson HR, et al. International study of asthma and allergies in childhood (ISAAC): rationale and methods. *Eur Respir J*. 1995; 8(3):483-91.
11. Topal E, Kaplan F, Türker K, Kutlutürk, Bağ HG. The prevalence of allergic diseases and associated risk factors in the 6-7 age children who are living in Malatya. *Asthma Allergy Immunol*. 2017; 15:129-34.
12. Strannegård İL, Strannegård Ö. Childhood bronchial asthma in a desert country. *Allergy*. 1990; 45(5):327-33.
13. Ellwood P, Asher MI, Beasley R, Clayton TO, Stewart AW; ISAAC Steering Committee. The international study of asthma and allergies in childhood (ISAAC): phase three rationale and methods. *Int J Tuberc Lung Dis*. 2005; 9(1):10-16.
14. Akcay A, Tamay Z, Dağdeviren E, Zencir M, Enes U, Güler N. Denizli'deki 6-7 yaş okul çocuklarında allerjik hastalıklarının prevalansları. *Ege Tıp Dergisi*. 2007; 46(3): 145-50.
15. Chinratapisit S, Suratannon N, Pacharn P, Sritipsukho P, Vichyanond P. Prevalence and risk factors of allergic rhinitis in children in Bangkok area. *Asian Pac J Allergy Immunol*. 2019; 37(4):232-39.
16. Harju M, Keski-Nisula L, Georgiadis L, Heinonen S. Parental smoking and cessation during pregnancy and the risk of childhood asthma. *BMC Public Health*. 2016; 16:428.
17. Turan Mİ, Ergüven M, Özdemir M. The evaluation of prenatal and enviromental risk factors in children with asthma, allergic rhinitis and bronchial asthma *Nobel Med*. 2013; 9(2):32-37.
18. Rusconi F, Zugna D, Annesi-Maesano I, et al. Mode of delivery and asthma at school age in 9 European birth cohorts. *Am J Epidemiol*. 2017; 185(6):465-73.
19. Bager P, Melbye M, Rostgaard K, Benn CS, Westergaard T. Mode of delivery and risk of allergic rhinitis and asthma. *J Allergy Clin Immunol*. 2003;111(1):51-6.
20. Matheson MC, D Olhaberriague AL, Burgess JA, et al. Preterm birth and low birth weight continue to increase the risk of asthma from age 7 to 43. *J Asthma*. 2017; 54(6):616-23.
21. Yeh KW, Ou LS, Yao TC, Chen LC, Lee WI, Huang JL; PATCH Study Group. Prevalence and risk factors for early presentation of asthma among preschoolchildren in Taiwan. *Asian Pac J Allergy Immunol*. 2011; 29(2):120-26.
22. Pekkanen J, Remes S, Kajosaari M, et al. Infections in early childhood and risk of atopic disease. *Acta Paediatrica*. 1999;88(7):710-4.
23. Alhammad AM, Alajmi G, Alenzi A, et al. Parental attitude and knowledge towards asthma care measures for their children in Saudi Arabia. *Pediatr Pulmonol*. 2020; 55(11):2901-907.
24. Saulyte J, Regueira C, Montes-Martínez A, Khudyakov P, Takkouche B. Active or passive exposure to tobacco smoking and allergic hinitis, allergic dermatitis and food allergy in adults and children: a systematic review and meta-analysis. *PLoS Med*. 2014; 11(3):e1001611.
25. Tarkan Ö, Sümerlioğlu Ö, Tuncer Ü. Alerjik rinitte güncel tanı ve tedavi yaklaşımları. *Arşiv Kaynak Tarama Dergisi*. 2009; 18(3):156-70.
26. Civelek E, Cakir B, Orhan F, et al. Risk factors for current wheezing and its phenotypes among elementary school children. *Pediatr Pulmonol*. 2011; 46(2):166-74.
27. Silva M, Traebert J, da Silva D, Traebert E. Prevalence of allergic rhinitis symptoms and associated factors in six-year-old children in a municipality in southern Brazil. *Rev Bras Epidemiol*. 2023; 26:e230024.